PHYSICS

BOOKS - XII BOARDS PREVIOUS YEAR

XII BOARDS

PHYSICS

1. What is the direction of the force acting on a charged particle q, moving with a velocity $\vec{v}$ a uniform magnetic field $\vec{B}$?

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2. Name the part of the electromagnetic spectrum of wavelength $10^{-2}m$ and mention its one application.

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3. An electron and alpha particle have the same de-Broglie wavelength associated with them. How are their kinetic energies related to each other ?

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4. A glass lens of refractive index 1.5 is placed in a trough of liquid. What must be the refractive index of the liquid in order to mark the lens disappear?

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5. A 500 μ C charge is at the centre of a square of side 10 cm. Find the work done in moving a charge of 10 μ C between two diagonally opposite points on the square.

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6. State the reason, why heavy water is generally used as a moderator in a nuclear reactor.

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7. How does the fringe width of interference fringes change, when the whole apparatus of Young's experiment is kept in a liquid of refractive index 1.3 ?

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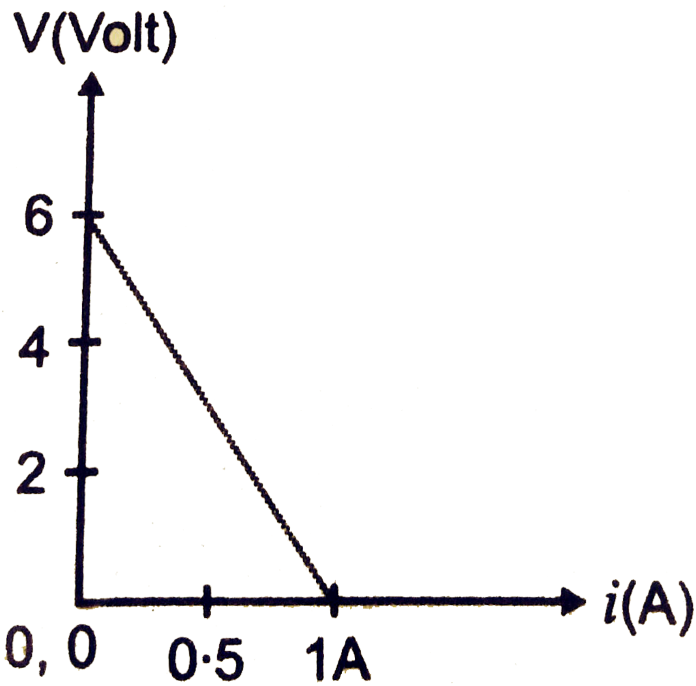
8. The plot of the variation of potential difference across a combination of three identical cells in series, versus current is as shown in figure. What is the emf and internal resistance of each cell?



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9. Derive the expression for the electric potential at any point along the axial line of an electric dipole.

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10. Define magnetic susceptibility of a material. Name two elements, one having positive susceptibility and the other having negative susceptibility . What does negative susceptibility signify ?

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11. The oscillating magnetic field in a plane electromagnetic wave is given by

$B_y = (8 \times 10^{-6})\sin[2 \times 10^{11}t + 300\pi x]T$

(i) Calculate the wavelength of the electromagnetic wave.

(ii) Write down the expression for the oscillating electric field.

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12. Prove that an ideal capacitor in an a.c. circuit does not dissipate power.

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13. Derive an expression for the impedance of an a.c. circuit consisting of an inductor and a resistor.

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14. The nucleus $.^{23} Ne$ deacays by β-emission into the nucleus $.^{23} Na$. Write down the β-decay equation and determine the maximum kinetic energy of the electrons emitted. Given, $\left(m\left(.^{23}_{11} Ne\right) = 22.994466 amu\right.$ and

$m\left(._{11}^{23} Na = 22.989770 amu\right.$. Ignore the mass of antineuttino $(\bar{v})$.

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15. (i) A transistor has a current gain of 30. If the collector resistance is $6K\Omega$ and input resistance is $1K\Omega$, calculate its voltage gain.

(ii) Why is a semiconductor damaged by strong current ?

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16. A convex lens of refractive index 1.5 has a focal length of 20 cm in air. Calculate the change in its focal length when it is immersed in water of refractive index 4/3.

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17. A ray of light passing through an equilateral triangular glass prism from air undergoes minimum deviation when angle of incidence is $\frac{3}{4}th$ of the angle of prism. Calculate speed of light in prism.

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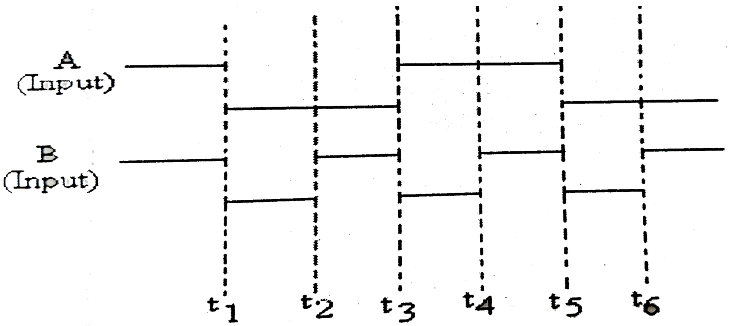
18. 

The give inputs A, B are fed to a 2-input NAND gate. Draw the output wave form of the gate.

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19. A transmitting antenna at the top of a tower has a height of 36 m and the height of the receiving antenna is 49 m. What is maximum

distance between them, for satisfactory communication is the LOS mode? (Radius of earth = 6400 km)

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20. How is a wavefront defined? Using Huygen's construction , draw a figure showing the propagation of a plane wave refracting at a plane surface separating two media. Hence verify Snell's law of refraction.

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21. A metallic rod of length l is rotated at a constant angular speed ω, normal to a uniform magnetic field B. Derive an expression for the current induced in the rod, if the resistance of the rod is R.

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22. Draw a circuit diagram of L.E.D. What are its advantages?

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23. An inductor 200 mH, capacitor $500\mu F$, resistor 10 ohm are connected in series with a 100 V, variable frequency a.c. source. Calculate (i) frequency at which power factor of the circuit is unity (ii) current amplitude at this frequency (iii) Q factor.

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24. An air cored solenoid is of length 0.3 m, area of cross section $1.2 \times 10^{-3} m^2$ and has 2500 turns. Around its central section, a coil of 350 turns is wound. The solenoid and the coil are electrically insulated from eachother. Calculate the e.m.f. induced in the coil if the initial current of 3 A in the solenoid is reversed in 0.25 s.

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25. State Gauss's theorem in electrostatics. Apply this theorem to derive an expression for electric field intensity at a point outside a uniformly charged thin spherical shell.

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26. An e-m wave of wavelength λ is incident on a photo sensitive surface of negligible work function. If the photoelectrons emitted from this surface have the de-Broglie wavelength λ_1. Find relation between $'\lambda'$ and $'\lambda_1$'-

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27. The energy level diagram of an element is given below. Identify, by doing necessary calculations , which transition corresponds of the emission of a spectral line of wavelength 102.7 nm.

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28. Draw a plot of the variation of amplitude versus ω for an amplitude modulated wave. Define modulation index. State its importance for effective amplitude modulation.

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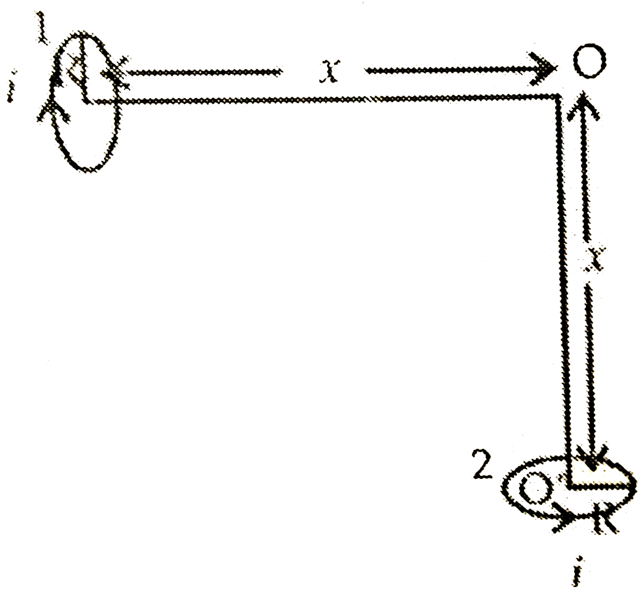
29. (a) Using Biot-Savart's law, derive an expression for the magnetic field at the centre of a circular coil of radius R, number of turns N, carrying current.

(b) Two small identical circular coils marked 1,2 carry equal currents and are placed with their geometric axes perpendicular to each other as shown in the figure. Derive an expression for the resultant magnetic field at O.



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30. Draw a schematic diagram of a cyclotron. Explain its underlying principle and working, stating clearly the function of the electric and magnetic fields applied on a charged particle.

Deduce an expression for the period of revolution and show that it does not depend on the speed of the charged particle.

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31. (a) For a ray of light travelling from a denser medium of refractive index n_1 to a rarer medium of refractive index n_2, prove that $\frac{n_2}{n_1} = \sin i_c$, where i_c is the critical angle of incidence for the media.

(b) Explain with the help of a diagram, how the above principle is used for transmission of video signals using optical fibers.

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32. (a) What is plane polarised light? Two polaroid sare placed at 90° to each other and the transmitted intensity is zero. What happens when one more polaroid is placed between these two, bisecting the angle between them? How will the intensity of transmitted light vary on further rotating the third polaroid?

(b) If a light beam shows no intensity variation when transmitted through a polaroid which is rotated, does it mean that the light is un-polarised? Explain briefly.

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33. (a) Using Gauss's law, derive an expression for the electric field intensity at any point outside a uniformly charged thin spherical shell of radius R and charge density $\sigma C / m^2$. Draw the field lines when the charge density of the sphere is (i) positive, (ii) negative.

(b) A uniformly charged conducting sphere of 2.5

m in diameter has a surface charge density of 100 $\mu C / m^2$. Calculate the

(i) charge on the sphere

(ii) total electric flux passing through the sphere.

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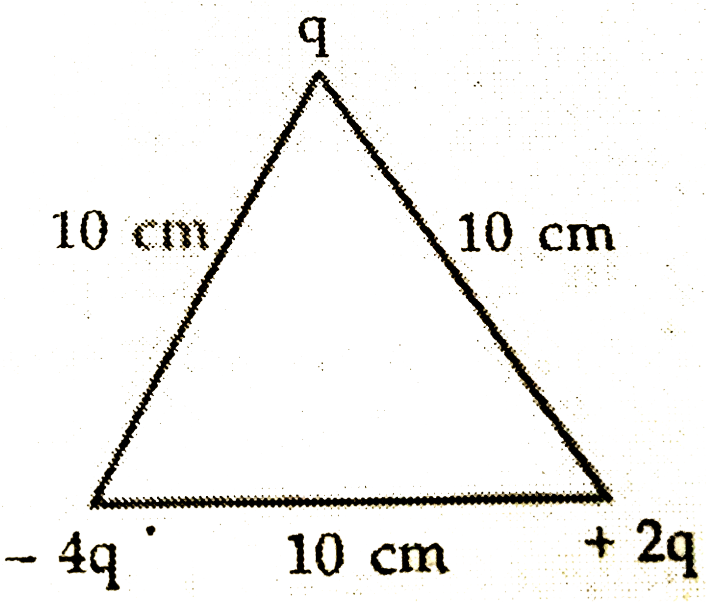
34. (a) Derive an expression for the torque experienced by an electric dipole kept in a uniform electric field.

(b) Calculate the work done to dissociate the system of three charges placed on the vertices of a triangle as shown.

Here $q = 1.6 \times 10^{-10} C$.



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35. State two characteristic properties of nuclear forces.

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36. How does the angle of minimum deviation of a glass prism vary, if the incident violet light is replaced with red light?

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37. The instantaneous current and voltage of an a.c. circuit are given by i=0 sin 3000 t A and v=200 sin 300 t V.

What is the power dissipation in the circuit?

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38. Why should the spring/ suspension wire in a moving coil galvanometer have low torsional constant?

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39. Why does the bluish colour predominate in a clear sky?

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40. Which orientation of an electric dipole in a uniform electric field would correspond to stable equilibrium ?

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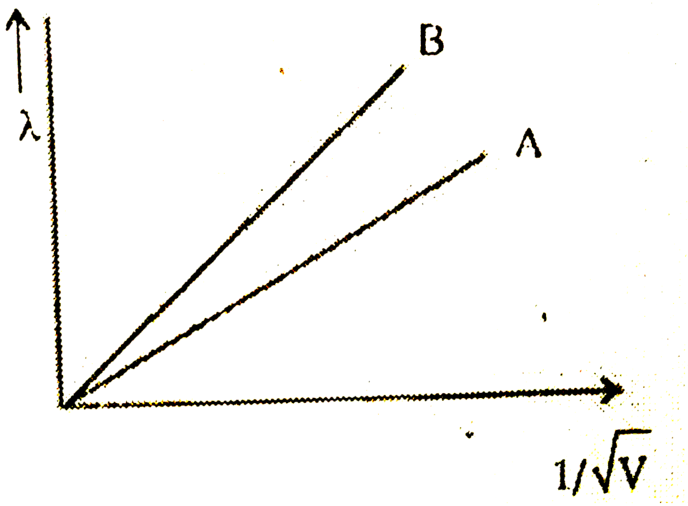
41. Two lines, A and B, in the plot given below show the variation of de-Broglie wavelength, λ versus $1/\sqrt{V}$, where V is the accelerating potential difference, for two particles carrying the same charge. Which one of two represents a particle of smaller mass?



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42. State the reason, why GaAs is most commonly used in making of a solar cell.

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43. Draw a labelled ray diagram of an astronomical telescope in the near point position. Write the expression for its magnifying power.

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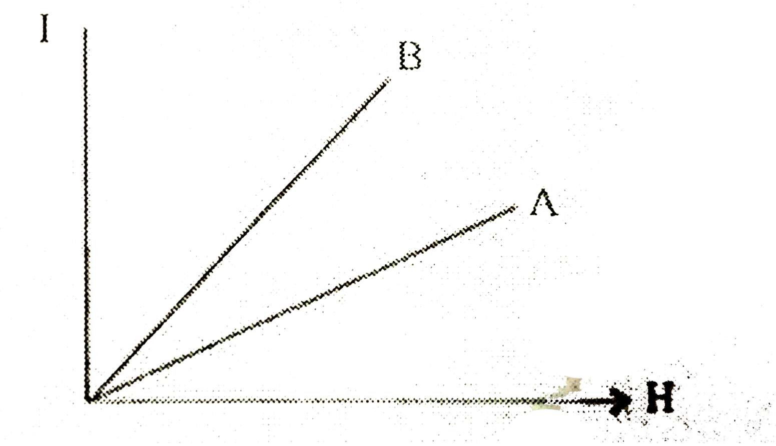
44. The following figure shows the variation of intensity of magnetisation versus the applied magnetic field intensity, H, for two magnetic materials A and B :

(a) Identify the materials A and B.

(b) Why does the material B, have a larger susceptibility than A, for a given field at constant temperature?



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45. Two metallic wires of the same material B, have the same length out cross-sectional area is in the ratio 1:2. They are connected (i) in series and (ii) in parallel. Compare the drift velocities of electrons in the two wires in both the cases (i) and (ii) .

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46. Draw a block diagram of a simple amplitude modulation. Explain briefly how amplitude modulation is achieved.

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47. Calculate the amount of energy released during the α-decay of

$$._{92}^{238}U \rightarrow_{90}^{234} Th + ._{2}^{4} He$$

Given: atomic mass of $._{92}^{238}U = 238.05079u$, atomic mass of $._{90}^{234}Th = 234.04363u$,

atomic mass

$._{2}^{4}He = 4.00260u$, $1u = 931.5MeV/c^2$. Is this decay spontaneous?Give reason.

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48. Using Ampere's circuital law, obtain an expression for the magnetic field along the axis of a current carrying solenoid of length l and having N number of turns.

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49. Derive an expression for the resistivity of a good conductor, in terms of the relaxation time of electrons.

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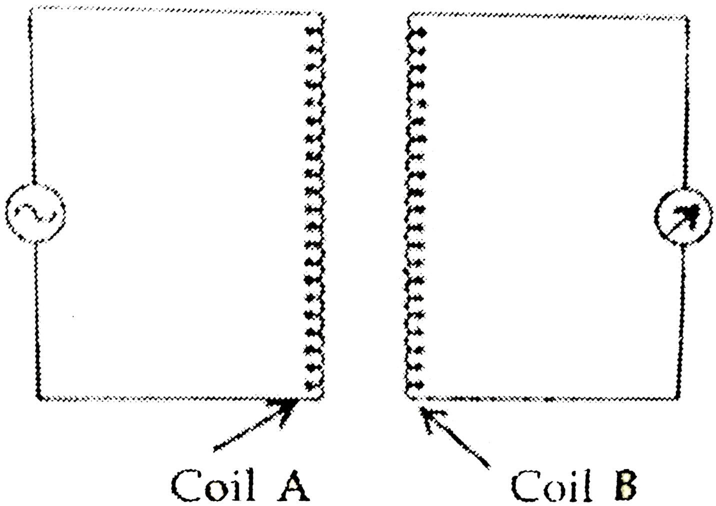
50. The circuit arrangement given below shows that when an a.c. passes through the coil A, the current starts flowing in the coil B.

(i) State the underlying principle involved.

(ii) Mention two factors on which the current produced in the coil B depends.



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51. A parallel beam of light of wavelength 600 nm is incident normally on a slit of width d. If the distance between the slits and the screen is 0.8 m and the distance of 2^{nd} order maximum from the centre of the screen is 15 mm. The width of the slit is

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52. Two point charges, $q_1 = 10 \times 10^{-8} C$ and $q_2 = -2 \times 10 - 8C$ are separated by a distance of 60 cm in air.

(i) Find at what distance from the 1st charge, q_1, would the electric potential be zero.

(ii) Also calculate the electrostatic potential energy of the system.

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53. Two point charges 4Q, Q are separated by 1m in air. At what point on the line joining the charges is the electric field intensity zero ?

Also calculate the electrostatic potential energy of the system of charges, taking the value of charge, $Q = 2 \times 10^{-7} C$.

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54. What does the term LOS communication mean? Name the types of waves that are used for this communication. Which of the two height of tansmitting antenna and height of receiving antenna can effect the range over which this mode of communication remains effective?

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55. A message signal of 12 kHz and peak voltage 20 V is used to modulate a carrier wave of frequency 12 MHz and peak voltage 30 V. Calculate the (i) modulation index (ii) side- band frequencies.

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56. Distinguish between unpolarised and plane polarised light. An unpolarised light is incident on the boundary between two transparent media. State the consition when the reflected wave is totally plane polarised. Find out the expression for the angle of incidence in this case.

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57. Draw the labelled circuit diagram of a common-emitter transistor amplifie : Explain clearly how the input and output signals are in opposite phase.

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58. State briefly the underlying principle of a transistor oscillator. Draw a circuit diagram showing how the feedback is accomplished by inductive coupling. Explain the oscillator action.

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59. The ground state energy of hydrogen atom is -13.6 eV.

(i) What is the kinetic energy of an electron in the 2^{nd} excited state ?

(ii) If the electron jumps to the ground state from the 2^{nd} excited state, calculate the wavelength of the spectral line emitted.

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60. For what kinetic energy of a proton, will the associated de-Broglie wavelength be 16.5 nm?

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61. To increase the current sensitivity of a moving coil galvanometer by 50% its resistance is increased so that the new resistance becomes twice its initial resistance. By what factor does its voltage sensitivity change?

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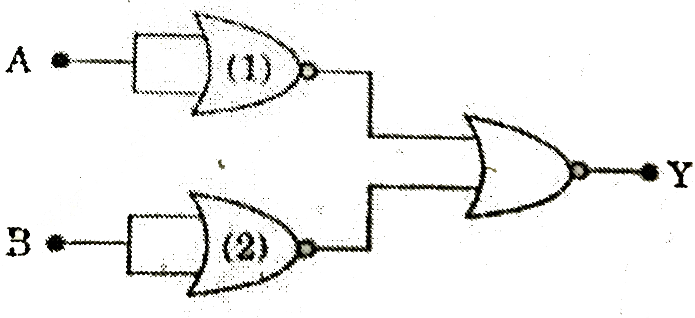
62. The inputs A and B are inverted by using two NOT gates and their outputs are fed to the NOR gate as shown:

Analyse the action of the gates (1) and (2) and identify the logic gate of the complete circuit so obtained. Give its symbol and the truth table.



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63. A $100\mu F$ capacitor in series with a 40Ω resistance is connected to a $100V_1 60Hz$ supply. Calculate (i) the reactance (ii) the impedance and (iii) maximum current in the circuit.

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64. Derive an expression for the energy stored in a parallel plate capacitor.

On charging a parallel plate capacitor to a potential V, the spacing between the plates is halved, and a dielectric medium of $\in_r = 10$ is introduced between the plates, without disconnecting the d.c. source.

Explain, using suitable expressions, how the (i) capacitance, (ii) electric field and (iii) electric field and (iii) energy density of the capacitor change.

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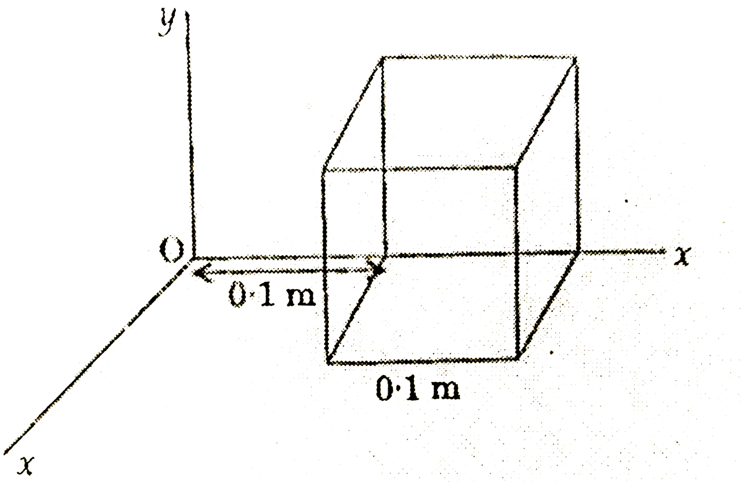
65. (a) Define electric flux. Write its SI units.

(b) The electric field components due to a charge inside the cube of side 0.1 m are as shown :



$E_x = \alpha x$, where $\alpha = 500 N/C - m$

$E_y = 0, E_z = 0.$

Calculate (i) the flux through the cube, and (ii) the charge inside the cube.

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66. Derive the lens formula, $\frac{1}{2} = \frac{1}{v} - \frac{1}{u}$ for a concave lens, using the necessary ray diagram.

Two lenses of powers 10 D and -5 D are placed in contact.

(i) Calculate the power of the new lens.

(ii) Where should an object be held from the lens, so as to obtain a virtual image of magnification 2?

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67. (a) what are coherent sources of light ? Two slits in Young's double slit experiments are illuminated by two different sodium lamps emitting light of the same wavelength. Why is no interference pattern observed?

(b) Obtain the condition for getting dark and bright fringes in Young's experiment. Hence write the expression for the fringe width.

(c) If s is the size of the source and its distance from the plane of the two slits, what should be the criterion for the interference fringes to be seen ?

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68. An a.c. source generating a voltage $v = v + (m)\sin \omega t$ is connected to a capacitor of capacitor of capacitance C. Find the expression for the current, I, flowing through it. Plot a graph of v and I versus ω t to show that the current is $\pi/2$ ahead of the voltage.

A resistor of 200Ω and a capacitor of $15.0\mu F$ are connected in series to a 220 V, 50 Hz a.c. source. Calculate the current in the circuit and the rms voltage across the resistor and the capacitor. Is the algebraic sum of these voltages more than the source voltages ? If yes, resolve the paradox.

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69. Explain briefly, with the help of a labelled diagram, the basic principle of working of an a.c. generator. In an a.c. generator, coil of N turns and area A is rotated at υ revolutions per second in a uniform magnetic field B. Write the expression for the emf produced.

A 100-turn coil of area $0.1 m^2$ rotates at half a revolution per second. It is placed in a magnetic field 0.01 T perpendicular to the axis of rotation of the coil. Calculate the maximum voltage generated in the coil.

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SET I

1. SKY WAVE OR IONOSPHERIC PROPAGATION

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2. write the following radiations in ascending order in respect of their frequencies: X-rays, microwaves, UV rays and radio waves.

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3. Magnetic field lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why?

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4. Your are given following three lense. Which two lenses will you use as an eyepiece and as an objective to construct as astronomical telescope ?

Lenses	Power (P)	Aperture (A)
L1	3D	8 cm
L2	6D	1 cm
L3	10D	1 cm

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5. If the angle between the pass axis of polariser and analyser is 45°, write the ratio of intensities of original light and the transmitted light after passing through analyser.

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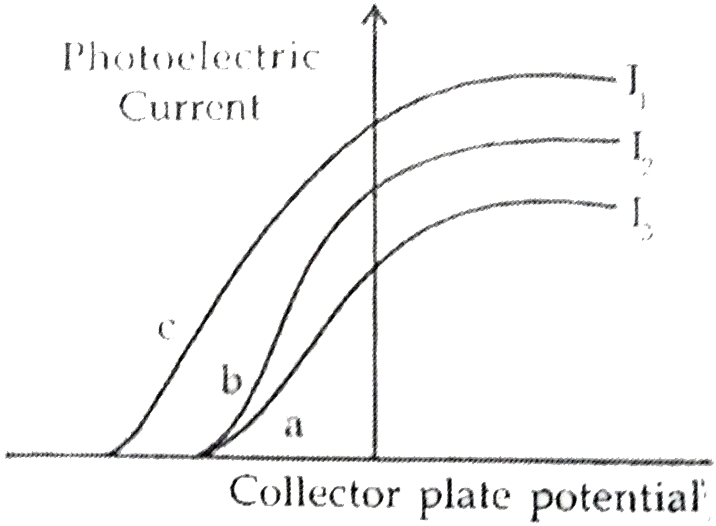
6. The figure shows a plot of three curves a, b, c, showing variation of photocurrent vs collector plate potential for three different intensities I_1, I_2 and I_3 having frequencies v_1, v_2 and v_3 respectively incident on a photosensitive surface.

Point out the two curves for which the incident radioations have same frequency but different intensities.



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7. what type of wavefront will emerge from (i) a point source and (ii) distant light source ?

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8. Two nuclei have mass number in the ratio 1:2. What is the ratio of their nuclear densities?

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9. A cell of e.m.f. 'E' and internal resistance 'r' is connected across a variable resistor 'R'. Plot a graph showing the variation of terminal potential 'V' with resistance R.

Predict from the graph the condition under which

'V' becomes equal of 'E'

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10. (i) Can two equaipotential surfaces intersect each other ? Give reasons

(ii) Two charges $-q$ and $+q$ are located at point A (0, 0 -a) and B(0, 0, +a) respectively. How much work is done in moving a test charge from point $P(7, 0, 0)$ to $Q(-3, 0, 0)$?

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11. By what percentage will the transmission range of a T.V. tower be affected when the height of the tower is increased by 21% ?

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12. Derive the expression for drift velocity of free electron in terms of relaxation time and electric field applied across a conductor.

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13. An infinite number of charges, each of coulomb, are placed along x-axis at $x = 1m, 3m, 9m$ and so on. Calculate the electric field at the point x = 0 due to these charges if all the charges are of the same sign.

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14. A sphere S_1 of radius r_1 encloses a total charge Q. If there is another concentric sphere S_2 of radius $r_2(> r_1)$ and there be no additional charges between S_1 and S_2 find the ratio of electric flux through S_1 and S_2,

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15. ATV tower has a height of 150m. By how much the height of tower be increased to double its coverage range ?

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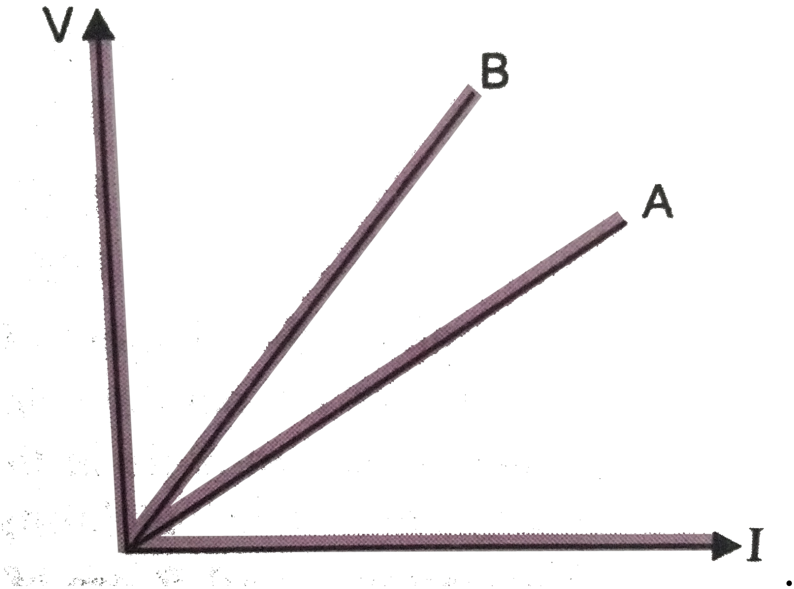
16. The $V - I$ graphs of parallel and series combinations of two metallic resistors are shown in (Fig. 3.53). Which graph represents the parallel

combinations ?



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17. Why are high frequency carrier waves used for transmission ?

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18. What is meant by term 'modulation' ? Draw a block diagram of a simple modulator for obtaining an AM signal.

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19. A radioactive nucleus undergoes a series of deacy according to the scheme.

$$A \xrightarrow{\alpha} A_1 \xrightarrow{\beta^-} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4$$

If the mass number and atomic number of A are 180 and 172 respectively, what are these numbers for A_4.

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20. A thin spherical shell of radius R has charge Q spread uniformly over its surface. Which of the following graphs most closely represents the electric field E(r) produced by the shell in the range $0 \leq r < \infty$, where r is the distance from the centre of the shell?

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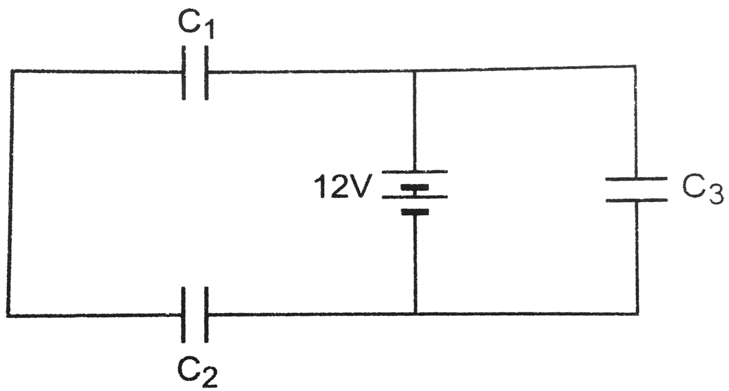
21. Three identical capacitors C_1, C_2 and C_3 of capacitance $6\mu F$ each are connected to a $12V$ battery as shown in Fig. Find

(i) charge on each capcitor

(ii) equivalent capacitance of the network.

(iii) energy stored in the network of capacitors.



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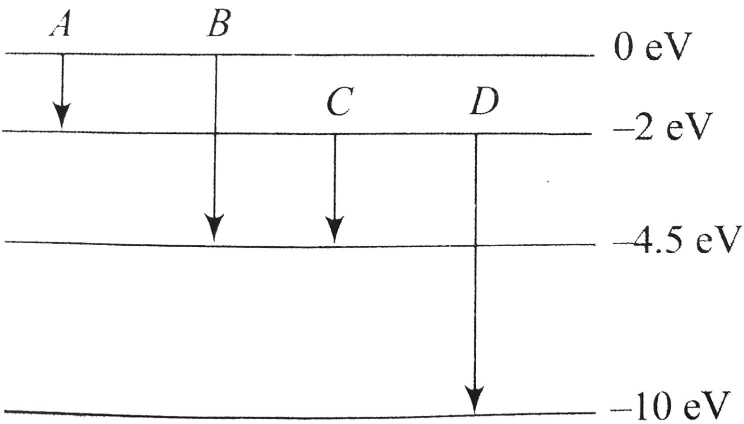
22. The energy levels of an atom are as shown in figure . Which one of those transition will result in the emission of a photon of wavelength $275nm$?



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23. A proton and alpha particle are accelerated through the same accelerating potential. Which one of the two has (a) greater value of de-broglie wavelength associated with it, and (b) less kinetic energy? justify your answer.

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24. In a singleslit diffraction experiment, when a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why ? State two points of difference the interference pattern obtained in Young's double slit experiment and the diffraction pattern due to a single slit.

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25. (a) Define self inductance. Write its S.I. units

(b) Derive and expression for self inductance of a long solenoid of length l cross-sectional area A having N number of turns.

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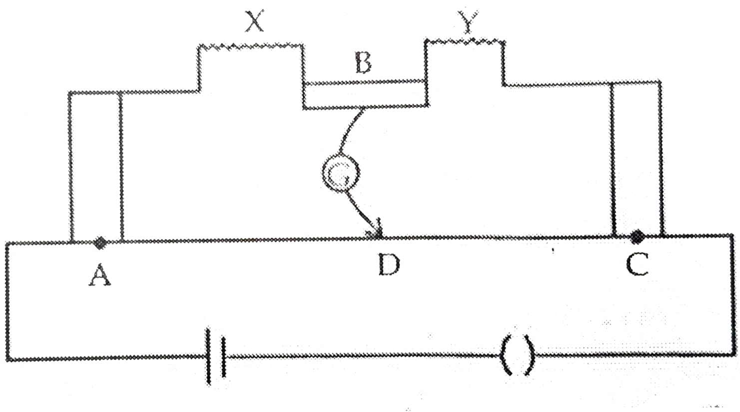
26. The figure shows experimental set up of a meter bridge. When the two unknown resistances X and Y are inserted, the null point D is obtained 40 cm from the end A. When a resistance of 10Ω is connected in series with X, the null point shifts by 10 cm. Find the position of the null point when the 10Ω resistance is instead connected in series with resistance 'Y'. Determine the value of the resistance X and Y



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27. Derive the expression for force per unit length between two long straight parallel current carrying conductors. Hence define one ampere.

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28. Explain the principle and working of a cyclotron with the help of a schematic diagram. Write the expression for cyclotron frequency.

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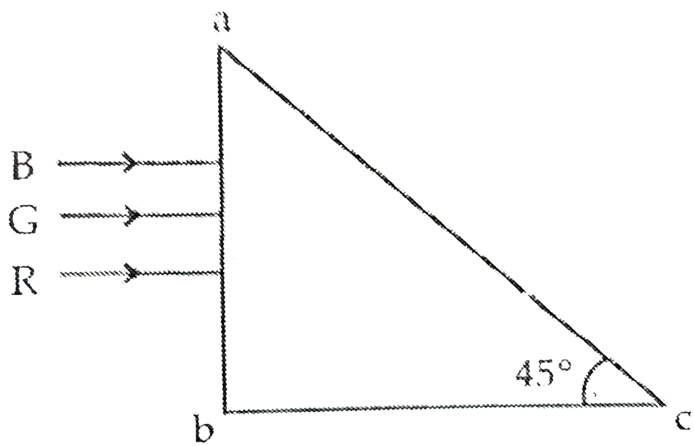
29. Three light rays red (R), green (G) and blue (B) are incident on a right angled prism 'abc' at face 'ab'. The refractive indices of the material of the prism for red, green and blue wavelengths are 1.39 , 1.44 and 1.47 respectively. Out of the time three which colour ray will emerge out of face 'ac' ? Justify your answer. Trace the path of these rays after passing through face 'ab'



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30. (a) Deriver and expression for the average power consumed in a series LCR circuit connected to a.c., source in which the phase different between the voltage and the current in the circuit is ϕ.

(b) Define the quality factor in an a.c. circuit. Why should the quality factor have high value in receiving circuits ? Name the factors on which it depends.

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31. (a) Derive the relationship between the peak and the rms value of current in an a.c. circuit.

(b) Describe briefly, with the help of a labelled diagram, working of a step-up transformer.

A step-up transformer converts a low voltage into high voltage. Does it not violate the principal of conservation of energy? Explain.

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32. (i) Draw a circuit diagram to study the input and output characteristics of an n-p transistor in its common emitter configuration. Draw the typical input and output characteristics.

(ii) Explain, with the hepl of a circuit diagram, the working of n-p transistor as a common emitter amplifier.

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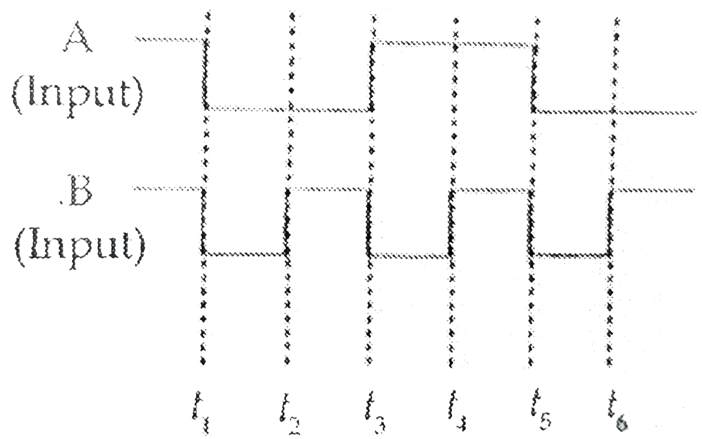
33. The given input A, B are fed to a 2-input NAND gate. Draw the output wave form of the gate



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34. Trace the ays of light showing the formation of an image due to a point object placed on the axis of a spherical surface separating the two media of refractive indices n_1 and n_2. Establish the relation between the distance of the object, the image and the radius of curvature from the central point of the spherical surface.

Hence derive the expression of the lends maker's formula

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35. Draw the labelled ray diagram for the formation of image by a compound microscope. Derive the expression for the total magnification of a compound microscope. Explain why both the objective and the eyepiece of a compound microscope must have short focal lengths.

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36. When electrons drift in a metal from lower to higher potential, does it mean that all the free electrons of the metal are moving in the same direction ?

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37. At a place, the horizontal component of earth's magnetic field is B and angle of dip is 60°. What is the value of horizontal component of earth's magnetic field at equator?

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38. Show on a graph, the variation of resistivity with temperature for a typical semiconductor.

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39. Why should electrostatic field be zero inside a conductor ?

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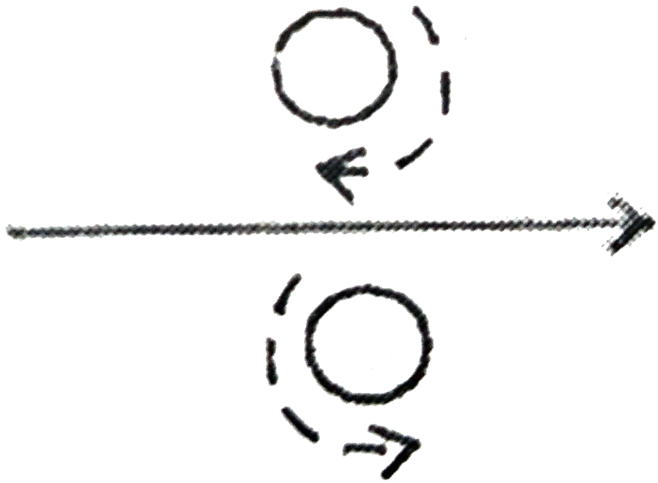
40. Name the physical quantity which remains same for microwaves of wavelength 1 mm and UV radiations of 1600 Å in vaccum.

Watch Video Solution

41. Under what condition does a biconvex lens of glass having a certain refractive index act as a plane glass sheet when immersed in a liquid ?

Watch Video Solution

42. Predict the directions of induced currents in metal rings 1 and 2 lying in the same plane where current I in the wire is increasing steadily.



Watch Video Solution

43. State de-Broglie hypothesis.

Watch Video Solution

44. A ray of light incident on an equilateral triangular glass prism of $\mu = \sqrt{3}$ moves parallel to the base of the prism inside it. What is the angle of incidence for this ray ?

Watch Video Solution

45. Distinguish between 'Analog and Digital signals'.

View Text Solution

46. Mention the function of any two of the following used in communication system :

(i) Transducer

(ii) Repeater

(iii) Transmitter

(iv) Bandpass Filter [Any two]

View Text Solution

47. A cell of emf E and internal resistance r is connected to two external resistance R_1 and R_2 and a perfect ammeter. The current in the circuit is measured in four different situations :

(i) without any external resistance in the circuit

(ii) with resistance R_1 only

(iii) with R_1 and R_2 in series combination

(iv) with R_1 and R_2 in parallel combination

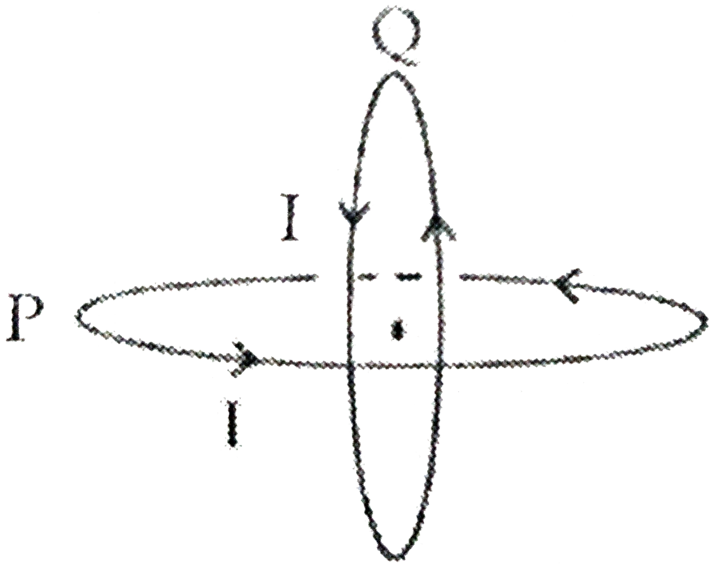
The currents measured in the four cases are 0.42A, 1.05 A, 1.4 A and 4.2 A, but not necessarily in that order. Identify the currents corresponding to the four cases mentioned above.

Watch Video Solution

48. The susceptibility of a magnetic material is -2.6×10^{-5}. Identify the type of magnetic material and state its two properties.

Watch Video Solution

49. Two identical circular wires P and Q each of radius R and carrying current 'I' are kept in perpendicular planes such that they have a common centre as shown in the figure. Find the magnitude and direction of the net magnetic field at the common centre of the two coils.



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50. When an ideal capacitor is charged by a dc battery, no current flows. However, when an ac source is used, the current flows continuously. How does one explain this, based on the concept of displacement current ?

Watch Video Solution

51. Draw a plot showing the variation of (i) electric field (E) and (ii) electric potential (V) with distance r due to a point charge Q.

View Text Solution

52. Calculate the force per unit length on a long straight wire carrying current $4A$ due to parallel wire carrying current $6A$ current. Distance

between the wires $= 3cm.$

Watch Video Solution

53. The current in the forward bias is known to be

more (in mA)

than the current in the reverse bias (in μA). What

is the reason then to operate

the photodiodes in reverse bias?

Watch Video Solution

54. A metallic rod of 'L' length is rotated with angular frequency of 'w' with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius L, about an axis passing through the centre and perpendicular to the plane of the ring. A constant and uniform magnetic field B parallel to the axis is present everywhere. Deduce the expression for the emf between the centre and the metallic ring.

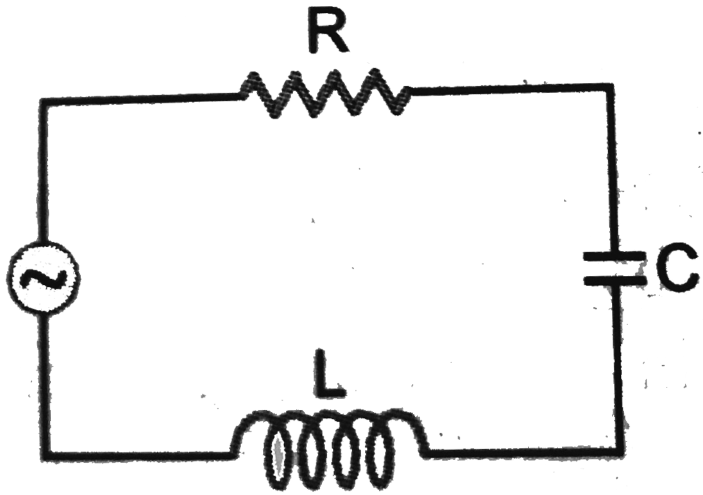
Watch Video Solution

55. Fig. shows series LCR circuit with $L = 5.0H, C = 80\mu F, R = 40\Omega$ connected to a variable frequency 240 V source. Calculate

(i) the angular frequency of the source which drives the circuit at resonance.

(ii) Current at the resonating frequency.

(iii) the rms pot. drop across the capacitor at resonance.



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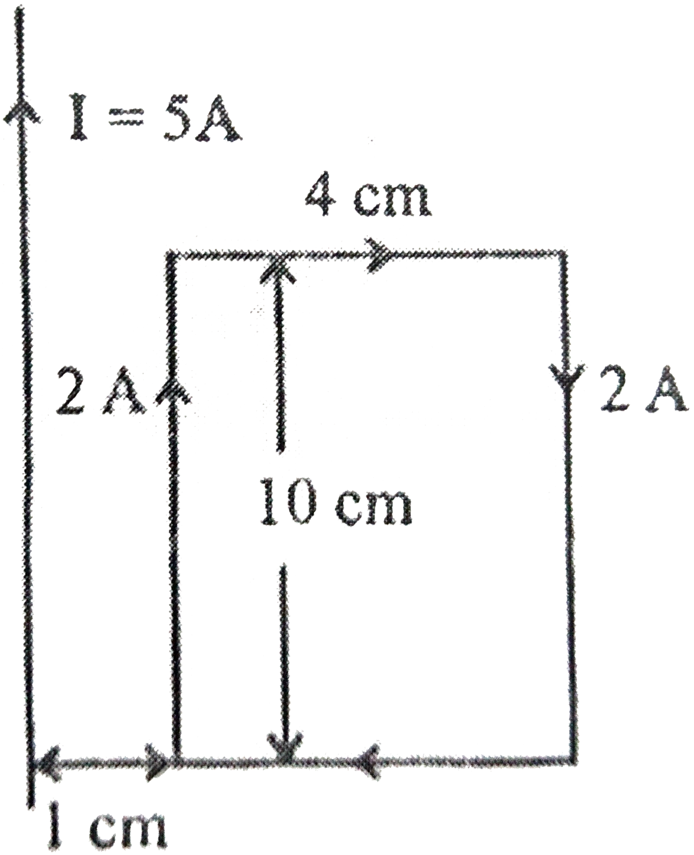
56. A rectangular loop of wire of size $4cm \times 10cm$ carries a steady current of 2A. A straight long wire carrying 5 A current is kept near the loop as shown. If the loop and the wire are coplanar, find

(i) the torque acting on the loop and

(ii) the magnitude and direction of the force on the loop due to the current carrying wire.



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57. (a) Using Bohr's second postulate of quantization of orbital angular momentum show that the circumference of the electron in the n^{th} orbital state in hydrogen atom is n times the de-Broglie wavelength associated with it.

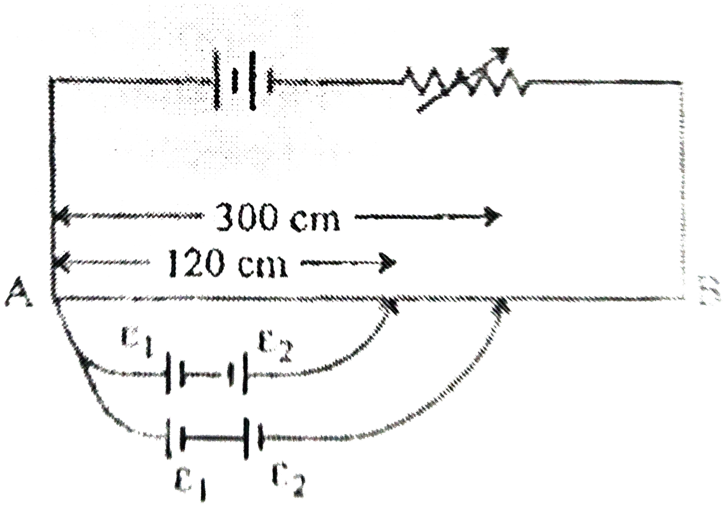
(b) The electron in hydrogen atom is initially in the third excited state. What is the maximum number of spectral lines which can be emitted which it finally moves to the ground state ?

Watch Video Solution

58. In the figure a long uniform potentiometer wire AB is having a constant potential gradient along its length. The null points for the two primary cells of emfs ε_1 and ε_2 connected in the manner shown are obtained at a distance of 120 cm and 300 cm from the end A. Find (i) $\varepsilon_1 / \varepsilon_2$ and (ii) position of null point for the cell ε_1.

How is the sensitivity of a potentiometer increased

?



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59. Using Kirchoff's rules determine the value of unknown resistance R in the circuit so that no current flows through 4Ω resistance. Also find the potential difference between A and D.

Watch Video Solution

60. (i) What characteristic property of nuclear force explains the constancy of binding energy per nucleon (BE/A) in the range of mass number 'A' lying $30 < A < 170$?

(ii) Show that the density of nucleus over a wide range of nuclei is constant-independent of mass number A.

Watch Video Solution

61. Write any two factors which justify the need for modulating a signal. Draw a diagram showing an amplitude modulated wave by superposing a modulating signal over a sinusoidal carrier wave.

View Text Solution

62. Write Einstein's photoelectric equation. State clearly how this equation is obtained using the photon picture of electro-magnetic radiation.

Write the three salient features observed in photoelectric effect which can be explained using this equation.

View Text Solution

63. (a) Why are coherent sources necessary to produce a sustained interference pattern ?

(b) In Young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. Find out the intensity of light at a point where path difference is $\lambda/3$.

Watch Video Solution

64. Use Huygens's principle to explain the formation of diffraction pattern due to a single slit illuminated by a monochromatic source of light.

When the width of the slit is made double the original width, how would this affect the size and intensity of the central diffraction band ?

View Text Solution

65. Explain the principle of a device that can build up high voltages of the order of a few million volts.

Draw a schematic diagram and explain the working of this device.

Is there any restriction on the upper limit of the high voltages set up in this machine ? Explain.

View Text Solution

66. (a) Define electric flux. Write its S.I. units.

(b) Using Gauss's law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it.

(c) How is the field directed if (i) the sheet is positively charged, (ii) negatively charged ?

View Text Solution

67. Define magnifying power of a telescope. Write its expression.

A small telescope has an objective lens of focal length 150 cm and an eye piece of focal length 5 cm. If this telescope is used to view a 100 m high tower 3 cm away, find the height of the final image when it is formed 25 cm away from the eye piece.

Watch Video Solution

68. A ray of light passing through an equilateral triangular glass prism from air undergoes minimum deviation when angle of incidence is $3/4$

th of the angle of prism. Calculate the speed of light in the prism.

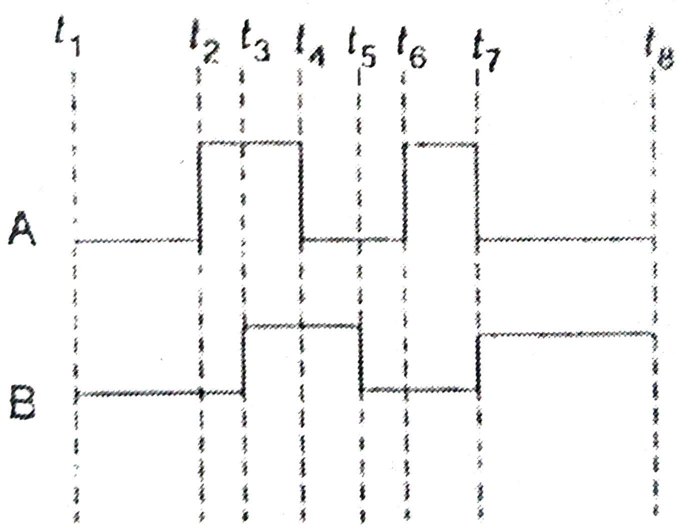
Watch Video Solution

69. Draw a simple circuit of a CE transistor amplifier. Explain its working. Show that the voltage gain, A_v, of the amplifier is given by $A_v = -\frac{\beta_{ac} R_I}{r_i}$, where β_{ac} is the current gain, R_L is the load resistance and r_i is the input resistance of the transistor. What is the significance of the negative sign in the expression of the voltage gain ?

View Text Solution

70. (a) Draw the circuit diagram of a full wave rectifier using p-n junction diole. Explain its working and show the output, input waveforms.

(b) Show the output waveforms (Y) for the following inputs A and B of (i) OR gate (ii) NAND gate :



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SET II

1. Name the part of the electromagnetic spectrum of wavelength $10^{-2}m$ and mention its one application.

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2. What is ground wave propagation ?

Watch Video Solution

3. Unpolarized light is incident on a plane surface of glass of refractive index μ at angle i. If the reflected light gets totally polarized, write the relation between the angle i and refractive index μ.

Watch Video Solution

4. Draw a diagram to show refraction of a plane wave front incident in a convex lens and hence draw the refracted wave front

Watch Video Solution

Watch Video Solution

5. Two nuclei have their mass numbers in the ratio of $1:3$. The ratio of their nuclear densities would be

Watch Video Solution

6. The output of a 2-input AND gate is fed to a NOT gate. Give the name of the combination and its logic symbol. Write down its truth table.

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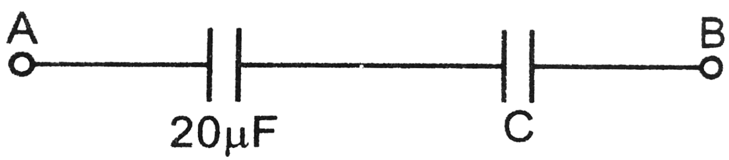
7. The equivalent capacitance of the combination between A and B in the given Fig. is $4\mu F$

(i) Calculate capacitance of capacitor C.

(ii) Calculate charge on each capacitor if a $12V$

(iii) What will be the potential drop across each capacitor ?



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8. State Gauss's law in electrostatics. Using this law derive an expression for the electric field due to a uniformly charged infinite plane sheet.

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9. An electron and a proton are accelerated through the same potential. Which one of the two has (i)b greater value of de-Broglie wavelength associated with it and (ii) less momentum?justify your answer.

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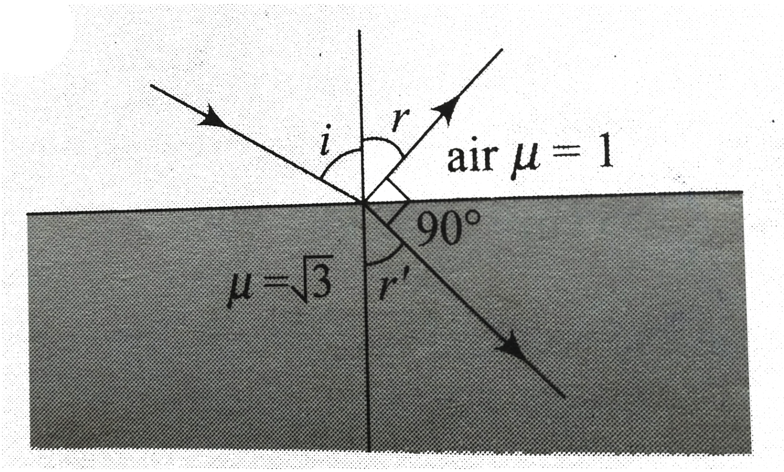
SET III

1. A ray of light is incident on a transparent glass slab of refractive index $\sqrt{3}$. If the reflected and refracted rays are mutually perpendicular, what is the angle of incidence?



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2. What do you understand by space wave propagation? Why is it known as line of sight propagation? Explain selective fading?

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3. Name the part of electromagnetic spectrum which is suitable for

(i) radar system used in aircraft navigation

(ii) treatment of cancer tumours.

View Text Solution

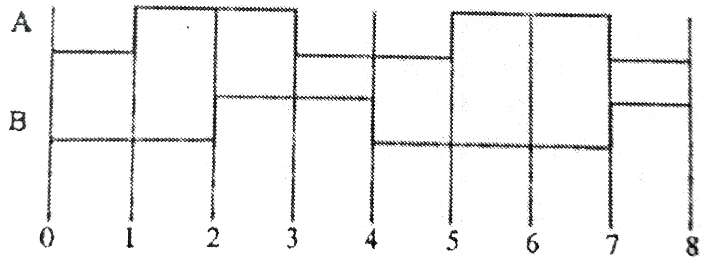
4. Two nuclei have mass numbers in the ratio 2:5. What is the ratio of their nuclear densities?

Watch Video Solution

5. Differential between a ray and a wavefront.

Watch Video Solution

6. (i) Sketch the output waveform from an AND gate for the inputs A and B shown in the figure.



(ii) If the output of the above AND gate is fed to a NOT gate, name the gate of the combination so formed.

View Text Solution

7. (i) Can two equpotential surfaces intersect each other ? Give reason.

(ii) Two charges $+q$ and $-q$ are located at points A $(0, 0, -2)$ and $B(0, 0, 2)$ respectively. How much work will be done in moving a test charge from point P$(4, 0, 0)$ to $(-5, 0, 0)$?

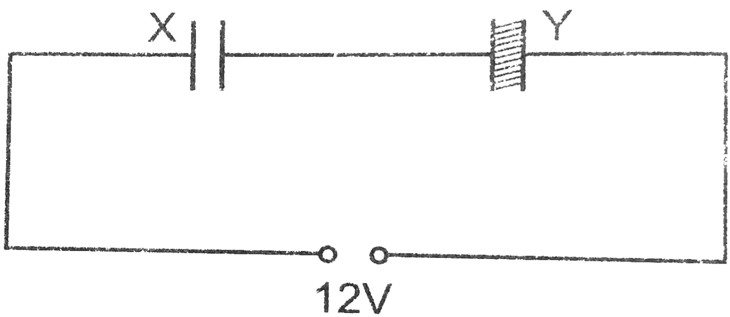
Watch Video Solution

8. State Gauss's law in electrostatics. Use this law to derive an expression for the electric field due to an infinitely long straight wire of linear charge density λcm^{-1}

Watch Video Solution

9. Two parallel palate capacitors X and Y have the same area of plates and same separation between then. X has air between the plates and Y contains a dielectric medium of $\in_r = 4$,

Calculate (i) capacitance of X and Y if equivalent capacitance fo combination is $4\mu F$. (ii) pot diff between the plates of X and Y. (iii) What is the ratio of electrostatic energy stored in X and Y ?



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SET-I

1. Electric potential at any point in equatorial plane of a dipole is ....

Watch Video Solution

2. Name the electromagnetic waves used for studying crystal structure of solids. What is its frequency range?

Watch Video Solution

3. An electron does not suffer any deflection while passing through a region of uniform magnetic field. What is the direction of the magnetic field ?

Watch Video Solution

4. How would the angular separation of interference fringes in Young's double slit experiment change when the distance of separation between slits and screen is doubled ?

Watch Video Solution

5. Two thin lenses of power $+6D$ and $-2D$ are in contact. What is the focal length of the combination ?

Watch Video Solution

6. The stopping potential in an experiment on a photo electric effect is 1.5 V. What is the maximum kinetic energy of the photoelectrons emitted?

Watch Video Solution

7. Two nuclei have mass number in the ratio 1:8. What is the ratio of their nuclear radii?

Watch Video Solution

8. Give the logic symbol of NOR gate.

Watch Video Solution

9. Draw 3 equipotential surfaces corresponding to a field that uniformly increases in magnitude but remains constant along positive Z-direction. How are these surfaces different from that of a constant electric field along Z-direction ?

Watch Video Solution

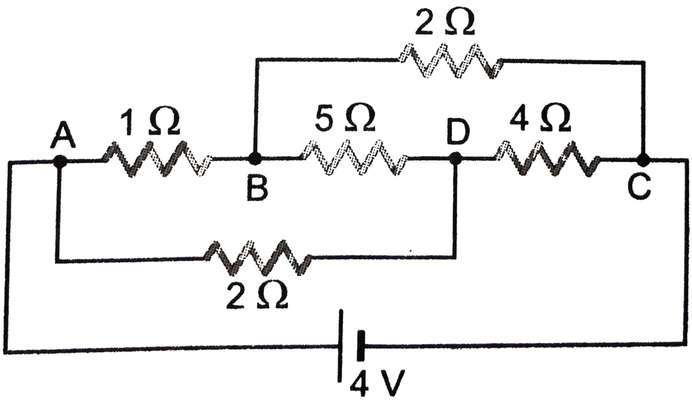
10. Define electric flux. Write its SI unit. A charge q is enclosed by a spherical surface of radius R. If the radius is reduced to half, how would the electric flux through the surface change ?

Watch Video Solution

11. Define refractive index of a transparent medium. A ray of light passes through a triangular prism. Plot a graph showing the variation of angle of deviation with the angle of incidence.

Watch Video Solution

12. Calculate the current the current drawn from the battery by the network of resistors shown in figure.



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13. Answer the following questions :

(a) Optical and radio telescopes are built on the ground while X-ray astronomy is possible only from satellites orbiting the Earth. Why ?

(b) The small ozone layer on top of the stratosphere is crucial for human survival. Why ?

View Text Solution

14. How does the resistivity of a consuctor depend upon temperature electrical consuctivity ?

Watch Video Solution

15. Define the term 'linearly polarised light'.

When does the intensity of transmitted light become maximum, when a polaroid sheet is rotated between two crossed polaroids ?

Watch Video Solution

16. A wire of 15Ω resistance is gradually stretched to double in original length. it is then cut into two equal parts .These parts are then connected in parallel across a 3.0 volt battery. Find the current draw from the battery .

Watch Video Solution

17. (a) The mass of a nucleus in its ground state is always less than total mass of its constituents - neutrons and protons. Explain.

(b) Plot a graph showing the variation of potential energy of a pair of nucleons as a function of their separation.

View Text Solution

18. Write the function of (i) Transducer and (ii) Repeater in the context of communication system.

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19. Write two factors justifying the need of modulation for transmission of a signal.

View Text Solution

20. A positive point charge (+q) is kept in the vicinity of an uncharged conducting plate. Sketch electric field lines originating from the point on to the surface of the plate.

Derive the expression for the electric field at the surface of a charged conductor.

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21. A parallel plate capacitor is charged by a battery. After some time the battery is disconnected and a dielectric slab of dielectric constant K is inserted between the plates. How would (i) the capacitance, (ii) the electric field between the plates and (iii) the energy stored in the capacitor, be affected ? Justify your answer.

Watch Video Solution

22. (i) State the principle of working of a meter bridge.

(ii) In a meter bridge balance point is found at a distance I_1 with resistances R and S as shown in the figure. When an unknown resistance X is connected in parallel with the resistance S, the balance point shifts to a distance I_2. Find the expression for X in terms of l_1, l_2 and S.

View Text Solution

23. (i) State Faraday's law of electromagnetic induction.

(ii) A jet plane is travelling towards west at a speed of 1800 km/h. What is the voltage difference developed between the ends of the wing having a span of 25 m, if the Earth's magnetic field at the location has a magnitude of $5 \times 10^{-4} T$ and the dip angle is 30° ?

Watch Video Solution

24. Laser light of wavelength $630 nm$ incident on a pair of slits produces an interference pattern where bright fringes are separated by $8.1 mm$. Another light produces the interference pattern, where the bright fringes are separated by $7.2mm$.

Calculate the wavelength of second light.

Watch Video Solution

25. Draw a schematic arrangement of the Geiger Marsden experiment. How did the scattering of α particles by a thin foil of gold provide an important way to determine an upper limit on the size of nucleus? Explain briefly.

Watch Video Solution

26. Distinguish between sky wave and space wave propagation. Give a brief description with the help of suitable diagrams indicating how these waves are propagated.

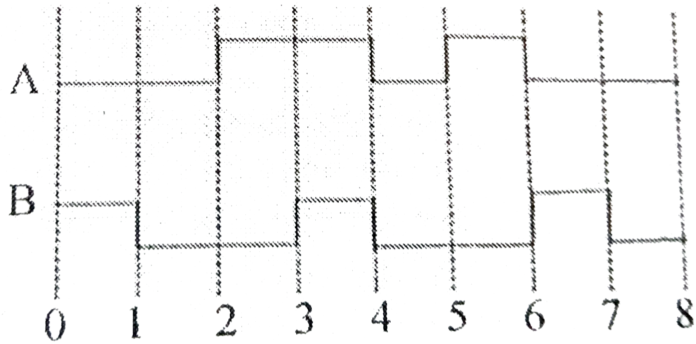
View Text Solution

27. Draw the output wave from (Y) of the

(i) OR gate

(ii) NOR gate

(iii) AND gate ltbtgt (iv) NAND gate



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28. Draw a plot showing the variation of binding energy per nucleon versus the mass number A. Explain with the help of this plot the release of energy in the processes of nuclear fission and fusion.

View Text Solution

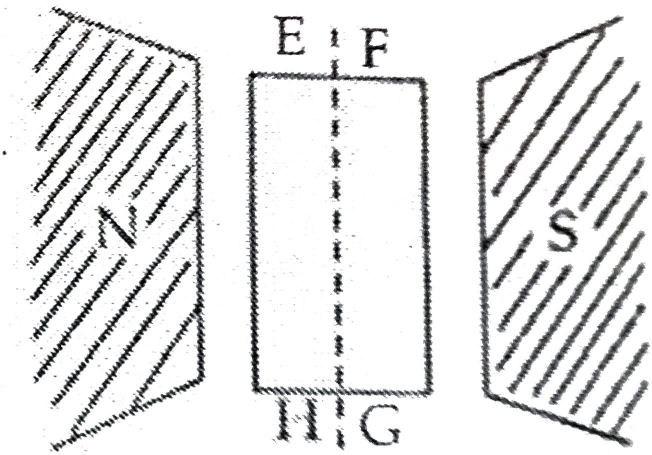
29. (a) Two straight long parallel conductors carry currents I_1 and I_2 in the same direction. Deduce the expression for the firce per unit length between them.

Depict the pattern of magnetic field lines around them.

(b) A rectangular current carrying loop EFGH is kept in a uniform magnetic field as shown in the figure.

(i) What is the direction of the magnetic moment of the current loop ?

(ii) What is the torque acting on the loop (A) maximum, (B) zero ?



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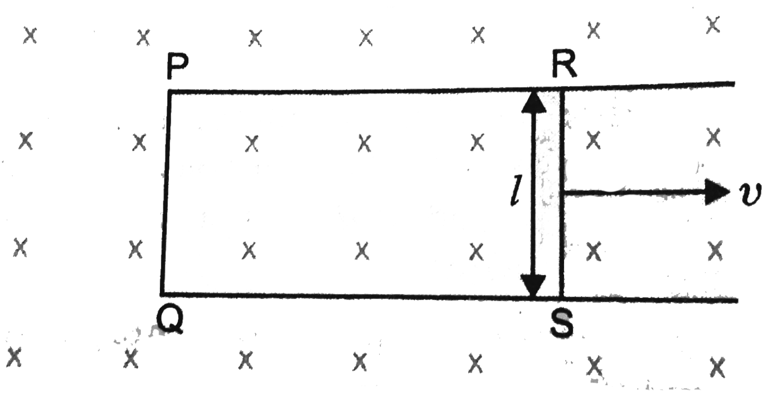
30. Fig. shows a rectangular conducting loop PQSR in which arm RS of length l is movalbe. The loop is kept in a uniform magnetic field B directed downwards perpendicular to the plane of the loop. The arem RS is moved with a uniform speed v. Deduce an expression for

(i) the emf induced across the are RS.

(ii) the external force required to move the arm, and

(iii) the power dissipated as heat.



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31. (a) State Lanz's law. Give one example to illustrate this law. "The Lenz's law is a consequence of the principle of conservation of energy." Justify this statement.

(b) Deduce a expression for the mutual inductance of two long coaxial solenoids but having different radii and different number of turns.

View Text Solution

32. (a) (i) Draw a labelled ray diagram to show the formation of image in an astronomical telescope for a distant object.

(ii) Write three distinct advantages of a reflecting type telescope over a refracting type telescope.

(b) A convex lens of focal length 10 cm is placed coaxially 5 cm away from a concave lens of focal length 10 cm. If an object is placed 30 cm in front of the convex lens, find the position of the image formed by the combined system.

Watch Video Solution

33. (a) With the help of a suitable ray diagram, derive the mirror formula for a concave mirror.

View Text Solution

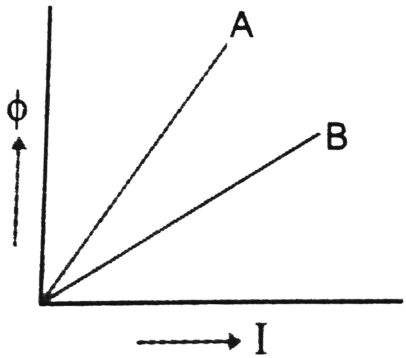
34. In which orientation, a dipole placed, in a uniform field is in (i) stable (ii) unstable equilibrioum?

Watch Video Solution

35. Which part of electromagnetic spectrum has largest penterating power.

Watch Video Solution

36. A plot of magnetic flux (ϕ) versus current (I) is shown for two inductors A and B. Which of the two has larger value of self inductance ?



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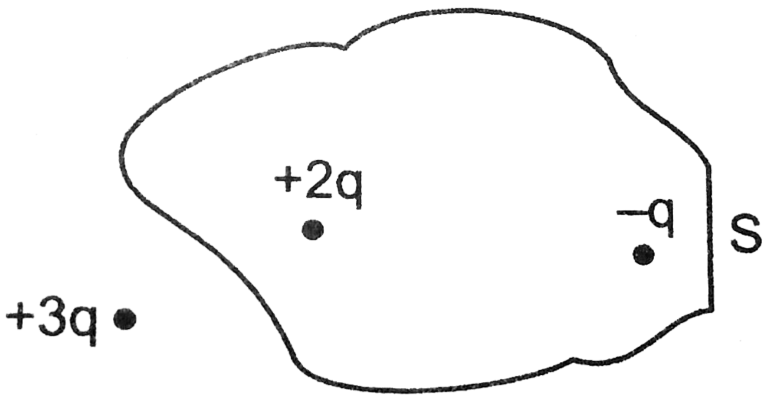
37. Fig shows three point charges $+2q, -q$ and $+3q$, What is the electric flux due to this configuration through the surface S ?



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38. A glass lens of refractive index 1.45 when immersed in a transparent liquid becomes invisible. Under what condition does it happen ?

Watch Video Solution

39. What is the ratio of radii of orbits corresponding to first excited state and ground state in hydrogen atom?

Watch Video Solution

40. A wire of resistance 8R is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?

Watch Video Solution

41. Conditions Of Total Internal Reflection

Watch Video Solution

42. What is the function of repeater in a communication system?

Watch Video Solution

43. (i) Write two characteristics of a material used for making permanaent magnets.

(ii) Why is core of an electromagnet made of ferromagnetic materials ?

View Text Solution

44. Draw magnetic field lines when (a) (i) diamagnetic ,(ii) paramagnetic substance is placed in an external magnetic field. Which magnetic property distinguishes this behaviour of the field lines due to the two substances ?

View Text Solution

45. Draw the circuit diagram of an illuminated photodiode in reverse bias? How is photodiode used to measure light intensity?

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46. An electric lamp having coil of negligible inductance connected in series with a capacitor and an a.c. source is glowing with certain brightness, Fig. How does the brightness of the lamp change on reducing (i) capacitance (ii) frequency

Watch Video Solution

47. Arrange the following electro-magnetic radiations in ascending order of their frequencies :

(i) Microwave

(ii) Radiowave

(iii) X-rays

(iv) Gamma rays.

Write two uses of any one of these.

Watch Video Solution

48. The radius of curvature of the faces of a double convex lens are $10cm$ and $15cm$. If focal length of lens of lens is $12cm$, find the refractive index of the material of the lens.

Watch Video Solution

49. An electron is accelerated through a potential difference of 100 volts. What is the de-Broglie wavelength associated with it ? To which part of the electromagnetic does this value of wavelength correspond ?

Watch Video Solution

50. A heavy nucleus X of mass number 240 and binding energy per nucleon $7.6 MeV$ is split into two fragments Y and Z of mass numbers 110 and 130. The binding energy of nucleons in Y and Z is $8.5 MeV$ per nucleon. Calculate the energy Q released per fission in MeV.

Watch Video Solution

51. (a) The blusih colour predominates in clear sky .

(b) Voilet colour is seen at the bottom of the spectrum when white light is dispersed by a prism.

State resons to explain these observations.

View Text Solution

52. Plot a graph showing the variation of stopping potential with the frequency of incident radiation for two different photosensitive having work functions W_1 and $1_2(W\_1 > W_2)$. On what factors does the (i) slope and (ii) intercept of the lines depend ?

View Text Solution

53. Write the principle of working of a potentiometer. Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a given cell.

View Text Solution

54. (i) Write the expression for the magnetic moment $\left(\vec{m}\right)$ due to a planar square loop of side 'l' carrying a steady current I in a vector form.

(ii) In figure., this loop is placed in a horizontal plane near a long straight conductor carrying a steady current I_1 at a distance l as shown. Give reasons to explain that the loop will experience a net force but no torque. Write the expression for this force acting on the loop.

55. (a) Depict the equipotential surfaces for a system of two identical positive point charges placed a distance 'd' apart.

(ii) Deduce the expression for the potential energy of a system of two point charges q_1 and q_2 brought from infinity of the points $\vec{r}_1$ and $\vec{r}_2$ respectively in the presence of external electric field $\vec{E}$.

View Text Solution

56. Define toatal internal reflection.State its essential conditions.

View Text Solution

57. Define 'activity' of a radioactive material and write its S.I.unit.

(ii) Plot a graph showing variation of activity of a given radioactive sample with time.

(iii) The sequence of stepwise decay of a radioactive nucleus is $D \xrightarrow{\alpha} D_1 \xrightarrow{\beta^1} D_2$.

If the atomic number and mass number of D_2 are 71 and 176 respectively, what are their corresponding values of D?

Watch Video Solution

58. A long straight wire of a curcular cross-section of radius 'a' carries a steady current 'I'. The current is uniformly distributed the across- section . Apply Amphere's circuital law to calculate the magnetic field at a point 'r' in the region for (i) $r < a$ and (ii) $r > a$.

View Text Solution

59. State the underlying principles of working of a moveing coil galvanometer. Write the two reasons why a galvonmeter cannot be used as such to measure current in a given circuit.Name any two factors on which that current sensitivity of a galvanometer depends.

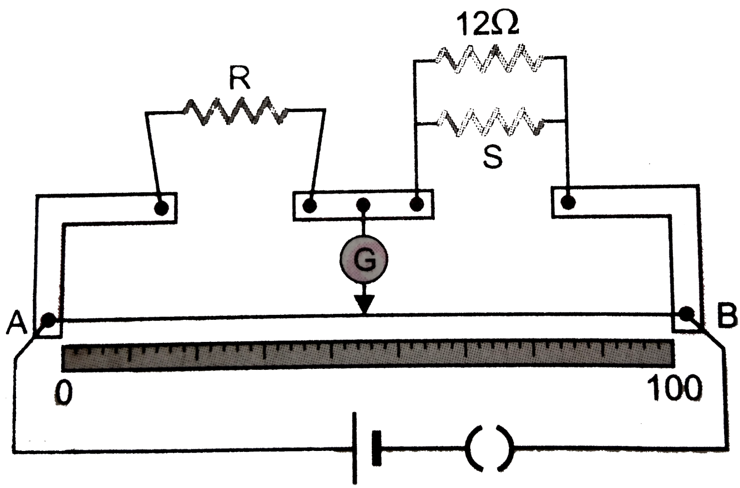
View Text Solution

60. What is space wave propagation? Give two examples of communication system which use space wave mode.

A TV tower is 80 m tall. Calculate the maximum distance upto which the signal transmitted from the tower can be received.

View Text Solution

61. In a meter bridge, the null point is found at a distance of $40cm$ from A. If a resistance of 12Ω in connected in parallel with S the null point occurs at $50.0cm$ from A Determine the value of R and S



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62. A series LCR circuit is connected to an ac source having voltage $v = v_m \sin \omega t$. Derive the expression for the instantaneous current I and its phase relationship to the applied voltage.

(i) Maximum and (ii) minimum.

View Text Solution

63. Using Huygen's construction, draw a figure showing the propagation of a plane wave reflecting at the interface of the two media. Show that the angle of incidence is equal to the angle of reflection.

View Text Solution

64. Draw a ray diagram to show the working of a compound microscope. Deduce an expression for the total magnification the final image is formed at the near point.

In a compound microscope , an object is placed at a distance of 1.5 cm from the objective of focal length 1.25cm. if the eye piece has a focal length of 5 cm and the final image is formed at the near point, estimate the magnifying the power of the microscope.

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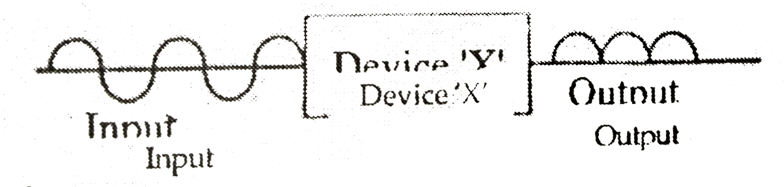
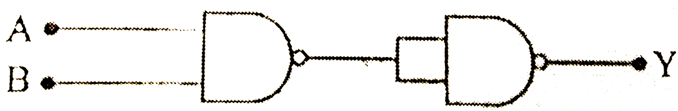
65. (a) In the figure given below the input waveform is converted into the output waveform by a device 'X'. Name the device and draw its circuit diagram.



(b) Identify the logic gate represented by the circuit as shown and write its truth table.



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66. With the help of the circuit diagram explain the working principle of a transistor amplifier as an oscillator.

(b) Distinguish between a conductor , a semiconductor and an insulator on the basis of energy band diagrams.

View Text Solution

67. Define electric dipole moment. Write its SI unit ?

Watch Video Solution

68. The angles of dip at two places are respectively 0° and 90°. Where are these values on earth?

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69. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface is 5 V. What is the potential at the centre of the sphere?

Watch Video Solution

70. How are radio waves produced?

Watch Video Solution

71. State two characteristic properties of nuclear forces.

Watch Video Solution

72. Two barmagnets are quickly moved towards a metallic loop connected across a capacitor'C' as shown in the figure. Predict the polarity of the capacitor.

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73. What happens to the width of depletion layer of a p-n junction when it is (i) forward biased, (ii) reverse biased?

Watch Video Solution

74. Define the term 'stopping potential' in relation to photoelectric effect.

Watch Video Solution

75. A thin straight infinitely long conducting wire having charge density λ enclosed bya cylindrical surface of radius r and length l_r, its axis coinciding with the length of the wire. Find the expression for the electric flux through the surface of the cylinder.

Watch Video Solution

76. Plot a graph showing the variation of coulomb force (F) versus $\left(\frac{1}{r^2}\right)$, where r is the distance between the two charges of each pair of charges: $(1\mu C, 2\mu C)$ and $(2\mu C - 3\mu C)$. Interpet the graphs obtained.

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77. Write the expression for Lorentz magnetic force on a particle of charges 'q' moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$.

Watch Video Solution

78. If χ stands for the magnetic susceptibility of a given material, identify the class of material for which

(i)$-1 \geq \chi < 0$

(ii)

$0\chi < \ \in (\in \text{stands for a small positive number})$

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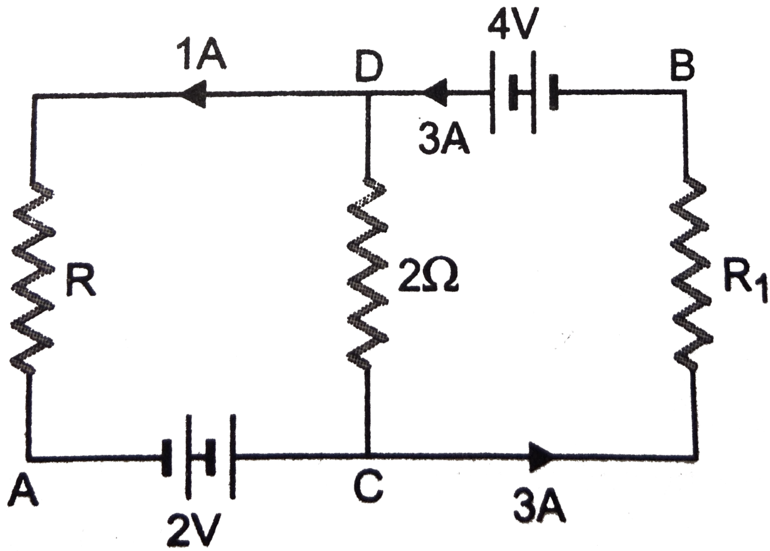
79. What are eddy currents ? Discuss brifly any two applications of eddy currents.

Watch Video Solution

80. What is sky wave communication Why is this mode of propagation restriced to the frequenceies only upto few MHz?

View Text Solution

81. In the given circuit assuming poiny A to at zero potential use kirchhoff's rules to determine the potential at point B



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82. What is the area of the plates of a 2 farad parallel plate air capacitor, given that the separation between the plates is 0.5 cm?

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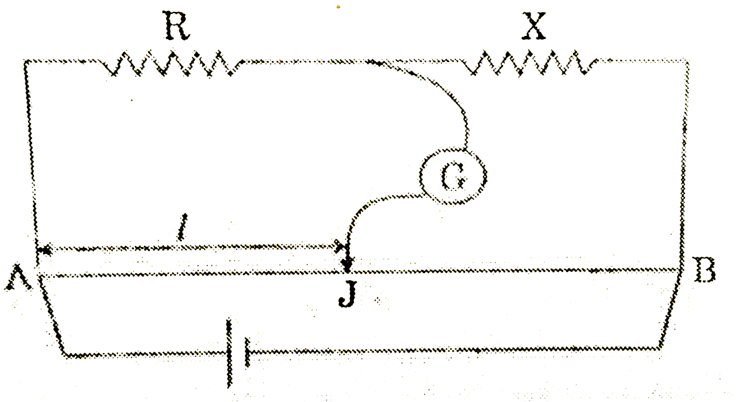
83. Net capacitance of three identical capacitors in series is $1\mu F$. What will be their net capacitance in parallel ? Find the ratio of energy stored in two configurations if they are connected to the same source.

Watch Video Solution

84. In the meter bridge experiment, balance point was observed at J with AJ=l.

(i) The values of R and X were doubled and then interchanged. What would be the new position of balance point

(ii) If the galvanometer and battery are interchanged at the balance position, how will the balance point get affected?



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85. A convex lens made up of glass of refractive index 1.5 is dippedin turn

(i) in a medium of refractive index 1.65

(ii) in a medium of refractive index 1.33

(a) Will it behave as converging or diverging lens in the two cases ?

(b) How will its focal length changes in the two media ?

Watch Video Solution

86. Draw a plot showing the variation of photoelectric current with collector plate potential for two different frequencies, $v_1 > v_2$ of incident radiation having the same intensity. In which case will the stopping potential be higher? Justify your answer.

Watch Video Solution

87. The velocity of a certain monochromatic light, in a given transparent medium is $2.25 \times 10^8 m/s$. What is the (a) critical angle of incidence, (b) polarising angle for this medium?

Watch Video Solution

88. Use the mirror equation to deduct that :

(a) an object between f and $2f$ of a concave mirror produces a real image beyond $2f$.

(b) a convax mirror always produces a virtual image independent of the location of the object.

(c) the virtual image produced by a convex mirror is always diminished in size and is located between the focus and the pole.

(d) an object placed between the pole and focus of a concave mirror produces a virtual and enlarged image.

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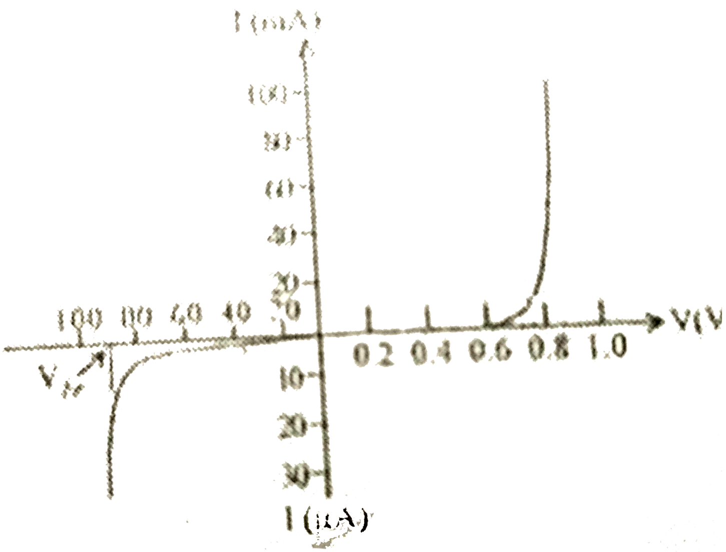
89. The figure below shows the V-I characteristic of a semiconductor diode.

(i) Identify the semiconductor diode used.

(ii) Draw the circuit diagram to obtain the given characteristic of this device.

(ii) Briefly explain how this diode can be used as a voltage regulator.



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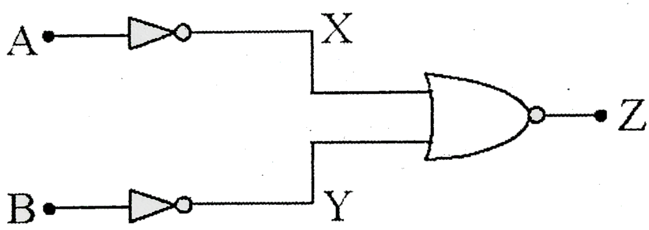
90. (a) Using de Broglie's hypothesis, explain with the help of a suitable diagram, Bolirs seconti pusitiaie of quantization of energy levels in a hydrogen atom.

(b) The ground state energy of hydrogen atom is -13.6 eV. What are the kinetic and poientialenegies of the electron in this state?

Watch Video Solution

91. 

You are given a circuit below. Write its truth table. Hence, identify the logic operation carried out by this circuit. Draw the logic symbol of the gate it corresponds to.

Watch Video Solution

92. A compound microscope uses an objective lens of focal length $4cm$ and eye lens of focal length $10cm$. An object is placed at $6cm$ from the objective lens. Calculate magnifying power of compound microscope if final image is formed at the near point. Also, calculate length of the tube of compound microscope.

Watch Video Solution

93. (i) A giant refracting telescope at an observatory has an objective lens of focal length 15 m . If an eyepiece of focal length 1.0 cm is used, what is angular magnification of the telescope ?

(ii) If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens ? the diameter of the moon is $3.48 \times 10^6 m$, and the radius of lunar orbit is $3.8 \times 10^8 m$.

Watch Video Solution

94. A resistor R_1 consumes electrical power P_1 when connected to an $emf \varepsilon$. When resistor R_2 is connected to the same emf , it consumes electrical power P_2 . In terms of P_1 and P_2, what is the total electrical power consumed when they are both connected to this emf source

(a) in parallel

(b) in series

Watch Video Solution

95. Prove that an ideal capacitor in an a.c. circuit does not dissipate power.

Watch Video Solution

96. Using Ampere's circuital law, obtaiin the expression for themagnetic field due to a long solneoid at a point inside the solenoid on its axis.

(b) In what respect different from a solenoid? Draw and compare the pattern of the magnetic field lines in the two cases.

(c)How is the magnetic field inside a given solenoid made strong?

View Text Solution

97. State the working of a.c. generator with the help of a labelled diagram. The coil of an a.c. generator having N turns, each of area A, is rotated with a constant angular velocity ω. Deduce the expression for the alternating e.m.f. generated in the coil. What is the source of energy generation in this device?

View Text Solution

98. (a) Show that an a.c. circuit containing a pure inductor, the voltage is ahead of current by p/2in phase. (b) A horizontal straight wire of length Lextending from east to westis falling with speed v at right angles to the horizontal component of Earth's magnetic field B.

(i) Write the expression for the instantaneous value of the e.m.f. induced in the wire.

(ii) What is the direction of the e.m.f.?

(iii) Which end of the wire is at the higher potential?

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99. Two charges of magnitude $-2Q$ and $+Q$ are located at points $(a, 0)$ and $(4a, 0)$ respectively . What is the electric flux due to charges through a sphere of radius '3a' with its center at the origin.

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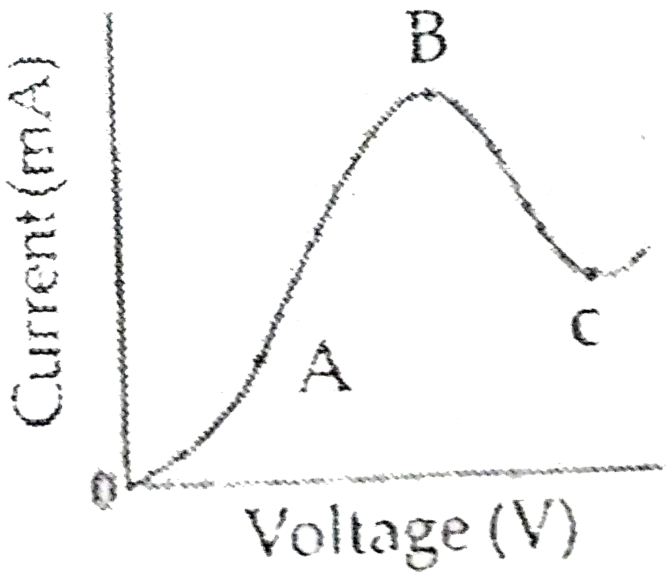
100. How is mutual inductance of a pair of coils affected when (i) separation between the coils in increased, (ii) the number of turns of each coil is increased , (iii) a thin iron sheet is placed between the two coils, other factors remaining the same ? Explain your answer in each case.

Watch Video Solution

101. The graph shown in the figure represents a plot of current versus voltage for a given semi-conductor. Identify the region, if any, over which the semicondutor has a negative resistance.



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102. Two identical cells each of emf ε, having negligible internal reistance r, are connercted in parallel with each other across an external

resistance R. What is the current through this resistance.

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103. The motion of copper plate is damped when it is allowed to oscillate between the two poles of a magnet. What is the cause of this damping?

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104. Define the activity of a radionuclide. Write its SI unit. Give a plot of the activity of a radioactive species versus time.

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105. Welders wear special goggles or face masks with glass windows to potect their eyes from electromagnetec radiations. Name the radiations and write the range of their frequency.

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106. Write the expression for the de-Broglie wavelength associated with a charged particle having charge 'q' and mass 'm' when it is accelerated by a potential V.

Watch Video Solution

107. Draw typical output characteristics of an n-p-n transistor in CE configuration. Show how these characteristics can be used to determine output resistance.

View Text Solution

108. A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observe on screen 1 m away. It is observed that the first minimum is at a distance of $2.5mm$ from the centre of the screen. Find the width of the slit.

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109. A slab of materail of dielectric constant K has the same area as the plates of a parallel plate capacitor but has thickness $d/2$, where d is the separation between the plates. Find the expression for the capacitance when the slab is inserted between the plates.

Watch Video Solution

110. A capacitor, made of two parallel plates each of plate area A and separation d, is being charged by an external ac socurce. Show that the displacement current inside the same as the current charging the capacitor.

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111. Explain the term 'drift velocity' of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of 'drift velocity'.

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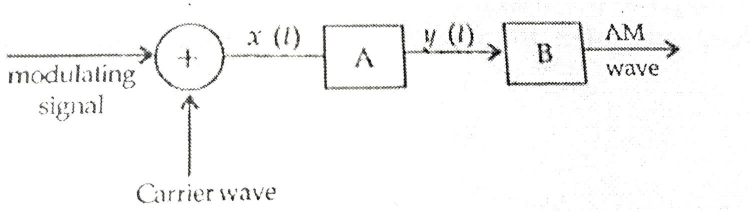
112. State the principle of potentiometer. With the help of circuit diagram, describe a method to find the internal resistance of a primary cell.

Watch Video Solution

113. A convex lens of focal length f_1 is kept in contact with a concave lens of focal length f_2. Find the focal length of the combination.

Watch Video Solution

114. In the block diagram of a simple modulator for obtaining an AM signal, shown in the figure, identify the boxes A and B. Write their functions.



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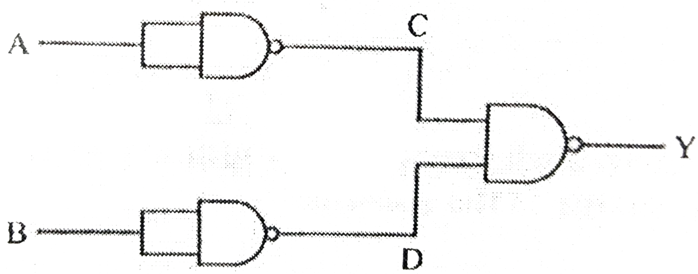
115. Write the truth table for the logic circuit shown below and identify the logic operation performed by circuit.



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116. (a) For a given a.c., $i = i_m$ sin wt, show that the average power dissipated in a resistor R over a complete cycle is $\frac{1}{2} i_m^2 R$.

(b) A light bulb is rated at 100 W for a 220 V a.c. supply. Calculate the resistance of the bulb.

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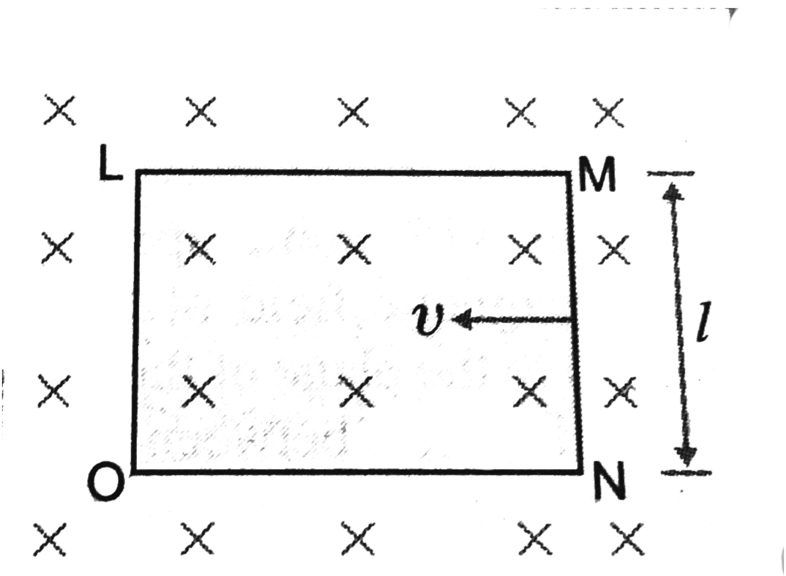
117. A rectangular conductor LMNO is place in a uniform magnetic field of 0.5 T Fig. The field is directed perpendicular to the plane to the conductor. When the arm MN of length 20 cm is moved with a velocity of 10 m/s calculate the emf induced in the arm. Find the value of induced current if resistance of arm MN is 5 Omega



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118. A wheel with 8 matallic spokes each 50 cm long is rotated with a speed of 120 $rev/\min$ in a plane normal to horizontal component of earth's magnetic field. Earth's magnetic field at the phase is 0.4 G and angle of dip 60°. Calculate the emf induced between the axle and rim of the wheel. How is the emf affected if number of spokes is increased ?

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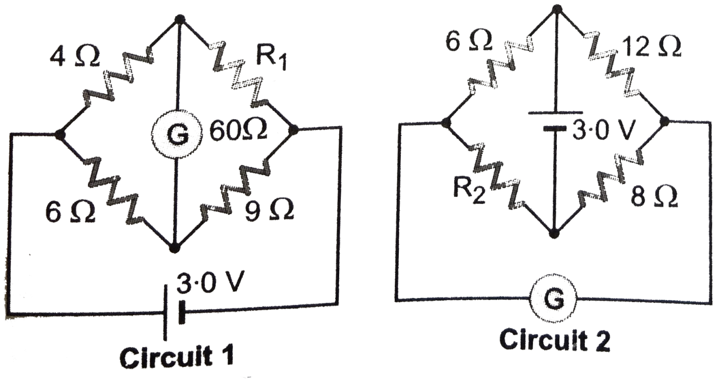
119. The galvanometer, in each of the two given circuits deos not show any deflection. Find the ratio of the resistors R_1 and R_2 used in these two circuits.



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120. A wire AB is carrying a steady current of 12 A and is lying on the table. Another wire CD carrying 5 A is held directly above AB at a height of 1mm. Find the mass per unit length of the wire CD so that it remains suspended at its position when left free. Give the direction of the current flowing in CD with respect to that in AB. [Take the value of $g = 10ms^{-2}$]

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121. Draw V-I Characteristics of a p-n junction diode. Answer the following questions, giving reasons-

(i) Why is the current under reverse bias almost independent of the applied potential upto a critical voltage?

(ii) Why does the reverse current show a sudden increase at the critical voltage?

Name any semiconductor device which operates under the reverse bias in the break down region.

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122. Draw a labelled ray diagram of a refracting telescope. Define its magnifying power and write the expression for it.

Write two important limitations of a refracting telescope over a reflecting type telescope.

View Text Solution

123. Write Einstein's photoelectric equation and point out any two characteristic properties of photons on which this equation is based.

Briefly explain the three observed freatures which can be explained by this equation.

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124. Name the type of waves which are used for line of sight (LOS) communication. What is the range of their frequencies?

A transmitting antenna at the top of a tower has a height of 20m and the height of the receiving antenna is 45m. Calculate the maximum distance between them for satisfactory communication in LOS mode. (Radius of the Earth $= 6.4 \times 10^6$ m)

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125. (a) What is linearly polarized light ? Describe briefly using a diagram how sunlight is polarised.

(b) Unpolarised light is incident on a polaroid. How would the intensity of transmitted light change when the polaroid is rotated?

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126. One day Chetan's mother developed a severe stomach ache all of a sudden. She was rushed to the doctor who suggested for an immediate endoscopy test and gave an estimate of expenditure for the same. Chetan immediately contacted his class teacher and shared the information with her. The class teacher arranged for the money and rushed to the hospital. On realising that Chetan belonged to a below average income group family, even the doctor offered concession for the test fee. The test was conducted suessfully.

Answer the following questions based on the above information :

(a) Which principle in optics is made use of in endoscopy ?

(b) Briefly explain the values reflected in the action taken by the teacher.

(c) In what way do you appreciate the response of the doctor on the given situation?

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127. (a) Using Biot-Savart's law, derive the expression for the magnetic field in the vector form at a point on the axis of a circular current loop.

(b) What does a toroid consist of? Find out the expression for the magnetic field inside a toroid for N turns of the coil having the average radius r and carrying a current I. Show the magnetic field in the open space inside and exterior to the toroid is Zero.

View Text Solution

128. (a) Draw a schematic sketch of a cyclotron. Explain clearly the role of crossed electric and magnetic field in accelerating the charge. Hence derive the expression for the kinetic energy acquired by the particles.

(b) An α-particle and a proton are relased form the centre of the cyclotron and made to accelerate.

(i) Can both be accelerated at the same cyclotron frequency? Give reason to justify your answer.

(ii) When they are accelerated in turn, which of the two will have higher velocity at the exit slit of the dees ?

View Text Solution

129. (a) Define electric dipole moment. Is it a scalar or a vector ? Derive the expression for the electric field of a dipole at a point on the equatorial plane of the dipole.

(b) Draw the equipotential surfaces due to an electric dipole. Locate the points where the potential due to the dipole is zero.

View Text Solution

130. Using Gauss' law deduce the expression for the electric field due to a uniformly charged sperical conducting shell of radius R at a point (i) outside and (ii) inside the shell.

Plot a graph showing variation of electric field as a function of $r > R$ and $r < R$. (r being the distance from the centre of the shell)

View Text Solution

131. Using Bohr's postulates, derive the expression for the frequency of radiation emitted when electron in hydrogen atom undergoes transition from higher energy state (quantum number n_i) to the lower state, (n_f). When electron in hydrogen atom jumps from energy state $n_i = 4$ to

$n_f = 3, 2, 1$, identify the spectral series to which the emission lines belong.

View Text Solution

132. (a) Draw the plot of binding energy per nucleon (BE/A) as a function of mass number A. Write two important conclusions that can be drawn regarding the nature of nuclear force.

(b) Use this graph to explain the relase of energy in both the processes of nuclear fusion and fission.

(c) Write the basic nuclear process of neutron undergoing β-decay. Why is the detection of neutrinos found very difficult?

View Text Solution

133. Derive an expression for the force between two long parallel current carrying conductors. Use this expression to define SI unit of current.

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134. To which part of the electromagnetic spectrum does a wave of frequency 5×10^{19}Hz belong ?

Watch Video Solution

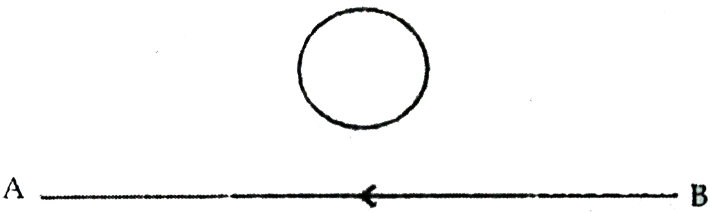
135. What is the force between two small charged of 2×10^{-7} C placed 30 cm apart in air?

Watch Video Solution

136. Define the term "Intensity" in photon picture of electromagnetic radiation.

Watch Video Solution

137. The electric current flowing in a wire in the direction from B to A decreasing. Find out the direction of the induced current in the metallic loop kept above the wire as shown.



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138. Why is it found experimentally difficult to detect neutrinos in nuclear β-decay?

Watch Video Solution

139. Why is the use of A.C. voltage preferred over D.C. voltage? Give two reasons.

View Text Solution

140. A biconcave lens made of a transparent material of refractive index 1.25 is immersed in water of refractive index 1.33. Will the lens behave as a converging or a diverging lens? Give reason.

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141. Using Rutherford's model of the atom, derive the expression for the total energy of the electron in hydrogen atom. What is the significance of total negative energy possessed by the electron?

View Text Solution

142. A parallel plate capacitor of capacitane C is charged to a potential V. It is then connected to another uncharged capacitor with the same capacitance. Find out the ratio of the energy stored in the combined system to that stored initially in the single capacitor.

View Text Solution

143. Considering the case of a parallel plate capacitor being charged, show how one is required to generalize Ampere's circuital law to include the term due to displacment current.

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144. A cell of emf ε and internal resistance r is connected across a variable resistor R. Plot a graph showing variation of terminal voltage V of the cell versus the current I. Using the plot, show how the emf of the cell and its internal resistance can be determined.

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145. Explain with the help of a circuit diagram, the working of a $p-n$ junction diode as a half wave rectifier.

Watch Video Solution

146. Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area $1.0 \times 10^{-7} m^2$ carrying a current of 1.5×10^{-19}A. Assume the density of conduction electrons to be $9 \times 10^{28} m^{-3}$.

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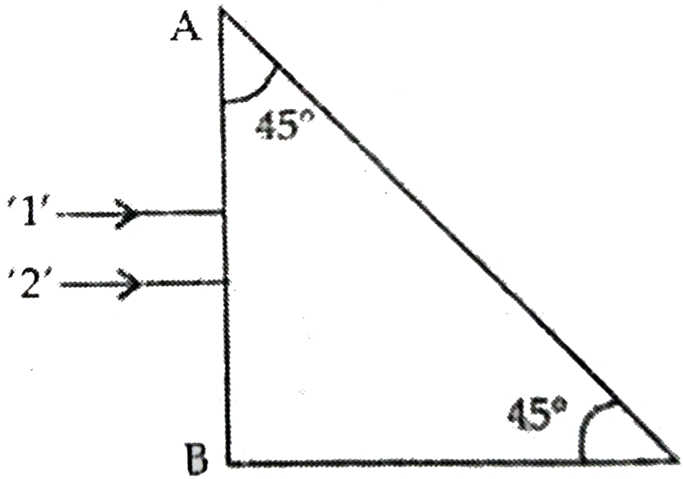
147. Two monochromatic ray of light are incident normally on the face AB of an isosceles right - angled 'I' and '2' are respectively 1.35 and 1.45. Trace path of these rays after entering through the prism.



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148. Write the function of (i) Transducer and (ii) Repeater in the context of communication system.

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149. Show diagrammatically the behaviour of magnetic field lines in the presence of :

(i) Paramagnetic and

(ii) Diamagnetic substance, How does one explain this distinguishing feature ?

Watch Video Solution

150. (a) Using the phenomenon of polarization, show, how, transverse nature of light can be demonstrated.

(b) Two polaroids P_1 and P_2 are placed with their pass axes perpendicular to each other. Unpolarised light of intensity 10 is incident on P1. A third polaroid P3 is kept in between P_1 and P_2 such that its pass axis makes an angle of 30° with that of P_1. Determine the intensity transmitted through P_1, P_2 and P_3.

Watch Video Solution

151. Define the term 'mutual inductance' between the two coils.

Obtain the expression for mutual inductance of a pair of long coaxial solenoids each of l and radii r_1 and r_(2)(r_(2)gt gt r_(1))

. $Total\nu mberofso \leq noidsare$N_(1) and N_(2)`

respectively.

Watch Video Solution

152. Answer the following :

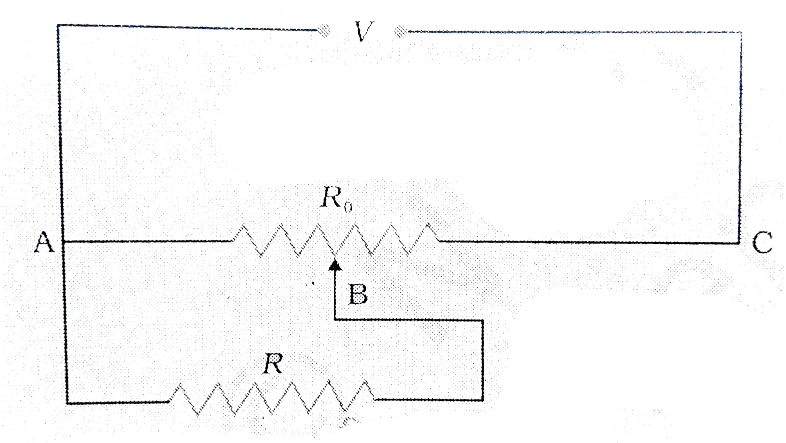
(a) Why are the connections between the resistors in a meter bridge made of thick copper strips?

(b) Why is it generally preferred to obtain the balance point in the middle of the meter bridge wire?

(c) Which material is used for the meter bridge wire and why?

Watch Video Solution

153. $R\Omega$ का कोई प्रतिरोध एक पोटेंशियोमीटर से विद्युत धारा प्राप्त कर रहा है पोटेंशियोमीटर का कुल प्रतिरोध $R_0\Omega$ है । (चित्र 3 .29) पोटेंशियोमीटर को वोल्टता V की आपूर्ति की गयी है । जब सर्पी संपर्क (सरकने वाला भाग या स्लाइड) पोटेंशियोमीटर के तार के मध्य के हो तो R के सिरों पर वोल्टता के लिए व्यंजक प्राप्त कीजिए ।



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154. A convex lens of focal length $20cm$ is placed co-axially with a convex mirror of radius of curvature $20cm$. The two are kept $15cm$ apart from each other. A point object is placed $60cm$ in front of the convex lens. Find the position of the image formed by the combination.

Watch Video Solution

155. A voltage $V = V_0 \sin \omega t$ is applied to a series LCR circuit. Derive expression for the average

power dissipated over a cycle.

Under What condition (i) no power is dissipated even though the current flows through the circuit? (ii) Maximum power is dissipated in the circuit?

Watch Video Solution

156. Write any two distinguishing features between conductors, semiconductors and insulators on the basis of energy band diagrams.

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157. For the past some time, Aarti had been observing some erratic body movement, unsteadiness and lack of Radha, who also used to complain of sever headache occasionally. Aarti suggested to her parents to get a medical check-up of Radha. The doctor thoroughly examined Radha and diagnosed that she has a brain tumour. What, according to you, are the values displayed by Aarti?

How can radioisotepes help a doctor to diagnose brain tumour?

View Text Solution

158. Write two basic modes of communication. Explain the process of amplitude modulation. Draw a schematic sketch showing how amplitude modulated signal is obtained by superposing modulating signal over a sinusoidal carrier wave.

View Text Solution

159. An electron microscope uses electrons accelerated by a voltage of $50kV$. Determine the De Broglie wavelength associated with the electrons. If other factors (such as numerical aperture, etc.) are taken to be roughly the same, how does the resolving power of an electron microscope compare with that of an optical microscope which uses yellow light?

Watch Video Solution

160. Draw a labelled diagram of Van de Graff generator. State its working principle to show how by introducing a small charged sphere into a larger sphere, a large amount of charge can be transferred to the outer sphere. State the use of this machine and also point out its limitations.

View Text Solution

161. (a) Deduce the expression for the torque acting on a dipole of dipole moment $\vec{P}$ in the presence of uniform electric field $\vec{E}$.

(b) Consider two hollow concentric spheres, S_1 and S_2, enclosing charges 2Q and 4Q respectively as shown in the figure.

View Text Solution

162. (a) In Young's double slit experiment, describe briefly how bright and dark frings are obtained on the screen kept in front of a double slit. Hence obtain the expression for the fringe width.

(b) The ratio of the intensities at minima to the maxima in the Young's double slit experiment is 9 : 25. Find the ratio of the widths of the two slits.

Watch Video Solution

163. (a) Describe briefly how a diffraction pattern is obtained on a screen due to a single narrow slit illuminated by a monochromatic source of light. Hence obtain the condition for the angular width of secondary maxima and secondary minima.

(b) Two wavelengths of sodium light of 590 nm and 596 nm are used in turn to study the diffraction taking place at a single slit of aperture 2×10^{-6}m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of first maxima of the diffraction pattern obtained in the two cases.

Watch Video Solution

164. (a) Deduce an expression for the frequency of revolution of a charged particle in a magnetic field and show that it is independent of velocity or energy of the particle.

(b) Draw a schematic sketch of a cyclotron. Explain, giving the essential details of its construction, how it si used to accelerate the charged particles.

View Text Solution

165. (a) Draw a labellel diagram of a moving coil galvanometer. Describe briefly its principle and working.

(b) Answer the following:

(i) Why is it necessary to introduce a cyclindrical soft iron core inside the coil of a galvanometer?

(ii) Increasing the current sensitivity of galvanometer may not necessarily increase its voltage sensitivity. Explain, giving reason.

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SET-II

1. What is the work done in moving a test charge q through a distance of 1 cm along the equatorial axis of an electric dipole ?

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2. Two thin lenses of power +4 D and -2 D are in contact. What is the focal length of the combination ?

Watch Video Solution

3. Give the logic symbol of NAND gate.

Watch Video Solution

4. Two nuclei have mass numbers in the ratio 8 : 125. What is the ratio of their nuclear radii ?

Watch Video Solution

5. The maximum kinetic energy of a photoelectron is 3 eV. What is its stopping potential ?

Watch Video Solution

6. (i) State the principle on which the working of an optical fiber is based.

(ii) What are the necessary conditions for this phenomenon to occur ?

Watch Video Solution

7. (i) State the law that gives the polarity of the induced emf.

(ii) A $15.0\mu F$ capacitor is connected to 220 V, 50 Hz source. Find the capacitive reactance and the rms current.

Watch Video Solution

8. Estimate the distance for which ray optics is good approximation for an aperture of $4mm$ and wavelength $400nm$.

Watch Video Solution

9. Use Gauss's law to derive the expression for the electric field between two uniformly charged large parallel sheets with surface charge densities σ and $-\sigma$ respectively.

View Text Solution

10. (a) A charge +Q is placed on a large spherical conducting shell of radius R. Another small conducting sphere of radius r carrying charge 'q' is introduced inside the large shell and is placed at

its centre. Find the potential difference between two points, one lying on the sphere and the other on the shell.

(b) How would the charge between the two flow if they are connected by a conducting wire ? Name the device which works on this fact.

Watch Video Solution

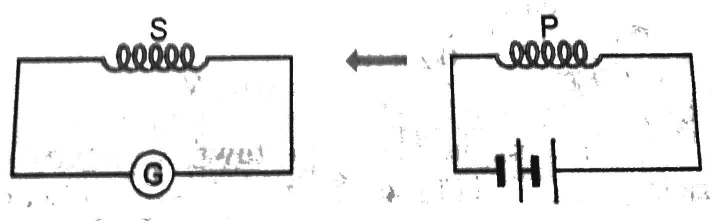
11. The radius of innermost electron orbit of a hydrogen atom is $5.3 \times 10^{-11} m$. What is the radius of orbit in second excited state?

Watch Video Solution

12. Which part of electromagnetic spectrum is absorbed from sunligh by ozone layer?

View Text Solution

13. When primary coil P is moved towards secondary coil S, Fig. the galvanometer shows memetary deflection in the can be done to have larger deflection in the galvanometer with same battery ? State the related law ?



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14. What is the range of frequencies used for TV transmission? What is common between these waves and light waves?

Watch Video Solution

15. A biconvex lens has focal length $\frac{2}{3}$ times the radius of curvature of either surface. Calculate refraction index f material of the lens.

Watch Video Solution

16. (i) Why does the sun appear reddish at sun-set or sun- rise ?

(ii) For which colour the refractive index of prism material is maximum and minimum ?

View Text Solution

17. (i) Why is communication using line of sight mode limited to frequencies above 40 MHz?

(ii) A transmitting antenna at the top of a tower has a height 32 m and the height of the receiving antenna is 50m . What is maximum distance between them for satisfactory communication in line of sight mode ?

Watch Video Solution

18. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface is 5

V. What is the potential at the centre of the sphere?

Watch Video Solution

19. How are X-rays produced?

Watch Video Solution

20. Where on the surface of Earth is the angle of dip zero?

View Text Solution

21. State the principle of working of a transformer. Can a transformer be used to step up or step down a d.c. voltage? Justify your answer.

View Text Solution

22. What is ground wave communication? On what factors does the maximum range of propagation in this mode depend?

View Text Solution

23. A convex lens made up of glass of refractive index 1.5 is dippedin turn

(i) in a medium of refractive index 1.65

(ii) in a medium of refractive index 1.33

(a) Will it behave as converging or diverging lens in the two cases ?

(b) How will its focal length changes in the two media ?

Watch Video Solution

24. A light metal disc on the top of an electromagnet is thrown up as the current is switched on. Why? Give reason.

View Text Solution

25. In the circuit shown in the figure, identify the equivalent gate of the circuit and make its truth table.

Watch Video Solution

26. A parallel beam of light of $600nm$ falls on a narrow slit and the resulting diffraction pattern is observed on a screen $.12m$ away. It is observed

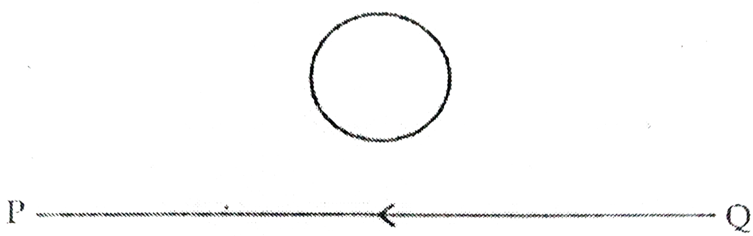
that the first minimum is at a distance of $3mm$ from the centre of the screen. Calculate the width of the slit.

Watch Video Solution

27. A write AB is carrying a steady current of 10A and is lying on the table. Another wire CD carrying 6A is held directly above AB at a height of 2 mm. Find the mass per unit length of the wire CD so that it remains suspended at its position when left free. Give the direction of the current flowing in CD with respect to that in AB. [Take the value of $g = 10ms^{-2}$]

Watch Video Solution

28. A conductor loop is help above a current carrying wire 'PQ' as shown in figure. Depict the direction of the current induced in the loop when the current in the wire PQ is constanly increasing.



View Text Solution

29. Why do the electrostatic field lines not form closed loop?

View Text Solution

30. A biconcave lens made of a transparent material of refractive index 1.5 is immersed in water of refractive index 1.33. Will the lens behave as a converging or a diverging lens? Give reason.

Watch Video Solution

31. To which part of the electromagnetic spectrum does a wave of frequency 3×10^{13}Hz belong?

Watch Video Solution

32. Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area $2.5 \times 10^{-7} m_2$ carrying current of 1.8 A. Assume the density of conduction electrons to be $9 \times$ 10^(26)m_(3)`.

Watch Video Solution

33. Write the functions of the following in communication systems:

(i). Receiver

(ii). Demodulator

Watch Video Solution

34. Define the term self indutance of a solenoid. Obtained the expresssion for the magnetic energy stored in an inductor or self-inductance L to a build up a certain I through it.

View Text Solution

35. A convex lens of focal length $20cm$ and a convex mirror of focal length $10cm$ are placed co-axially $50cm$ apart from each other. An incident beam parallel to its principal axis is incideent on the convex lens. Locate the position of final image formed due to the combination.

Watch Video Solution

SET-III

1. Define the term potential energy of charge q at a distance r in an external electric field.

Watch Video Solution

2. The stopping potential in an experiment on photoelectric effect is 2V. What is the maximum kinetic energy of the photoelectrons emitted ?

Watch Video Solution

3. Two thin lenses of power +5 D and -2.5 D are in contact. What is the focal length of the combination ?

Watch Video Solution

4. How would the angular separation of interence fringes in Young's double slit experiment change when the distance between the slits and screen is halved ?

Watch Video Solution

5. Give the logic symbol of AND gate.

Watch Video Solution

6. Two nuclei have mass numbers in the ratio 27 : 125. What is the ratio of their nuclear radii ?

Watch Video Solution

7. (i) What is the relation between critical angle and refractive index of a material ?

(ii) Does critical angle depend on the color of light ? Explain.

Watch Video Solution

8. A wire of 20Ω resistance is gradually stretched to double its original length. It is then cut into two equal parts. These parts are then connected in parallel across a 4.0 volt battery. Find the current drawn from the battery.

Watch Video Solution

9. What are polaroids ? Mention some of their practical uses ?

Watch Video Solution

10. Define the activity of a radio nuclide. Write its S.I. unit. Give a plot of the activity of a radioactive species versus time.

How long will a radioactive isotope, whose half life is T years, take for its activity to reduce to $1/8$th of its initial value ?

Watch Video Solution

11. A hollow metal sphere of radius 6 cm is charged such that the potential on its surface is 12 V.What is the potential at the centre of the sphere?

Watch Video Solution

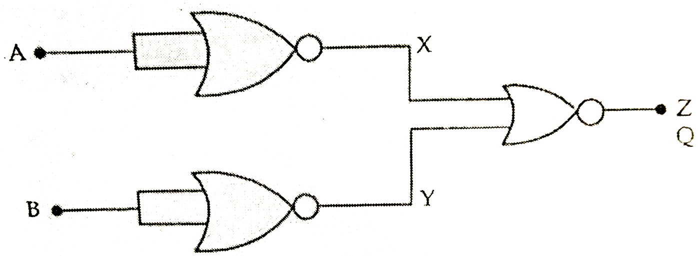
12. How are microwaves produced?

Watch Video Solution

13. A converging lens has a focal length of $20cm$ in air. It is made of a material of refractive index 1.6. If it is immersed in a liquid of refractive index 1.3, what will be its new foacl length ?

Watch Video Solution

14. You are given a circuit below. Write its truth table. Hence, identify the logic operation carried out by this circuit. Draw the logic symbol of the gate it corresponds to.



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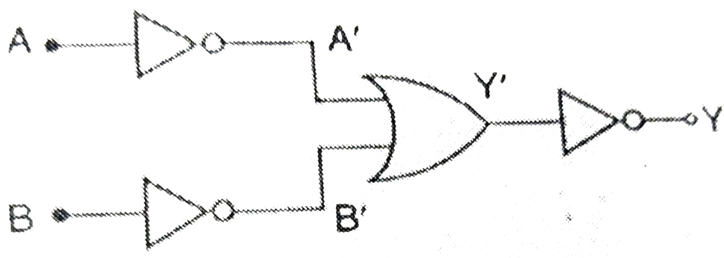
15. Two charges of magnitudes +4Q and -Q and located at points (a, 0) and (-3a, 0) respectively.

What is the electric flux due to these charges through a sphere of radius '2a' with its centre at the orgin ?

Watch Video Solution

16. In the circuit shown in the figure, identify the equivalent gate of the circuit and make its truth table.



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17. A parallel beam of light of 450 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1.5 m away. It is observed that the first minimum is at a distance of 3 mm from the centre of the screen. Calculate the width of the slit.

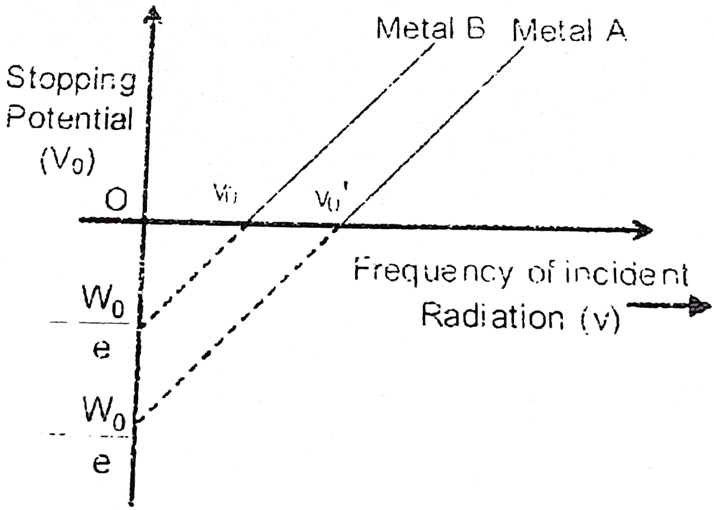
Watch Video Solution

18. Name the type of waves which are used for line of sight (LOS) communication. What is the range of their frequencies?

A transmitting antenna at the top of a tower has a height of 20m and the height of the receiving antenna is 45m. Calculate the maximum distance between them for satisfactory communication in LOS mode. (Radius of the Earth $= 6.4 \times 10^6$ m)

Watch Video Solution

19. The graph shows variation of stopping potential V_0 versus frequency of incident radiation v for two photosensitive metals A and B. Which of two metals has higher threshold frequency and why?



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20. Why do the electric field lines never cross each other ?

View Text Solution

21. To which part of the electromagnetic spectrum does a wave of frequency 5×10^{19}Hz belong ?

Watch Video Solution

22. Estimate the average drift velocity of conduction electrons in a copper wire of cross-sectional area $2.5 \times 10^{-7} m^2$, carrying a current of 2.7 A. Assume the density of conduction electrons to be $9 \times 10^{28} m^{-3}$.

Watch Video Solution

23. Write the functions of the following in communication systems:

(i). Receiver

(ii). Demodulator

Watch Video Solution

24. A convex lens of focal length 20cm is placed coaxilly with a convex mirror of radius of curvature 20 cm. The two are kept 15 cm apart. A point object is placed 40 cm in front of the convex lens. Find the position of the image formed by this combination. Draw the ray diagram showing the image formation.

Watch Video Solution

25. (a) A rod of length l is moved horizontal with a uniform velocity v in a direction perendicular to its length through a region in which a uniform magnetic field is acting vertically downward. Derive the expression for the emf induced across the end of the rod.

(b) How does one understand this motional emf by invoking the Lorentz force acting on the free charge carriers of the conductor? Explain.

View Text Solution

SET-III DELHI BOARD

1. Which part of electromagnetic spectrum is used in radar systems ?

View Text Solution

2. Calculate the speed of light in a medium whose critical angle is 30°.

Watch Video Solution

3. Write an expression for Bohr's radius in hydrogen atom.

Watch Video Solution

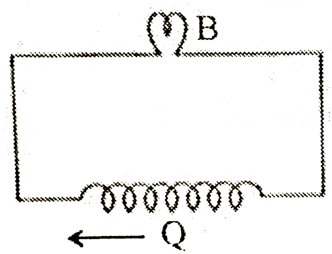
4. What is the range of frequencies used in satellite communication? What is common between these waves and light waves?

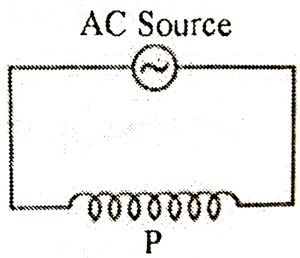
Watch Video Solution

5. A coil Q is connected to low voltage bulb B and placed near another coil P as shown in the fiugre. Give reasons to explain the following observations :

(a) The bulb 'B' lights.

(ii) Bulb gets diameter if the coil Q is moved towards left.





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6. Find the radius of curvature of the convex surface of a plan-convex lens, whose focal length is 0.3 m and the refractive index of the material of the lens is 1.5.

Watch Video Solution

7. An electron is accelerated through a potential difference of 64volts. What is the de-broglie wavelength associated with it? To which part of the electromagnetic spectrum does this value of wavelength correspond?

Watch Video Solution

8. A parallel plate capacitor is charged to a potential difference V by a dc source. The capacitor is then disconnected from the source. If the distance between the plates in doubled, state with reason how the following will change,

(i) electric field between the plates,

(ii) capacitance and

(iii) energy stored in the capacitor.

Watch Video Solution

9. When are two object just resolved ? Explain . How can the resolving power of a compound microscope be increased ? Use relevant formula to support your answer .

View Text Solution

10. What is the line of sight communication? (ii) Why is it not possible to use sky waves for transmission of T.V. signals? Upto what distance can a signal be transmitted using an antenna of height h?

Watch Video Solution

11. A proton and an α-particle are accelerated through same potential difference. Find the ratio of their de-Brogile wavelength.

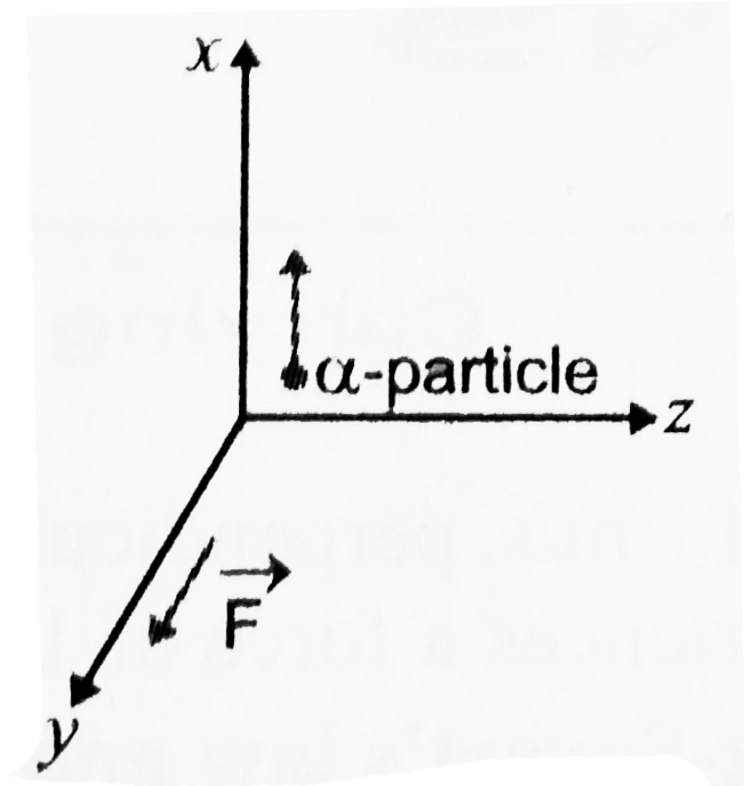
Watch Video Solution

SET -I

1. Name the physical quantity which has its unit joule coulomb^{-1}. Is it a scalar or vector quantity?

Watch Video Solution

2. A beam of α particles projected along + x-axis, experiences a force due to a magnetic field along the +y-axis figure. What is the direction of magnetic field.



Watch Video Solution

3. Define self-inductance of a coil . Write its S.I. units ?

Watch Video Solution

4. A converging lens is kept coaxially in contact with a diverging lens - both the lenses being of equal focal length . What is the focal length of the combination ?

Watch Video Solution

5. Define ionisation energy. What is the value for a hydrogen atom?

Watch Video Solution

6. Two different wires X and Y of same diameter but different materials are joined in series across a battery. If the number density of electrons in X is twice that in Y, find the ratio of drift velocity of electrons in the two wires .

Watch Video Solution

7. Name the part of electromagnetic spectrum whose wavelength lies in the range of $10^{-10}m$. Give its one use.

Watch Video Solution

8. When light travels from a rarer to denser medium, it loses some speed. Does the reduction in speed imply a reduction in the energy carried by the light wave ?

Watch Video Solution

9. What is the magnitude of the equatorial and axial fields due to a bar manget of length $5 \cdot 0 cm$ at a distance of $50 cm$ from its mid-point? The magnetic moment of the bar magnet is $0 \cdot 40 Am^2$.

Watch Video Solution

10. A spherical conducting shell of inner radius r_1 and outer radius r_2 has a charge Q.

(a) A charge q is placed at the center of the shell. What is the surface charge density on the inner and outer surfaces of the shell ?

(b) Is the electric field intensity inside a cavity is (with no charge) zero, even if the shell is not spherical, but has any irregular shape ? Explain.

Watch Video Solution

11. How are electromagnetic waves produces by oscillating charges ? Draw a sketch of linearly polarized EM waves propagating in z-direction. Indicate the direction of oscillating electric and magnetic fields

Watch Video Solution

12. Show that the electric field at the surface of a charged conductor is given by $\overrightarrow{E} = \frac{\sigma}{\varepsilon_0}\widehat{n}$, where σ is the surface charge density and $\widehat{n}$ is a unit vector normal to the surface in the outward direction .

Watch Video Solution

13. Two identical loops , one of copper and the other of aluminium , are rotated with the same angular speed in the magnetic field . Compare (i) the induced emf and (ii) the current produced in the two coils .

Justify your answer .

Watch Video Solution

14. A proton and deuteron are accelerated by same potential difference.Find the ratio of their de-Broglie wavelengths.

Watch Video Solution

15. Write two factors justifying the need of modulating a signal.

A carrier wave of peak voltage $12V$ is used to transmit a message signal. What should be the peak voltage of the modulating signal in order to have a modulation index of 75% ?

Watch Video Solution

16. Write Einstein's photoelectric equation. State clearly any two salient features observe in photoelctric effect, which can be explained on the basis of the above equation.

Watch Video Solution

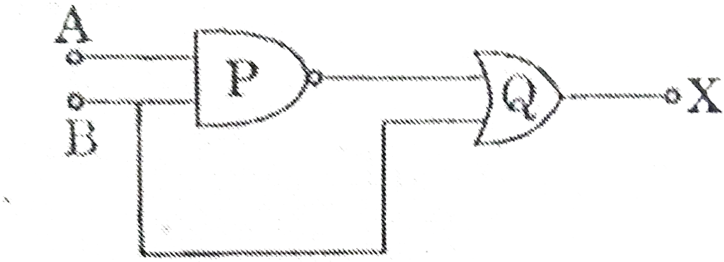
17. Draw a plot of potential energy of a pair of nucleons as a function of their separation . Write two important conclusions which you can draw regarding the nature of nuclear forces .

Watch Video Solution

18. Draw a plot of the binding energy per nucleon as a function of mass number for a large number of nuclei , $2 \leq A \leq 240$. How do you explain the constancy of binding energy per nucleon in the range $30 < A < 170$ using the property that nuclear force is short-ranged ?

Watch Video Solution

19. (i) Identify the logic gates marked P and Q in the given logic circuit.



(ii) Write down the output at X for the inputs A = 0 , B = 0 and A = 1 , B = 1.

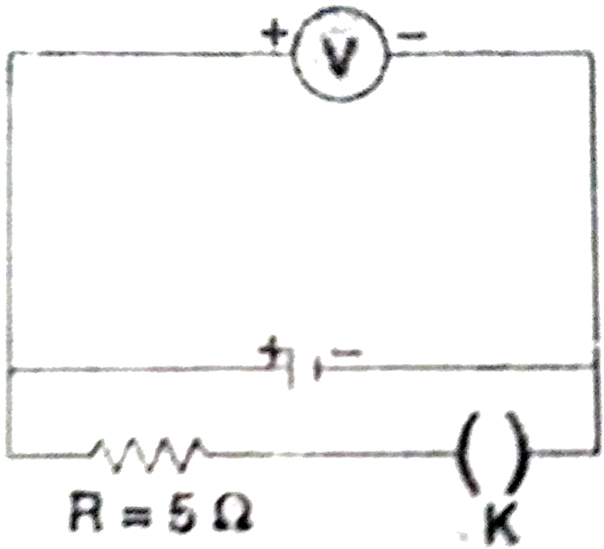
Watch Video Solution

20. Which mode of propagation is used by short wave broadcast services having frequency range from a few MHz upto 30 MHz ? Explain diagrammatically how long distance communication can be achieved by this mode .

Why is there an upper limit to frequency of waves used in this mode ?

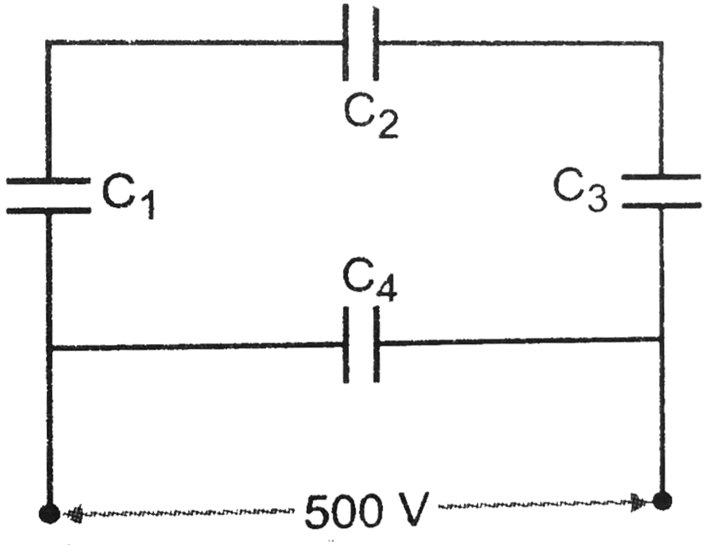
Watch Video Solution

21. Write any two factors on which internal resistance of a cell depends .The reading on a high resistance voltmer,where a cell is connected across it , is 2.2 V. When the terminals of the cell are also connected to a resistance of 5 Ω as shown in the circuit , the voltmeter reading drops to 1.8 V .Find the interval resistance of the cell.



Watch Video Solution

22. A network of four each of $12\mu F$ capacitance is connected to a $500V$ apply as shown in Fig.



(a) Equivalent capacitance of the network.

(b) Charge on each capacitor.

Watch Video Solution

23. (i) Draw a neat labelled ray diagram of an astronomial telescope in normal adjustment .

Explain briefly its working .

(ii) An astronomical telescope uses two lenses of powers 10 D and 1 D . What is its magnifying power in normal adjustment ?

Watch Video Solution

24. (i) Draw a neat labelled ray diagram of a compound microscope . Explain briefly its working .

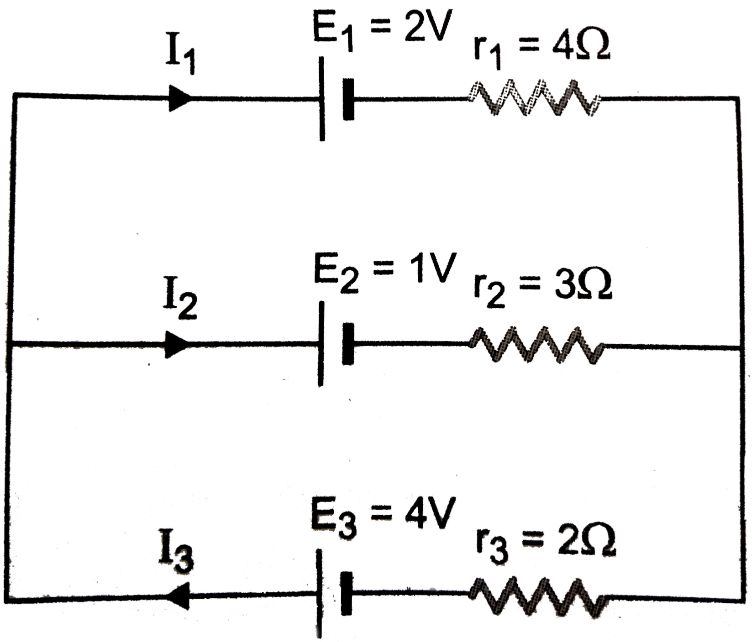
(ii) Why must both the objective and the eye-piece of a compound microscope have short focal lengths ?

View Text Solution

25. In Young's double slit experiment, the two slits $0.15mm$ apart are illuminated by light of wavelength $450nm$. The screen is $1.0m$ away from the slits. Find the distance of second bright fringe and second dark fringe from the central maximum. How will the fringe pattern change if the screen is moved away from the slits ?

Watch Video Solution

26. Using kirchhoff's rules wire the experssion for the current I_1, I_2 and I_3 in the circuit diagram



Watch Video Solution

27. (a) Write symbolically the β-decay process of

${}^{32}_{15}P$.

(b) Derive an expression for the average life of a radionuclide . Give its relationship with the half-life.

Watch Video Solution

28. How does an unpolarised light get polarised when passed through a polarised ?

Two polaroids are set in crossed positions . A third polaroid is placed between the two making an angle θ with the pass axis of the first polaroid . Write the expression for the intensity of light transmitted from the second polaroid . In what orientations will the transmitted intensity be (i) minimum and (ii) maximum ?

View Text Solution

29. An illuminated object and a screen are placed $90cm$ apart. What is the focal length and nature of the lens required to produce a clear image on the screen twice the size of the object ?

Watch Video Solution

30. (a) With the help of a diagram , explain the principle and working of a moving coil galvanometer .

(b) What is the importance of a radial magnetic field and how is it produced ?

(c) Why is it while using a moving coil galvometer as a voltmeter a high resistance in series is required whereas in an ammeter a shunt is used ?

Watch Video Solution

31. (a) Derive an expression for the force between two long parallel current carrying conductors .

(b) Use this expression to define S.I. unit of current

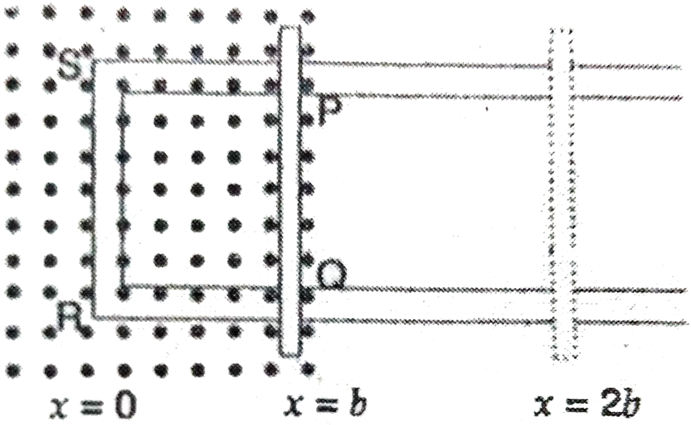
.

(c) A long straight wire AB carries a current I.A proton P travels with a speed v , parallel to the wire , at a distance d from it in a direction opposite to the current as shown in the figure . What is the force experienced by the proton and what is its direction ?

View Text Solution

32. State Faraday's law of electromagnetic induction .

Figure shows a rectangular conductor PQRS in which the conductor PQ is free to move in a uniform magnetic field B perpendicular to the plane of the paper . The field extends from x = 0 to x = b and is zero for $x > b$. Assume that only the arm PQ possesses resistance r . When the arm PQ is pulled outward from x = 0 with constant speed v , obtain the expressions for the flux and the induced emf . Sketch the variations of these quantities with distance $0 \leq x \leq 2b$.



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33. Draw a schematic diagram of a step-up transformer . Explain its working principle . Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils . In an ideal transformer , how is this ratio related to the currents in the two coils ?

How is the transformer used in large scale transmission and distribution of electrical energy over long distances ?

View Text Solution

34. (a) Draw the circuit arrangement for studying the input and output characteristics of an n-p-n transistor in CE configuration . With the help of these characteristics define (i) input resistance , (ii) current amplification factor .

(b) Describe briefly with the help of a circuit diagram how an n-p-n transistor is used to produce self-sustained oscillations .

View Text Solution

SET -II

1. Find the ratio of energies of photons produced due to transition of electron of hydrogen atom form its (i) second permitted energy level to the first level (ii) highest permitted energy level to the first permitted level.

Watch Video Solution

2. An electron beam projected along + X-axis, experience a force due to a magnetic field along the + Y-axis. What is the direction of the magnetic field?

Watch Video Solution

3. Which of the following has the shortest wavelength ?

View Text Solution

4. A rectangular loop and a circular loop are moving out of a uniform magnetic field to a field-free region with a constant velocity 'v' as shown in the figure . Explain the which loop do you expect the induced emf to the constant during the passage out of the field region . The magnetic field is normal to the loops .

View Text Solution

5. A network of four capacitors each of $15\mu F$ four capacitors each of the μF capacitance is connected to a 500 V supply as shown in the figure

. Determine (a) equivalent capacitance of the network and (b) charge on each capacitor .

Watch Video Solution

6. Write any two factors on which internal resistance of a cell depends . The reading on a high resistance voltmeter , when a cell is connected across it , is 2.0 V . When the terminals of the cell are also connected to a resistance of 3Ω as shown in the circuit , the voltmeter reading drops to 1.5 V . Find the internal resistance of the cell.

Watch Video Solution

7. In Young's double slit experiment the two slits 0.12 mm apart are illuminated by monochromatic light of wavelength 420 nm. The screen is 1.0 m away from the slits .

(a) Find the distance of the second (i) bright fringe , (ii) dark fringe from the central maximum .

(b) How will the fringe pattern change if the screen is moved away from the slits ?

Watch Video Solution

8. State Kirchhoff's rules . Apply Kirchhoff's rules to the loops ACBPA and ACBQA to write the expressions for the currents I_1, I_2 and I_3 in the network .

Watch Video Solution

9. The image obtained with a convex lens is erect and its length is 4 times the length of the object. If the focal length of lens is $20cm$, calculate the object and image distances.

Watch Video Solution

SET -III

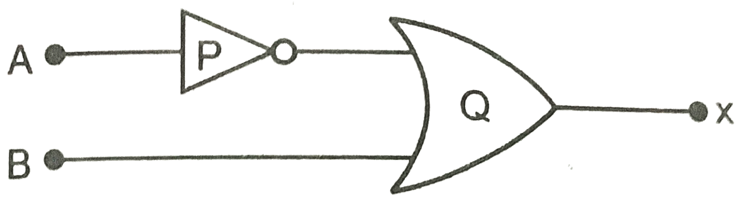
1. When light travels from a rarer to denser medium, it loses some speed. Does the reduction in speed imply a reduction in the energy carried by the light wave ?

Watch Video Solution

2. The energy of the electron in the ground state of hydrogen atom is $-13.6eV$. Find the kinetic energy and potential energy of electron in this state.

Watch Video Solution

3. (i) Identify the logic gates marked P and Q in the given logic circuit Fig.



(ii) Write down the output at X for the inputs $A = 0, B = 0$ and $A = 1, B = 1$.

Watch Video Solution

4. A convex lens is used to throw on a screen $10m$ from the lens, a magnified image of an object. If the magnification is to be 19, find the focal length of the lens.

Watch Video Solution

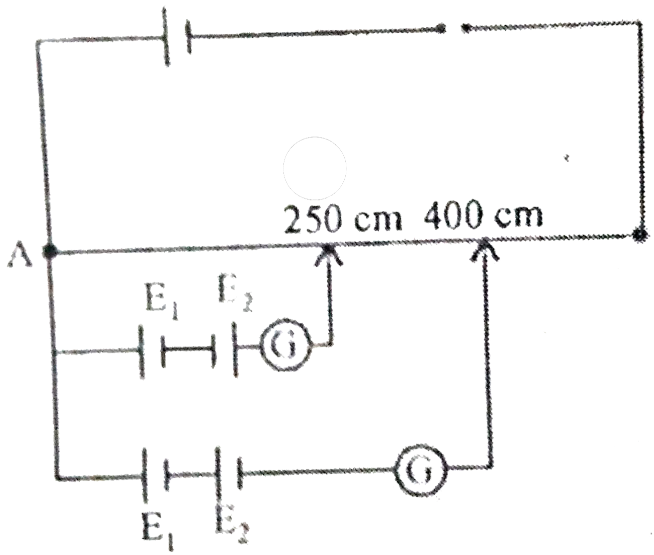
5. In Young's double slit experiment , the two slits 0.20 mm apart are illuminated by monochromatic light of wavelength 600 nm . The screen 1.0 m away from the slits .

(a) Find the distance of the second (i) bright fringe , (ii) dark fringe from the central maximum .

(b) How will the fringe pattern change if the screen is moved away from the slits ?

Watch Video Solution

6. Two primary cells of emfs E_1 and E_2 are connected to the potentiometer wire AB as shown in the figure . If the balancing lengths for the two combinations of the cells are 250 cm and 400 cm , find the ratio of E_1 and E_2 .



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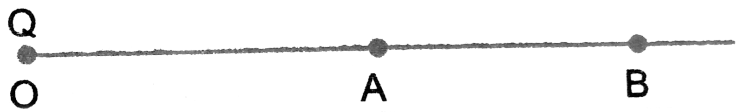
PHYSICS (Theory) [SET -I]

1. A point charge Q is placed at the point O as shown in Fig. Is the potential difference $(V_A - V_B)$ positive, negative or zero if Q is (i) possible (ii) negative ?



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2. A plane electromagnetic wave travels in vacuum along z-direction. What can you say about the direction of electric and magnetic field vectors?

Watch Video Solution

3. A resistance R is connected across a cell of emf ε and internal resistance r. A potentiometer now measures the potential difference between the terminals of the cell is V. Write the expression for r in terms of ε, V and R`.

Watch Video Solution

4. The permeability of magnetic material is 0.9983. Name the type of magnetic materials it represents.

Watch Video Solution

5. Show graphically, the variation of the de-Broglie wavelength λ with the potential V through which an electron is accelerated from rest.

Watch Video Solution

6. In a transistor, doping level in base is increased slightly. How will it affect (i) collector current and (ii)base current?

Watch Video Solution

7. Define the term 'wattles current'.

Watch Video Solution

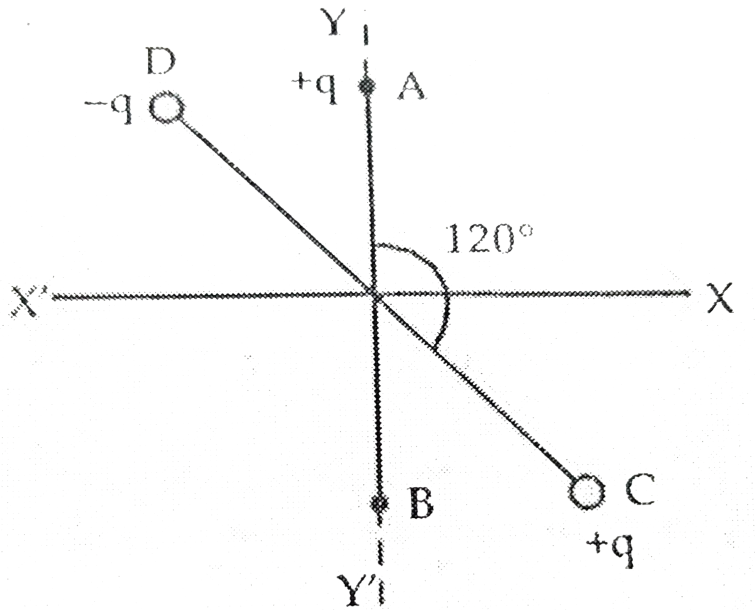
8. When monochromatic light travels from one medium to another, its wavelength changes, but its frequency remains the same. Why ?

Watch Video Solution

9. Two large parallel thin plates having uniform charge densities $+\sigma$ and $-\sigma$ are kept in X-Z plane at a distance d apart. Sketch an equipotential surface due to electric field between the plates. If a particle of mass m and charge $-q$ remains stationary between the plates, what is the magnitude and direction of the field ?

Watch Video Solution

10. Two small identical electrical dipoles AB and CD, each of dipole moment 'p' are kept at an angle of 120° as shown in the figure. What is the resultant dipole moment of this combination? If this system is subjected to electric field $\vec{E}$ directed along + X direction, what will be the magnitude and direction of the torque acting on this ?



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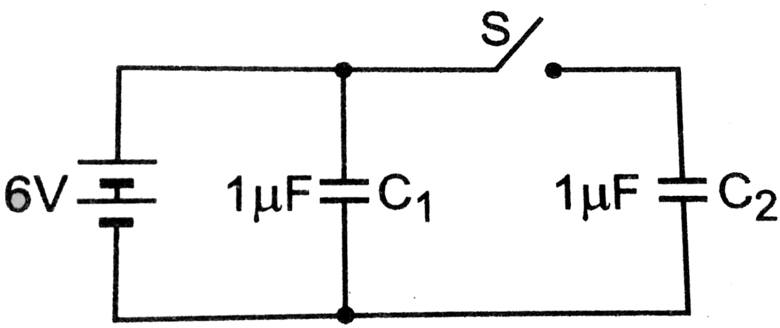
11. A magnetic needle free to rotate in a vertical plane parallel to magnetic meridian has its north

tip down at 60° with the horizontal. The horizontal component of earth's magnetic field at that place is $0 \cdot 4G$. Determine the magnitude of earth's magnetic field at the place.

Watch Video Solution

12. Fig, shows two indentical capacitors C_1 and C_2 each of $1\mu F$ capacitance connected to a battery of 6V. Inditally, swich S is closed. After some time, the swich S is left open and dielectric slabs of K = 3 are inserted to filll completely the space between the plates of two capacitors . How will (i) the charge and (ii) potential difference between the plates of the capacitors be affected after the slabs are inserted ?



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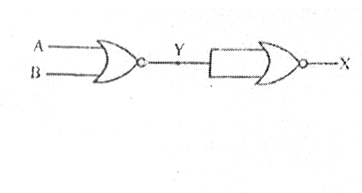
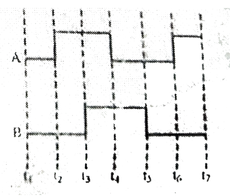
13. Two convex lenses of same focal length but of aperture A_1 and $A_2 (A_2 < A_1)$ are used as the objective lenses in two astronomical telescope having identical eye pieces. What is the ratio of

their resolving power ? Which telescope will you prefer and why ? Give reason.

Watch Video Solution

14. Draw the output waveformed at X, using the given inputs A and B for the logic circuit shows below. Also, identify the logic operation performed by this circuit.





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15. Name the semiconductor device that can be used to regulate an irregulation dc power supply. With the help of I-V characteristics of this device, explain its working.

Watch Video Solution

16. How are infrared waves produced? Why are these referred to as 'heat waves'? Write their one improtant use.

View Text Solution

17. Draw the tramsfer characteristic curve of a base biased transistor in CE configuration. Explain clearly how the active region of the V_o versus V_i curve in a transistor is used as an amplifier.

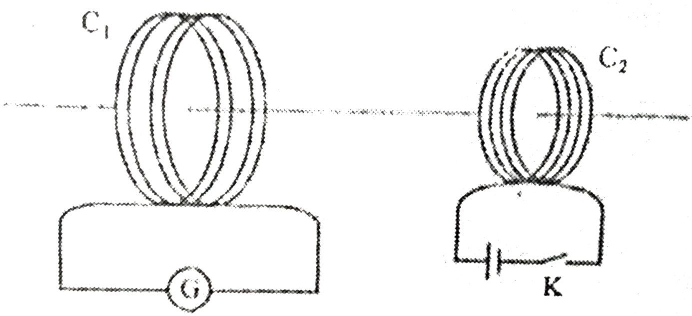
Watch Video Solution

18. Define modulation index. Why is it generally kept less than one ?

Watch Video Solution

19. A current is induced in coil C_1 due to the motion of current carrying coil C_2.

(a) Write any two ways by which a large deflection can be obtained in the galvanometer G. (b) Suggest an altermative device to demonstrate the induced current in place of galcanometer.



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20. A conductor of length L is connected to a dc source of emf ε. If this conductor is replaced by another conductor of same material and same area of cross-section but of length 3L, how will the drift velocity change?

Watch Video Solution

21. Using Gauss's law obtain the expression for the electric field due to uniformly charged thin spherical shell of radius R at a point outside the shell. Draw a graph showing the variation of electric tield with r, for r gt R and r lt R.

Watch Video Solution

22. An electron and a photon each have a wavelength 1.00 nm. Find

(i) their momenta,

(ii) the energy of the photon and

(iii) the kinetic energy of electron.

Watch Video Solution

23. Draw a schematic diagram showing the (i) ground wave (ii) sky wave and (iii) space wave

propagation modes for em waves.

Write the frequency range for each of the following :

(i) Standard AM broadcast (ii) television (iii) Satellite communication

Watch Video Solution

24. Describe Young's double slitexperiment to produce interference pattern due to a monochromatic source of light. Deduce the expression for the fringe width.

View Text Solution

25. (a) Describe briefly, with the help of suitable diagram, how the transverse nature of light can be demonstrated by the phenomenon of polarization.

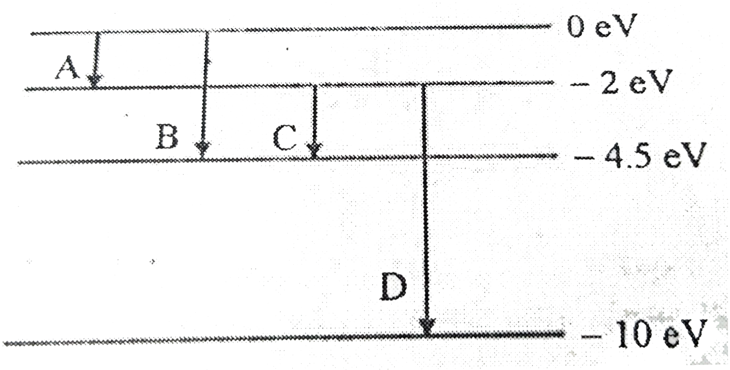
(b) When unpolarized light passes from air to a transparent medium, under what condition does the reflected light get polarized?

View Text Solution

26. The energy levels of a hypothetical aton are shown below. Which of the shown transitions will result in the emmission of a photon of wavelength

275 nm?

Which of these transitions correspond to emission of radiation of (i) maximum and (ii) minimum wavelength?



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27. State the law of radioactive decay. Plot a graph showing the number (N) of undecayed nuclei as a function of time (t) for a given radioactive sample having half life $T_{1/2}$

Depict in the plot the number of undecayed nuclei

at

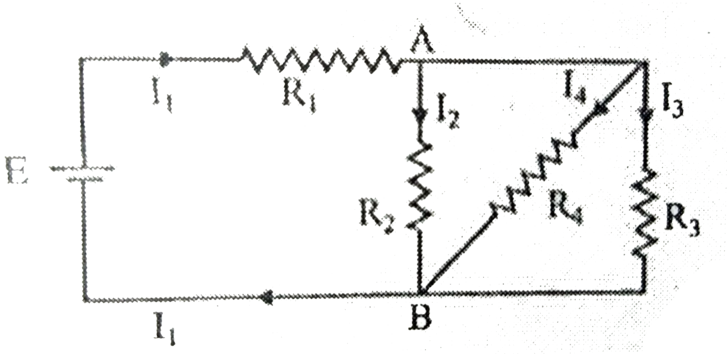
(i) $t = 3T_{1/2}$ and (ii) $t = 5T_{1/2}$.

Watch Video Solution

28. In the circuit shown,

$R_1 = 4\Omega, R_2 = R_3 = 15\Omega, R_4 = 30\Omega$ and $E = 10V$

. Caculate the equivalent resistance of te circuit and the current in each resistor.



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29. State Biot-Savart law, giving the mathematical expression for it.

Use this law to derive the expression for the magnetic field due to a circular coil carrying current at a point along its axis.

How does a circular loop carrying curent behave as a magnet?

View Text Solution

30. With the help of labelled diagram, state the underlying principle of a cylclotron. Explain clearly how it works to accelerate the charged particles to high energies.

Show that cyclotron frequency is independent of energy of the particle. Is there an upper limit on the enregy acquired by the particle? Give reason.

Watch Video Solution

31. (a) Draw a ray diagram to show regraction of a ray of monochromatic light passing through a glass prism.

Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation.

(b) Explain briefly how teh pheomenon of total internal reflection is used in fibre optics.

View Text Solution

32. (a) Obtain lens makers formula using the expression

$$\frac{n_2}{v} - \frac{n_1}{u} = \frac{(n_2 - n_1)}{R}$$

Here the ray of light propagating from a rarer medium of refractive index (n_1) to a denser medium of refractive index (n_2) is incident on the convex side of sperical refracting surface of radius of curvature R.

(b) Draw a ray diagram to show the umage formation by concave mirror when the object is kept between its focus and the pole. Using this diagram, derive the magnification formula for the image formed.

View Text Solution

33. (i) with the help of a labelled diagram, describe briefly the underlying principle and working of a stepup transformer.

(ii) Write any two sources of energy loss in a transformer. (iii) A step-up transformed converts a low input voltage into a high output voltage. Does it violate law of conservation of energy ? Explain.

View Text Solution

SET-II, DELHI BOARD

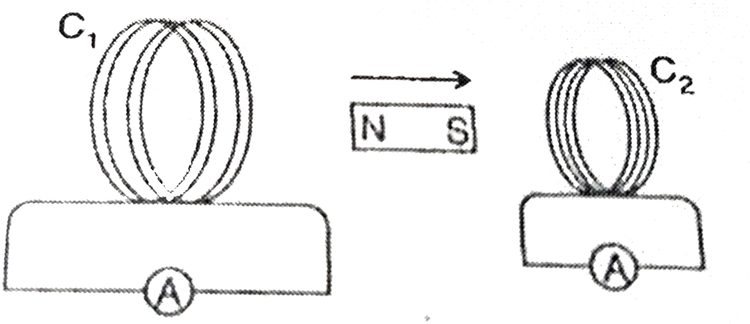
1. The susceptibility of a magnetic material is $1 \cdot 9 \times 10^{-5}$. What type of material does it represent?

Watch Video Solution

2. A plane electroagnetic wave travels in vacum along x-direction. What can you say about the direction of electric and magnetic field vectors?

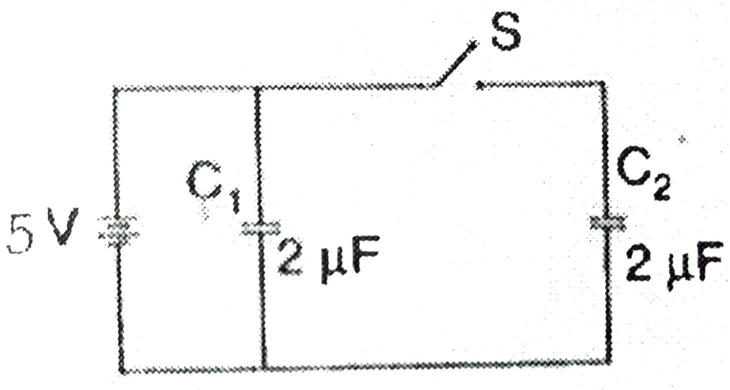
Watch Video Solution

3. A magnetis quickly moved in the direction indicated by an arrow between two coils C_1 and C_2 as shown in the figure. What will be the direction of induced cu. Rent in each coil as seen frim the magnet? Justify your answer.



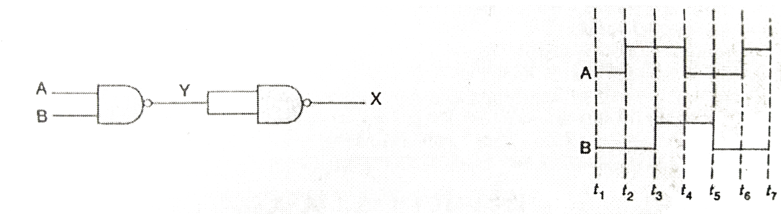
View Text Solution

4. Figure shows two identical capacitors C_1 and C_2 each of $2 \mu F$ capacitance, connected to a battery of 5 V. Initially switch 'S' is closed. After some time 'S' is left open and dielectric slavs of dielectric constant K = 5 are inserted to fill completely the space between the plates of the two capacitors. How will the (i) charge and (ii) potential difference between the plates of the capacitors be affected after the slabs are inserted?



Watch Video Solution

5. Draw the output waveform X, using the given inputs A and B for the logic circuit shows below. Also, identify the logic operation performed by this circuit.



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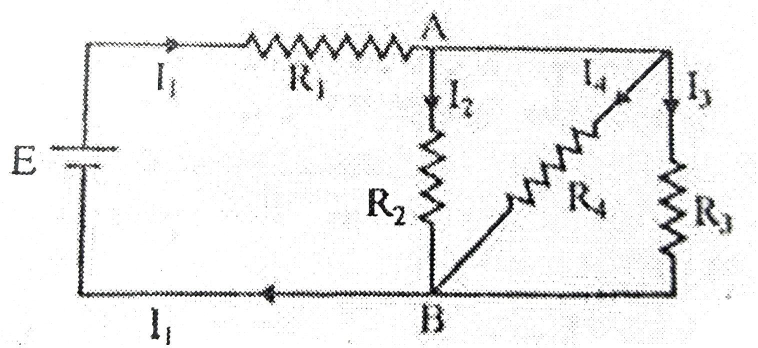
6. How is forward biasing different from reverse biasing in a p-n junction diode?

Watch Video Solution

7. In the circuit shown, $R_1 = 2\Omega$, $R_2 = R_3 = 10\Omega$ and $E = 6V$. Work out the equivalent resistance of the circuit and the current in each resistor.



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8. An electron and a photon each have a wavelength of 1.50 nm. Find (i) their momenta, (ii) the energy of the photon and (iii) kinetic energy of the electron.

Watch Video Solution

SET-III, DELHI BOARD

1. A plane electromagnetic wave travels in vacuum along y-direction. What can you say about the direction of electric and magnetic field vectors?

Watch Video Solution

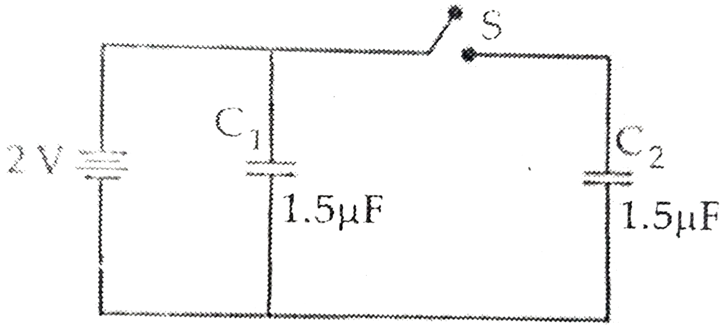
2. The susceptibility of a magnetic material is $-4\cdot 2\times 10^{-6}$. What type of material does it represent?

Watch Video Solution

3. What is meant by depletion region in a junction diode? How is this region formed?

Watch Video Solution

4. Figure shows two identical caoacitors C_1 and C_2 each of $1.5\mu F$ caoacitance, connected to a battery of 2 V. Initially switch 'S' is closed. After some time 's' is left open and dielectric slabs of dielectric constant K=2 are inserted to fill completely the space between the plates of the two capacitors. How will the (i) charge and (ii) potential difference between the plates of the capacitors be affected after the slabs are inserted.



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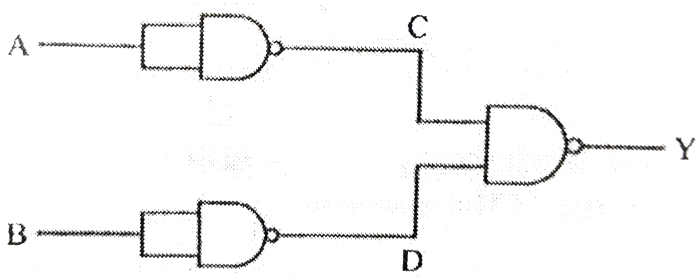
5. Write the truth table for the logic circuit shown below and identify the logic operation performed

by circuit.



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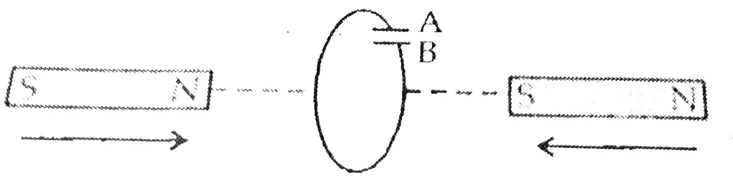
6. Predict the polarity of the capacitor when the two magnets are quickly moved in the directions marked by arrows.



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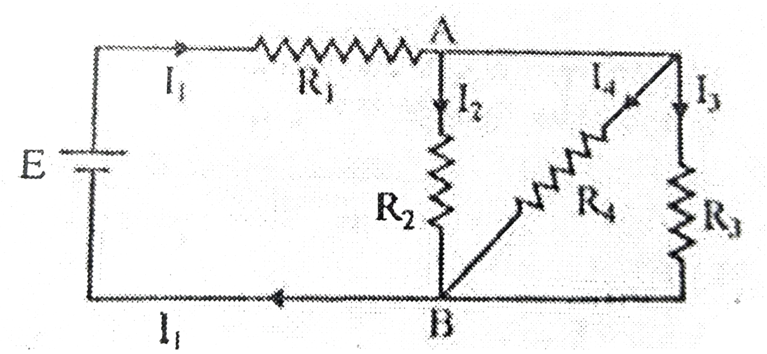
7. In the circuit shown, $R_1 = 2\Omega$, $R_2 = R_3 = 10\Omega$ and $E = 6V$. Work out the equivalent resistance of the circuit and the current in each resistor.



Watch Video Solution

8. An electron and a photon each have a wavelength of 2.00nm. Find (i) their momenta (ii) the energy of the photon and (iii) the kinetic energy of electron. $h = 6.63 \times 10^{-34} Js$

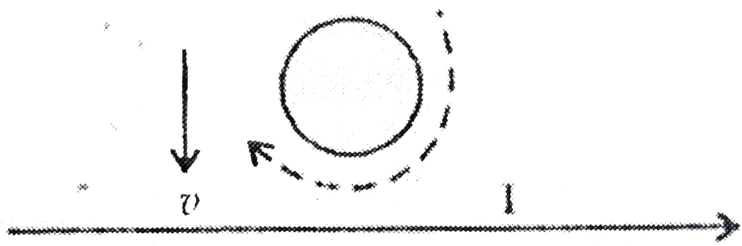
Watch Video Solution

[Set- II]

1. Why the electric field at the outer surface of a hollow charged conductor is normal to the surface?

Watch Video Solution

2. Predict the direction of induced current in a metal ring when the ring is moved towards a straight conductor with constant speed v. The conductor is carrying current I in the direction shown in the figure.



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3. Derive the expression for the self inductance of a long solenoid of cross sectional area A and length l, having n turns per unit length.

View Text Solution

4. The susceptibility of magnetic material is 2.6×10^{-5}. Identify the type of magnetic material and state its two properties.

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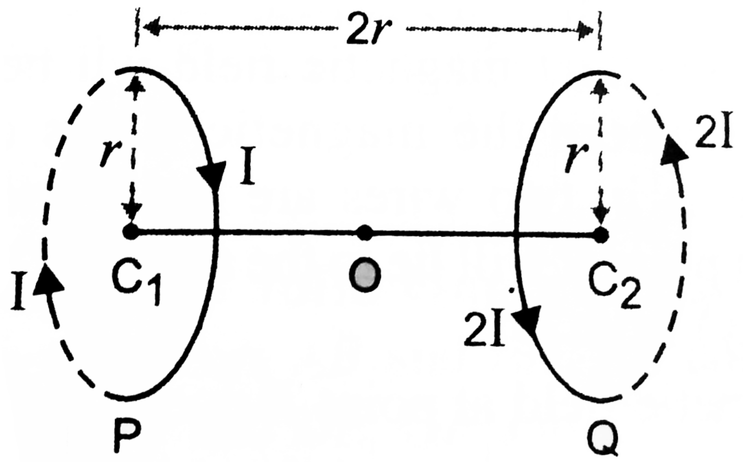
5. Two identical circular loops, P and Q each of radius r and carrying currents I and 2I respectively are lying in parallel planes such that they have a common axis. Their centres are distance $2r$ apart. The direction of current in both the loops is clockwise as seen from O which is equidistant from both the loops. Find the magnitude of the net magnetic field at point O.



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6. A series LCR circuit with $L = 4.0H, C = 100\mu F$ and $R = 60\Omega$ is connected to a variable frequency 240 V source. Calculate

(i) angular frequency of the source which drives the circuit in resonance,

(ii) current at the resonating frequency,

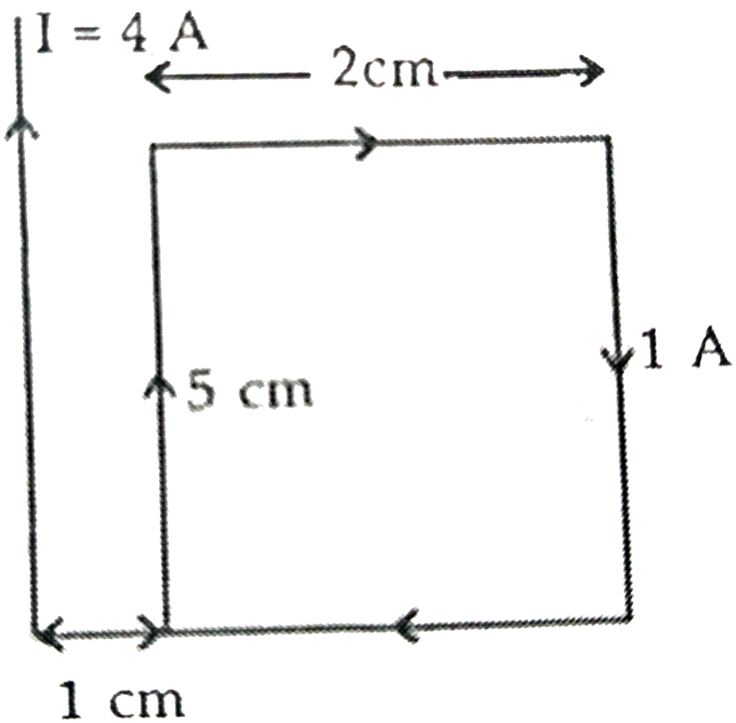
(iii) rms potential drop across the inductance at resonance.

Watch Video Solution

7. A rectangular loop of wire of size $2cm \times 5cm$ carries a steady current of 1A. A straight long wire carrying 4 A current is kept near the loop as shown. If the loop and the wire are coplanar, find

(i) the torque acting on the end

(ii) the magnitude and direction of the force on the loop due to the current carrying wire.



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8. Explain using a proper diagram, the mode of propagation used in the frequency range above 40

MHz.

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[Set-III]

1. Justify that electrostatic potential is constant throughout the volume of charged conductor and has same value on its surface as inside it.

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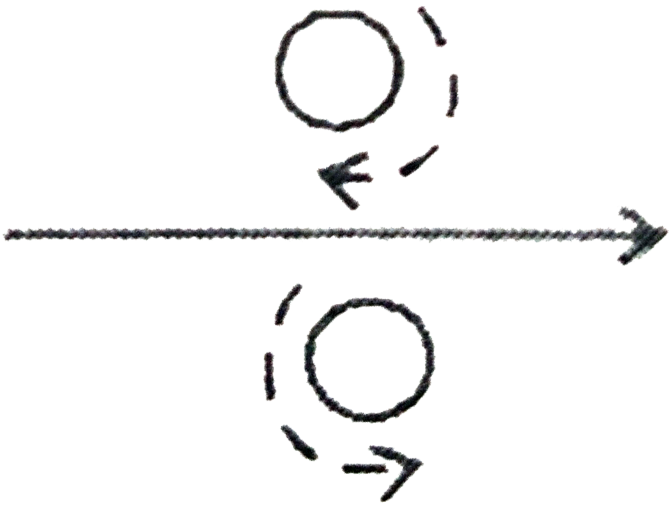
2. Predict the direction of induced current in metal rings 1 and 2 when current I in the wire is steadily decreasing .



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3. The relative magnetic permeability of a magnetic material is 800. Identify the nature of magnetic material and state its two properties.

Watch Video Solution

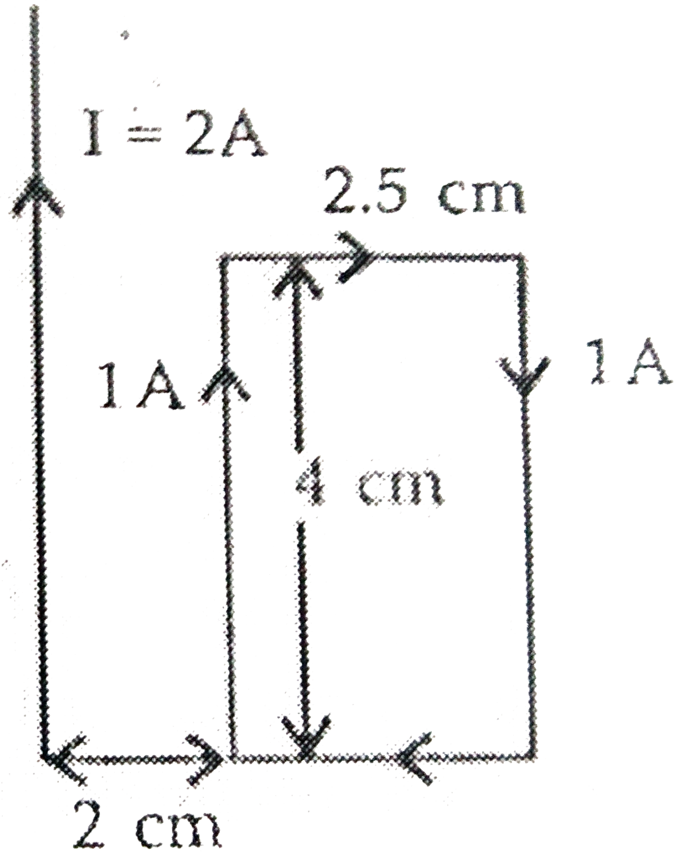
4. Define mutual inductance between two long coaxial solenoids. Find out the expression for the mutual of inner solenoid of length 1 having the radius r_1 and the number of turns n_1 per unit length due to the second other solenoid of same length and n_2 number of turns per unit length.

Watch Video Solution

5. A rectangular loop of wire of size $2.5cm \times 4cm$ carries a steady current of 1A. A straight long wire carrying 2 A current is kept near the loop as shown. If the loop and the wire are coplanar, find

(i) the torque acting on the loop and

(ii) the magnitude and direction of the force on the loop due to the current carrying wire.



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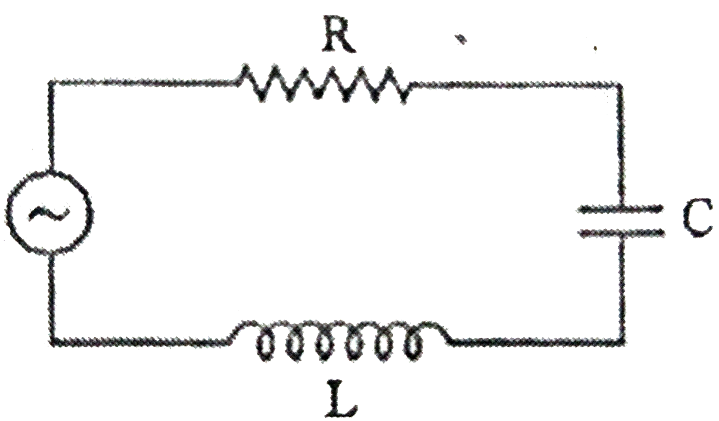
6. The figure shows a series LCR circuit with $L = 10.0H_2, C = 40\mu F, R = 60\Omega$ connected to a variable frequency 240 V source. Calculate

(i) The angular frequency of the source which drives the circuit at resonance.

(ii) The current at the resonating frequency.

(iii) The rms potential drop across the capacitor at resonance.



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PHYSICS (Theory) [SET - I]

1. Two wires of equal length one of copper and other of manganin have the same resistance. Which wire is thicker?

Watch Video Solution

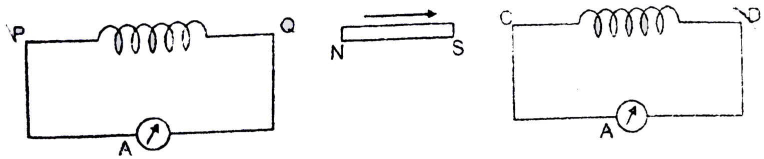
2. What are the directions of electric and magnetic field vectors relative to each other and relative to the direction of propagation of electromagnetic waves ?

Watch Video Solution

3. How does the angular separation between frings in single-slit diffraction experiment change when the distance of separation between the slit and screen is doubled ?

Watch Video Solution

4. A bar magnet is moved in the direction indicated by the arrow between two coil PQ and CD. Predict the directions of induced in each coil.



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5. For the same angle of incidence in media P,Q and R, the angles of refraction are $35^\circ, 25^\circ, 15^\circ$ respectively. In which medium will the velocity of light be minimum?

Watch Video Solution

Watch Video Solution

6. A proton and an electron have same kinetic energy. Which one has greater de-Broglie wavelength and why ?

Watch Video Solution

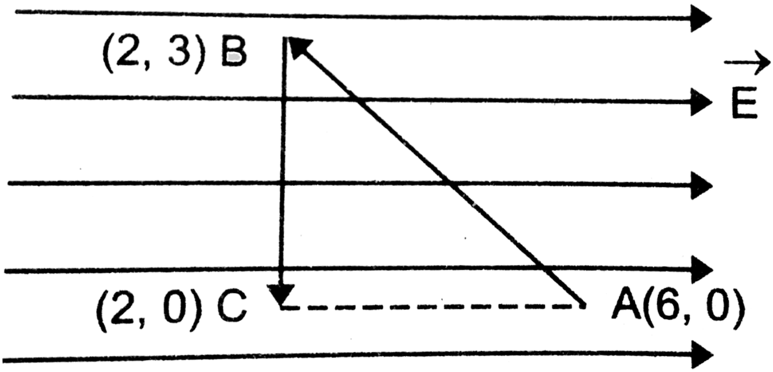
7. Mention two characteristic properties of the material suitable for making core of a transformer.

Watch Video Solution

8. A charge q is placed at the centre of a cube of side l what is the electric flux passing through two opposite faces of the cube ?

Watch Video Solution

9. A test charge q is moved without acceleration from A to C along the path from A to B and then from B to C in electric field E as shown in Fig. (i) Calculate the potential difference between A and C (ii) At what point [of A and C] is the electric potential more and why?



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10. An electric dipole is held in a uniform electric field.

(i) Show that the net force acting on it is zero.

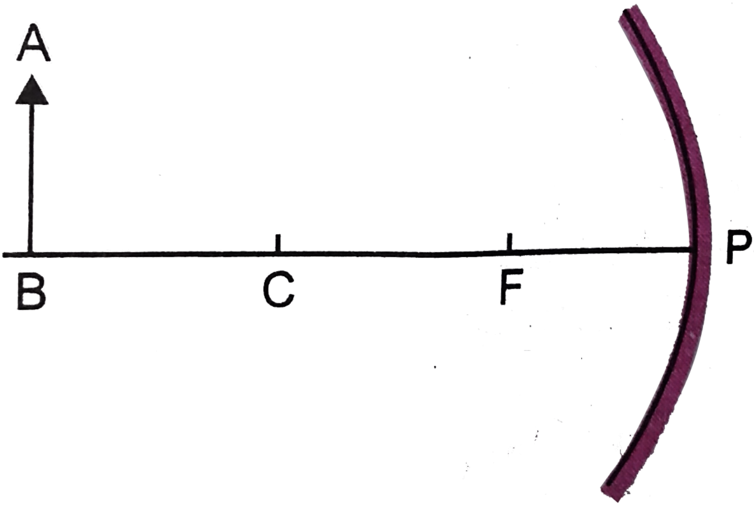
(ii) The dipole is aligned parallel to the field. Find the work done in rotating it through the angle of 180°.

Watch Video Solution

11. A capacitor of capacitance 'C' is being charged by connecting it across a dc source along with an ammeter. Will the ammeter show a momentary deflection during the process of charging? If so, how would you explain this momentary deflection and the resulting continuity of current in the circuit? Write the expression for the current inside the capacitor.

View Text Solution

12. An object AB is kept in front of a concave mirror as shown in Fig.



(i) Complete the ray diagram showing the image formation of the object.

(ii) How will the position and intensity of the image be affected surface is painted black ?

Watch Video Solution

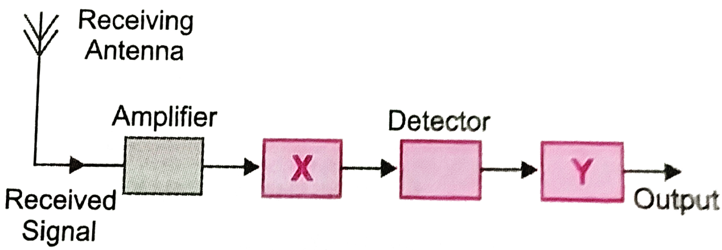
13. Explain the scattering of light with an example.

View Text Solution

14. Describe briefly with the help of a circuit diagram, how the flow of current carriers in a p-n-p transistor is regulated with emitter-base junction forward baised and base-collector junction reverse baised.

View Text Solution

15. In the given block diagram of a receiver, Figure, identify the boxes labelled as X and Y and write their functions.



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16. A light bulb is rated 100 W for 220 V ac supply of 50 Hz. Calculate

(i) the resistance of the bulb,

(ii) the rms current through the bulb.

Watch Video Solution

17. An alternating voltage given by $V = 140 \sin 314t$ is connected across a pure resistor of 50 ohm. Find (i) the frequency of the source. (ii) the rms current thought the resistor.

Watch Video Solution

18. A circular coil of N turns and radius R carries a current I. It is unwound and rewound to make another coil of radius $R/2$. Current I remaining the same. Calculate the ratio of the magnetic moments of the new coil and the original coil.

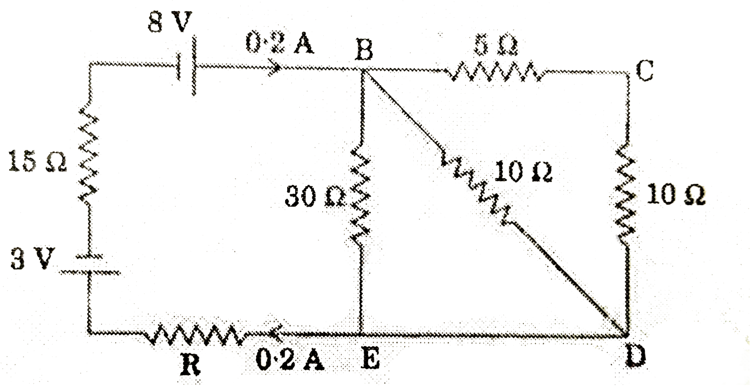
Watch Video Solution

19. Deduce the expression for the electrostatic energy stored in a capacitor of capacitance 'C' and having charge 'Q'.

How will the (i) energy stored and (ii) the electric field inside capacitor be affected when it is completely filled with a dielectric material of dielectric constant 'K'?

Watch Video Solution

20. Calculate the value of the resistance R in the circuit shown in the figure so that the current in the circuit is 0.2 A. What would be the potential difference between points B and E?



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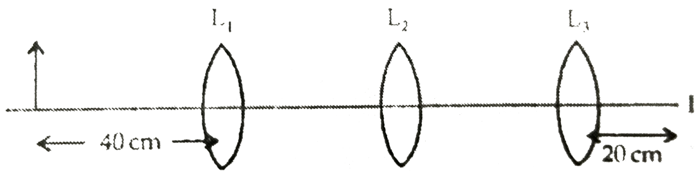
21. You are given three lenses L_1, L_2 and L_3 each of focal length 20 cm. An object is kept at 40 cm in front of L_1, as shown. The final real image is formed at the focus 'I' of L_3. Find the separations between L_1, L_2 and L_3.



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22. Explain thermionic emission, field emission and photoelectric emission.

View Text Solution

23. Obtain the resonant frequency (ω_r) of a series LCR circuit withL = 2.0 H, C = 32 μF and R = 10 ohm. What is the Q value of this circuit ?

Watch Video Solution

24. Mention three different modes of propagation used in communications system. Explain with the help of a diagram how long distance communication can be achieved by ionospheric reflection of radio waves?

Watch Video Solution

25. Draw a plot of potential energy of a pair of nucleons as a function of their separations. Mark the regions where the nuclear force is (i) attractive and (ii) repulsive. Write any two characteristic features of nuclear forces.

View Text Solution

26. In a Geiger- Marsden experiment, calculate the distance of closest approach to the nucleus of Z=80, when an α particle of 8 Me V energy impinges on it before it comes momentarily to rest and reverses its direction.

How will the distance of closest approach be affected when the kinetic energy of the $\alpha-$ particle is doubled ?

Watch Video Solution

27. The ground state energy of hydrogen atom is $-13.6eV$. If an electron makes a transition form an energy level $-0.85eV$ to $-3.4eV$, calculate the wavelength of spectral line emitted. To which series of hydrogen spectrum does this wavelength belongs?

Watch Video Solution

28. Define relaxation time of the free electrons drifting in conductor. How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material.

View Text Solution

29. (a) In Young's double slit experiment, derive the condition for (i) constructive interference and (ii) destructive interference at a point on the screen.

(b) A beam of light consisting of two wavelengths, 800 nm and 600 nm is used to obtain the interference frings in a Young's double slit experiment on a screen placed 1.4 m away. If the two slits are separated by 0.28 mm, calculate the least distance from the central bright maximum where the bright fringes of the two wavelengths coincide.

Watch Video Solution

30. (a) How does an unpolarized light incident on polaroid get polarized ?

Describe briefly, with the help of necessary diagram, the polarization of light by reflection from a transparent medium. (b) Two polaroids 'A' and 'B' are kept in crossed position. How should a third polaroid 'C' be placed between them so that the inlensity of polarized light transmitted by polaroid B reduces to $1/8^{th}$ of the intensity of unpolarized incident on A?

Watch Video Solution

31. (a) Write the expression for the force, $\overrightarrow{F}$, acting on a charged particle of charge 'q', moving with a velocity $\overrightarrow{V}$ in the presence of both electric field $\overrightarrow{E}$ and magnetic field $\overrightarrow{B}$. Obtain the condition under which the particle moves undeflected through the fields.

(b) A rectangular loop of size $l \times b$ carrying a steady current I is placed in a uniform magnetic field $\overrightarrow{B}$. Prove that the torque $\overrightarrow{\tau}$ acting on the loop is given by

$\overrightarrow{\tau} = \overrightarrow{m} \times \overrightarrow{B}$, where $\overrightarrow{m}$ is the magnetic moment of the loop.

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32. (a) Explain, giving reasons, the basic difference in converting galvanometer into (i) a voltmeter and (ii) an ammeter.

(b) Two long straight parallel conductors carrying steady currents I_1 and I_2 are separated by a distance 'd'. Explain briefly, with the help of a suitable diagram, how the magnetic field due to one conductor acts on the other. Hence deduce the expression for the force acting between the two conductors. Mention the nature of this force.

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PHYSICS (Theory) [SET - II]

1. An electric dipole of diople moment $20 \times 10^{-6} Cm$ is enclosed by a closed surface.

What is the net electric flux coming out of the surface ?

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2. In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band ?

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3. A light bulb is rated 200 W for 220 V supply at 50 Hz. Calculate resistance of the bulb and rms current through the bulb.

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4. An alternating voltage given by $E = 280 \sin 50\pi t$ is connected across a pure resistor of 40 ohm. Find frequency of source and rms current through the bulb.

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5. In a Geiger - Marsden experiment, calculate the distance of closest approach to the nucleus of Z=75, when an α - particle of 5 Me V enery impinges on it before it comes momentarily to rest and reverses its direction.

How will the distance of closest approach be affected when the kinetic energy of the α-particle is doubled ?

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6. The ground state energy of hydrogen atom is -13.6eV. If an electron makes a transition from an energy level -0.85 eV to -1.51 eV, calculate the wavelength of spectral line emitted. To which series of hydrogen spectrum does this wavelength belongs?

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PHYSICS (Theory) [SET - III]

1. How does the fringe width, in Young's double-slit experiment, change when the distance of separation between the slits and screen is doubled ?

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2. The speed of an electromagnetic wave in a material medium is given by $n = \frac{1}{\sqrt{\mu\varepsilon}}$, m being the permeability of the medium and e its permittivity. How does its frequency change ?

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3. Mention two characteristic properties of the material suitable for making core of a transformer.

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4. A proton and an electron have same kinetic energy. Which one has greater de-Broglie wavelength and why ?

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5. A circular coil of closely wound N terns and radius r carriers a current I.

Write the expressions for the following :

(i) the magnetic field at its centre

(ii) the magnetic moment of this coil

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6. A light bulb is rated 150 W for 220 V ac supply of 60 Hz. Calculate

(i) the resistance of the bulb,

(ii) the rms current through the bulb.

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7. An alternating voltage given by $V = 70 \sin 100\pi t$ is connected across a pure resistor of 25Ω. Find

(i) the frequency of the source.

(ii) the rms current through the resistor.

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8. An electric dipole is held in a uniform electric field.

(i) Show that the net force acting on it is zero.

(ii) The dipole is aligned parallel to the field. Find the work done in rotating it through the angle fo 180°.

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9. Explain briefly the following terms used in communication system :

(i) Transducer

(ii) Repeater

(iii) Amplification

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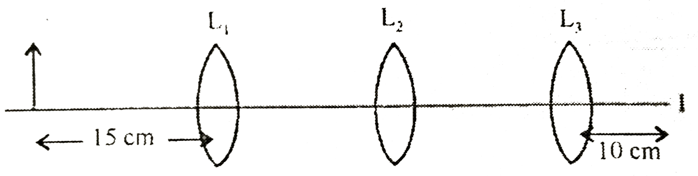
10. You are given three lenses L_1, L_2 and L_3 each of focal length 10 cm. An object is kept at 15 cm in front of L_1, as shown. The final real image is formed at the focus 'T' of L_3. Find the separations between L_1, L_2 and L_3.



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SET - I

1. What are permanent magnets? Give one example.

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2. What is the geometrical shape of equipotential surfaces due to a single isolated charge ?

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3. Which of the following waves can be polarized (i) Heat waves (ii) Sound waves?

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4. A capacitor has been charged by ad.c. source. What are the magnitudes of conduction and displacement currents, when it is fully charged?

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5. The relation between angle of incidence i, angle of prism A and angle of minimum deviation for a triangular prism is.

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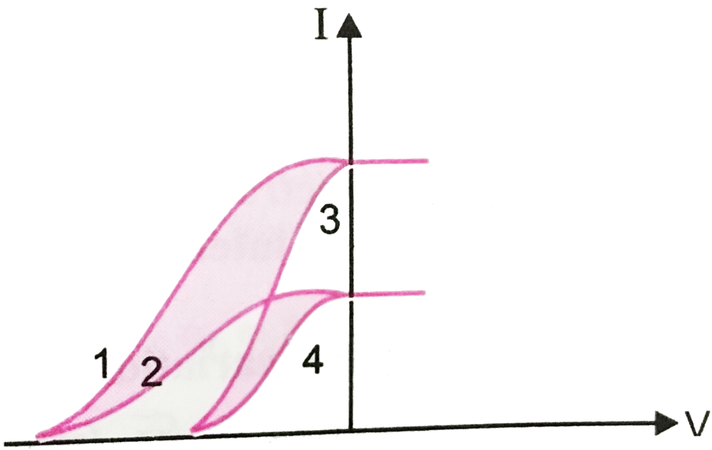
6. The graph of Fig. shows the variation of photoelectric current (I) versus applied voltage (V) for the two different photosensitive materials for two different intensities of the incident radiation.

Identify the pairs of curves that correspond to different materials but same intensity of incident radiation.



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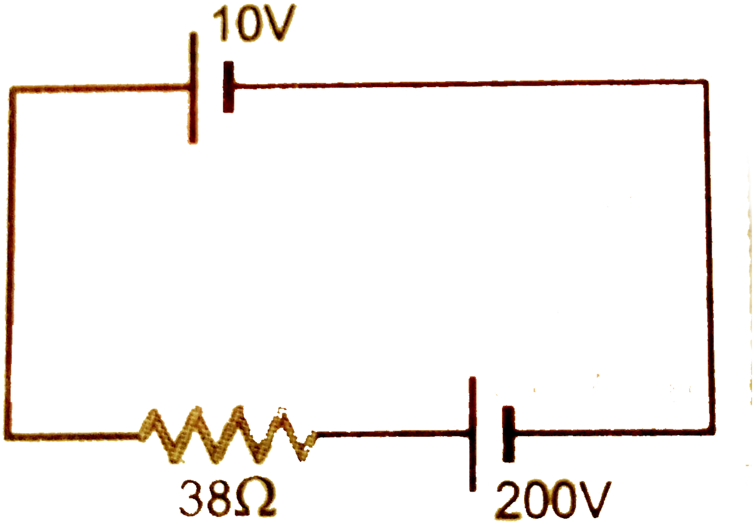
7. A 10 V battery of negilgible internal resistance is connected across a 200V battery and a resistance of 38Ω as shown in figure.



. Find the value of current in the circuit.

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8. The emf of a cell is always greater than its terminal voltage. Why? Give reason.

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9. What is the relation between refractive index and critical angle for a given pair of optical media ?

Watch Video Solution

10. State Lenz's Law.

A metallic rod held horizontally along east-west direction, is allowed to fall under gravity. Will there be an emf induced at its ends? Justify your answer.

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11. A convex lens of focal length $25cm$ is placed co-axially in contact with a concave lens of focal length $20cm$. Determine the power of the combination. Will the system be converging or diverging in nature ?

Watch Video Solution

12. An ammeter of resistance $0 \cdot 80\Omega$ can measure current upto $1 \cdot 0A$.

(a) What must be the value of shunt resistance to enable the ammeter to measure current upto

$5 \cdot 0A$?

(b) What is the combined resistance of the ammeter and the shunt?

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13. In the given circuit diagram, a voltmeter 'V' is connected across a lamp 'L'. How would (i) the brightness of the lamp and (ii) voltmeter reading 'V' be affected, if the value of resistance 'R' is decreased ? Justify your answer.

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14. (a) An EM wave is travelling in a medium with a velocity $\overrightarrow{v} = v\hat{i}$.Draw a sketch showing the propagation of the EM wave, indicating the direction of the oscillating electric and magnetic fields.

(b) How are the magnitudes of the electric and magnetic fields related to the velocity of the EM wave?

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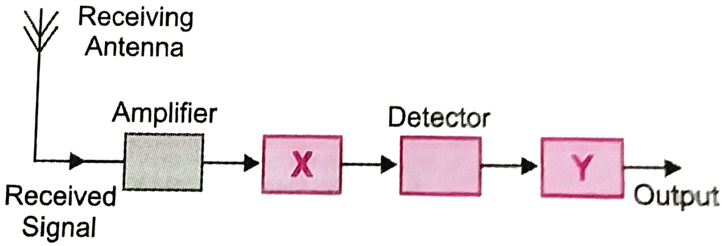
15. In the given block diagram of a receiver, Figure, identify the boxes labelled as X and Y and write their functions.



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16. Explain, with the help of a circuit diagram, the working of a photo diaode. Write briefly how it is used to detect the optical signals.

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17. Mention the important considerations required while fabricating a p-n junction diode to be used as light emitting diode (LED). What should be the order of the band gap of an LED if it is required to emit light in the visible region.

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18. Write three important factors which justify the need of modulating a message signal.

Show diagrammatically how an amplitude modulated wave is obtained when a modulating signal is superimposed on a carrier wave.

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19. Calculate the capacity of unknown capacitance is connected acrosss a battery of V volts. The charge stored in it is $360\mu C$. When potential across the capacitor is reduced by 120V, the charge stored in it becomes $120\mu C$.

Calculate (i) the potential V and unknown capacitance C. (ii) What will be the charge stored in the capacitor. If the voltage applied had increased by 120 V

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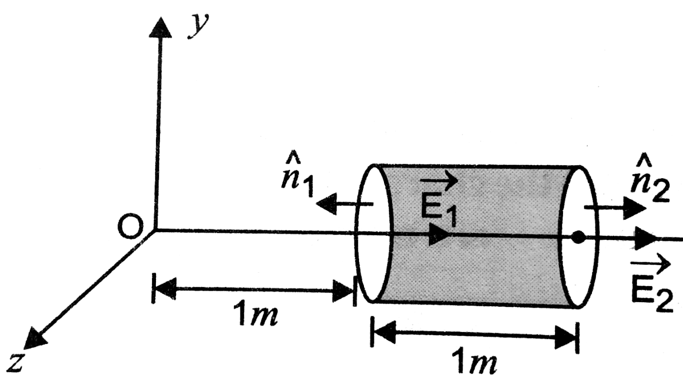
20. A hollow cylindrical box of length 1m and area of cross section $25 cm^2$ is placed in a three dimensional co-ordinate system as shown in Fig, The electric field in the region is given by $\vec{E} = 50x\hat{i}$, where E is in NC^{-1} and x is in meter. Find

(i) Net flux through the cylinder

(ii) Charge enclosed by the cylinder.



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21. In a typical unclear reaction, e.g.

$$ {}_{1}^{2}H + {}_{1}^{2}H \rightarrow {}_{2}^{3}He + n + 3.27 MeV, $$

although number of nucleons is conserved is conserved, yet energy is released. How ? Explain.

(b) Show that nuclear dendity in a given nucleus is independent of mass number A.

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22. (a) Why photoelectric effect cannot be explained on the basis of wave nature of light?

(b) Write the basic features of photon picture of electromagnetic radiation on which Einstein's photoelectric equation is based.

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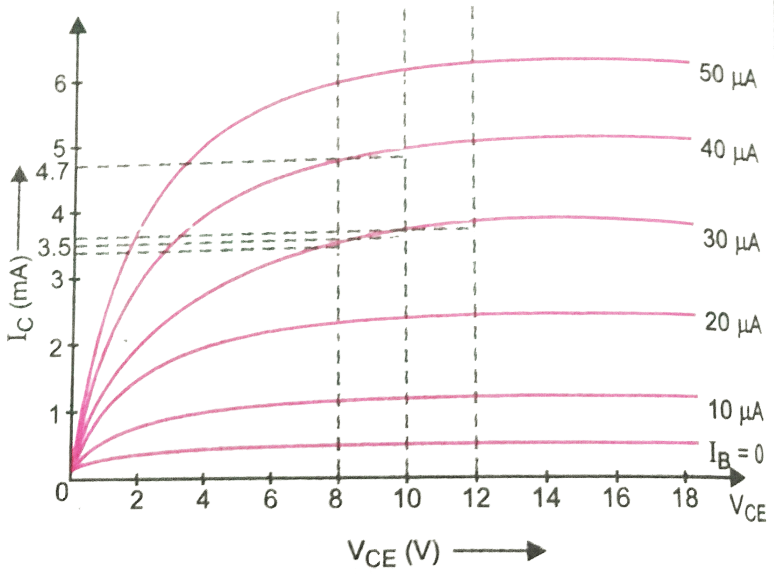
23. Output characteristics of an n-p-n transistor in CE configuration is shown in the Fig. Determine



(i) dynamic output resistance (ii) dc current gain and (iii) ac current gain at an opererating point $V_{CE} = 10V$, when $I_B = 30\mu A$.

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24. Using Bohor's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.

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25. (a) In what way is diffraction from each slit related to the interference pattern in a double slit experiment ?

(b) Two wavelengths of sodium light 590 nm and 596 nm are used, in turn, to study the diffraction taking place at a single slit of aperture $2 \times 10^{-4} m$. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of the first maxima of the diffraction pattern obtained in the two cases.

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26. In a series LCR circuit connected to an ac source of variable frequency and voltage $v = v_m \sin \omega t$, draw a plot showing the variation of current (I) with angular frequency (ω) for two different values of resistance R_1 and $R_2 (R_1 > R_2)$. Write the condition under which the phenomenon of resonance occurs. For which value of the resistance out of the two curves, a sharper resonance is produced ? Define Q-factor of the circuit and give its significance.

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27. While travelling back to his residence in the car, Dr. Pathak was caught up in a thunderstorm. It became very dark. He stopped driving the car the waited for thunderstom to stop. Suddenly he noticed a child walking alone on the road. He asked the boy to come inside the car till the thunderstorm stopped. Dr. Pathak dropped the boy at his residence. The boy insisted that Dr. Pathak should meet hsi parents. The parents expressed their gratitude to Dr. Pathak for his concern for safety of the child.

Answer the following questions based on the above information:

(a) Why is it safer to sit inside a car during a thunderstorm?

(b) Which two values are displayed by Dr. Pathak in his actions?

(c) Which values are reflected in parents response to Dr. Pathak ?

(d) Give an example of a similar action on your part in the past from everyday life.

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28. (a) State Huygen's principle . Using this principle draw a diagram to show how a plane wave front incident at the interface of the media gets refracted when it propagates from a rarer to a denser medium. Hence verify Snell's law of refraction.

(b) When monochromatic light travels from a rarer to a denser medium, explain the following, giving reasons-

(i) Is the frequency of reflected and refracted light same as the frequency of incident light?

(ii) Does the decrease in speed imply a reduction in the energy carried by light wave?

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29. State the working principle of potentiometer. With the help of the circuit diagram, explain how a potentiometer is used to compare the emf's of two primay cells. Obtain the required expression used for comparing the emfs. Write two possible causes for one sided deflection in a potentiometer experiment.

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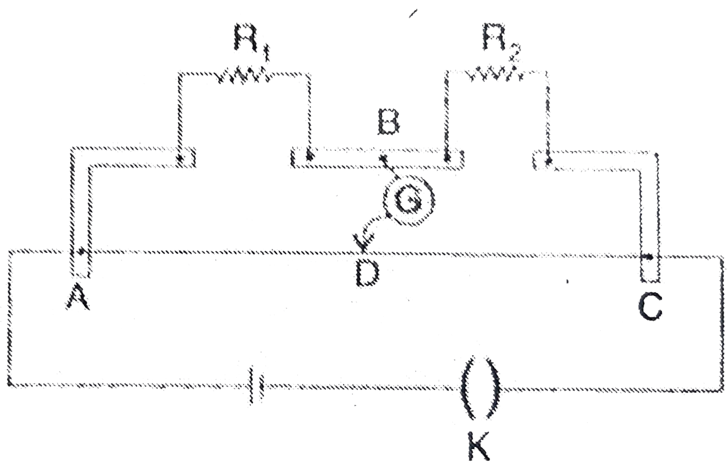
30. (a) State Kirchhoff's rules for an electirc network. Using Kirchhoff's rules, obtain the balance condition in terms of the resistances of four arms of Wheatstone bridge.

(b) In the meter bridge experimental set up, shown in the figure, the null point 'D' is obtained at a distance of 40 cm from end A of the meter bridge wire. If a resistance of 10Ω is connected in series with R_1, null point is obtained at $AD = 60cm$. Calculate the values of R_1 and R_2.



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SET - II (Delhi Board)

1. A cell of emf 'E' and internal resistance 'r' draws a current 'I'. Write the relation between terminal voltage 'V' in terms of E, I and r.

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2. Which of the following substances are diamagnetic?

Bi, Al, Na, Cu, Ca and Ni.

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3. A heating element is marked 210 V, 630 W. What is the value of the current drawn by the element when connected to a 210 V dc source ?

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4. An ammeter of resistance 1 W can measure current upto 1.0 A. (i) What must be the value of the shunt resistance to enable the ammeter to measure upto 5.0 A? (ii) What is the combined resistance of the ammeter and the shunt?

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5. A convex lens of focal length $25cm$ is placed co-axially in contact with a concave lens of focal length $20cm$. Determine the power of the combination. Will the system be converging or diverging in nature ?

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6. Using Bohr's postulates, obtain the expressions for (i) kinetic energy and (ii) potential energy of the electron in stationary state of hydrogen atom. Draw the energy level diagram showing how the transitions between energy levels result in the appearance of Lymann Series.

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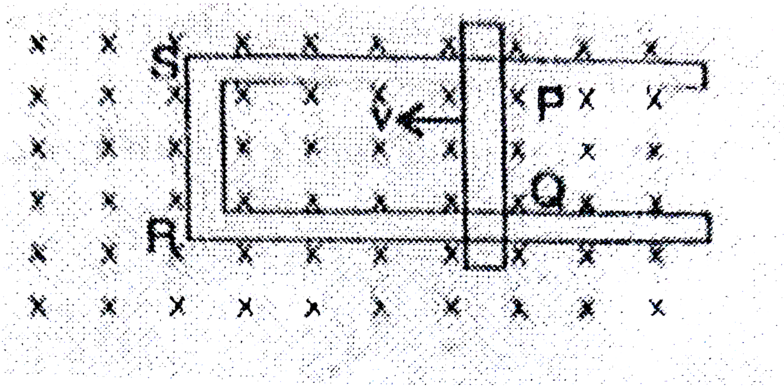
7. Figure shows a rectangular loop conducting PQRS in which the arm PQ is free to move. A uniform magnetic field acts in the direction perpendicular to the plane of the loop. Arm PQ is moved with a valocity v towards the arm RS. Assuming that the arms QR, RS and SP have negligible resistances and the moving arm PQ has the resistance r, obtain the expression for (i) the current in the loop (ii) the force and (iii) the power required to move the arm PQ.



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8. Distinguish between 'sky waves' and 'space waves' modes of propagation in communication system.

(a) Why is sky wave mode propagation restricted to frequencies upto 40 MHz?

(b) Give two examples where space wave mode of propagation is used.

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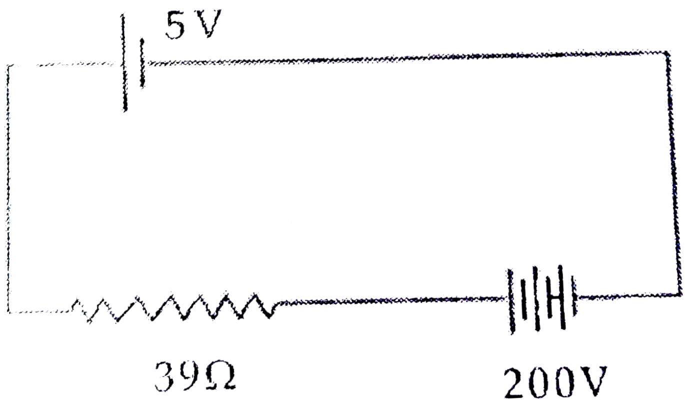
SET - III (Delhi Board)

1. A 5 V battery of negligible internal resistance is connected across a 200 V battery and a resistance of 39Ω as shown in the figure. Find the value of the current.



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2. Which of the following substances are para-magnetic?

Bi, Al, Cu, Pb, Ni

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3. An ammeter of resistance 0.6Ω can measure current upto 1.0 A. Calculate (i) The shunt resistance required to enable the ammeter to measure current upto 5.0 A (ii) The combined resistance of the ammeter and the shunt.

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4. A convex lens of focal length 30 cm is placed coaxially in contact with a concave lens of focal length 40 cm. Determine the power of the combination. Will the system be converging or diverging in nature?

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5. A capacitor of unknown capacitance is connected across a battery of V volts. The charge stored in it is 300 μC. When potential across the capacitor is reduced by 100 V, the charge stored in it becomes 100 μC. Calculate the potential V and the unknown capacitance. What will be the charge stored in the capacitor if the voltage applied had increased by 100V?

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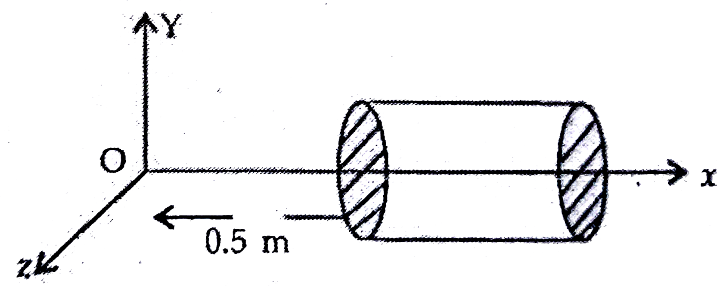
6. A hollow cylindrical box of length 0.5m and area of cross-section $20cm^2$ is placed in a three dimensional coordinate system as shown in the figure. The electric field in the region is given by $\vec{E} = 20x\hat{i}$, where E is NC^{-1} and x is in meters, Find



(i) Net flux through the cylinder.

(ii) Charge enclosed in the cylinder.

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7. (a) Write two characteristics features distinguishing the diffraction pattern from the interference fringes obtained in Young's double slit experiment.

(b) Two wavelengths of sodium light 590 nm and 596 nm are used , in turn, to study the diffraction taking place due to a single slit of aperture $1 \times 10^{-4} m$. The distance between the slit and the screen is 1.8m. Calculate the separation between the positions of the first maxima of the diffraction pattern obtained in the two cases.

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8. (a) In a nuclear reaction $_{2}^{3}He + _{2}^{3}He \rightarrow _{2}^{4}He + _{1}^{1}H + _{1}^{1}H + 12.86$ MeV, though the number of nucleons is conserved on both sides of the reaction, yet the energy is released. How? Explain.

(b) Draw a plot of potential energy between a pair of nucleons as a function of their separation. Mark the regions where potential energy is (i) positive and (ii) negative.

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[SET - I]

1. Define the term 'mobility' of charge carriers. Write its S.I. unit.

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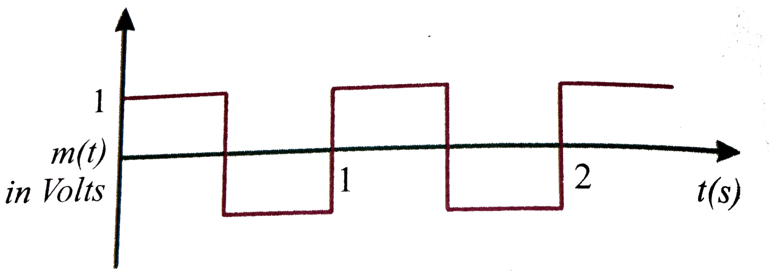
2. A modulating signal is a square wave as shown in figure.



The carrier wave is given by

$c(t) = 2\sin(8\pi t)\text{volt}.$

The modulation index is

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3. For any charge configuration, equipotential surface through a point is normal to the electric field. Justify.

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4. Two spherical bobs, one metallic and other of glass, of the same size are allowed to fall freely from the same height above the ground. Which of the two would reach the ground earlier and why ?

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5. Show variation of resistivity of copper as a function of temperature in a graph.

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6. A convex lens is placed in contact with a plane mirror. An axial point object at a distance of $20cm$ from this combination, has its image coinciding with itself. What is the focal length of the convex lens ?

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7. Write an expression in a vector form for the Lorentz magnetic force $\overrightarrow{F}$ on a charge Q moving with velocity $\overrightarrow{V}$ in a magnetic field $\overrightarrow{B}$. What is the direction of the magnetic force?

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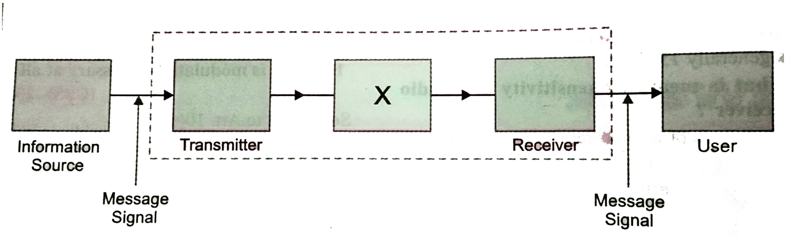
8. Figure shows the block diagram of a generalized communication system. Identify the element

labelled X and write its function.



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9. Out of the two magnetic materials. 'A' has relative permeability slightly greater than unity while 'B' has less than unity. Identify the nature of materials 'A' and 'B'. Will their susceptibilities be positive or negative?

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10. Given a uniform electric field $\overrightarrow{E} = 5 \times 10^3 \hat{i} N/C$, find the flux of this field through a square of 10cm on a side whose plane is parallel to the y - z plane. What would be the flux through the same square if the plane makes a 30° angle with the x-axis?

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11. For a single slit of width "a" the first minimum of the interference pattern of a monochromatic light of wavelength e occurs at an angle of $\frac{\lambda}{a}$. At the same angle of $\frac{\lambda}{a}$, we get a maximum for two narrow slits separated by distance "a". Explain.

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12. Write the truth table for the combination of the getes shown. Name the gates used.

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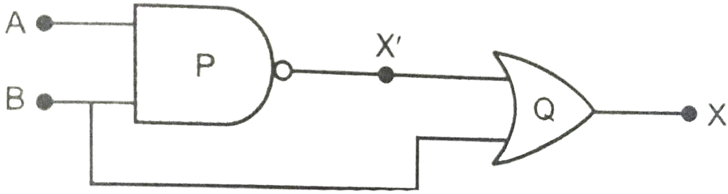
13. Identify the logic gates marked P and Q in the circuit Fig. Write the truth table for this combination.



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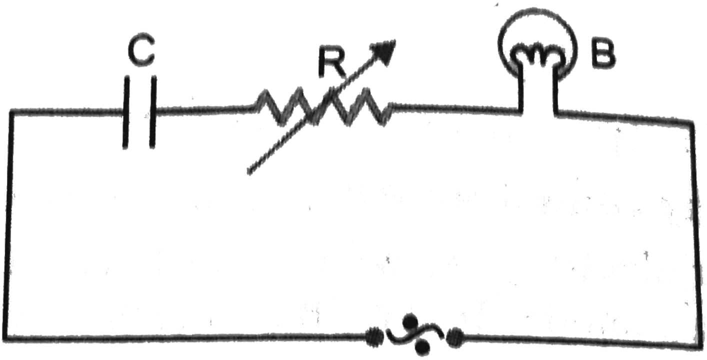
14. A capacitor C, a variable resistor R and a bulb B are connected in series to the ac mains in circuits as shown if Fig. The bulb glows with some brightness. How will the glow of the bulb change if (i) a dielectric slab is introduced between the plates of the capacitor, keeping resistance T to be the same, (ii) the resistance R to be the same, (ii) the resistance R is increased keeping the same capacitance.



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15. A proton and deutron are accelerated through the same accelerating potential. Which one of the two has (a) greater value of de-broglie wavelength

associated with it, and (b) less momentum? Give reasons to justify your answer.

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16. (i) Mono chromatic light of frequency $6.0 \times 10^{14} Hz$ is produced by a laser. The power emitted is $2.0 \times 10^{-3} W$. Estimate the number of photons emitted per second on an average by the source.

(ii) Draw a plot showing the variation of photoelectric current versus the intensity of incident radiation on a given photosensitive surface.

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17. A 12/5 eV electron beam is used to bombard gaseous hydrogen at room temperature. Upto which energy. Level the hydrogen atoms would be excited ? Calculate the wavelengths of the first memeber of Lyman and first member of Balmer series.

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18. When Sunita, a class XII student, came to know that her parents are planning to rent out the top floor of their house to a mobile company she protested. She tried hard to convince her parents that this move would be a health hazard.

(i) Ultimately her parents agreed.

(1) In what way can the setting up to transmission tower by a mobile company in a residential colony prove to be injurious to health?

(2) By objective to this move the parents, what value did Sunita display?

(3) Estimate the range of e.m. waves which can be

transmitted by an antenna of height 20m. (Given radius of the earth = 6400 km).

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19. A potentiometer wire of length 1 m has a resistance of 10Ω. It is connected to a 6V battery in series with a resistance of 5Ω. Determine the emf of the primary cell which gives a balance point at 40cm.

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20. (a) Draw a labelled ray diagram showing the formation of a final image by a compound microscope at least distance of distinct vision.

(b) The total magnification produced by a compound microscope is 20. The magnification produced by the piece is 5. The microscope is focused on a certain object. The distance between the objective and eyepiece is observed to be 14cm. If least distance of distinct vision is 20cm, calculate the focal length of the objective and the eye piece.

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21. (a) A mobile phone lies along the principal axis of a concave mirror. Show, with the help of a suitable diagram, the formation of its image. Explain why magnification is not uniform.

(b) Suppose the lower half of the concave mirror's reflecting surface is covered with an opaque material. What effect this will have on the image of the object? Explain.

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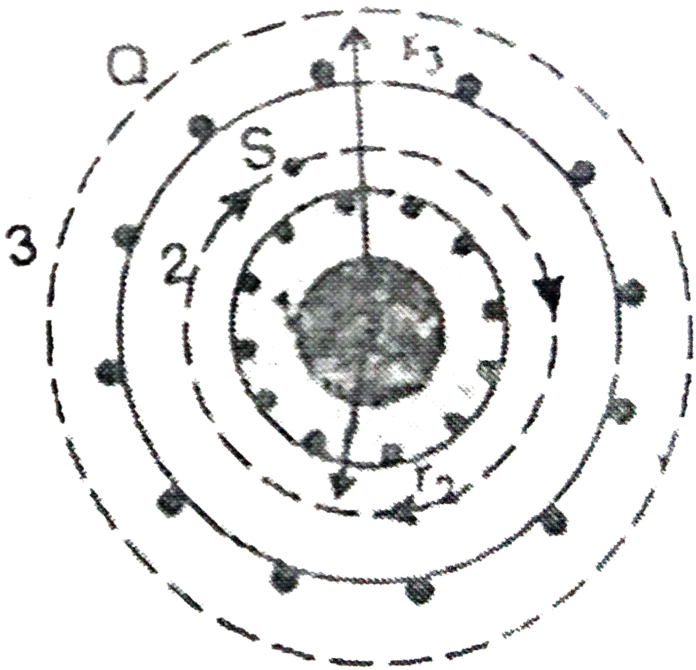
22. (a) How is a toroid different from a solenoid?

(b) Show that in an ideal toroid, the magnetic field

(i) inside the toroid and (ii) outside the toroid at any point in the open space is zero.



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23. Derive an expression for the magnetic moment $\left(\overrightarrow{\mu}\right)$ of an electron revolving around the nucleus in termsof its angular momentum $\left(\overrightarrow{l}\right)$. What is the direction of the magnetic moment of the electron with respect to its angular momentum?

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24. (a) State Ampere's circuital law, expressing it in the integral form.

(b) Two long coaxial inlsulated soenoids, S_1 and S_2 of equal lengths are would one over the other as shown in the figure. A steady current "I" flows through the inner solenoid S_1 to the other end B, which is connected to the outer solenoid S_2 through which the same current "I" flows in the opposite direction so as the come out at end A. If n_1 and n_2 are the number of turns per unit length, find the magnitude and direction of the net magnetic field at a point

(i) inside on the axis and

(ii) outside the combined system.

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25. Answer the following :

(a) Name the em waves which are suitable for radar system used in aircraft navigation. Write the range of frequencey of these waves.

(b) If the earth did not have atmosphere, would its average surface temperature be higher or lower than what it is now? Explain.

(c) An em waves exerts pressure on the surface on which it is incident. Justify.

View Text Solution

26. Deduce the expression, $N = N_0^{-\lambda t}$ for the law of radioactive decay.

(b) Is the nucleus formed in the decay of the nucleus $._{11}^{12} Na$, an isotope or isobar?

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27. (a) (i) Two independent mono chromatic sources of light cannot produced a sustained interference pattern'. Give reason.

(ii) Light waves each of amplitude "a" and frequency "w", emanating from two coherent light sources superpose at a point. If the displacements due to these waves is given by $y_3 = a\cos\omega t$ and $y_2 = a\cos(\omega t + \phi)$ where ϕ is the phase difference between the two, obtain the expression for the resultant intensity at the point.

(b) In Young's double slit experiment, using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. Find out the intensity of light at a point where path difference is $\lambda / 3$.

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28. (a) How does one demonstrate, using a suitable diagram, that unpolarised light when passed through a Polaroid gets polarised?

(b) A beam of unpolarised light is incident a glass-air interface. Show using a suitable ray diagram, that light reflected from the interface is totally polarised, when $\mu = \tan i_B$, when μ is the refractive index of glass with respect to air and i_B, is the Brewster's angle.

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29. (a) Describe a simple experiment (or activity) to show that the polarity of emf induced in a coil is always such that it tends to produce a current which opposes the change of magnetic flux that produces it.

(b) The current flowing through an inductor of self inductance L is continuously increasing. Plot a graph showing the variation of

(i) Magnetic flux versus the current

(ii) Induced emf versus dI/Dt

(iii) Magnetic potential energy stored versus the current.

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30. Draw a schematic sketch of an generator describing its basic elements. State briefly its working principle. Show a plot of variation of

(i) Magnetic flux and

(ii) Alternating emf versus time generated by a loop of wire rotating in a magnetic field.

(b) Why is choke coil needed in the use of fluorescent tubes with ac mains?

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31. Using the necessary circuit diagram, show how the V-I characteristics of a p-n junction are obtained in (i) forward biasing (ii) Reverse biasing. How are these characteristics made use of in rectification?

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32. (a) Differentiate between three segments of a transistor on the basis of their size and level of dopping.

(b) How is a transistor biased to be in active state?

(c) With the help of necessary circuit diagram, describe briefly how n-p-n trnasistor in Ce configuration amplifies a small sinusoidal input voltage. Write the expression for the ac current gain.

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[SET - II DELHI BOARD]

1. The carrier wave is represented by

$C(t) = 5\sin(10\pi t)$ volt

A modulating signal is a square wave as shown in figure. Determine modulation index.

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2. A proton and alpha particle are accelerated through the same accelerating potential. Which one of the two has (a) greater value of de-broglie wavelength associated with it, and (b) less kinetic energy? justify your answer.

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3. Given a uniform electric field $E = 2 \times 10^3 \hat{i} N/C$ find the flux of this field through a square of side 20cm, whose plane is parallel to the y-z plane. What would be the flux through the same square, if the plane makes an angle of 30° with the x axis?

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4. A $12.9eV$ beam of electrons is used to bombard gaseous hydrogen atom at room temperature. Up to which energy level the hydrogen atoms would be excited?

Calculate the wavelength of the first member of Paschen series and first member of Balmer series.

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5. Asnwer the following :

(a) Name the em waves which are used for the treatment of certain forms of cancer. Write their frequency range.

(b) Thin ozone layer on top of stratosphere is crucial for human survival. Why ?

(c) Why is the amount of the momentum transferred by the em waves incident on the surface so small?

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6. A potentiometer wire of length 1.0 m has a resistance of 15 ohm. It is connected to a 5 V source in series with a resistance of 5Ω. Determine the emf of the primary cell which has a balance point at 60 cm.

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[SET - III, DELHI BOARD]

1. Define the term 'drift velocity' of charge carriers in a conductor and wire its relationship with the current flowing through it.

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2. The carrier wave of a signal is given by C(t) = $3\sin(8\pi t)$volt.

The modulating signal is a square wave as shown. Find its modulation index.

Watch Video Solution

3. Plot a graph showing variation of current versus voltage for the material Ga.

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4. An electric dipole of length 1cm, which places with its axis making an angle of 60° with uniform electric field, experience a torque ot $6\sqrt{3}Nm$, Calculate potential energy.

Watch Video Solution

5. A proton and alpha particle are accelerated through the same accelerating potential. Which one of the two has (a) greater value of de-broglie wavelength associated with it, and (b) less kinetic energy? justify your answer.

Watch Video Solution

6. Given a uniform electric field $\overrightarrow{E} = 4 \times 10^3 \hat{i} N/C$. Find the flux of this field through a square of side 5cm on a side whose plane is parallel to the y-z plane. What would be the flux through the same square, if the plane makes a 30° angle of with the x-axis?

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section A

1. Define self-inductance of a coil . Write its S.I. units ?

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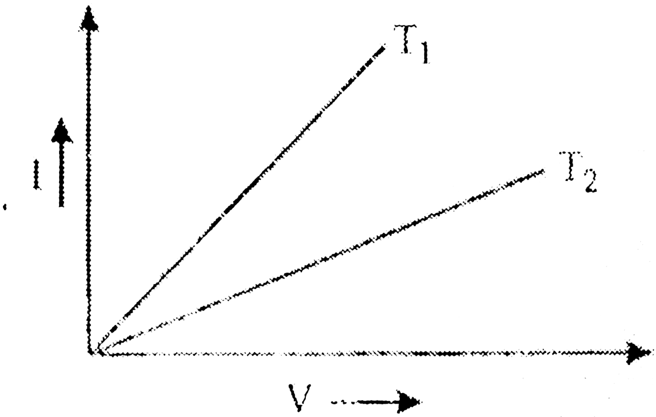
2. Why does the bluish colour predominate in a clear sky?

Watch Video Solution

3. I-V graph for a metallie wire at two different tempearture, T_1 and T_2 is as shown in the figure. Which of the two temperatures is lower and why ?



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4. Name the two basic modes of communication. Which one is used for telephonic communication?

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5. Why do the electrostatic field lines not form closed loops ?

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section B

1. When an election in hydrogen atom jumps from the third excited state to the ground state, how would the de-Broglie wavelength associated with the electron change ? Justify your answer.

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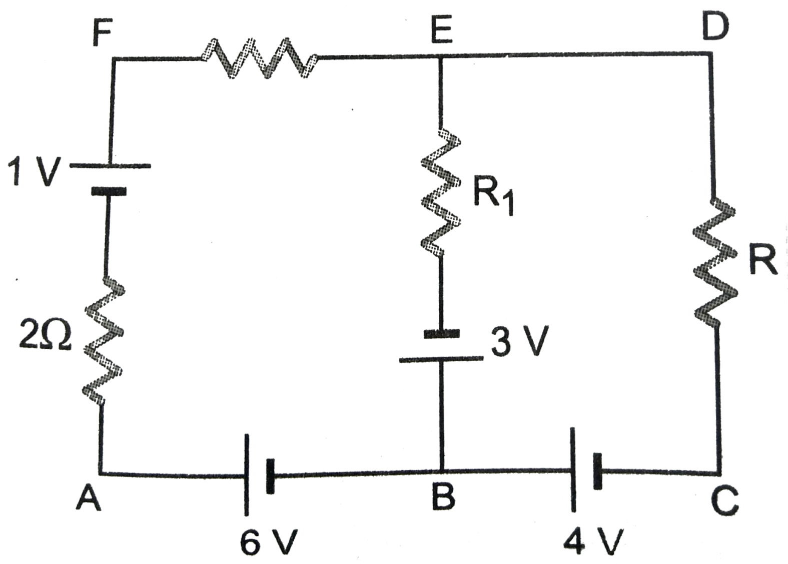
2. Write two factors which justify the need of modulating a low frequnecy signal into high frequencies before transmission .

View Text Solution

3. Use Kirchhoff's rules to determine the potential differnce between the poits A and D when no current flows in the arm BE of the electric network shown in figure



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4. You are given two converging lenses of focal lengths 1.25 cm and 5cm to design a compaound microscope.if it is desired to have a magnification of 30, find out the separation between the object and the eyepiece.

or

A small telescope has an objective lens of focal length 150 cm and eyepiece of focal length 5 cm. What is the magnifying of the telescope for viewing distant objects on normal adjustment ?

If this telescope is used to view a 100 m tall tower 3 km away, what is the height of the image of the tower formed 3km away, what is the height of the image of the tower formed by the objective lens ?

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5. Calculate the shortest wavelength in the Balmer series of hydrogen atom. In which region (infrea-red, visible, ultraviolet) of hydrogen spectrum does this wavelength lie ?

Watch Video Solution

section C

1. In fig. $C_1 = 20\mu F, C_2 = 30\mu F$ and $C_3 = 15\mu F$ and the insulated plate of C_1 is at a potential of 90 V, one plate of C_3 being earthed. What is the potential difference between th plates of C_2 three capacitors being connected in series ?

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2. State clearly how an unpolarised light gets linearly polarised when passed through a polaroid. Unpolarised light intensity I_0 is incident P_1 which is kept near another polaroid P_2 whose pass axis is parallel to that of P_1. How will the intensities of light, I_1 and I_2 , transmitted by the polarids P_1 and P_2 respectively, change on rotating P_1[without disturbing P_2 ?

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3. Define modulation index. Why is its value kept in practies, less than one ?

A carrier wave of frequency 1.5 MHz and amplitude 50 V is moduclated by a sinusoidal wave of frequency 10KHz producing 50% ampitude moducation. Calculate the amplitude of the AM wave and frequencies of the side bands produced.

Watch Video Solution

4. A uniform magnetic field $\overrightarrow{B}$ is set up along the positive x-axis. A particle of charge 'q' and mass 'm' moving with a velocity $\overrightarrow{v}$ entresthe field at the origin in X-Y plane such that it has velocity companents both along and perpendicular to the magnetic field $\overrightarrow{B}$. Trace, giving reason. the fraectory followed by the particle . Find out the expression for the distance moved by the particle along the magnetic field in one rotation.

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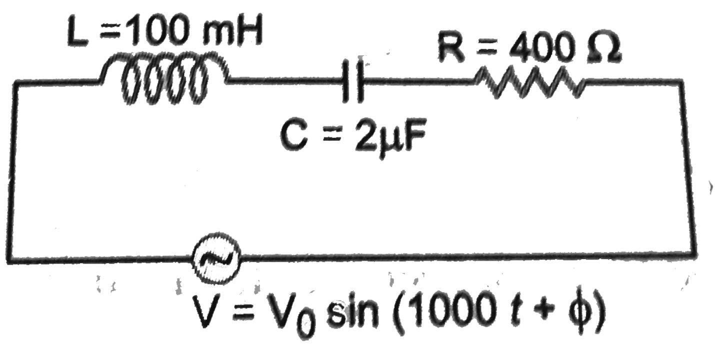
5. Find the value of phase lag/lead between the current and voltage in the given CLR circuit, fig. Without making any other change, find the value of additional capacitor, such that when joined switably to $C = 2\mu F$, would make the power factor of this circuit unity.



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6. write the expression for the generalized form of Ampere's circuital law. Discuss its significance and describe briefly how the concept of dislacement current is explained through charing/discharging of a capacitor in an electric circuit.

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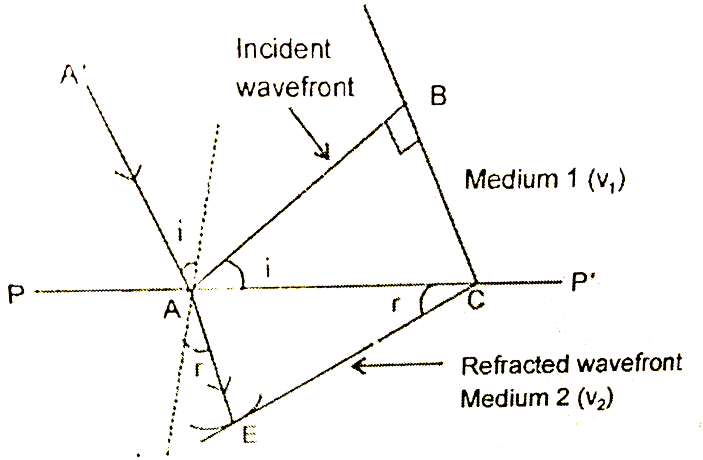
7. Use Huygen's principle to show how a plane wavefront propagates from a denser to rarer medium. Hence verift snell's law of refreaction.



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8. Identify the gates P and Q shown in the figure. Write the truth table for the combination of the gates shown.

Name the equivalent gate representing this circuit and write its logic symbol.

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9. (a) write three characteristic properties of nuclear force.

(b) Draw a plot of potential energy of a pair of nucleons as a function of their separation. Write two important conclusions that can be drawn from the graph.

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10. (a) describe briefly three experimentally observed features in the phenomenon of photoelectric effect.

(b) Discuss briefly how wave theory of light cannot explain these features.

OR

(a) Write the important properties of photons which are used to establish Eintein's photoelectric equation .

(b) Use this equation to explain the concept of (i) threshould frequency and (ii) stopping potential .3.

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section -D

1. One morning an old man walked bare-foot to replacce the fuse wire in kit kat fitted with the power supply mains for his house. Suddenly he screamed and collapsed on the floor. His wife cried loudly for help. His neighbour's son Anil heard the crises and rushed to the place with shoes on. He took a wooden baton and used it to switch off the main supply .

Answer the following questions.

(i) what is the voltage and frequency of mains supply in India ?

(iii) Can a transformer be used to step up d.c. voltage ?

(iv) write two qualities displayed by Anil by his action.

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2. Ravi is a student of mechanical engineering studying in one of the engineering colleges. The other day he saw an old man who suddenly collapsed as he walked out of the house in his neighbourhood. Ravi the emergency ward of the hospital. On getting the medical aid, the old man soon goy recovered. He did not forget to thank Ravi for the timely help he rendered. He was wondering that in his times to get the telephone connection. One had to wait for years whereas these days it takes no time to get the connection. Ravi told him it was all because of the technological progress/deveolpement due to which the simple phenomenon in physics could be easily used.

Answer the following questions based on the above :

(a) To which phenomenon in physics was Ravi referring to, which made the land line links so easily accessible?

(b) What are the essential conditions required to observe this phenomenon ?

(c) Write two values displayed by Ravi and the old man in this episode.

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3. Meeta father was driving her to the school. At the traffice signal she noticed that each traffic light was made of many tiny lights instead of a signal bulb. When Meeta asked this question to her father's he explained the reason for this.

Answer the following question based on above information:

(i) What were the values displayed by Meeta and her father?

(ii) What answer did Meeta's father give?

(iii) What are the tiny light in traffice signal called and how do these operate?

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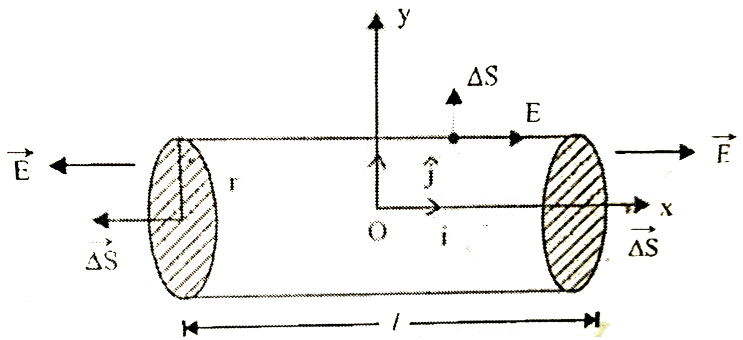
section -E

1. (a) define electrie flux. Write its, S.I unit.

" Gauses'[s law in electrostatis is true for any closed surface, no matter what its shape or size is.

Justify this statement with the help of a suitable example.

(b) Use Gauss's law to prove that the electric field inside a uniformly charged spherical shell is zero.



OR

(a) Derive the expression for the energy stored ina parallel plate capactor. Hence obtain the expresion for the energy density of the electric field.

(b) A fully charged parallel plate capacitor is connected across an ucharged identical capacitor. Show that the energy stored in the combination is less than that stored initially in the single capacitor.

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2. Explain, using a laballed diagram, the principal and working of a moviong coil galvnometer.

What is the function of (i) unifrom radial magnetic field (ii) soft iron core ?

Define the terms (i) current sensitivity and (ii) voltage sensitively of a galvanmeter. why does increasing the current sensitivity not neessarily increases voltage sensitivity ?

OR

(a) Write, using Biot-Savart law, the expression for the magnetic field $\overrightarrow{B}$ due to an element $\overrightarrow{d\,l}$ carrying current I at a distance $\overrightarrow{r}$ from it in a vector form.

Hence ,derive the expression for the magnetic field due to a current carring loop of radius R at a point P distant x from its centre along the axis of the loop.

(b) Explain how Biot- Savart law enables one to express the Ampere,s cicuital law in the integral from , viz

$$\oint \vec{B}, \vec{dl} = \mu_0 I$$

Where I is total current passing through the surface.

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3. Consider two coherent sources S_1 and S_2 producing monochromatic waves to produce interference patten. Let the displacement of the wave produced by S_1 be given by

and the displacement by

S_2 be $Y_1 = a \cos \omega t$

$Y_2 = a \cos(\omega t - \phi)$

Find out expression for the amplitude of the resultant displacement at a point and show that the intensity at that point will be

$$I = 4a^2 \cos^2 \phi / 2$$

Hence establish the conditions for constructive and destructive interference.

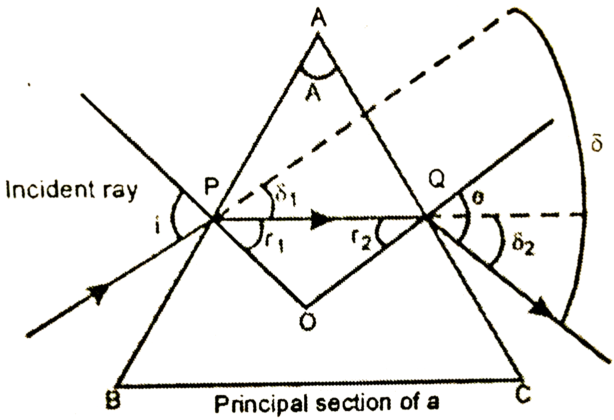
(b) What is the effect on the interference friinges in Young's double slit experiment when (i) the width of the source slit is increased, (ii) the monochromatic source is replaced by a source is replaced by a source of white light ?

OR

(a) A ray, 'PQ' of light on the face AB of glass prism ABC (as shown in the figure) and emerges out of the face AC. Trace the path of the ray. Show that

$\angle i + \angle e = \angle A + \angle \delta$

Where δ and e denote the angle of deviation and angle of emergence respectively.



Principal section of a equalateral glass prism

Plot a graph showing the variation of the angle of deviation as a function of angle of incidence. state the condition under which $\angle \delta$ is minimum.

(b) Find out the relation between the refractive index (μ) of the glass prism and $\angle A$ for the case when the angle of prism (A) is equal to the angle of minimum deviation (δ_m) . Hence obtain the value of the refractive index for angle $Ae = 60^\circ$.

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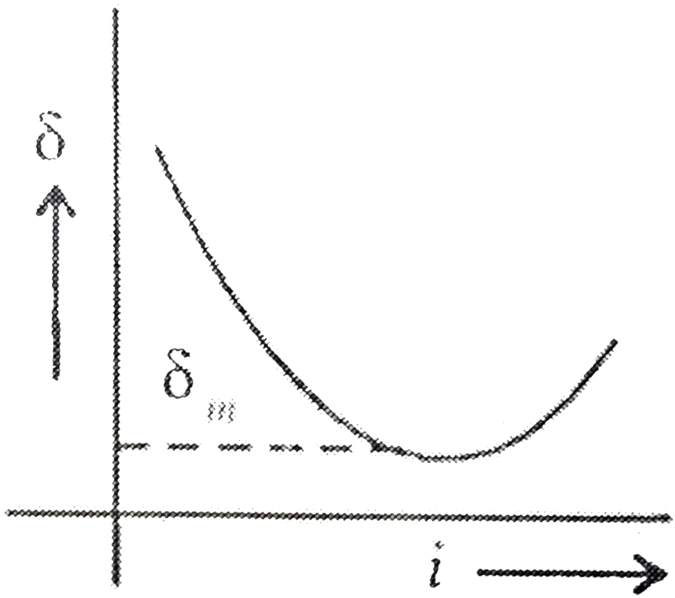
4. (a) The relation, between the angle of incidence : (i) and the corresponding , angle of deviation (δ) , for a certain optical decice, is represented by the graph shown in the figure. Identify this device. Draw a ray diagram for this device and use it for obtaining and expression for the refractive index of the material of this device in terms of an angle characteristic of the device and the angle, marked as δ_m, in the graph.

(b) Based on Huuygen's construction , draw the shape of a plane wavefront as it gets refracted on passing through a convex lens.



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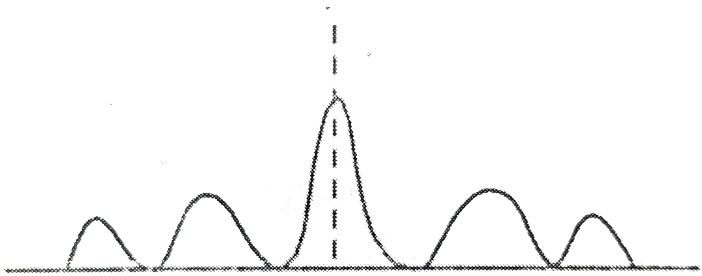
5. When a plane wave front of light, of wavelength λ, is incident on a narrow slit, an intensity distribution pattern, of the form shown is observed on a screen, suitably kept behind the slit. Name the phenomenon observed.



(a) Obtain the conditions for the formation of central maximum and secondary maxima and the minima.

(b) Why is there significant fall in intensity of the secondary maxima compared to the central maximum, whereas in double slit experiment all the bright fringes are of the same intensity ?

(c) When the width of the slit is made double the original width, how is the size of the central band affected ?

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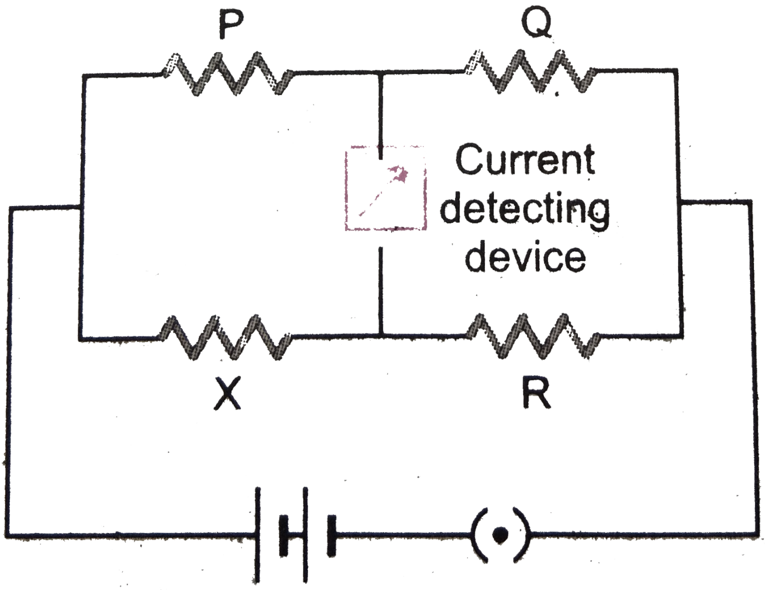
6. (a) Obtain the condition under which the current flowing in the current detecing device used in the circuit shown in figure, becomes zero.

(b) Describe briefly the device, based on the above condition. Draw a circuit diagram for this device and discuss, in brief, how it is used for finding as unknown resistance.



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7. (a) Why do the 'free electrons' , in a metal wire , flowing by themselves' not cause any current flow

in the wire ?

Define drift velocity' and obtain an expression for the current flowing in a wire, in terms of the 'drift velocity of the free electrons.

(b) Use the above expression to show that the 'resistivity ' of the material of a wire is inversely proportional to the 'relaxation time' for the 'free electrons ' in the metal.

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8. Draw the Energy bands 'diagrams for a (i) pure semiconductor , (ii) insulator , How does the energy band, for a pure semiconductor , get affected when this semiconductor is doped with

(a) an acceptor impurity

(b) donor impurity ? Hence discuss why the 'holes' and the 'electrons' respectively, become the 'majority change carries' in these two cases ?

Write the two processes involved in the formation of $p-n$ junction.

9. Draw the diagram of the circuit arangement used for studying the 'input' and the 'output' characteristics of an n-p-n transistor inits CE configuration. Briefly explain how these two types of characteristics are obtained and draw these characteristics.

(b) 'Define' the terms (i) Input resistance, (ii) Output resistance , (iii) Current amplification factor, for a given transistor.

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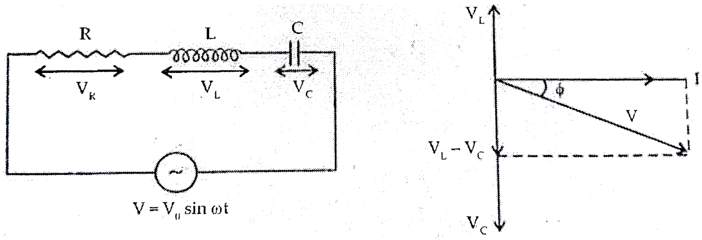
10. (i) An a.c. Source of voltage $V = V_0 \sin \omega t$ is connected to a series combination of L,C and R . Use the phasor diagram to obtain expression for impedance of the circuit and phase angle between voltage and current . Find the condition when current will be phase with the voltage . What is the circuit in this condition called ?

(ii) In a series LR circuit $X_L = R$ and power factor of the circuit is P_1. When capacitor which capacitance C such that $X_L = X_C$ is put in series , the power factor becomes P_2 .Calculate P_1 / P_2



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11. (i) Write the functions of a transformer . State its principle of working with the help of the a diagram mentions various energy losses in this divice .

(ii) The primary coil of an ideal step up transformer has 100 turns and transformation ratio is also 100. The input voltage and power are respectively 220 V and 100w. Calculate

(a) number of turns in secodary

(b) current in primary

(c) voltage across secodary

(d) current in secondary

(e) power in secondary

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12. (i) In Young's double slit experiment the condition for (a) constructive and (b) destructive interference at a point on the screen . Draw a graph showing variation of intensity in the interference pattern against position 'x' on the screen .

(ii) Compare the interference pattern observed in Young's double silt experiment with single slit diffraction pattern pointing out three distinguishing features.

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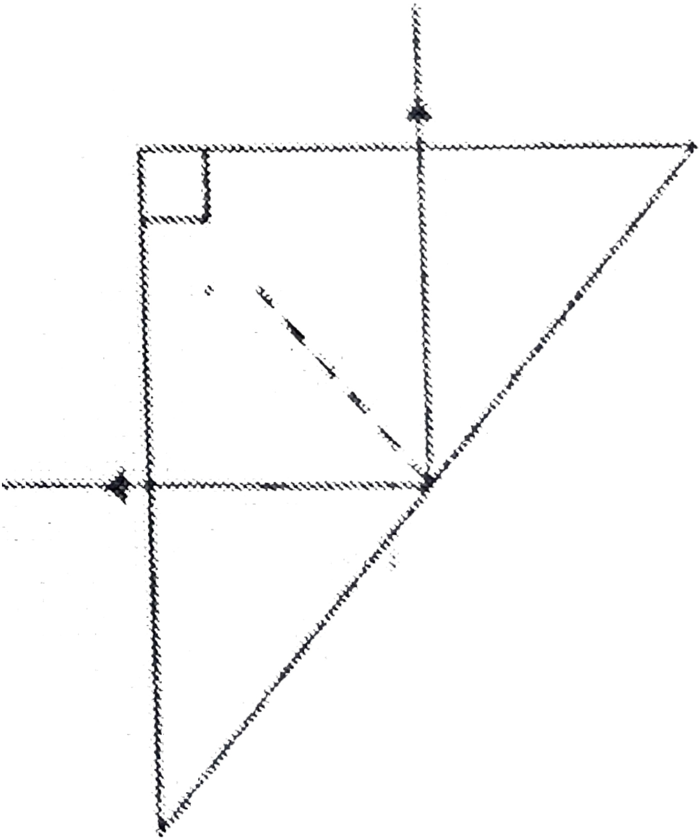
13. (i) Plot a graph to show variation of the angle of deviation as function of angle of incidence for light passing through a prism. Derive an expression for refractive index of the prism in terms of angle of minimum deviation and angles of prism.

(ii) What is dispersion of light ? Why is its cause ?

(iii) A ray of light incident normally on one face of a right isosceles prism is totally reflected as shown in fig . what must be the minimum value of refractive index of glass ? Give relevant calculations



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14. (i) Define the term drift velocity .

(ii) On the basis of electron drift , derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. On what factors does resistivity of a coductor depend ?

(iii) Why alloys like constantan and manganin are used for making standard restores ?

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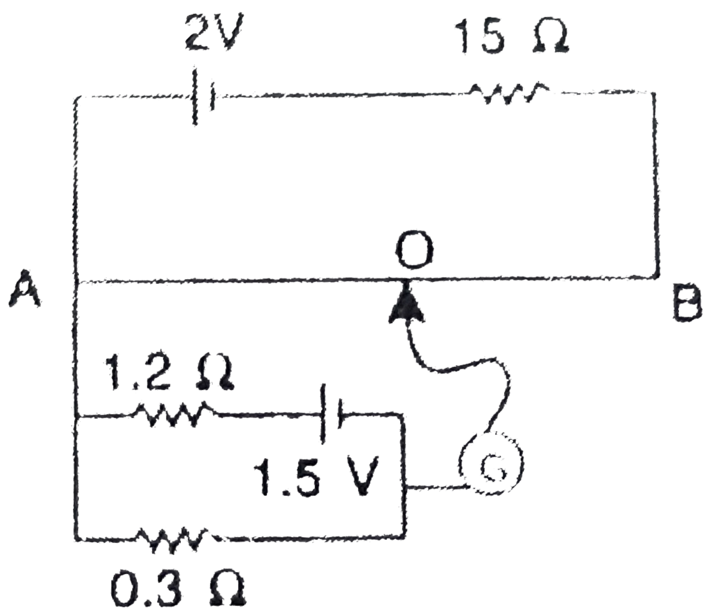
15. (i) State the principle of working of a potentiometer.

(ii) In the following potentiometer circuit AB is a uniform wire of length 1 m and resistance 10Ω Calculate the potential gradient along the wire and balance length AO (=l)



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SECTION-A

1. Show on a plate the nature of variation of the (i) Electric field (ii) potenital (V), of a (small) electric dipole with the distance (r) of the filed point from the centre of the dipole.

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2. For an ideal inductor, connected across a sinusoidal ac voltage source, state which one of the following quantity is zero:

(i) Instantaneous is zero :

(ii) Average power over full cycle of the ac voltage source.

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3. A beam of unpolarised light is incident, on the boundary between two transparent media, at an angle of incidence $= i_B$, the Brewester's angle. At what angle does the reflected light get polarised ?

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4. Define the activity of a radionuclide. Write its SI unit. Give a plot of the activity of a radioactive species versus time.

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5. Name the two basic modes of communication system.

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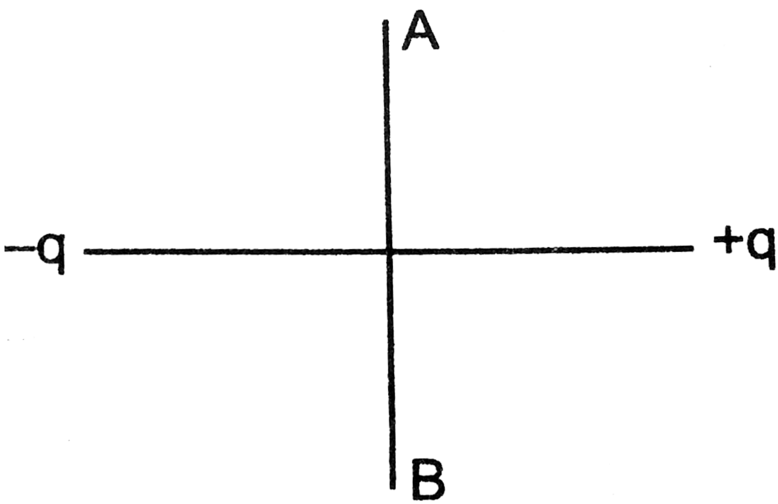
6. A charge q is moved from a point A above a dipole moment p to a point B below the dipole on equatorial plane without acceleration. Find the work done in the process.



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7. In what way is the behaviour of a diamagnetic material different from that of a paramagnetic material, when kept in an external magnetic field?

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8. Essential elements of a communication system are

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9. How can we explain the reddish appearance of sun at sunrise or sunset? Why does it not appear red at noon?

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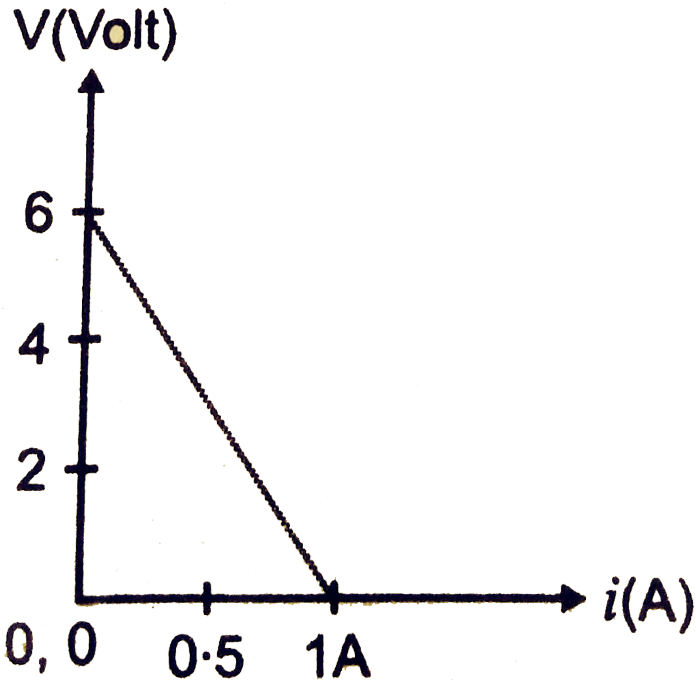
10. The plot of the variation of potential difference across a combination of three identical cells in series, versus current is as shown in figure. What is the emf and internal resistance of each cell?



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11. Draw a plot showing variation of electric field with distance from the centre of a solid

conducting sphere of radius R, having of $+Q$ on its surface.

Watch Video Solution

12. State one factor which determines the intensity of light in the photon picture of light.

Watch Video Solution

13. An iron-cored solenoid has self- inductance. 2.8 H. When the core is removed, the self inductance becomes 2 mH. What is the relative permeability of the core used?

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14. An object is kept in front of a concave lens.What is the nature of the image formed?

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15. When light travels from a rarer to denser medium, it loses some speed. Does the reduction in speed imply a reduction in the energy carried by the light wave ?

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16. A point charge +Q is placed in the vicinity of a conducting surface. Draw the eletric field lines between the surface and the charge

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17. Define modulation index. Why is it generally kept less than one ?

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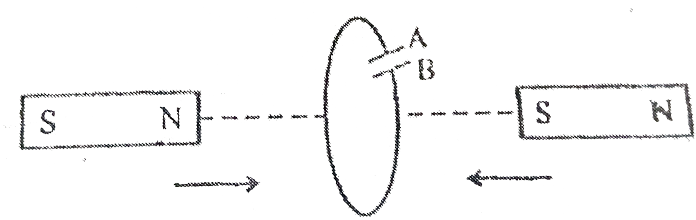
18. In the figure given, mark the polarity of plates A and B of a capacitor when the magnets are quickly moved towards the coil.



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19. The objective lenses of two telescope have the same apertures but their focal lengths are in the ration $1:2$. Compare the resolving powers of the two telescopes.

Watch Video Solution

20. Define the conductivity of a conductor. Write its SI unit

Watch Video Solution

21. Nichrome and copper wires of same length and same radius are connected in sereis. Current is I

passed through them. Which up more ? Justify your answer.

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22. Do electromagnetic waves carry energy and momentum?

Watch Video Solution

23. How does the angle of minimum deviation of a glass prism vary, if the incident violet light is replaced with red light?

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24. Name the phenomenon which shows the quantum nature of electromagnetic radiation.

Watch Video Solution

25. Draw the pattern of electric lines, when a point charge - Q is kept near an uncharged coducting plate.

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26. How does the mobility of electrons in a conductor change, if the potential difference applied across the conductor is doubled, keeping the length and temperature of the conductor constant ?

Watch Video Solution

27. Define the term "threshold freq uence", in the context of photolelectric emission.

Watch Video Solution

28. Define the term "Intensity" in photon picture of electromagnetic radiation.

Watch Video Solution

29. What is the speed of light in a denser medium of polarising of polarising angle 30°?

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30. Why is the transmission of signals using sky waves restricted to frequencies upto 30 mega hertz?

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31. On what factors, does the maximum range of ground wave propagation depend?

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SECTION-B

1. An α- particle moving with initial kinetic energy K towards a nucleus of atomic number z approaches a distance 'd' at which it reverse its direction.

Obtain the expression for the distance of closest approach 'd' in terms of the kinetic energy of α-particle K.

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2. Find the ratio between the wavelength of the most energetic' spectral lines in the Balmer and Paschen series of the hydrogen spectrum.

Watch Video Solution

3. For a plane electromagnetic wave, propagating along the z-axis, write the two possible pair of its oscillating electric and magnetic fields. How are the peak values of these (oscillating) fields related to each other?

Watch Video Solution

4. An electromagnetic wave Y_1, has a wavelength 1 cm while other electromagnetic wave Y_2 has a frequency of $10^{15} Hz$. Name these two types of waves and write one useful application for each.

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5. The kinetic energy (K.E.) of a beam of electrons, accelerated through a potential V, equalws the energy of a photon of wavelength of 5460 nm. Find the de-Broglie wavelength associated with this beam of electrons.

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6. If both the number of protons and the number of neutrons are conserved in each nuclear reaction, in what way is mass converted into energy (or vice-versa) in a nuclear reaction ? Explain.

View Text Solution

7. Define modulation index. Why is it generally kept less than one ?

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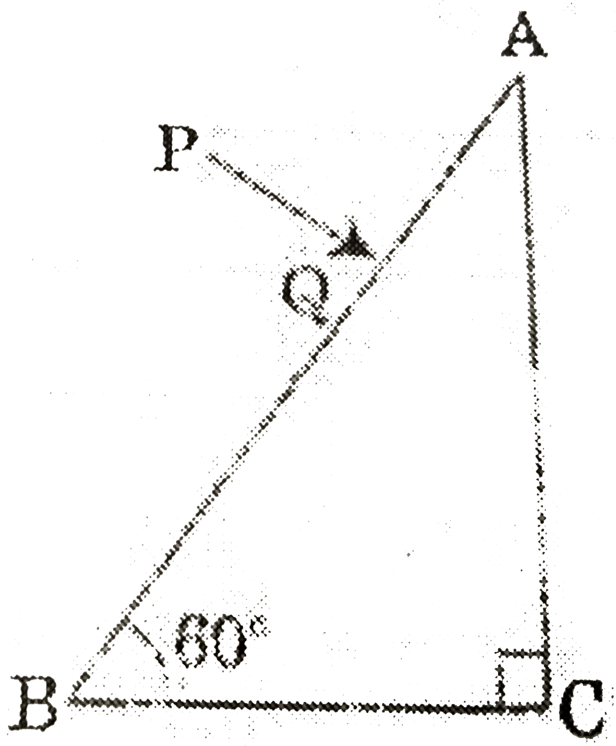
8. A ray PQ incident normally on the refracting face BA is refracted in the prism BAC made of material of refractive index 1.5. Complete the path ray through the prism. From which face will the ray

emerge ? Justify your answer.



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9. Calculate the de-Brogile wavelength of the elctron orbiting in the $n = 2$ state of hydrogen atom.

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10. Define ionization energy. How would the ionization energy change when electron in hydrogen atom is replaced by a particle 200 times heavier than electron, but having the same charge?

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11. Calculate the shortest wavelength of the spectral emitted ub Balmer series.

[Given Rydberg constant, $R = 10m^{-1}$]

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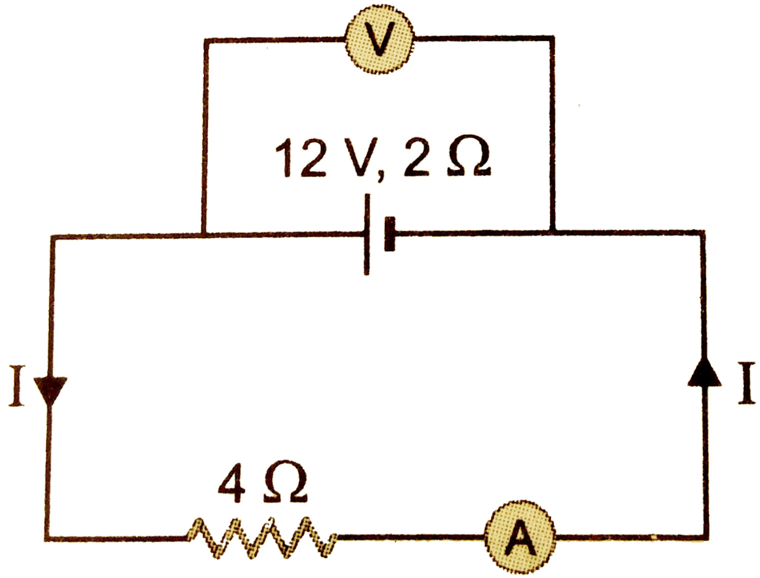
12. A battery of emf $12V$ and internal resistance 2Ω is connected two a 4Ω resistor. Show that the a voltmeter when placed across cell and across the resistor in turn given the same reading



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13. How is electromagnetic wave produced ? Draw a sketch of a plane e.m. wave propagating along X-axis depicting the directions of the oscillating electric and magnetic fields.

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14. A change q of mass m is moving with a velocity of V, at right angles to a uniform magnetic fiels B. Deduce the expression for the radius of the circular path it describes.

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15. Calculate the shortest wavelength of light emitted in the Paschen series of hydrogen spectrum. Which part of the electromagnetic spectrum, does it belong ? (Given : Rydberg constant , R = $1.1 \times 10^7 m^{-1}$

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16. A small illuminated bulb is at the bottom of a tank, containing a liquid of refractive index μ upto a height H. Find the expression for the diameter of an opaque disc, floating symmetrically on the liquid surface in order to cut- off the light from the bulb.

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17. A ray of light is incident on a glass prism of refractive index μ and refractive angle A. If it just suffers total internal reflection at the other face, obtain an expression relating the angle of incidence , angle of prism and critical angle.

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18. (i) Define refractive index of a medium.

(ii) In the following ray diagram, calculate the speed of light in the liquid of unknown refractive index.

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19. Electrons are emitted from the cathode of a photocell of negligible work function, when photons of wavelength λ are incident on it. Derive the expression for the de Broglie wavelength of the electrons emitted in terms of the wavelength of the incident light

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20. Derive Bohr's quantisation condition for angular momentum of orbiting electron in hydrogen atom using De Broglie's hypothesis.

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21. (a) Write two characteristic features of nuclear force.

(b) Draw a plot of potential energy of a pair of nucleons as a function of their separation

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22. Distinguish between Sky wave and Space wave modes of propagation in a communication system.

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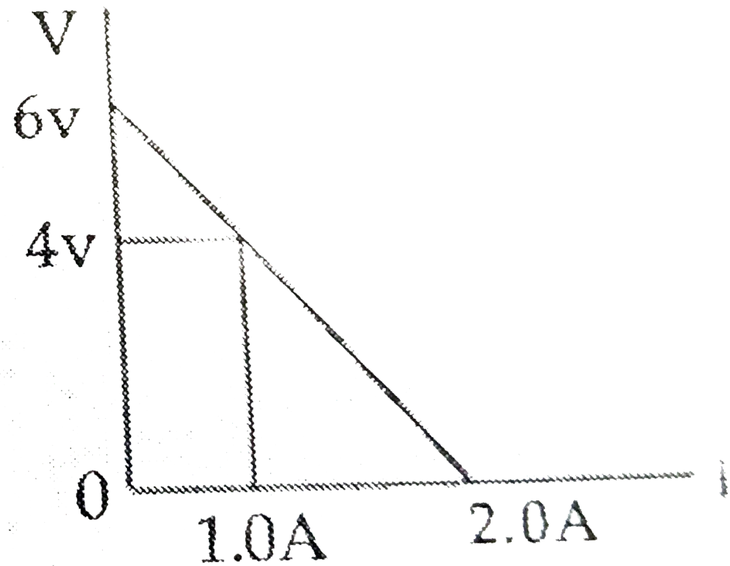
23. The figure shows a plot of terminal voltage 'V' verus the current 'I' of a given cell. Calculate from the graph (a) emf of the cell and (b) internal resistance of the cell.



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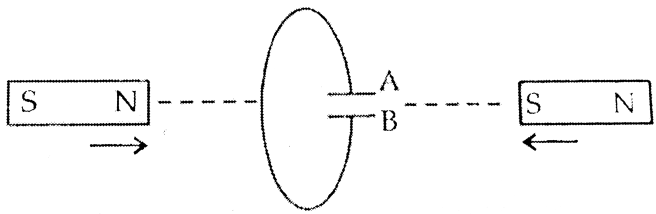
24. Predict the polarity of the capacitor in the situation described below



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25. Draw the intensity patten for single slit diffraction and double slit interference. Hence , state two differences between interference and diffraction patterns.

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26. Unpolarised light is passed through a polaroid P_1. When this poalrised beam passes through another polaroid P_2, and if the pass axis of P_2 makes an angle θ with pass axis of P_1, then write the expression for the polarised beam passing through P_2. Draw a plot showing the variation of intensity when θ varies from 0 to 2 π.

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27. Identify the electromagnetic waves whose wavelength very as: (a) $10^{-12}m < \lambda < 10^{-8}m$ (b) $10^{-3}m < \lambda < 10^{-1}m$. Write one use each.

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28. Find the under which the charged particles moving with differnet speeds in

the presence of electirc and magnetic field vactors

can be used to select charaged particles

of a particular spped.

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29. A $12.5eV$ electron beam is used to excite a gaseous hydrogen atom at room temperature. Determine the wavelengths and the corresponding series of the lines emitted.

Watch Video Solution

30. Write two properties of ameterial of a meteriable suitable for making (a) a perment magnet, and (b) an

eletromagnet.

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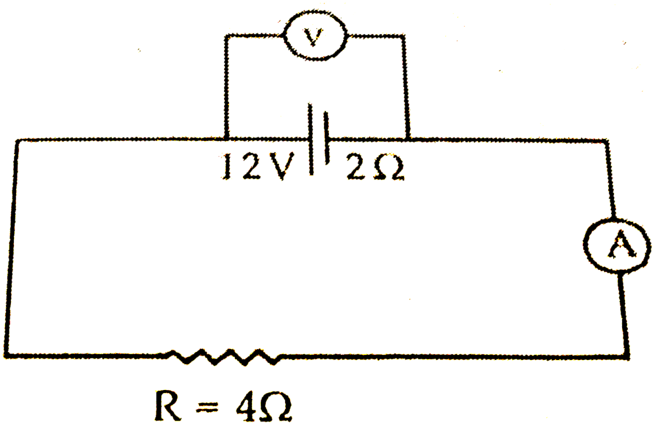
31. (a) The potential difference applied across a given resistor is altered so that the heat produced per secound increases by a factor of 9 . By what factor does the applied potential difference change ?



(b) In the figure shown, an ammeter A and a resistor of 4 Ω are connected to the terminals of the socrce . The emf of the source is 12 V having

an internal resisitance of 2 Ω

Calculate the voltmeter and ammeter readings.

Watch Video Solution

32. How is amplitude modulation achieved ?

(b) The frequencies of two side bands in an AM weve are 640 kHz and 660 kHz respectively.

Find the frequencies of carrier and modulating signal. What is the bandwidth required for amplitude modulation ?

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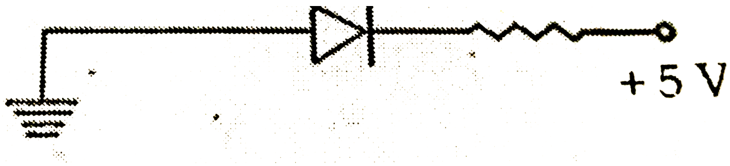
33. (a) In the following diagram, is the junction diode forward biased or reverse biased ?



(b) Draw the circuit diagram of a full weve rectifier and state how it works .

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34. Using photon picture of light, show how Einstein's photoelectic equation can be established. Write two features of photoelectric effect which cannot be explained by b

weve theory.

View Text Solution

35. (a) Monochromatic light of wevelengh 589 nm in incident from air on a water surface. If μ for water is 1.33, find the wevelength, frequency and speed of the refracted light .

(b) A duble conbex lens is made of a glass of refractive index 1.55 , with both faces of the same radius of curbature. Find the radius of curvature required , if the focal length is 20 cm.

Watch Video Solution

36. Define mutual inductance between a pair of coils. Derive expression for the mutuel inductance of two long coaial solenoids of same length wound one over the other.

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37. Define salf-inductance of a coil. Obain the expression for the energy stored in an inductor L connected across a

source of emf.

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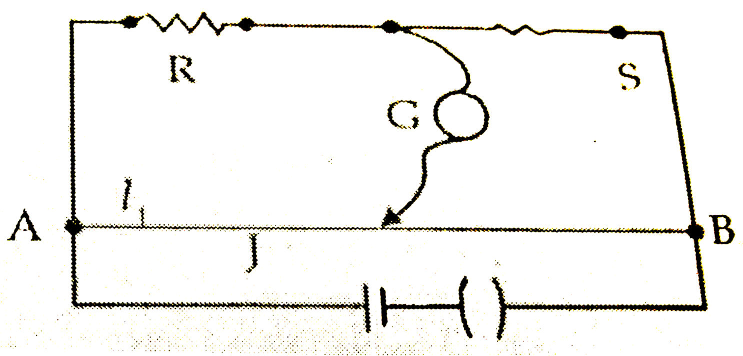
38. (a) Write the principle of working of a metre bridge.

(b) In a metre bride, the balance point is found at a distance I_1 with resistances R and S as shown in the figure.



An unknown resistance X is now connected in parallel to the reisitance S and the balance point is found at a distance I_2 , Obtain a formauila for x in terms of I_1, I_2 and S .

View Text Solution

39. Draw a block diagram of a generalized communication system. Write the functions of each of the following:

(a) Transmitter

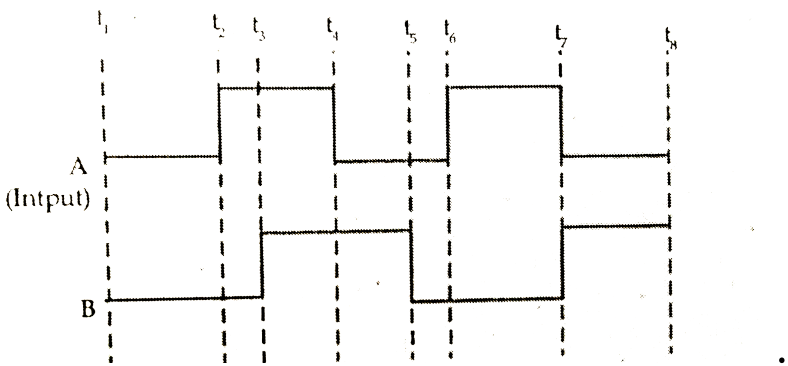
(b) Channel

(c) Receiver .

Watch Video Solution

40. (a) write the functions of the three segments of a transistor.

(b) The figure shows the input weveforms A and B for 'AND' gate Draw the output waveform and write the truth table for this logic gate



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41. (a) Draw a ray diagram depicting the formation of the image by an astronomical telesope in normal adjustmemt .

(b) You are given the following three leness. Which two lensee will you use as an eyepiece and as an objective to construct an astronomial telescope ? Give reason.

Lenses	Power (D)	Aperture (cm)
L_1	3	8
L_2	6	1
L_3	10	1

View Text Solution

42. (a) State Biot - Savart law and express this law in the vactor form.

(b) Two identical circular coils, P and Q each of radius R, carrying currents 1A and $\sqrt{3}A$ respectively, are placed concentrically and perpendicular to each other lying in the XY and YZ planes. Find the magnitude and direction of the net magnetic field at the centre of the coils.

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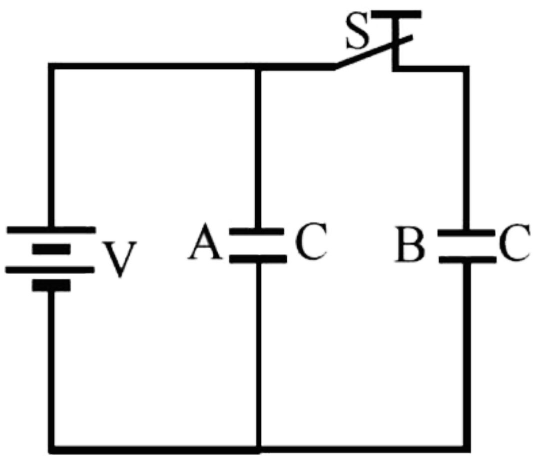
43. The figure shows two identical parallel plate capacitors connected to a battery with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant(or relative permittivity) 3. Find the ratio of the total electrostatic energy stored in both capacitors before and after the introduction of the dielectric.



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44. Asha's mother read an article in the newspaper about a disaster that took place at Chernobyl. She could not understand much from the article and asked a few questions from Ashs regarding the article . Asha tried to answer her mother's questions based on what she learnt in Class XII Physics.

(a) What was the installation at Chernobyl where the disaster took place ? What according to you, wes the cause of this disaster?

(b) Explain the process of release of energy in the intallation at Cheronbyl.

(c) What, according to you, were the values displayed by Asha and her mother ?

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45. (a) Derive an expression for the elecrtric field E due to a dipole of length '2a at a point distant r from the centre of the dipole on the axial line.

(b) Draw a graph of E versus r for r $> > a$.

(c) If the diploe were kept in a uniform external electric fields E_0 Diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions

for the torque acting on the dipole in both the cases.

View Text Solution

46. (a) Use Gauss's theorem to find the electric field due to a uniformly charged infinitely

large plane thin sheet with surface charge density.

Σ

(b) An infinitely large thin plane sheet has a uniform surface charge density $+\sigma$. Obtain the expression for the amount of work done in bringing a point charge q from infinity to a point , distant r, in front of the charged plane sheet.

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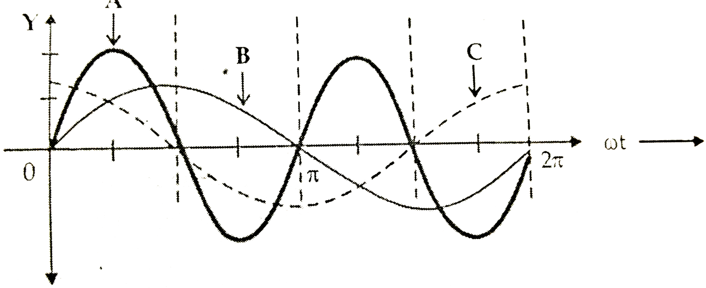
47. A device 'X' is connected to an ac sourde $V = V_0 \sin \omega t$. The variation of voltage, current and power in one cycle is shown in the following graph:



(a) Identify the device 'X'

(b) Which of the curves A,B and C represent the valtage , current and the power consumed in the circuit ? Justify your answer.

(c) How does its impendence very with frequency of the source ? Show graphically.

(d) Obtain an expression for the current in the circuit and its phase relation with ac voltage.

View Text Solution

48. (a) Draw a labelled diagrame of an ac generator. Obtain the expression for the emf induced

in the rotating coil of N turns each of cross-sectional are A, in the presence of a magnetic field $\vec{B}$.

(b) A horizonatal conducting rod 10m long extending from east to west is falling with a speed 5.0 ms ^(-1) at right angles to the horizontal component of the Earth's magnetic fields.

$0.3 \times 10^{-4} Wbm^{-2}$. Find the instantaneous value of the emf induced in the rod .

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49. (a) Define wevefront. Use Huygens 'principle to verify the laws of refraction .

(b) How is linearly polarised light obtained by the process of scattering of light ? Find the Brawster angle for air- glass interface, when the refractive index of glass = 1.5

Watch Video Solution

50. (a) Draw a ray diagram to show the image formation by a combination of two thin convex lenses in contact . Obtain the expression for the power of this combination in terms of the focal lengths of the lenses.

(b) A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is $\frac{3}{(4)^{th}}$ of the angle of prism . Calculate the speed of ltbRgt light in the prism.

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51. Two elelctric bulbs P and Q have their resistance in the ratio of 1: 2. They are connected in series across a battery. Find the ratio of the power dissipation in these bulbs.

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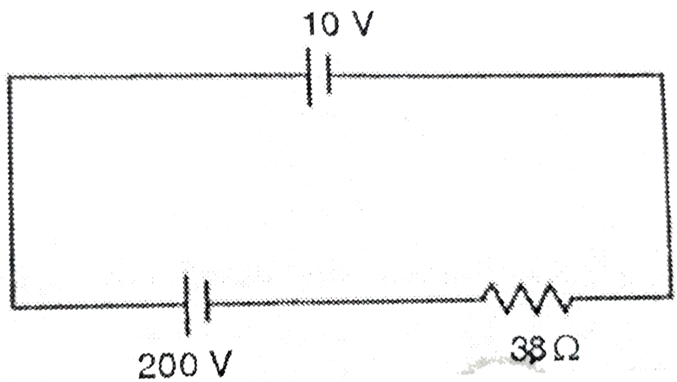
52. A 10 V cell of neglible internal resitsance is connected in parallel across a battery of emf 200 V and internal resistance 38Ω as shown in the figure. Find the value of current in the circuit.



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53. In a potentiometer arrangement for determining the emf of cell, the balance point of the cell in open circuit is 350 cm. When a resistance of 9Ω is used in the external circuit of cell , the balance point shifts to 300 cm. Determine the internal resistance of the cell.

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54. (a) Why are infrared waves often called heat waves? Explain.

(b) What do you understand by the statement, "Electromagnetic waves transport momentum"?

View Text Solution

55. If light of wavelength 412.5 nm is incident on each of the metals given below, which one will show photoelectric emission and why? .

Metal	Work Function (eV)
Na	1.92
K	2.15
Ca	3.20
Mo	4.17

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56. A carrier wave of peak voltage 15 V is used to transmit a message signal. Find the peak voltage of the modulating signal in order to have a modulation index of 60%.

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57. Two bulbs are reled (P_1, V) and (P_2, V). If they are connected (i) iin series and (ii) in perallel across a supply V, find th power dissipated in the two combinations in terms of P_1 and P_2.

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58. Calculate the radius of the curvature an equi-concave lens refrective index 1.5, when it is kept in a medium refrecation index 1.4, to have a power of -5D ?

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59. An equilateral glass prism has a refrective index 1.6 in air. Calculate the angle of minimum deviation of the prism, when kept in a medium of refractive index $4\frac{\sqrt{2}}{5}$.

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60. An $\alpha -$ particle and a proton of the same kinetic energy are in turn allowed to pass through a magnetic field $\vec{B}$, acting normal to the direction of motion of the praricles. Calculate the ratio of radii of the circular paths described by them.

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61. State Both's quantization condition of angular momentum. Calculate the shortest wavelegth of the Bracket series and state to which part of the electromagnetic spectrum does it belog.

Watch Video Solution

62. Calculate the orbital period of the electron in the first excited state of hydrogen atom.

Watch Video Solution

63. Why a signal transmitted from a TV tower cannot received beyound a certain distance ? Write the expression for the optimum separation separation between the receiving and the transmitting antenna.

Watch Video Solution

64. Why is wave theory electromagnetic raiation not able to explain photo electric effect? How does photon picture resolve this problem ?

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65. Plot a graph showing variation of a de Broglie wavelength (λ) associated with a charged particle of mass m, verses $1/\sqrt{V}$, where V is the potential difference thrugh which the particle is accelerated. How does this graph give us the information the magnitude the magnitude of the charge of the particle ?

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SECTION-C

1. A charge $+Q$, is uniformaly distributed within a sphere of radius R. Find the electric field, due to this charge distribution, at a point distant r form the centre of the spehre where :

(i) $0 < r < R$ and

$(ii) r > R$

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2. Define an equipotential surface. Draw equipotential surfaces :

(i) in the case of single point charge and

(ii) in a constant electric field in Z-direction.

Why the equpotential surfaces about a single charge are not equidistant ?

(iii) Can electric field exist tangential to an equipotential surface ? Given reason.

Watch Video Solution

3. (a) State law of Malus.

(b) Draw a graph showing the variation of intensity (I) of polarised light transmitted by an analyser with angle (θ) between polariser and analyser.

(c) What is the value of refractive index of a medium of polarising angle 60° ?

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4. Sketch the graphs, showing the variation of stopping potential V_s with frequency v of the incident radiations for two photosensitive materials A and B having threshold frequencies $v_0 > v'_0$ respectively.

(i) which of the two metals A or B has higher work function?

(ii) What information do you get from the slope of the graphs?

(iii) What does the value of the intercept of graph A on the potential axis represent?

Watch Video Solution

5. (a) Write the basic nuclear process involved in the emission of β^+ in a symbolic form, by a radioactive nucleus.

(b) In the reaction given below:

$${}_6 C^{11} \to {}_y B^z = x + v$$

$${}_6 C^{12} + {}_6 C^{12} \to {}_a Ne^{20} + {}_b He^c$$

Find the values of x,y,z and a,b,c.

Watch Video Solution

6. (i) Derive an expression for drift velocity of free electrons.

(ii) How many drift velocity of electrons in a metallic conductor vary with increase in temperature ? Explain.

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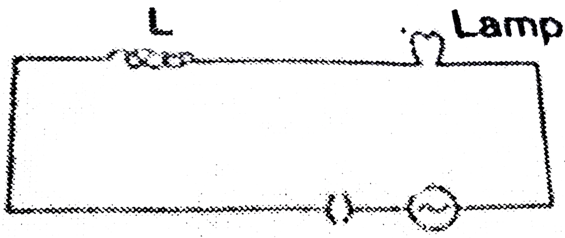
7. (i) When an AC source is connected to an ideal inductor show that the average power supplied by the source ever a complete cycle is zero.

(ii) A lamp is connected in series with an inductor and an AC source. What happens to the brightness of the lamp when the key is plugged in and an iron rod is inserted the indcutor ? Explain.



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8. Explain the formation of depletion layer and potential barrier in p-n junction.

Draw the circuit diagram of a half wave rectifier and explain its working.

Watch Video Solution

9. (i) Which mode of propagation is used by shortwave broadcast services having frequency range from a few MHz upto MHz ? Explain diagrammatically how long distance communication can be achieved by this mode.

(ii) Why is there an upper limit to frequency of waves used in this mode ?

View Text Solution

10. (i) Identify the part of electronmagnetic spectrum which is :

(a) suitable for radar system used in aircraft navigation,

(b) Produced by bombarding a metal target by high speed electrons.

(iii) Why does galvanometer show a momentary deflection at the time of charging or discharging a capacitor ? Write the necessary expression to explain this observation.

View Text Solution

11. For a CE-transistor amplifier, the audio signal voltage across the collector resistance of $2k\Omega$ is $2V$. Suppose the current amplification factor of the transistor is 100, find the input signal voltage and base current, if the base resistance is $1k\Omega$.

Watch Video Solution

12. Define the term wave front. State Huygen's principles.

Consider a plane wave front incident on a thin convex lens. Draw a proper diagram to show how the incident wave front traverses through the lens and after refraction focuses on the focal point of the lens, giving the shape of the emergent wave front.

View Text Solution

13. Explain the following giving reasons :

(i) When monochromatic light is incident on a surface separating two media, the reflected and refracted light both have the same frequency as the incident frequency.

(ii) When ligjt travels from a rarer to a denser medium, the speed decreases. Does this decrease in speed imply a reduction in the energy carried by the wave ?

(iii) In the wave picture of light, intensity of light is determined by the square of the amplitude of the wave. What determines the intensity in the photon picture of light ?

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14. Use Biot-Savart law to derive the expression for the magnetic field on the axis of a current carrying circular loop of radius R.

Draw the magnetic field lines due to circular wire carrying current I.

Watch Video Solution

15. Depict the behaviour of magnetic field lines near(i) diamagnetic and (ii) paramagnetic substances. Justify, giving reasons.

View Text Solution

16. Draw a graph showing the variation of de Broglie wavelength of a particle of charge q and mass m with accelerating potential. Proton and deuteron have the same de Broglie wavelengths. Explain which has more kinetic energy.

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17. Explain the term , 'amplitude modulation' of a signal . For an amplitude modulated wave, the maximum amplitude is 10 V and the minimum amplitude is 2 V.Calculate the modulation index.

Watch Video Solution

18. State the Lorenz's force and express it in vector form. Which pair of vectors are always perpendicular to each other? Derive the expression for the force acting on a current carrying conductor of length L in a uniform magnetic field 'B'.

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19. An optical instrument uses eye-lens of power 16 D and objective lens of power 50D and has a tube length of 16.25 cm. Name the optical instrument and calculate its magnifying power if forms the final image at infinity.

Watch Video Solution

20. Explain the two processes involved in the information of a p-n junction diode. Hence, define the term 'barrier potential'.

View Text Solution

21. (a) Write two properties by which electric potential is related to the electric field .

(b) Two point charges q_1 and q_2 separated by a distance of r_{12} are kept in an external electric field. Derive an expression for the potential energy of the system of two charges in the field.

View Text Solution

22. State Gauss's law in electrostatics. Derive an expression for the electric field due to an infinitely long straight uniformly charged wire.

View Text Solution

23. State Lenz's law. Explain, by giving examples that Lenz's law is a consequence of conservation of energy.

View Text Solution

24. Calculate the capacity of unknown capacitance is connected acrosss a battery of V volts. The charge stored in it is $360 \mu C$. When potential across the capacitor is reduced by 120V, the charge stored in it becomes $120 \mu C$.

Calculate (i) the potential V and unknown capacitance C. (ii) What will be the charge stored in the capacitor. If the voltage applied had increased by 120 V

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25. A plane wavefront propagating from a rarer into a denser medium is incident at an angle of incidence i on a refracting surface. Draw a diagram showing incident wavefront and refracted wavefront . Hence verify Snell's laws of refraction.

View Text Solution

26. Distinguish between sky wave and space wave modes of communication. What is the main limitation of space wave mode? Write the expression for the optimum separation between the transmitting and receiving antenna for effective reception of signals in this mode of communication.

View Text Solution

27. A parallel plate capcitor of capacitance C is charged to a potential V by a battery. Without disconencting the battery = distance between the plates of capacitor is triple and a dielectric medium of $K = 10$ is introduced between the plates of capacitor. Explain giving reasons how will the following be affected ?

(a) Capacitance of capacitor

(b) Charge on capacitor

(c) Energy density of capacitor.

Watch Video Solution

28. (a) Draw a graph showing the variation of binding energy per nucleon (BE/A) vs mass number A for the nuclei in $20 \leq A \leq 170$.

(b) A nucleus of mass number 240 and having binding energy/nucleon 7.6 MeV splits into two fragments Y, Z of mass numbers 110 and 130 respectively. If the binding energy/nucleon of Y, Z is equal to 8.5 MeV each, calculate the energy released in the nuclear reaction

Watch Video Solution

29. (a) In Young's double slit experiment, the two slits are illuminated by two different lamps having same wavelength of light. Explain with reason, whether interference pattern will be observed on the screen or not.

(b) Light waves waves from two coherent sources arrive at two points on a screen with path differences of 0 and $\lambda/2$. Find the ratio of intensities at the points.

Watch Video Solution

30. Using Bohr's postulates, derive the expression for the total energy of the electron revolving in n^{th} orbit of hydrogen atom. Find the wavelength of H_{α} line, given the value of Rydberg constant, $R = 1.1 \times 10^{7} m^{1}$

Watch Video Solution

31. Name the e.m. waves in the wavelength range 10 nm " to " $10^{-3} nm$. How are these waves generated ? Write their two uses.

View Text Solution

32. (a) Draw the pattern of magnetic field lines for a circular coil carrying current.

(b) Two identical planes such that they have a common centre at P as shown in the figure. Find the magnitude and direction of the net magnetic field at the point P due to the loops

View Text Solution

33. State the reason, why the photodiode is always operated under reverse bias. Write the working principle of operation of a photodiode. The semiconducting material used to fabricate a photodiode, has an energy gap of 1.2 eV. Using calculations, show whether it can detect light of wavelength of 400nm incident on it

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34. Draw the circuit diagram of a common emitter transistor amplifier. Write the expression for its voltage gain. Explain , how the input and output signal differ in phase by 180°

Watch Video Solution

35. Draw a circuit diagram of a full-wave rectifier. Explain its working principle. Draw the input/output wave forms indicating clearly the function of the two diode used.

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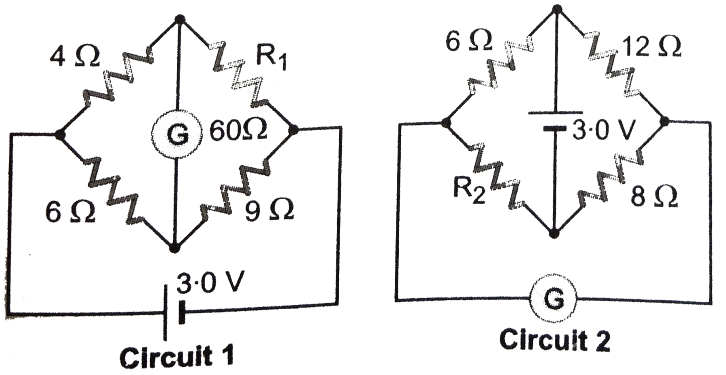
36. Briefly explain the three factors which justify the need of modulating low frequency signal into high frequencies

View Text Solution

37. The galvanometer, in each of the two given circuits deos not show any deflection. Find the ratio of the resistors R_1 and R_2 used in these two circuits.



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38. The current through two inductors of self inductance 12 mH and 30 mH is increasing with time at the same rate. Draw graphs showing the variation of the (a) e.m.f. induced with the rate of change of current in each inductor. (b) enargy stored in each inductor with the current flowing through it.

Compare the energy stored in the coils if power dissipated in the coil is same.

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39. (a) Explain how the intensity of diffraction pattern changes as the order (n) of the diffraction band varies.

(b) Two wavelengths of sodium light 590 nm and 596 nm are used in turn to study the diffraction at a single slit of size 4mm. The distance between the slit and screen is 2m. Calculate the separation between the positions of the first maximum of the diffraction pattern obtained in the two cases.

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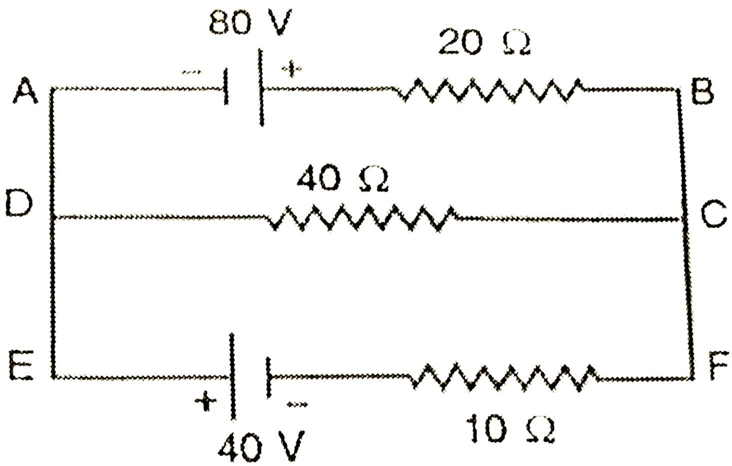
40. (a) Draw the equipotential surfaces corresponding to a uniform electric field in the z-direction.

(b) Derive an expression for the electric potential at any point along the axial line of an electric dipole

Watch Video Solution

41. Using Kirchoff's rules, calculate the current through the 40Ω and 20Ω resistors in the following circit :



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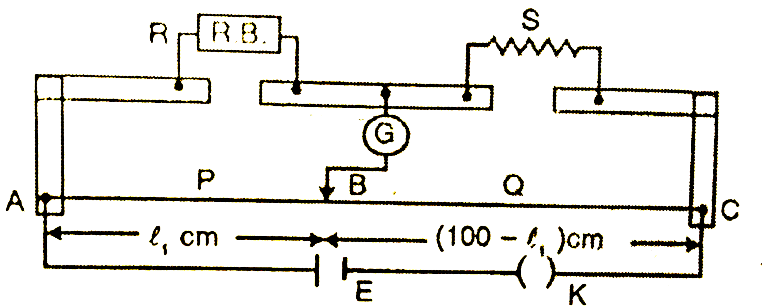
42. What is end error in a metre bridge ? How is it overcome ? The resistances in the two arms of the metre bridge are $R = 5\Omega$ and S respectively.

When the resistance S is shnted with an equal resistance, the new balance length forund to be 1.5 l_1, Where l_1 is the initial balancing length. Calculate the value of S.



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43. (a) Identiy the part of the electromagnatic spectrum used in (i) radar and (ii) eye surgery. Write their frequency range.

(b) Prove that the average energy density of the oscillating electric field is equal to that of the oscilating magnetic field.

Watch Video Solution

44. Define the term wavefront. Using Huygen's wave theory, verigy the law of reflection.

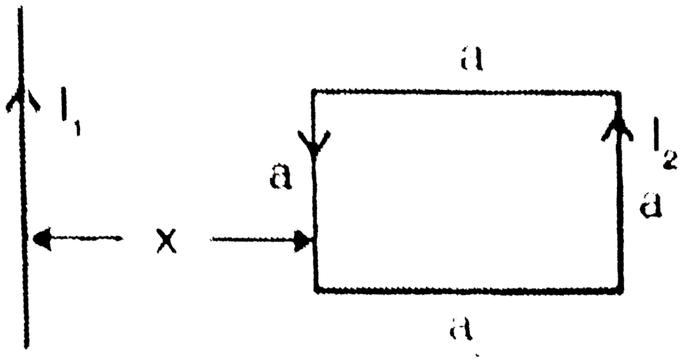
View Text Solution

45. Define term, "refreactive index " of a medium. Verify Snell's law refraction when a plane wavefront is propagating from a denser to a rarer medium.

View Text Solution

46. (a) Dfine mutaul indutace and write its S.I. unit.

(b) A square loop of side 'a' carrying a current I_2 is kept at distance x from an infinitely long straight wire carrying a current I_1 as shown in thefigure. Obtain the expression for the resultant force on the loop.



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47. (a) Derive the expression for the torque acting on a current carrying placed in a magnetic field.

(b) Explain the significance of a radial magnetic when current carrying coil is kept in it.

View Text Solution

48. (i) A giant refracting telescope at an observatory has an objective lens of focal length 15 m . If an eyepiece of focal length 1.0 cm is used, what is angular magnification of the telescope ?

(ii) If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens ? the diameter of the moon is $3.48 \times 10^6 m$, and the radius of lunar orbit is $3.8 \times 10^8 m$.

Watch Video Solution

49. (a) State Gauss's law for magnetism. Explain its significance.

(b) Write the four important properties of the magnetic field lines due to a bar magnet.

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50. Write three points of differences between para, dia-and ferro- mangetic materials, giving one example for each.

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51. Define the term 'decay constant' of a radioactive sample. The of disintergration of a given radioactive nucleus is 10000 disintegrations/s and 5,000 disintegration/s after 20 hr. and 30 hr. respectively from start. Calculate the half life and initial number of nuclei at t = 0.

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52. Three photodiodes D_1, D_2 and D_3 are made of semiconductors having

band gaps of $2.5eV$, $2eV$ and 3 eV , respectively .

Which one will be able to detect light of wavelength 6000Å ?

Watch Video Solution

53. (a) Describe briefly the functions of the three segments of n-p-n transistor.

(b) Draw the circuit arrangment for studying the output characterstics of n-p-n transistor in CE configuration. Explain how the output characterstics is obtained.

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54. Draw a circuit diagram of a full-wave rectifier. Explain its working principle. Draw the input/output wave forms indicating clearly the function of the two diode used.

Watch Video Solution

55. (a) If A and B represent the maximum amplitudes of an amplitude modulated wave, wrigte the expression for the modulation index in terms of A and B.

(b) A message signal of frequency 20 kHz and peak voltage 10 V is used to modulate a carrier of frequency 2 MHz and peak voltage of 15 V. Calculate the modulation index. Why the modulation index is generally less than one ?

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PHYSICS (Theory) DELHI BOARD -2016 [SET -I] [COMPTT.]

1. A student connects a cell of emf ε_2 and internal resistance r_2, with a cell of emf ε_1 such that their combinationhas a net internal resistance less then r_1. This combination in the connected across a resistance R. Draw a circuit of the 'set up' and obtain an expression for the current flowing through the resistance R

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2. Write the expression for the magnetic force $\overrightarrow{F}$ acting on a charged particle q moving with $\overrightarrow{v}$ in the presence of the magnetic field $\overrightarrow{B}$ in a vector form. Show that no work is done and no charge in the magnitude of the velocity of the particle is produced by this force. Hence define the unit of magnetic field.

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3. A long straight wire of a circular cross-section of radius 'a' carries a steady current I. The current is uniformly distributed across the cross-section. Apply Ampere's circuital law to calculate the magnetic field at a point at distance 'r' in the region for (i) $r < a$ and (ii) $r > a$.

Watch Video Solution

4. Derive the expression for the torque τ acting on a rectangular current loop of area A placed in a

uniform magnetic field B. Show that $\overrightarrow{\tau} = \overrightarrow{m} \times \overrightarrow{B}$

where $\overrightarrow{m}$ is the moment of the current loop given

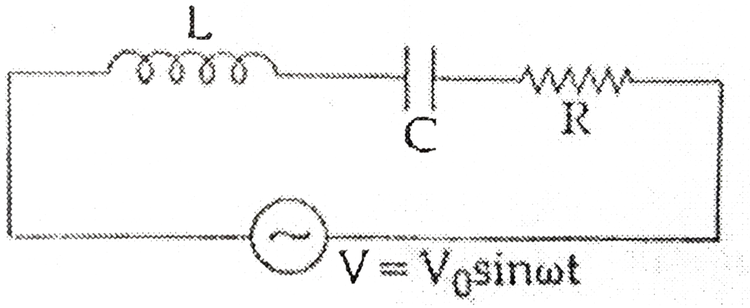
by $\overrightarrow{m} = \overrightarrow{I} A$.

View Text Solution

5. Define self-inductance of a coil and hence write the definition of 'Henry'.

View Text Solution

6.



The current in the LCR circuit shown in the figure is observed to lead the voltage in phase. Without making any other change in the circuit, a capacitor, of capacitance C_0 is (appropriately) joined to the capacitor C. This results in making the current, in the joined to the capacitor C. This results in making the current, in the modified' circuit, flow in phase with the applied voltage.

Draw a diagram of the modified circuit and obtain an expression of C_0 in terms of Ω, L and C.

Watch Video Solution

7. Point out two distinct features observed experimentally in photolelectric effect which cannot be explained on the basis of wave theory of light. State how the 'photon picture' of light provides an explanation of these features.

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8. It is required to design a (two -input) logic gate, using an appropriate number, of :

(a) NAND gates that gives a 'low' output only when both the inputs are 'low'.

(b) NOR gates that gives a 'high' output only when both the inputs are 'high'.

Draw the logic circuits for these two cases and write the truth table, corresponding to each of the two designs.

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9. Give (brief) reasons for the following :

(a) We use 'sky wave' mode of propagation of electromagnetic waves, only for frequencies upto

30 to 40 MHz.

(b) The LOS communication, via space waves, has a (fairly) limited range.

(c) A mobile phone user gets uninterrupted link to talk while walking.

Watch Video Solution

10. A parallel plate capacitar, of capacitance, $20\mu F$, is connected to a 100 V supply. After some time, the battery is disconnected , and the space, between the plates of the capacitor is filled with a dielectric, of dielectric constant 5. Calculate the energy stored in the capacitar (i) before (ii)after dielectric has been put in between its plates.

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11. A convex lens, of focal length 25 cm, and a concave mirror, of radius of curvature 20 cm. are placed co-axially 4 cm aprat from each other. An incident beam, parallel to the principal axis, is incident on the convex lens. Find the position and nature of the image formed by this combination.

Watch Video Solution

12. A 200 Mh (pure) inductor, and a $5\mu F$ (pure) capacitor , are connected , one by across a singusoidal ac voltage source $V=[70.7\sin(1000t)]$ voltage. Obtain the experiessions for the current in each case.

Watch Video Solution

C.B.S.E.CLASS-XII PHYSICS (THEORY) [SET-I] (SECTION-A)

1. A coil, of areas A, carrying a steady current I, has a magnetic moment, $\vec{m}$, associated with it. Write the relation, between $\vec{m}$, I am A in vector form.

View Text Solution

2. What are eddy currents ? Discuss brifly any two applications of eddy currents.

Watch Video Solution

3. Identify the logic gate whose output equals 1 when both of its inputs are 0 each.

Watch Video Solution

4. Why do we prefer a potentiometer to measure emf of a cell rather than a voltmeter ?

Watch Video Solution

5. Write the full forms of the terms:

(i) LAN

(ii) WWW.

Watch Video Solution

SECTIONS-B

1. The work function (ϕ_0), of a metal X, equals $3 \times 10^{-19} J$. Calculate the number (N) of photons, of light of wavelength 26.52nm, whose total energy equal W. Plank's constant $= 6.63 \times 10^{-34} Js$.

Watch Video Solution

2. Distinguish between Sky wave and Space wave modes of propagation in a communication system.

Watch Video Solution

3. The following data was obtained for a given transistor:

$V_{CE} \rightarrow$	10.0 V	10.0 V
$V_{BE} \rightarrow$	0.82 V	0.72 V
$I_B \rightarrow$	80 μ A	30 μ A

For the data, calcalate the input resistance of the given transistor.

Watch Video Solution

4. Draw a ray diagram to show a right angled isosceles prism may be used to "bend the path of light rays by 90°.

Write the necessary condition in terms of the refractive index of the material of this prism for the ray to bend to 90°.

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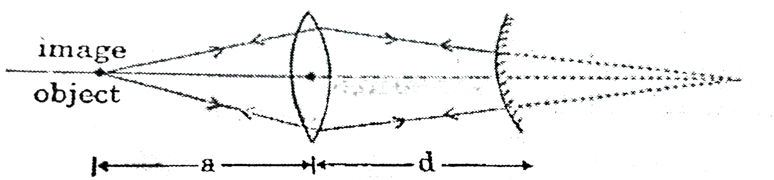
5. The image of an object, formed by a combination of a convex lens (of focal length f) and a convex mirror (of radius of curvature R), set up as shown is observed to coincide with the object.



Redraw this diagram to mark on it the position of the centre of the mirror. Obtain the expression for R in terms of the distances, marked as a and d, and the focal lenght f, of the convex lens.

Watch Video Solution

6. The electon, in a hydrogen atom, is in its second excited state. Calculate the wavelength of the lines in the Lyman series, that can be emitted through the permisible transitions of this electron.

Given the value of Rydberg constant, $R = 1.1 \times 10^7 m^{-1}$)

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SECTIONS-C

1. Two thin concentric and coplanar spherical shells, of radii a and b $(b > a)$ carry charges, q and Q, respectively. Find the magnitude of the electric field at a point distant x, from their common center for 3

(i) $0 < x < a$ (ii) $a \le x < b$ (iii) $b \le x < \infty$

$b \le x < \infty$

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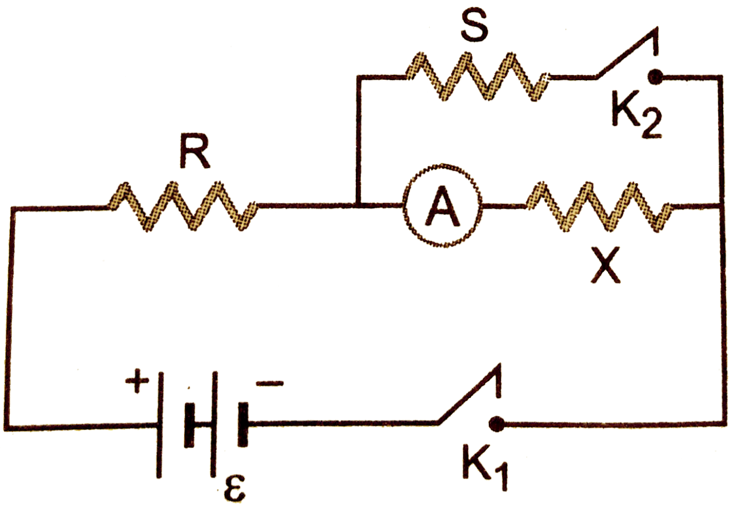
2. The reading of an ammeter in the circuit



(i) I when key K_1 closed key K_2 is open

(ii) $I/2$ when both keys K_1 and K_2 are closed

Find the expression for the resistance of X in terms of the resistances of R and S

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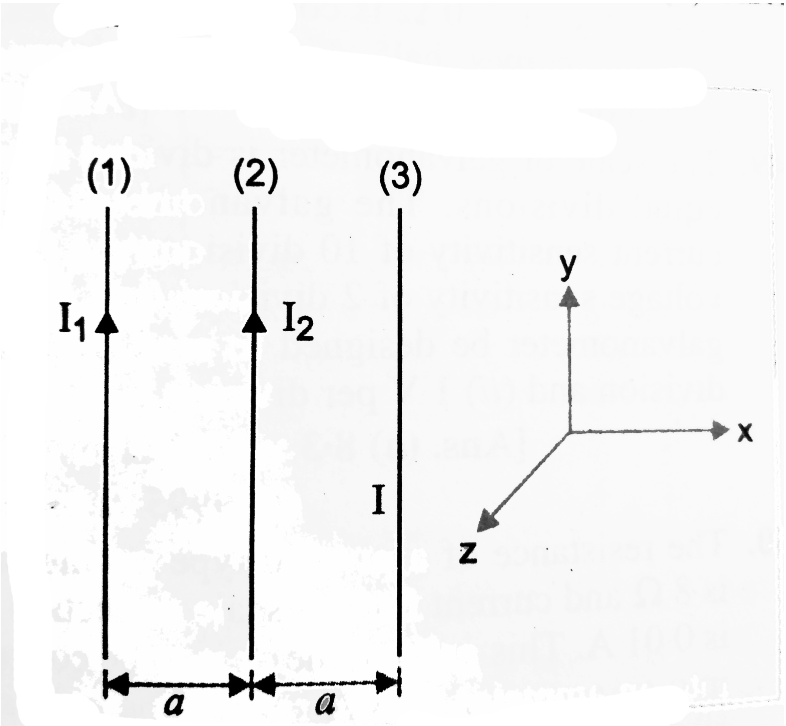
3. Three long straight parallel wires are kept as shown in figure. The wire (3) carries a current I.



(i) The direction of flow of current I in wire (3), is such that the net force, on wire (1), due to other two wires, is zero (ii) By reversing the direction of I, the net force, on the wire (2) due to the other two wires, becomes zero.

What will be the directions of current I, in the two cases? Also obtain the relation between the magnitudes of current I_1, I_2 and I.

Watch Video Solution

4. Derive the expression for the average power disspated in a series LCR circuit for an ac source of a voltage, $v = v_m \sin \omega t$, carrying a current, $i = i_m \sin(\omega t + \phi)$.

Hence, define the them "Wattless current". State under what condition it can be realized in a circuit.

View Text Solution

5. Obtain the expression for the magnetic energy stored in an ideal inductor of self inductance L when a current I passes through it.

Hence obtain the expression for the energy density of magentic field produced in the inductor.

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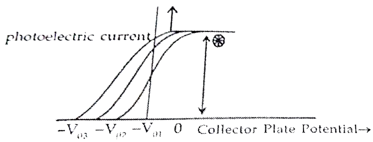
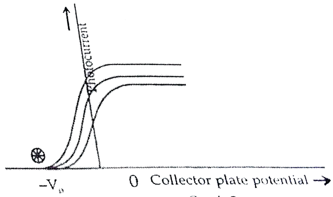
6. The graphs, drawn here, are for the phenomenon of photoelectric effect.



Graph 1



Graph 2

(i) Identify which of the two characteristics (intensity/frequency) of incident light, is being kept constant in each case.

(ii) Name the quantity, corresponding to the in eact case.

(iii) Justify the existence of a threshold for a given photosenitive surface.

View Text Solution

7. Obtain the relation $N = N_0 e^{-\lambda t}$ for a sample of radio active material having decay constant λ where N is the number of nuclei present at instant t. Hence, obtain the relation between decay constant λ and half life $T_{1/2}$ of the sample.

Watch Video Solution

8. Given reasons for the following :

(i) High reverse voltage do not appear across a LED.

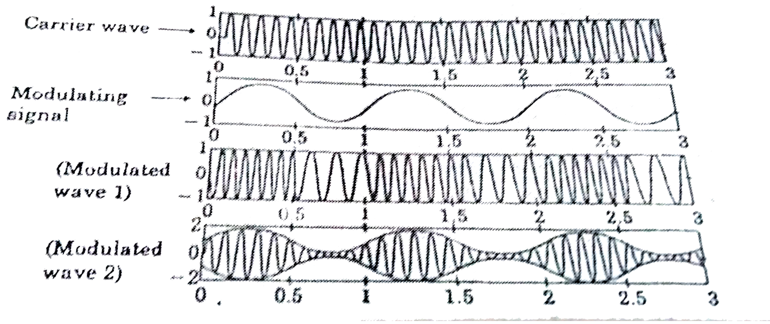
(ii) Sunlight is not always required for the working of a solar cell.

(iii) The electric field, of the junction of a Zener diode, is very high even for a small reverse bias voltage of about 5 V.

Watch Video Solution

9. What does the term 'Modulation' used in communication system, mean ?

Identify the two types of modulation shown here. Give two advantages of any one of these over the other.



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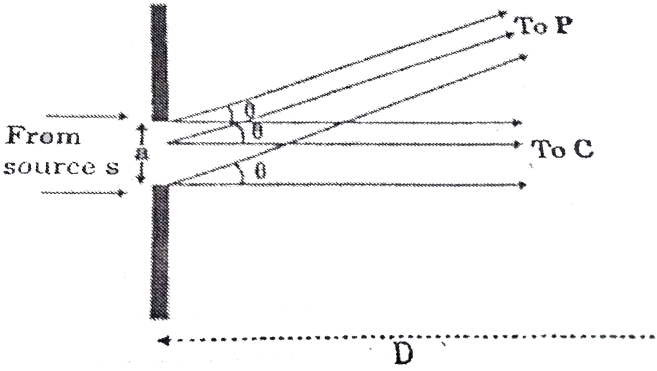
10. The figure, drawn here, shows the geometry of path differences for diffraction by a single slit of width a.



Given appropriate reasoning to explain why the intensity of light is

(i) maximum of the central point C on the screen.

(ii) (nearly) zero for point P on the screen when $\theta = \lambda / a$.

Hence, write an expression for the total linear width of the central maxima on a screen kept at a distance D from the plane of the slit.

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11. A circualr coil, having 100 tures of wire, of readius (nearly) 20cm each, lies in the XY plane with its centre at the origin of co-ordinates. Find the magnetic field, at the point $(0, 0, 20\sqrt{3}Cm)$, when this coil carries a current of $\left(\frac{2}{\pi}\right)A$.

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12. The temperature coefficient of resistance for two material A and B are $0.0031^{\circ}C$ and $0.0068^{\circ}C^{-1}$ respectively .Two resistance R_1 and R_2 made from material A and B respectively . Have resistance of 200Ω and 100Ω at $0^{\circ} C$. Show as a diagram the colour cube of a carbon resistance that would have a resistance equal to the series combination of r_1 and R_2 at a temperature of $100^{\circ} C$ (Neglect the ring corresponding to the tolerance of the carbon resistor)

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13. Two polaroids, P_1 and P_2 are set-up so that their pass-axis crossed with respect to each other. A third polaroids, P_3 is now introduces between these two so that its pass-axis makes and anlge θ with the pass-axis of P_1.

A beam of unpolarised light, of intensity I, is incident on P_1. If the intensity of light, that gets transmitted through this combination of three polaroids is I find the ratio $\left(\frac{I}{I}\right)$ when θ equals.

$(i) 30^\circ$ $(ii) 45^\circ$

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SECTIONS-D

1. Rakesh and Rajesh are 8th class students. They are fond of watching cricket match, particularly when it is played between Australia and India. They observed that most of the players, when they are in the field, apply a cream on their face. They did not know its reason. One day they asked this question to their teacher. The teacher thought it to be a good question and explained the reason for applying this cream to the whole class.

Based on this paragraph, answer the following questions:

(i) In your opinion, what explanation did the teacher offer to the students in the class?

(ii) Why is small ozone layer on top of the stratosphere considered crucial for human survival?

(iii) Write any two values displayed by Rakesh and Rajesh and their class teacher?

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2. Discuss how Faraday's law of e.m induction is applied in an ac-generator for converting mechanical energy into elecrical energy.

Obtain an expression for the instantaneous value of the induced emf in an ac generator.

Draw graphs to show the phase relationship between the instantaneous (i) magnetic flux (ϕ) linked with the coil and (ii) induced emf (ε) in the coil.

View Text Solution

3. Draw an arrangement for winding of primary and secondray coils in a transformer with two coils on a separate limb of the core.

State the underlying principles of a transformer.

Deduce the expression for the ratio of secondary voltage to the primary voltage in terms of the ratio of the number of turns of prrmary and secondary winding. For an ideal transfomer, obtain the ration of primary and secondary currents in terms of the ratio of the voltage in the secondary and primary voltages.

Write any two reasons for the energy losses which occur in actual transformers.

View Text Solution

4. (a) A point object, O is on the principle axis of a spherical surface having a radius of curvature, R. Draw a diagram to obtain the relation between the object and image distances, the refractive indicess of the media and the radius of curvature of the spherical surface.

View Text Solution

SECTIONS-E

1. (a) Obtain the expression for the potential due to a point charge.

(b) Use the above expression to show that the potential, due to an electric dipole (length 2a), varies as the inverse square' of the distance r of the 'field point' from the centre of the dipole for $r > a$.

Watch Video Solution

2. (a) Define the SI unit of capacitance.

Watch Video Solution

3. (b) Obtain the expression for the capacitance of a parallel plate capacitor.

View Text Solution

4. (c) Derive the expression for the affective capacitance of a series combination of n capacitors.

View Text Solution

C.B.S.E.CLASS-XII PHYSICS (THEORY) [SET-I]

1. (b) Write the Lens Maker's formula and use it to obtain the range of μ (The refractive index of the material of the lens) for which the focal length of and equiconvex lens, kept in air, would have a greater magnitude than that of the radius of curvature of its two surfaces.

View Text Solution

2. (a) Draw a diagram showing the Young's arrangement for producing 'a sustained interference pattern. Hence obtain the expression for the width of the interference fringes obtainet in this patten.

View Text Solution

3. (b) If the principal source point S was to be moved a little upwards, towards the slit S_1 from its usual symmetrical position with respect to the two slits S_1 and S_2 discuss how the interference pattern, obtained on the screen, would get affected.

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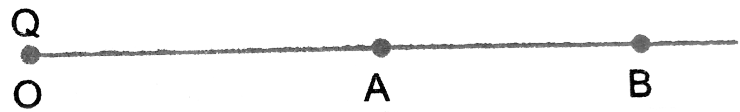
Section -A

1. A point charge Q is placed at the point O as shown in Fig. Is the potential difference $(V)_A - V_B)$ positive, negative or zero if Q is (i) possible (ii) negative ?



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2. How does the electric flux due to a point charge enclosed by a spherical Gaussian surface get a affected when its radius is increased ?

Watch Video Solution

Watch Video Solution

3. Write the underlying principle of a moving coil galvanometer.

View Text Solution

4. Why are microwaves considered suitable for radar system used in aircraft navigation?

Watch Video Solution

5. Define quality factor of resonance in series LCR circuit.What is its SI unit ?

Watch Video Solution

6. Draw a graph showing the intensity distribution of fringes due to diffraction at single slit

Watch Video Solution

7. Two protons of equal kinetic energies enter a region of uniform magnetic field . The first proton enters normal to the field direction while the second enters at 30° to the field direction . Name the trajectories followed by them.

View Text Solution

8. Define power of a lens and write its unit

Watch Video Solution

9. Write the range of frequencies of electromagnetic waves which propagate through sky wave mode.

View Text Solution

10. An electron is accelerated through a potential difference V. Write the expression for its final speed , if it was initially at rest.

Watch Video Solution

11. A porton and an electron travelling along parallel paths entre a regions of unifrom magnetic field, acting prependicular to their paths. Which of

them will move in a circular path with higher frequncy?

Watch Video Solution

12. Name the electromagentic readiations used for (a) water puification, and (b) eye surgery.

View Text Solution

13. Darw graphs showing variation of photoelctric current with applied voltage for two incident radiations of equal frequecny and different intensities. Mark the graph for the radiaiton of higher intensity.

Watch Video Solution

14. Four nuclei of an elements undergo fusion to form a heavier nucles, with release of energy. Which of the two - the parent or the daughter nucleus - would have higher binding energy per nucleon ?

Watch Video Solution

15. Which mode of propagation is used by short wave broadcast services ?.

View Text Solution

Section -B

1. Explain the terms (i) Attenuation and (ii) Demodulation used in Communication System.

View Text Solution

2. Plot a graph showing variation of de-broglie wavelength λ versus $1/\sqrt{V}$, where V is accelerating potential for two particle A and P carrying same charge but of masses m_1 and $m_2(m_1 > m_2)$. Which one of the two represents a particle of smaller mass and why?

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3. A nucleus with mass number A =240 and BE / A = 7.6 Me V breaks into two fragments each of A =120 with BE/A =8.5 Me V .Calculate the released energy .

Watch Video Solution

4. Calculate the energy in fusion reaction .

$_{1}^{2}H + _{1}^{2}H \rightarrow _{2}^{4}He + n$ " where BE of " $_{1}^{2}H = 2.23 MeV$" and of " $_{2}^{4}He = 7.73 MeV$

Watch Video Solution

5. Two cells of emfs 1.5 V and 2.0v having internal resistance 0.2Σ and 0.3 Σ respectively are connected in parallel . Calculate the emf and internal resistance of the equivalent cell .

Watch Video Solution

6. State Brewster's Law

The value of Brewster angle for a transparent medium is different for light of different colours . Give reason.

Watch Video Solution

7. Calculate the ratio of the frequencies of the radiation emitted due to transition of the electron in a hydrogen atom from its (i) second permitted energy level to the first level and (ii) highest permitted energy level to the second permitted level .

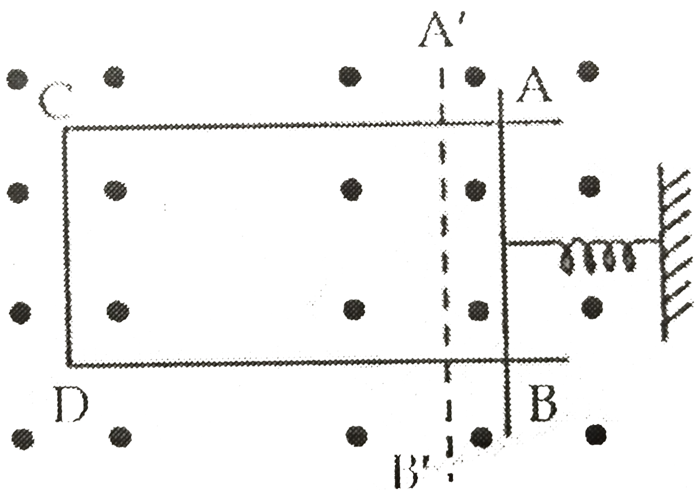
Watch Video Solution

8. (a) Define the term magnetic susceptibility and write its relation in terms of relative magnetic permeability .

(b) Two magnetic materials A and B have relative magnetic permeabilities of 0.96 and 500 . Identify the magnetic materials A and B .

View Text Solution

9. A rectangular frame of wire is placed in a uniform magnetic field directed outwards , normal to the paper . AB is connected to a spring which is stretched to A'B' and then released at time t=0. Explain qualitatively how induced e. m .f in the coil would very with time . (Neglect damping of oscillations of spring).



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10. Find the frequency of light which ejects electrons from a metal surface , fully stopped by a retarding potential of 3.3 V. If photo electric emission begins in metal at a frequency of $8 \times 10^{14} Hz$, calculate the work function (in eV) for this metal.

Watch Video Solution

11. Monochromatic light of frequency $6.0 \times 10^{14} Hz$ is produced by a laser. The power emitted is $2.0 \times 10^{-3} W$, (a) What is the energy of

a photon in the light beam? (b) How many photons per second, on the average, are emitted by the source? Given $h = 6.63 \times 10^{-34} Js$

Watch Video Solution

12. (a) Give one use of electromagnetic rediations obtained in nuclear disintegrations.

(b) Give one example each to illustrate the situations where there is (i) displacement current but no conduction current and (ii) only conduction current but no displacement current.

View Text Solution

Section -C

1. A charge is distributed uniformly over a ring of radius 'a' Obtain an expression for the electric intensity E at a point on the axis of the ring . Hence show that for point a lerge distance from the ring it behaves like a point charge .

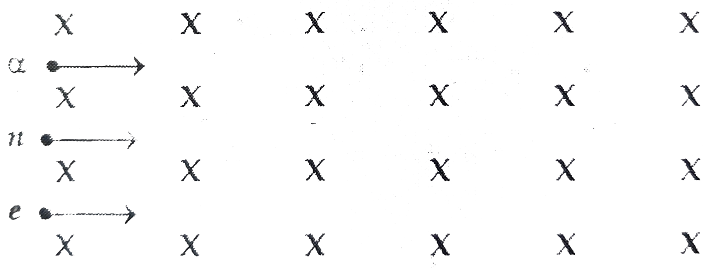
View Text Solution

2. Write the three characteristic features in photoelectric effect which cannot be explained on the basis of wave theory of light, but can be explained by using Einstein's equation.

Watch Video Solution

3. (a) Write the expression for the magnetic force acting on a k charged particle moving with velocity v in the presence of magnetic field B .

(b) A neutron an electron and an alpha particel moving with equal velocities enter a uniform magnetic field going into the plane of the paper as shown. Trace their paths in the field and justify your answer .



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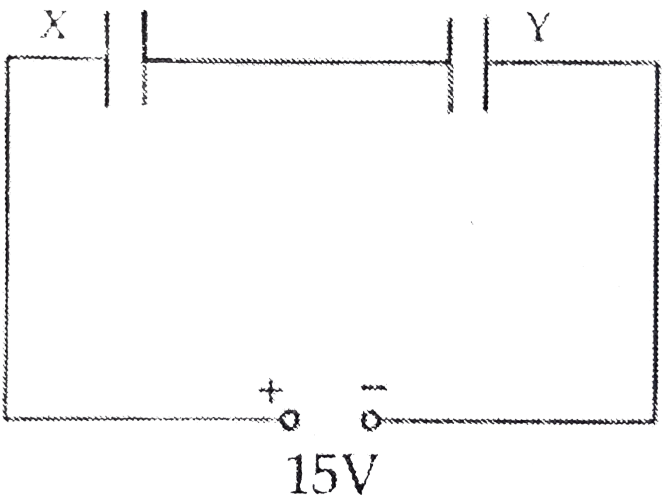
4. (i) Define mutual inductance.

(ii) A pair of adjacent coils has a mutual inductance of 1.5 H . If the current in one coil changes from 0 to 20 A in 0.5s, what is the change of flux linkage with the other coil ?

Watch Video Solution

5. Two parallel plate capacitors X and Y have the same area of plates and same separation between them.

X has air between the plates while Y contains a dielectric medium of $e_r = 4$



(i) Calculate capacitance of aech capacitor if equivalent capacitance of the combination is $4\mu_F$

(ii) Calculate the potential difference between the plates of X and Y

(iii) Estimate the ratio of electrostatic energy stored in X and Y .

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6. How are electromagnetic waves produces by oscillating charges ? Draw a sketch of linearly polarized EM waves propagating in z-direction. Indicate the direction of oscillating electric and magnetic fields

Watch Video Solution

7. (a) Explain any two factors which justify the need of modulating a low frequency signal.

(b) Write two advantages of frequency modulation over amplitude modulation.

View Text Solution

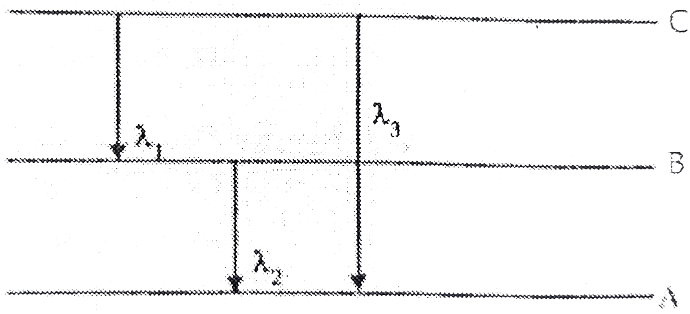
8. (i) Calculate the distance of an objective of height h from a concave mirror of radius of curvature 20 cm , so as to obtain a real image of magnification 2. find the location of image also .

(iii) Using mirror formula explain Why does a convex always produce a virtual image .

Watch Video Solution

9. (i) State Bohr's quantization condition for defining stationary orbits . How does de- Broglie hypothesis explain the stationary orbits ?

(ii) find the relation beween the three wavelengths λ_1, λ_2 and λ_3 from the energy level diagram shown :



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10. Draw a schematic ray diagram of reflecting telescope showing how rays coming from a distant object are received at the eye - piece . Write its two important advantage over a refracting telescope.

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Section-D

1. Ram is a student of class X in a village school. His uncle gifted him a bicycle with a dynomo fifted in it. He was very excited to get it. While cycling during night, he could light the bulb and see the objects on the road. He, however, did not know how this device works. He asked this questions to his teacher. The teacher considered it an opprtunity to explain the working to the whole class.

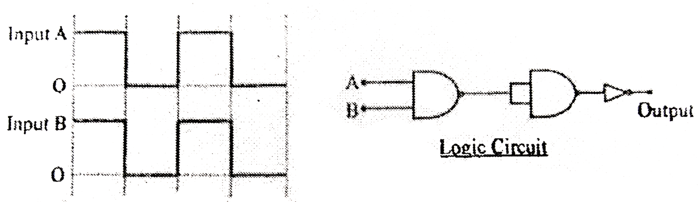
Answer the following questions :

(i) State the principle and working of dynamo.

(ii) Write two values each displayed by Ram and his school teacher.

View Text Solution

2. Using the wave forms of the input A and B, draw the output waveform of the given logic circuit . Identify the logic gate obtained . Write also the truth table.



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3. Derive the expression for the current density of a conductor in terms of the conductivity and applied electic field. Explain with reason how the mobility of electrons in a conductor changes when the potential difference applied is doubled, keeping the temperature of the conductor constant.

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4. Ram was a daily wage worker in a factory. He was suffering from Cancer. On hearing this, most of his co-workers, started avoiding him under the impression that it was a contagious disease. When Prof. Srivastava came to know about this, case, he took him to a leading radiologist, who examined him and told that it was at the beginning stage. He advised that it could be easily cured and also certified that it was not a communicable disease. After this, Ram was given proper treatment by the doctor and got cured completely.

(1) What moral values did Prof. Srivastava display ?

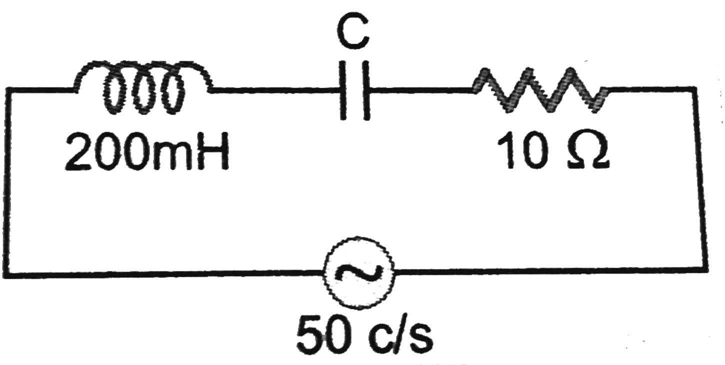
(2) How is mean life of a radioactive element related to its half life?

(3) A radioactive sample has activity of 10,000 disintegrations per second after 20 hours . After

next 10 hours, its activity reduces to 5,000 dps. Find out its half - life and initial activity.

Watch Video Solution

5. In the circuit shown in fin. Calculate the capacitance C of the capacitor, if the power factor of the circuit is unity. Also, calculate Q factor of the circuit.



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6. (a) Prove that the current flowing through an ideal inductor connected across a.c. source, lags the voltage in phase by $\frac{\pi}{2}$.

(b) An inductor of self inductance 100 mH, and a bulb are connected in series with a.c. sources of rms voltage 10 V, 50 z. It is found that effective voltage of the circuit leads the current in phase by $\frac{\pi}{4}$.

Calculate the inductance of the inductor used and average power dissipated in the circuit, if a current of 1 A flows in the circuit.

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7. Explain with diagram, how plane polarized light can be produced by scattering of sunlight . An incident beam of light of intensity I_0 is made to fall on a polaroid A. Another polaraid B is so oriented with respect to A that there is no light emerging out of B. A third polaroid C is now introduced mid-way between A and B is so oriented that its axis bisects that angle between the axes of A and B. Calculate the intensity of light transmitted by A,B and C.

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8. (a) In Young's double slit experiment, a monochromatic source of light S is kept equidistant from the slits S_1 and S_2. Explain the information of dark and bright fringes on the screen.

(b) A beam of light consisting of two wavelength, 650 nm and 520 nm, is used to obtain interference fringes in a Young's double - slit experiment.

(i) Find the distance of the third bright fringe on the screen from the central maximum for wavelengths 650 nm.

(ii) What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide ?

Given: The seperation between the slits is 4 mm and the distance between the screen and plane of the slits is 1.2 m.

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9. (a) Draw a circuit diagram of a meter bridge used to determine the unknown resistance R of a given wire. Hence derive the expression for R in terms of the known resistance S.

(b) What does the term 'end error' in a metre bridge circuit mean and how is it corrected ? How will the balancing point be affected , if the positions of the battery and galvanometer are interchanged in a metre bridge experiment ? Give reason for your answer.

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10. (a) State the working principle of a potentiometer with help of the circuit diagram , explain how the internal resistance of a cell is determined.

How are the following affected in the

potentiometer circuit when (i) the internal resistance of the driver cell increases and (ii) the series resistor connected to the driver cell is reduced ? Justify your answer. 5

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11. Mr Kamath, the chief mechanical engineer in Northern railways went to Tokyo to attend a seminar on fast moving trains. His friend Mr. Hiroki explained how Japnese people are concentrating on energy conservation and saving fossil fuels using maglev trains. Mr. Kamath travelled from

Tokyo to Osaka in maglev train and found that the sound is less, travel is smooth and understood the Japanese technology in mass transporting system. Maglev trains work on the principle of Meissner's effect.

(a) Mention two values which Mr Kamath found in Mr. Hiorki.

(b) Which values in Mr Kamath do you appreciate ?

(c) What is Meissner's effect ? Write the value of magnetic permebility for perfect diamagnetism.

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12. The teachers of Geeta's school took the students on a study tirp to a power generating station, loactad nearly 200km away form the city.The teacher explained that electrical energy is transmitted over such a long distance to their city, in the form of alternating current (ac) raised to a high voltage. At the receiving end is the city, the voltage is reduced to operate the devices. As a result, the power loss is reduced. Geeta listened to the teacher and asked question about how the ac is converted to a higher or lower voltage.

(a) Name th device used to change the alternating to a higher or lower value. State one cause for power dissipation in this device.

(b) Explain with an example, how power loss is reduced if the energy is transmitted over long distance as an alternating current rather than a direct current,

(c) Write two values each shown by the teachers and Geeta.

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13. (a) In a series LCR circuit connected across an AC source of variable frequency, obtain the expression for its impedance and draw a plot showing its variation with frequency of the AC source.

(b) What is the phase difference between the voltages across inductor and the capacitor at resonance in the LCR circuit ?

(c) When and inductor is connected to a 200 V DC voltage, a current of 1Aflows trough it. when the same inductor is connected to a 200 V, 50 Hz AC source, only 0.5 A current flows. Explain, why ? Also, calculate the self inductance of the inductor.

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14. (a) Draw the diagram of a device which is used to decrease high S voltage into a AC voltage and state its working principle. Write four sources of energy loss in this device.

(b) A small town with a demand of 1200 kW of electric power at 220 V is situated 20 Km away from an electric plant generating power at 440V. The resistance of the two wire line carrying power is 0.5Ω per km. The town gets the power from the line through a 4000-220 V step-down transformer at s sub-station in the town. Estimate the line power loss in the from of heat.

Watch Video Solution

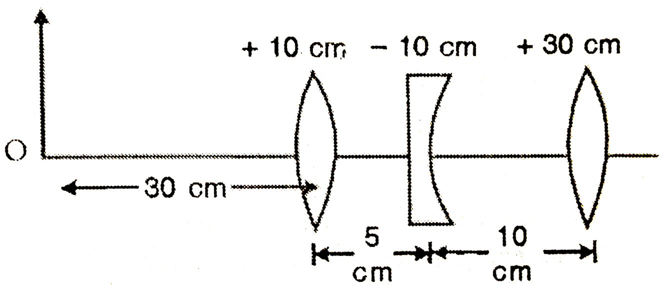
15. Describe any two characteristic feature which distiguish interference and diffraction phenomena. Derive the expression for the intensity at a point of the interference pattern in Young's double slit experiment.

(b) In the diffration due to single slit experiment, the aperture of the slit is 3 mm. If monochromatic light of wavelength 620 nm in incident normally on the slit, calculate the separation in between the first order minima and the 3^{rd} order maxima on one side of the screen. The distance between the slit and the screen is 1.5 m.

Watch Video Solution

16. (a) Under what conditions is the phenomenon of total internal reflection between the critical angle of incidence and the refractive index of the medium.

(b) Three lenses of focal lengths+10 cm, -10 cm and + 30 cm are arranged coaxially as in the figure given below. Find the position of the final image formed by the combination.



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17. (a) Describe briefly the process of transferring charge between the two plates of a parallel plate capacitor when connected to a battery. Derive an expression for the energy stored in a capacitor.

(b) A parallel plate capacitor is by a battery to a potential difference V. It is disconneted from battery and then connected to another uncharged capacitor of the same capaitance. Calculate the ratio of the energy stored in the combination to the initial energy on the single capacitor.

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18. (a) Derive and expression for the electric field at any point on the equatorial line of an electric dipole.

(b) Two identical point charges, q each kept 2m apart in air. A third point charge Q of unknown magnitude and sign is placed on the line joining the charges such that the system remains in equilibrium. Find the position and nature of Q.

Watch Video Solution

Section-E

1. (i) Draw a labelled diagram of a step-down transformer. State the principle of its working.

(ii) Find the ratio of primary and secondary currents in terms of turn ratio in an ideal transformer.

(iii) How much current is drawn by the primary of a transformer connected to $220V$ supply when it delivers power to a $110V - 550W$ refrigerator ?

Watch Video Solution

2. (a) Explain the meaning of the term mutual inductance. Consider two concentric circular coils, one radius r_1 and the other of radius $r_2(r_1 < r_2)$ placed coaxially with centres coinciding with each other. Obtain the expression for the mutual inductance of the arrangement.

(b) A rectangular coil of area A, having number of turns N is rotated at $'f'$ revoluation per second in a uniform magnetic field B, the field being perpendicular to the coil. Prove that maximum emf induced in the coil is $2\pi fNBA$.

3. (i) Device the mathematical n between refractive indices n_1 and n_2 of two radii and radius of curvature R for refraction at a convex shperical surface. Consider the object to be a point since lying on the principal axis in rarer medium of refractive index n_1 and a real image formed in the denser medium of refractive index n_2. Hence, derive lens marker's formula.

(ii) Light from a point source in air falls on a convex spherical glass surface of refractive index 1.5 and radius of curvature $20cm$. The distance of light source from the glass surface is $100cm$. At what position is the image formed ?

Watch Video Solution

4. (a) Draw a labelled ray diagram to obtain the real image formed by an astronomical telescope is normal adjustment position. Define its magnifying power.

(b) You are given three lenses of power $0.5D$, $4D$ and $10D$ to design a telescope.

(i) Which lenses should be used as objective and eyepiece? Justify your answer.

(ii) Why is the aperture of the objective preferred to be large ?

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5. (i) Use Gauss's law to find the electric field due to a uniformly charged infinite plane sheet. What is the direction of field for positive and negative charge densities?

(ii) Find the ratio of the potential differences that must be applied across the parallel and eries combination of two capacitors C_1 and C_2 with their capacitances in the ratio $1:2$ so that the energy stored in the two of two capacitors C_1 and C_2 with their capacitances in the ratio $1:2$ so that the energy stored in the two cases becomes the same.

Watch Video Solution

6. (i) If two similar large plates, each of area A having surface charge densities $+\sigma$ and $-\sigma$ are separated by a distance d in air,find the expression for

(a) field at points between the two plates and on outer side of the plates. Specify the direction of the field in each case.

(b) the potential difference between the plates.

(c) the capacitance of the capacitor so formed.

(ii) Two metallic spheres of radii R and $2R$ are charged so that both of these have same surface charge density σ. If they are connected to each other with a conducting wire, in which direction will the charge flow and why ?

Watch Video Solution

7. (a) State Gauss's law. Using this law, obtain the expression for the electric field due to an infinitely long straight conductor of linear charge desntiy λ.

(b) A wire AB of length L has linear charge density $\lambda = kx$, where x is measured from the end A of the wire.

This wire is enclosed by a Gaussian hollow surface.

Find the expression for the electric flux through this surface.

Watch Video Solution

8. (a) Derive the expression for the electric potential at any point P, at distance r from the centre of an electric dipole, making angle α, with its axis.

(b) Two point charges $4\mu C$ and $+1\mu C$ are separated by a distance of 2m in air. Find the point on the line joining charges at which the net electric field of the system is zero.

Watch Video Solution

9. (a) Prove that an ideal capacitor in ac circuit does not dissipate power.

(b) An inductor of 200m H, capacitor of $400\mu f$ and a resistaor of 10Ω are connected in series to ac source of 50 V of variable frequency. Calculate the

(i) angular frquency at which maximum power dissiplation occurs in the circuit and the corresponding value of the effective current, and

(iii) value of Q-factor in the circuit.

Watch Video Solution

10. (a) A metallic rod of length l is moved perpendicular to its length with velocity v in a magnetic field $\vec{B}$ acting perpendicular to the plane in which rod moves. Derive the expression for the inducced emf.

(b) A wheel with 15 metallic spokes each 60 cm long, is rotated at 360 rev/min in a plane normal to the horizontal component of earth's magnetic field. The angle of dip at that place is 60°. If the emf induced between rim of the wheel and the axle is 400 mV, calculate the horizontal component of earth's magnetic field at the place.

How will the induced emf change, if the number of spokes is increased ?

Watch Video Solution

11. (a) Explain with reason, how the power of a diverging lens changes when (i) it is kept in a medium of refractive index greater than that of the lens, (ii) incident red light is replaced by violet light.

(b) Three lenses L_1, L_2, L_3 each of focal length 30 cm are placed co-axially as shown in the figure. An object is held at 60 cm from the optic center of lens L_1. The final real image is formal at the focus of L_3. Calculate the separation between (i) $(L_1 \text{ and } L_2)$ and (ii) $(L_2 \text{ and } L_3)$.

Watch Video Solution

12. (a) Deduce the expression, by drawing a suitable ray diagram, for the refractive index of a triangular glass prisms in terms of the angle of minimum deviation (D) and the angle of prism (A). Draw a plot showing the variation of the angle of deviation with the angle of incidence.

(b) Calculate the value of the angle of incidence when a ray of light incident on one face of an equilateral glass prism produces the emergent ray, which just grazes along the adjacent face. Refractive index of prism is $\sqrt{2}$

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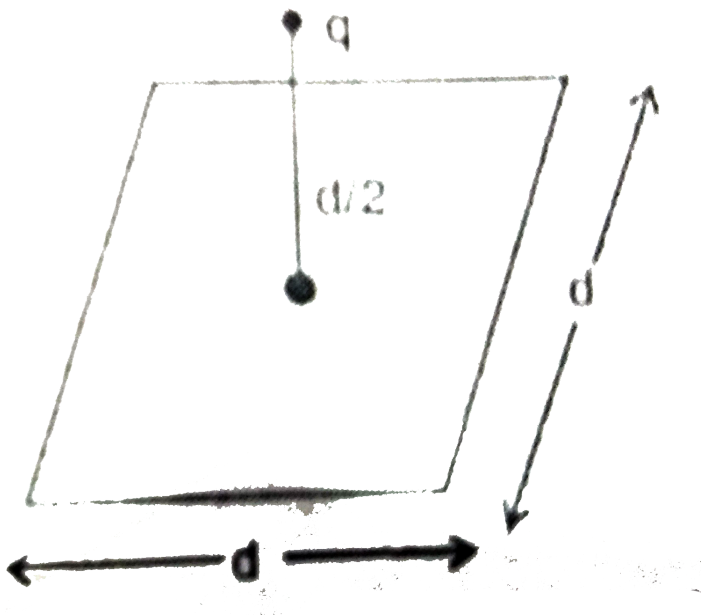
13. (a) Define electric flux. Is is the scalar or a vector quantity?

A point charge q is at a distance of $d/2$ directly above the centre of a square of side d, as shown in the figure. Use Gauss's law to obtain the expression for the electric flux through the square.

(b) If the point charges is now moved to a distance 'd' from the centre of the square and the side of the square is doubled, explain how the electric flux will be affected.



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14. (a) Use Gauss's law to derive the expression for the electric filed $\left(\vec{E}\right)$ due to straight uniformaly charges infinite line of charges density $\lambda C/m$.

(b) Draw a graph to show the variation of E with perpendicular from the line of charge.

(c) Find the work done in brining a charge q from prependicular distance r_1 to $r_2(r_2 > r_1)$.

View Text Solution

15. (a) State the principle of an ac generator and explain its working with the help of a labelled digram. Obtain the expression for the emf induced in a coil having N turns each of cross-section area. A, rotating with a constant angular speed ω in a magnetic filed ω, directed prependicular to the axis of rotation.

(b) An aeroplane if flying horizontally for west to east with a velocity of 900 km/hours. Calcuate the potential difference developed between the ends of its wings having a span of 20n. The horizontal component of the Earth's magnetic field is $5 \times 10^{-4}T$ and the angle of dip is 30°.

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16. A device X is connected across an ac source of voltage $V = V_0 \sin \omega t$. The current throught X is given as $I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right)$

(a) Identify the device X and write the expression for its reactance.

(b) Draw graph showing variation of voltage and current with time over one cycle of ac, for X.

How does the reactance of the device X vary with frequency of the ac? Show this variation graphically.

(d) Draw the phasor diagram for the device X.

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17. (a) Draw a ray diagram to show image fromation when the concave mirror produces a real, inverted and magnified image of the object

(b) Obtain the mirror formula and write the expression for the liner magnification.

(c) Explain two advantages of a reflecting telescope over a refracting telescope.

View Text Solution

18. (a) Define a wavefront. Using Huygen's principle, verify the laws of reflection at a plane surface .

(b) In a single slit diffraction experiment the wildth of the slit is made double the orignal width.

How does this affect the size and intensity of the central diffraction band ? Explain.

(c) When a tiny circular obstacle in placed in the path of light from a distance source, a bright spot is seen at the centre of the obstacle . Explain why.

View Text Solution

SET-I (SECTION-A)

1. Does the charge given to a metallic sphere depend on whether it is hollow or solid ? Give reason for your answer.

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2. A long straight current carrying wire passes normally through the centre of circular loop. If the current through the wire increases, will there be an induced emf in the loop ? Justify.

Watch Video Solution

3. At a place, the horizontal component of earth's magnetic field is V and angle of dip is 60°. What is te value of horizontal component of earth's magnetic field at equator ?

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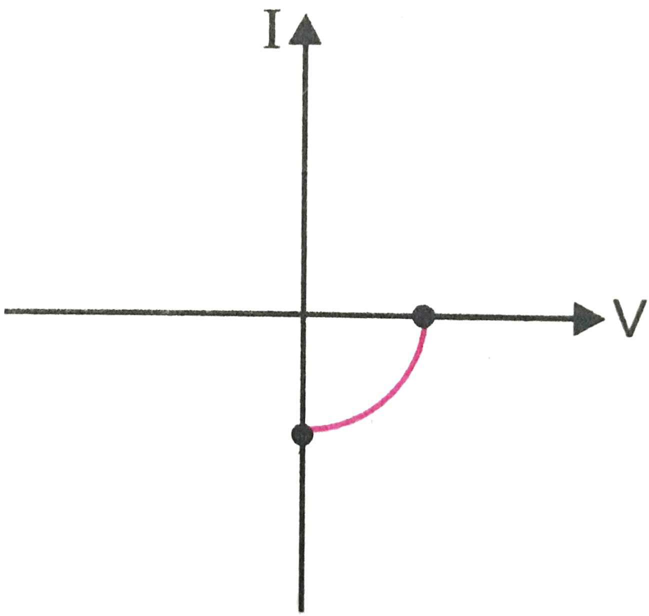
4. Name the junction diode whose I-V characteristics are drawn below:



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5. How is the speed of EM waves in vacuum determined by the electric and magnetic fields ?

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SET-I (SECTION-B)

1. How does Ampere-Maxwell law explain the flow the of current through a capacitor when it is being charged by a battery? Write the expression for the

displacement current in terms of the rate of change of electric flux.

Watch Video Solution

2. Define the distance of closest approach. An α-particle of kinetic enegy $'K'$ is bombarded on a thin gold foil. The distance of the closest approach is $'r'$. What will be the distance of closest approach for an α-particle of double the kinetic energy ?

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3. Write two important limitations of Rutherford nuclear model of the atom.

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4. Find out the wavelength of the electron orbiting in the ground state of hydrogen atoms.

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5. Which basic mode of communcations is used in satellite communication ? What type of wave propagation is used this mode ? Write, giving reason, the frequency range used in this mode of propagation.

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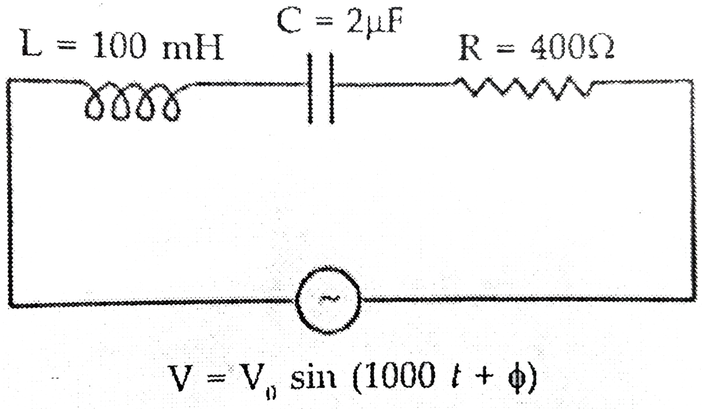
SET-I (SECTION-C)

1. (i) Find the value of the phase difference between the current and the voltage in the series LCR circuit shown below. Which one leads in phase : current or voltage ?



(ii) What making any other change, find the value of the additional capacitor C_1 to be connected in parallel with the capacitor C, in order to make the power factor of the circuit unity.

Watch Video Solution

2. Write the two processes that take place in the formation of a p-n junction. Explain with the help of a diagram, the function of depletion region and barrier potential in a p-n junction.

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3. (i) Obtain the expression for the cyclotron frequency.

(ii) A deutron and a proton are accelerated by the cyclotron. Can both the accelerated with the same oscillator frequency ? Give greason to justify your answer.

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4. (i) How does one explain the emission of electron from a photosensitive surface with te help of Einstein's photoelectric equation ?

(ii) The work function of the following metals is given : $Na = 2.75eV, K = 2.3eV, Mo = 4.17eV$ and $Ni = 5.15eV$. Which of these metals will not cause photoelectric emission for radiation of wavelength 3300Å from a laser source placed 1 m aways from these metals ? What happens if the laser source is brought nearer and placed 50 cm away ?

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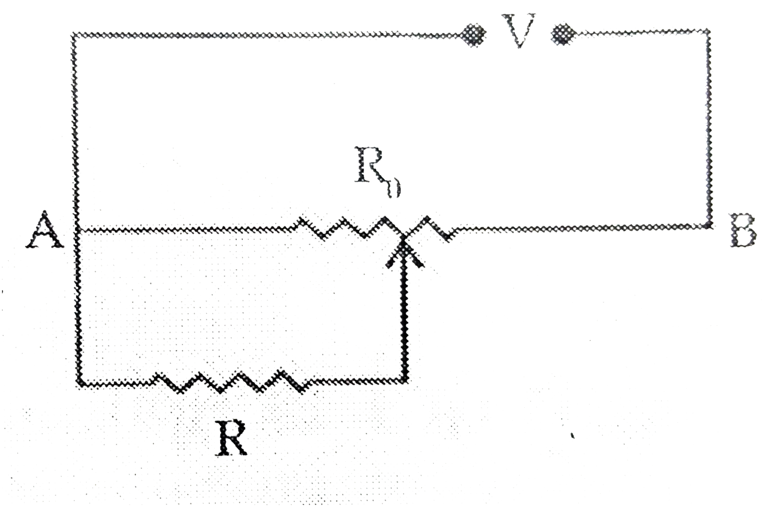
5. A resistance of R draws current from a potentiometer. The potentiometer wire, AB , has a total resistance of R_0, A voltage V is supplied to the potentiometer. Derive an expression for the voltage across R when the sliding contact is in the middle of potentialmeter wire.



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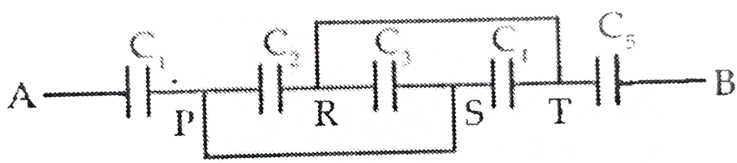
6. Define the term 'amplitude modulation'. Explain any two factors which justify the need for modulating a low frequency base-band signal.

View Text Solution

7. (i) Find equivalent capacitance between A and B in the combination give below . Each capacitor is a of $2\mu F$ capacitance .



(ii) If a dc source of 7V is connected across AB, how much charge is drawn from the source and what is the energy stored in the network ?

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8. (i) Derive the expression for electric field at a point on the equatorial line of an electric dipole.

(ii) Depiet the orientation of the dipole in (i) stable, (ii) unstable equilibrium in a uniform electric field.

View Text Solution

9. (i) A radioactive nucleus 'A' undergoes a series of decays as given below :

$$A \xrightarrow{\alpha} A_1 \xrightarrow{\beta} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4.$$

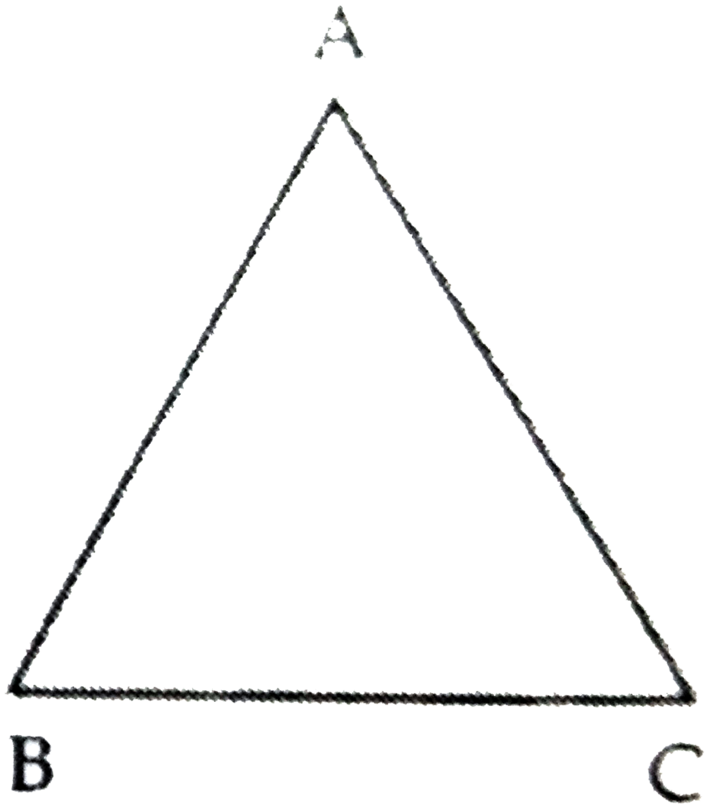
The mass number of atomic number of A_2 are 176 and 171 respectively. Determine the mass and atomic numbers of A_4 and A.

(ii) Write the basic nuclear processes underlying β and β^- decays.

Watch Video Solution

10. (i) A ray of light incident on face AB of an equilateral glass prism, shows minimum deviation of 30°. Calculate the speed of the light through the prism.

(ii) Find the angle of incidence at face AB so that the emergent ray grazes along the face AC.



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11. In a CE transistor amplifier, the audio signal voltage across the collector resistance of $2k\Omega$ is $2V$. If the base resistance is $1k\Omega$ and the current amplification of the transistor is 100, the input signal voltage is:

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12. Describe the working principle of a moving coil galvanometer. Why is necessary to use

(i) a radial magnetic field and (ii) a cylinderical soft iron core in a galvanometer ? Write the expression for current sensitivity of the galvanometer .

Can a galvanometer as such be used for measuring the current ? Explain .

View Text Solution

13. (a) Define the term 'self-inductance' and write the S.I. unit.

(b) Obtain the expression for the mutual inductance of two long co-axial solenoids S_1 and S_2 wound one over the other, each of length L and radii r_1 and r_2 andn_1 and n_2 number of turns per unit length , when a current I is set up in the outer solenoid S_2.

View Text Solution

SET-I (SECTION-D)

1. Mrs, Rashmi Singh broke her readings glasses. When she went to shopkeeper to order new spects, he suggested that she should get spectacles with plastic lenses instead of galss lenses. On getting the new spectacles, she found that the new ones were thicker than the earlier ones. She asked this question to the shopkeeper but he could not offer satisfactory explanation for this. At home, Mrs. Singh raised the same question to her daughter Anuja who explained why plastic lenses were thicker.

(a) Write two qualities displayed each by Anuja and her mother .

(b) How do you explain this fact using lens maker's formula ?

View Text Solution

SET-I (SECTION-E)

1. (a) Draw a labelled diagram of AC generator. Derive the expression for the instantaneous value of the emf induced in the coil.

View Text Solution

2. (a) Draw a labelled diagram of a step-up transformer. Obtain the ratio of secondary to primary voltage in terms of number of turns and currents in the two coils.

(b) A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at $220V$.

Watch Video Solution

3. (a) Distinguish between unpolarized light and linearly polarized light. How does one get linearly polarised light with the help of a plaroid ?

(b) A narrow beam of unpolarised light of intensity I_0 is incident on a polaroid P_1. The light transmitted by it is then incident on a second polaroid P_2 with its pass axis making angle of 60° relative to the pass axis of P_1. Find the intensity of the light transmitted by P_2.

Watch Video Solution

4. (a) Explain two features to distinguish between the interference pattern in Young's double slit experiment with the difference pattern obtained due to a single slit.

(b) A monochromatic light of wavelength $500nm$ is incident normally on a single slit of width 0.2 nm of produce a diffraction pattern. Find the angular width of the central maximum obtained on the screen.

Estimate the number of fringes obtained in Young's double slit experimental with fringe width $0.5mm$, which can be accommodated within the region of total angular spread of the central maximum due to single slit.

Watch Video Solution

5. (i) Derive expression for drift velocity of electrons in a conductor. Hence deduce ohm's law .

(ii) A wire whose cross-sectional area is increasing linealy from its one end to the other, is connected across a batteryof V volts. Which of the following quantities remains constant in the wire ?

(a) drift speed , (b) current density

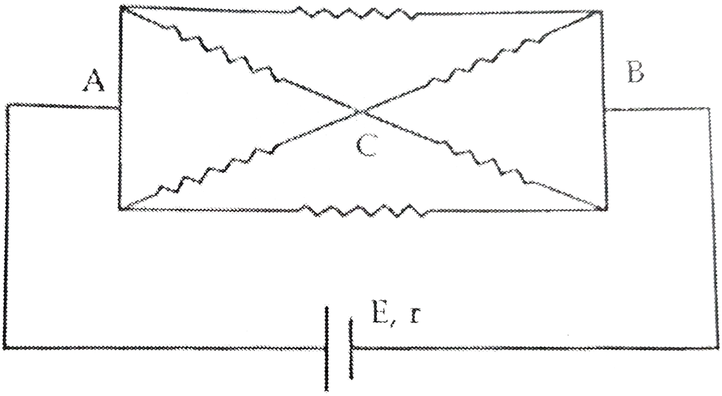
(c) electric current , (d) electric field.

Justify your answer.

View Text Solution

6. (i) State the two Kirchhoff's laws, Explain of the briefly how these rules are justified.

(ii) The current is drawn from a cell of emf E andinternal resistance r connected to the network of resistors each of resistance r as shown in the figure. Obtain the expression for (i) The current draw from the cell and (ii) the power consumed in the network .



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SET-II DELHI BOARD (SEC-B)

1. Distinguish between a transducer and a repeater.

Watch Video Solution

2. Why should the objective of a telescope have focal length and large apearture ? Justify your answer .

View Text Solution

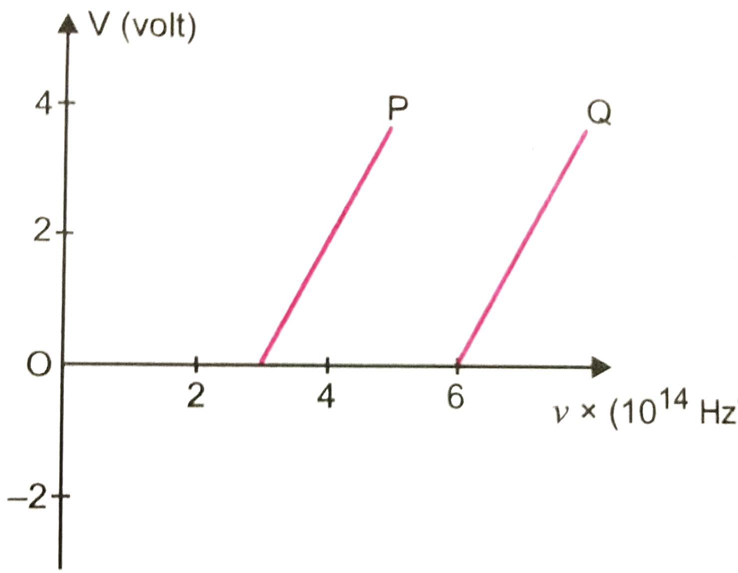
SET-II DELHI BOARD (SEC-C)

1. In the study of a photoelectric effect the graph between the stopping potential V and frequency ν of the incident radiation on two different metals P and Q is shown in fig.

(i) which one of two metals have higher threshold frequency

(ii) Determine the work function of the metal which has greater value

(iii) Find the maximum kinetic energy of electron emitted by light of frequency $8 \times 10^{14} Hz$ for this metal.



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2. A 12 pF capacitor is connected to a 50 V battery. How much electrostatic energy is stored in the capacitor ? If another capacitor of 6 pF is connected across the combination, find the charge stored and potential difference across each capacitor.

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3. A Zener diode is fabricated by heavily doping both p- and n-sides of the junctions. Explain, why ? Briefly explain the use of zener diode as a do voltage regularor with the help of a circuit diagram.

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4. A electron of mass, m_e revolves around a nucleus of charge $+Ze$. Show that it behaves like a tiny magnetic dipole. Hence, prove that the magnetic moment associated with it is expressed as $\overrightarrow{\mu} = -\frac{e}{2m_e}\overrightarrow{L}$, where $\overrightarrow{L}$ is the orbital angular momentum of the electron. Give the signification of negative sign.

Watch Video Solution

5. (i) Derive the expression for the specific for the electric potential due to an electric dipole at a point on its axial line.

(ii) Depiet the equivpotential surfaces due to an electric dipole.

View Text Solution

1. (i) State two important features of Einstein's photoelectric equation.

(ii) Radiation of frequency $10^{15} Hz$ is incident on two photosensitive surface P and Q. There is no photoemission from surface P. Photoemission occurs from Q but photoelectrons have zero kinetic energy. Explain these observation and find the value of work function for surface Q.

Watch Video Solution

2. (i) Obtain the expression for the torque $\overrightarrow{\tau}$ experienced by an electric dipole of dipole moment $\overrightarrow{p}$ in a uniform electric field , $\overrightarrow{E}$,

(ii) What will happen if the field were not uniform ?

View Text Solution

3. Explain briefly with the help of necessary diagram, the forward and the reverse biasing of p-n junction diode. Also draw their characteristic curves in the two cases.

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4. Two identical capacitors of $12pF$ each are connected in a series across a battery of 50V. How much electrostatic energy is stored in the combination ? If these were connected in parallel across the same battery , how much energy will be stored in combintion now ?

Also find the charge drawn from the battery in each case.

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5. (a) Write the expression for the force $\overrightarrow{F}$ acting on a particle of mass m and charge q moving with velocity$\overrightarrow{V}$ in a magnetic field $\overrightarrow{B}$. Under what conditions will it move in

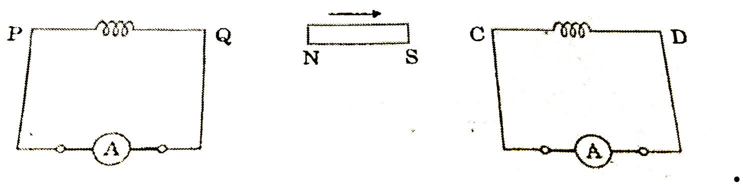
(i) a circular path and (ii) a helical path ?

(b) Show that the kinetic energy of the particle moving a magnetic field remains constant.

View Text Solution

[SET -II, OUTSIDE DELHI]

1. A bar magnet moved in the direction indicated by the arrow between two coils PQ and CD . Predict the dircation of the induced currnet in each coil .



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2. Write the relation for the speed of electromagnetic wave in terms of the amplitudes of electric and magnetic fields.

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3. Identify the electromagnetic waves whose wavelength very as: (a) $10^{-11}m < \lambda < 10^{-14}m$ (b) $10^{-4}m < \lambda < 10^{-6}m$. Write one use each.

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4. The short weve length limit for the Lyman series of the hydrogen spectrum is 913.4Å

Calculate the short wevelength limit for Balmer series of the hydrogen spectrum.

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5. (a) Draw a ray diagram showing the formation of image by a reflecting telescope

(b) Write two advantages of a reflacting telescope over a refracting telescope .

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6. Explain giving reasons for the following :

(a) Photoelectric current in a photocell increases with the increases in intensity of the incident radiation.

(b) The stopping potential V_0 varies linearly with the frequency ν of the incident radiation for a given photosensitive surface with the slope remaining the same for different surfaces.

(c) Maximum kinetic energy of the photoelectrons is independent of the intensity of incident radiation.

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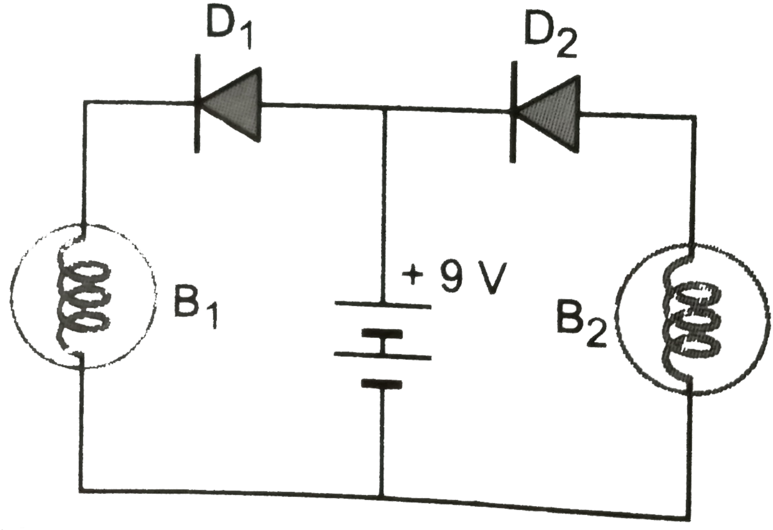
7. In the following diagram, which bulb out of B_1 and B_2 will glow and why?



Draw a diagram of an illuminated p-n junction solar cell

Explain briefly the three processes due to which generation of emf takes place in a solar cell.

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8. (a) Draw the circuit diagram for studying the characteristics of a transistor in common emitter configuration. Explain briefly and show how input and output characteristics are drawn.

(b) The figure shows input weve forms A and B to a logic gate . Draw the output waveform for an OR gate . Write the truth table for this logic gate and draw the output waveform for an OR gate . Write truth table for this logic gate and draw its logic symbol.

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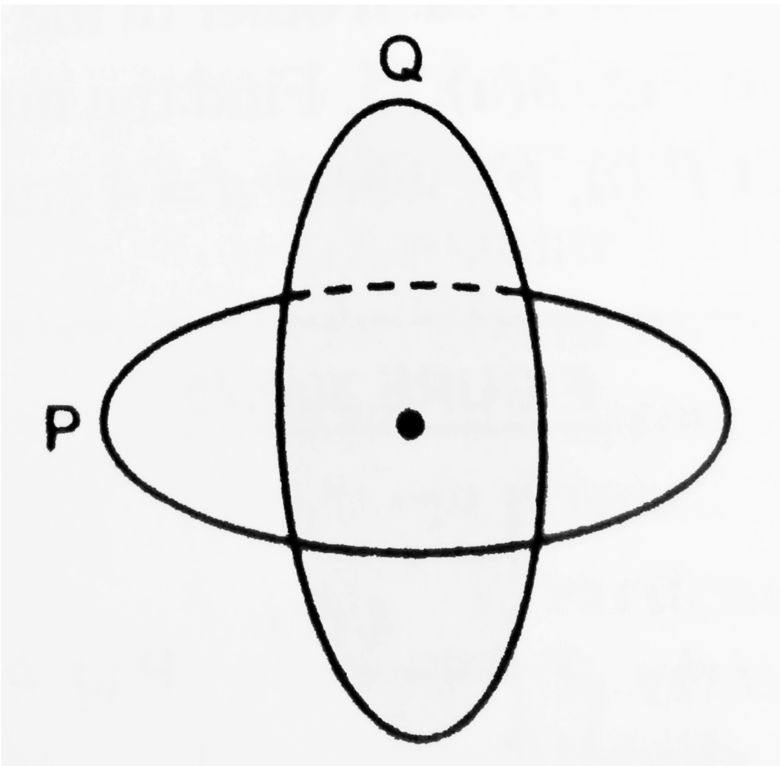
9. Two identical loops P and Q each of radius $5cm$ are lying in perpendicular planes such that they have a common centre as shown in the figure. Find the magnitude and direction of the net field at the common centre of the two coils, if they carry currents equal to $3A$ and $4A$ respectively.



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[SET -III, OUTSIDE DELHI]

1. Name the phenomenon which shows the quantum nature of electromagnetic radiation.

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2. How is electromagnetic wave produced ? Draw a sketch of a plane e.m. wave propagating along X-axis depicting the directions of the oscillating electric and magnetic fields.

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3. The grond state energy of hydrogen atom is $13.6eV$. If an electron makes a transition from an energy level - 1.51 eV to - 3.4 e V , calculate the wevelength of the spectrel line emitted and name the series of hydrogen spectrum to which it belongs.

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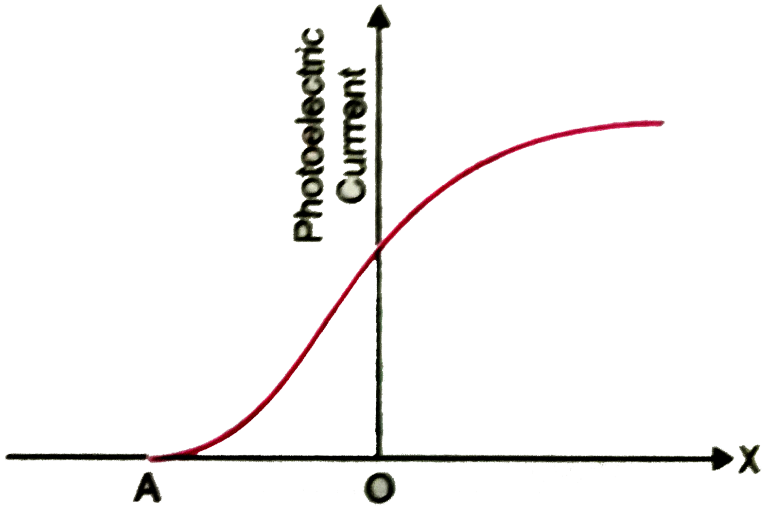
4. The following graph shows the variation of photoelectric current for a photosensitive metal .



(a) Identify the variable X on the horizontal line.

(b) What does the point A on the horizontal axis represent?

(c) Draw this graph for three different values of frequencies of incident radiation v_1, v_2 and $v_3 (v_1 > v_2 > v_3)$ for same intensity.

(d) Draw this graph for three different values of intensities of incident radiation $I_1, I_2, I_3 (I_1 > I_2 > I_3)$ having same frequency.

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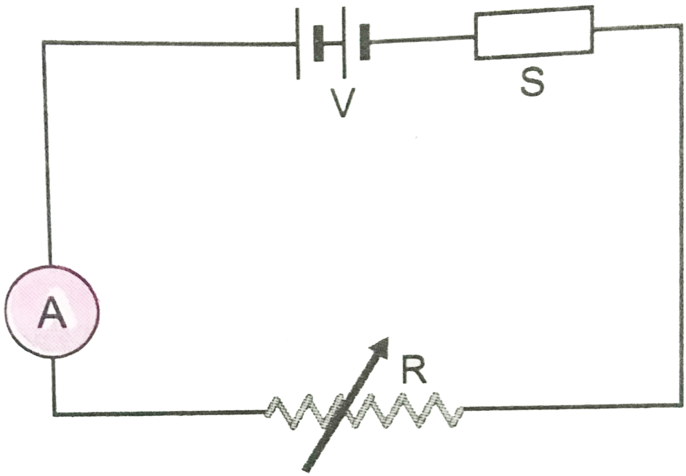
5. The diagram Fig.12 shown a piece of pure semiconductor S in series with a variable resistor R, and a source of constant voltage V. Would you increase or decrease the value of R to keep the reading of ammeter constant, when semiconductor S is heated? Give reason.



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SECTION - C

1. (a) Draw a plot showing the variation of potential energy of a pair of nucleons as a

function of their separation . Mark the regions where the nuclear force is :

(i) attractive and (ii) repulsive.

(b) In the nuclear reaction

$n + \underset{92}{235_U} \rightarrow \underset{54}{a_{Xe}} + \underset{b}{94_{Sr}} + 2n$ determine the values of a and b .

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2. Draw a labelled circuit diagram of n - p - n germanium transistor in common emitter configuration. Explain briegfly , how this transistor is used as a voltage amplifier.

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3. (a) State Biot - Savart law and ecpress it in the vector form.

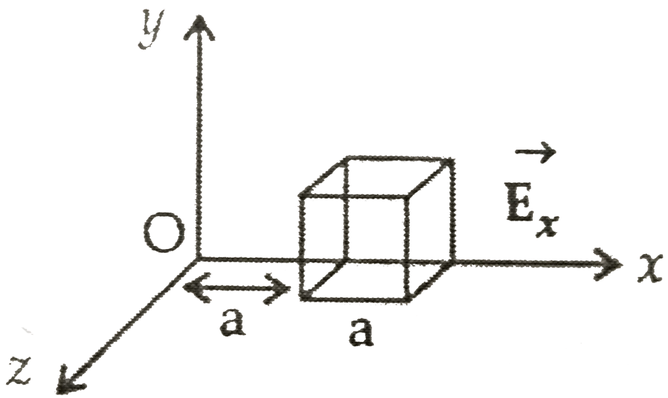
(b) Using Biot - Savart law, law obtain the expression for the magnetic field due to a circular coil of radius r, carrying a current I at point on its axis distant x from the centre of the coil.

View Text Solution

4. Define electric flux and write its SI unit . The electric field components in the figure shown are :

$E_x = \alpha x, E_y = 0, E_z = 0$ where $\alpha = \frac{100N}{Cm}$.

Calculate the charge within the cube , assuming a = 0.1 m .



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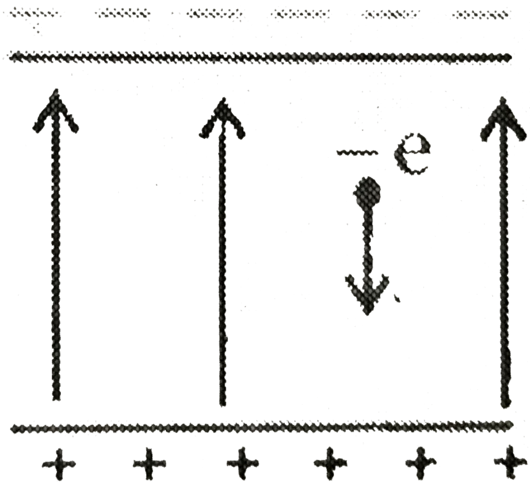
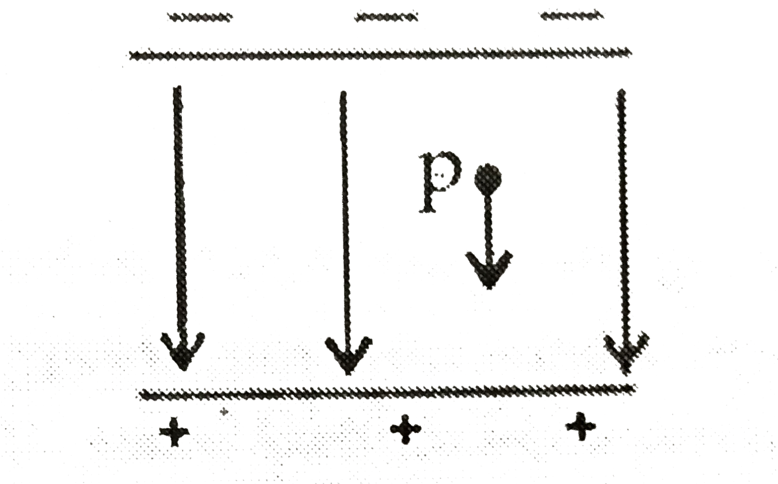
5. An electron falls through a distance of 1.5 cm in a uniform electric field of magnitude $2.0 \times 10^4 N/C(Fig. a)$



(a)

Calculate the time it takes to fall through this distance starting from rest. If the direction of the field is reversed (fig .b) keeping its magnitude unchanged, calculate the time taken by a proton to fall through this distance starting from rest.



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6. Using Kirchhoff ' s rules , calculate the potential difference between B and D in the circuit diagram as shown in the figure.

7. Define SI unit of current in terms of the force between two parallel current carrying conductors.

(b) Two long straight parallel conductors carrying steady currents I_a and I_b along the same direction are separated by a distance d. How does one explain the force of attraction between them ? If a third conductor carrying a current I_c in the opposite direction is placed just in the middle of these conductors , find the resultant force acting on the third conductor.

8. (a) With the help pf a ray diagram , show how a concave mirror is used to obtain an erect and magnified image of an object .

(b) Using the ray diagram below , obtain the mirror formula and the expression for linear magnification.

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9. Two cells of emfs ε_1 and ε_2 and internal resistances r_1 and r_2 respectively are connected in parallel . Obtain expressions for the equivalent (i) resistance and , (ii) emf of the combination.

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10. (i) Write two points to distinguish between interference and diffraction fringes.

(ii) In a Young 's double slit experiment , fringes are obtained on a screen placed at certain distance away from the slits . If the screen is moved by 5 cm towards the slits , the fringe width changes by 30 μm . Given that the slits are 1 mm apart , calculate the wavelength of the light used.

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11. (a) When an unpolarized light of intensity I_0 is passed through a polaroid , what is the intensity of the linearly polarized light ? Does it depend on the orintation of the polaroid ? Explain your answer.

(b) A plane polarized beam of light is passed through a polaroid . Show graphically the variation of the intensity of the transmitted light with angle of rotation of the polaroid in complete one rotation.

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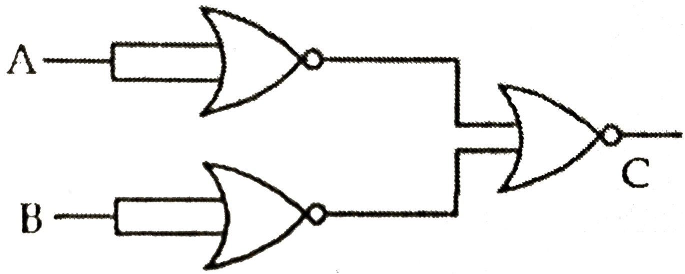
12. (a) Write the truth table for the combination of the gates shown in the figure.



(b) Explain briefly how a photodiode operates.

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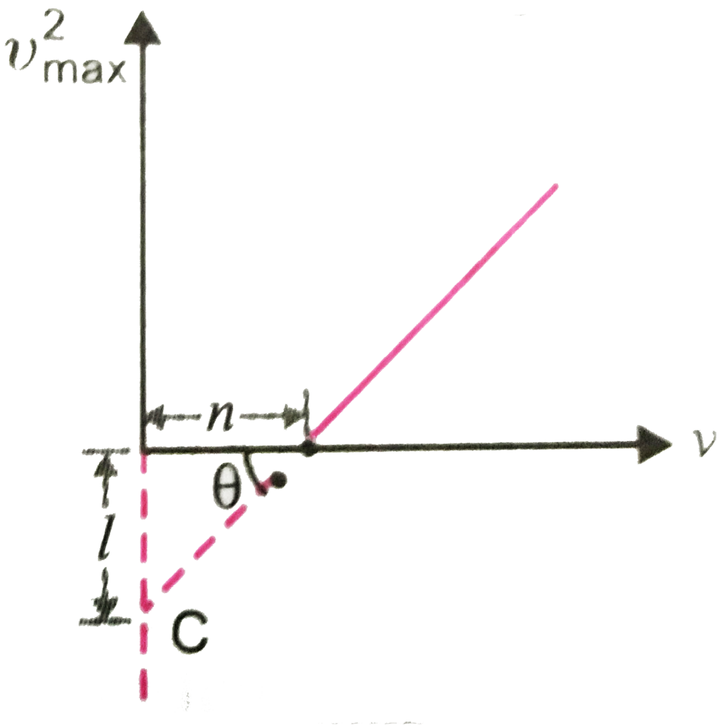
13. When a given photosensitive material is irradiated with light of frequency ν, and maximum speed of the emitted photoelectrons equals $v_{\max}$.

The square of $v_{\max}$ is observed to very with v, as per the graph shown in fig. Obtain expression for (i) Planck's constant and (ii) the work function of the given photosensitive material, in terms of the parameter l, n and the mass m of the electrons.



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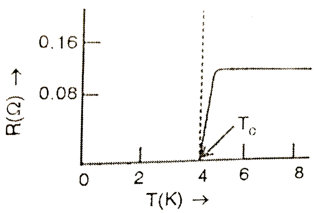
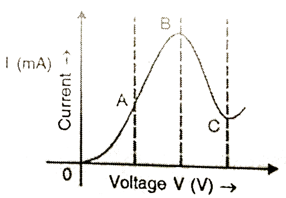
14. (a) Draw graph showing the variation of current versus voltage in an electroyte when an external resistance is also connceted.

(b) (i) The graph between resistance (R) and temperature (T) for Hg is shown in the figure (a). Explain the behaviour of Hg near 4k.

(ii) In which region of the graph shown in the figure (b) is the resistance negative and why?





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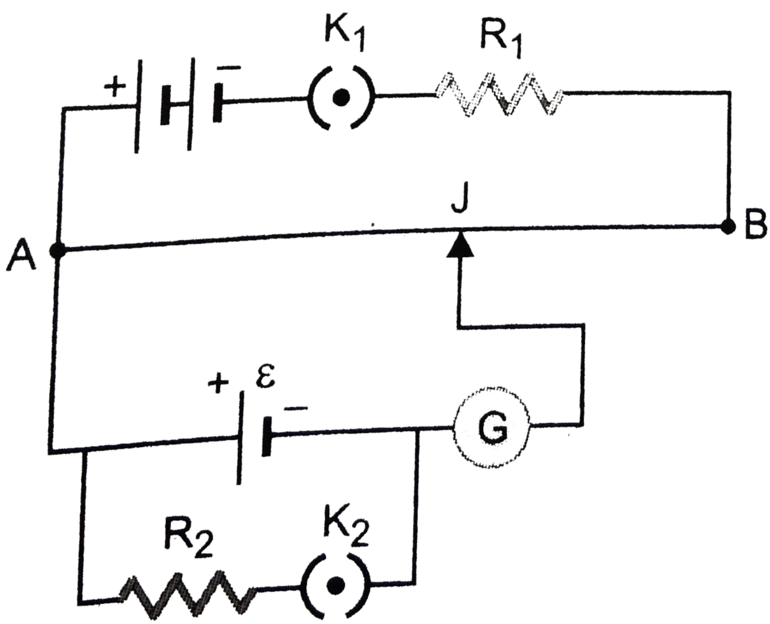
15. For the circuit would the balancing length increase, decrease or remain the same if (i) R_1 is decreased (ii) R_2 is increased, without any change (in each case) in the rest of the circuit ? Justify your answer in each case.



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16. State the underlying princeiple of mater bridge. Draw the circuit diagram and explain how the unknown resistance of a conductor can be determined by this method.

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17. A proton, a deuteron and an alpha particle, are accelerated through the same potential difference and then subjected to a unifrom magnetic field $\vec{B}$, perpendicular to the direction of their motions.

Compare (i) their kinetic energies, and (ii) if the radius of the ciruclar path described by proton is 5 cm, determine the radii of the paths described by deuteron and alpha partcile.

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18. (a) Briefly explain how a galvanometer is converted into an ammeter.

(b) A galvanometer coil has a resistance of 15Ω and it shows full scale deflection for a current of 4 mA. Convert it into an ammeter of range 0 to 6 A.

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19. (a) Briefly explain how a galvanometer is converted into a voltmeter.

(b) A voltmeter of a certain range is constructed by connecting a resistance of 90 Ω in series with a galvanometer. When the resistance of 470Ω is connected in series, the range gets halved. Find the resistance of the galvanometer.

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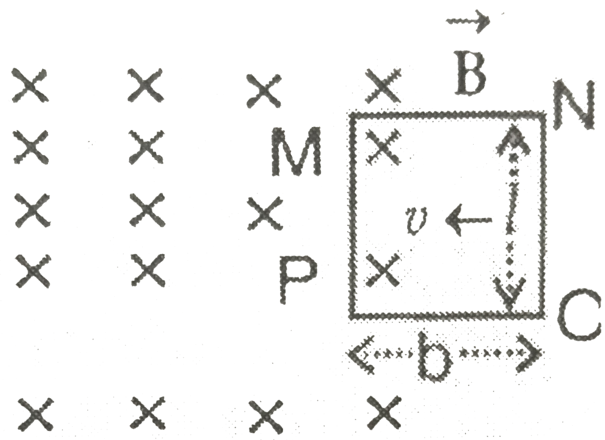
20. The figure shows arectangular conducting frame MNOP of resistance R placed partly in a perpendicular magnetic field $\vec{B}$ and moved with velocity $\vec{V}$ as shown in the figure.

Obtain the expressions for the

(a) force acting on the arm 'ON' and its direction, and

(b) power required to move the frame to get a steady emf induced between the arms MN and PO.



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21. Draw aray diagram to show the image formation of a distant object by a refracting telescope. Write the expression for its angular magnification in terms of the focal lengths of the lensesused. State the important considerations required to achieve large resolution and their consequent limitations.

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22. (a) Plot a graph for angle of deviation as a function of angle of incidence for a triangular prism.

(b) Derive the relation for the refractive index of the prism in terms of the angle of minimum deviation and angle of prism.

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23. (a) What is amplitude modulation? Draw a diagram showing an amplitude modulated wave obtained by modulation of a carrier sinusoidal wave on a modulating signal.

(b) Define the terms (i) modulation index, and (ii) side bands. Mention the significance of side bands.

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SECTION - D

1. Mrs Rajlakshmi had a sudden fall and was thereafter unable to stand striaight . She was in great pain Her daughter Rita took her to the docter . The docter took a photograph of Mrs . Rajlakshmi 's bones and found that she had suffered a fracture . He advised her to rest and take the required treatment.

(a) Write two values displayed by Rita .

(b) Mention the range of the wavelength of this electromagnetic radiation.

(c) How is this radiation produced ?

(d) Name the electromagnetic radiation used to take the photograph of the bones.

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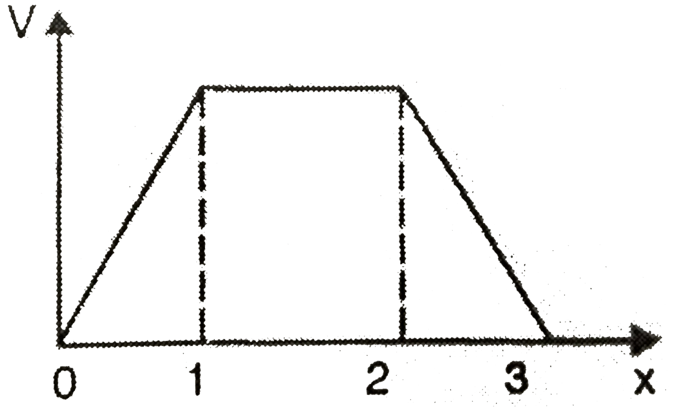
2. (a) When a parallel plate capacitor is connected across a d c battery, explain briefly how the capacitor gets charged.

(b) A parallel plate capacitor of capacitance 'C' is charged to 'V' volt by a battery. After some time the battery is disconnected and the distance between the plates is doubled. Now a slab of dielectric constant $1 < k < 2$ is introd uced to fill the space between the plates. How will the following be affected ?

(i) The electric field between the plates of the capacitor.

(ii) The energy stored in the capacitor. Justify your answer in each case.

(c) The electric potential as a function of distance 'x' is shown in the figure. Draw a graph of the electric field E as a function of x.



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3. (a) Derive an expression for the potential energy of an electric dipole in a uniform electric field. Explain conditions for stab le and unstable equilibrium.

(b) Is the electrostatic potential necessarily zero at a point where the electric field is zero ? Give an example to support your answer.

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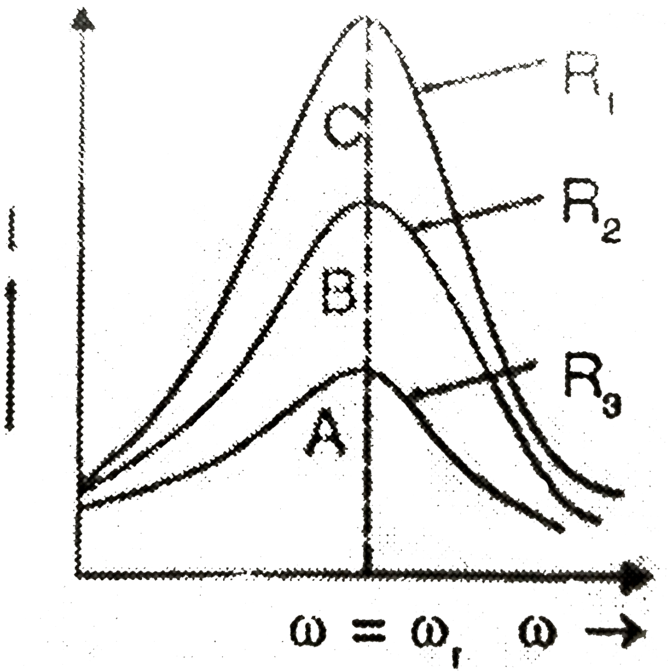
4. (a) What do you understand by 'sharpness of resonance' for a series LCR resonant circuit? How is it related with the quality factor 'Q' of the circuit? Using the graphs given in the diagram, explain the factors which affect it. For which graph is the resistance (R) minimum?

(b) $A2\mu F$ capacitor, 100Ω resistor and 8 H inductor are connected in serieswith an ac source.

Find the frequency of the ac source for which the current drawn in the circuit is maximum.

If the peak value of emf of the source is 200 V, calculate the (i) maximum current, and (ii) inductive and capacitive reactance of the circuit at resonance.



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5. (a) Draw a schematic diagram of an AC generator. Explain is working and obtain the expression for the instantaneous value of the emf in terms of the magnetic field B, number of turns N of the coil of area A rotating with angular frequency ω. Show how an alternating emf is generated by loop of wire rotating in a magnetic field.

(b) A circular coil of radius 10 cm and 20 turns is rotated about its vertical diameter with angular speed of 50 rad s^{-1}. in a uniform horizontal magnetic field of $3.0 \times 10^{-2} T$.

(i) Calculate the maximum and average emf induced in the coil.

(ii) If the coil forms a closed loop of resistance 10Ω, calculate the maximum current in the coil and the average power loss due to Joule heating.

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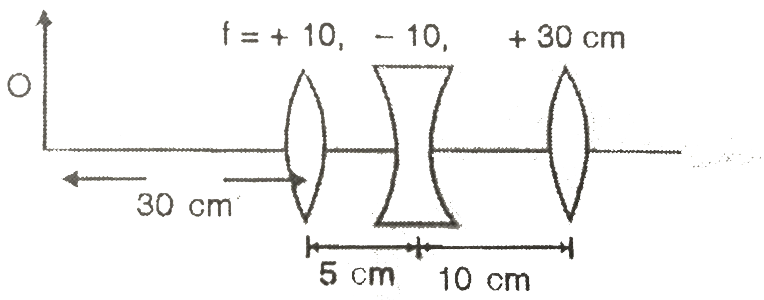
6. (a) Using the ray diagram for a system of two lenses of focal lengths f_1 and f_2 in contact with each other, show that the two lens system can be regarded as equivalent to a single lens of focal length f, where

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

Also write the relation for the equivalent power of the lens combination.

(b) Determine the position of the image formed by the lens combination given in the figure.



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SECTION - E

1. (a) Explain with the help of suitable diagram , the two processes which occur during the formations of a p -n junction diode . Hence , define the terms : (i) depletion region and (ii) potential barrier :

(b) Draw a circuit diagram of a p - n junction diode under forward bias and explain its working .

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2. (a) Describe briefly three factors which justify the need for modulation of audio frequency signals over long distances in communication .

(b) Draw the waveforms of (i) carrier wave , (ii) a modualating signal and , (iii) amplitude modulated wave.

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3. Two point charges q and - q are located at points (0 , 0 , - a) and (0 , 0 , a) respectively :

(a) Find the electrostatic potential at (0 , 0 , z) and (x , y , 0).

(b) How much work is done in moving a small test charge from the point (5 , 0 , 0 ,) to (-7 , 0 , 0) along the x - axis ?

(c) How would your answer change if the path of the test charge between the same points is not along the x axis but along any other random path ?

(d) If the above point charges are now placed in the same position in a uniform external electric field $\vec{E}$, what would be the potential energy of the charge system in its orientation of unstable equilibrium ? Justify your answer in each case .

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4. A capacitor of capacitance C_1 is charged to a potential V_1 while another capacitor of capacitance C_2 is charged to a potential difference V_2 . The capacitors are now disconnected from their respective charging batteries and connected in parallel to each other .

(a) Find the total energy stored in the two capacitors before they are connected.

(b) Find the total energy stored in the parallel combination of the two capacitors.

(c) Explain the reason for the difference of energy in parallel combination in comparison to the total energy before they are connected.

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5. (a) Draw graphs showing the variations of inductive reactnace and capacitive reactance with frequency of the applied ac source .

(b) Draw the phasor diagram for a series RC circuit connected to an ac source.

(c) An alternating voltage of 220 V is applied across a device X , a current of 0.25 A flows , which lag behind the applied voltage in phase by $\frac{\pi}{2}$ radian . If the same voltage is applied across another device Y , the same current flows but now it is in phase with the applied voltage .

(i) Name the devices X and Y.

(ii) Calculate the current flowing in the circuit when the same voltage is applied across the series combination of X and Y.

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6. State the principle of working of a transformer.

(b) Define efficiency of a transformer.

(c) State any two factors that reduce the efficiency of a transformer.

(d) Calculate the current drawn by the primary of a 90% efficient transformer which steps down 220 V to 22 V , if the output resistance is 440 Ω.

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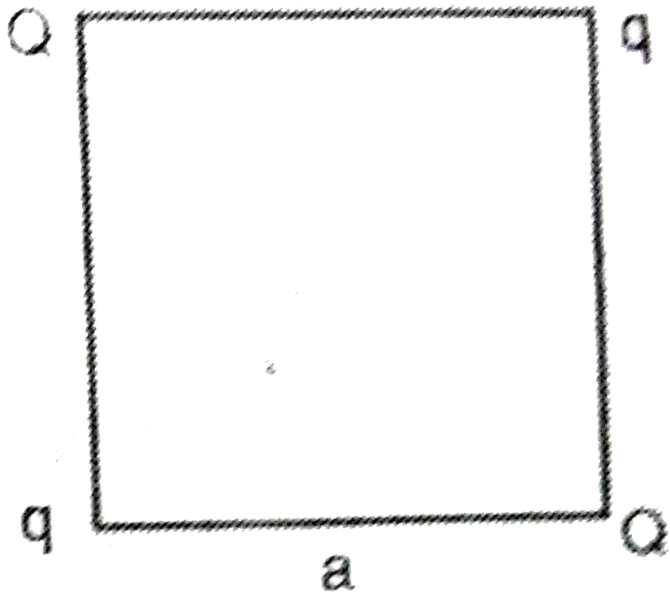
SECTION - C

1. Four point charges Q, q, Q and q are placed at the corners of a square of side' a' as shown in the figure.

Find the .

(a) resultnat electric force on a charge Q and .

(b) potential energy of this system.



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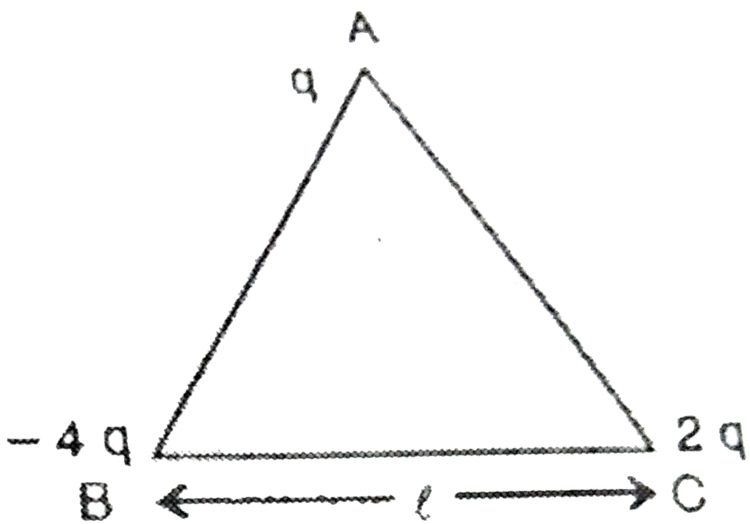
2. (a) Three point charges q,-4q and 2q are placed at the vertices of an equilateral triangle ABC of side 'l' as shown in the figure. Obtain the expression for the magnitude of the resultant electric force acting on the charge q.

(b) Find out the amount of the work 4one to separate the charges at infinite distance.



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3. (a) Define the term 'conductivity' of a metallic wire. Write its SI unit.

(b) Using the concept of free electrons in a conductor, derive the expression for the conductivity of a wire in te'rms of number density and relaxation time. Hence obtain the relation between current density and the applied electric field E.

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4. A bar magnet of magnetic moment 6 J/T is aligned at 60° with a uniform external magnetic field of 0.44 T. Calculate (a) the work done in turning the magnet to align its magnetic moment (i) normal to the magnetic field, (ii) opposite to the magnetic field, and (b) the torque on the magnet in the final orientation in case (ii).

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5. (a) An iron ring of relative permeability μ_r has windings of insulated copper wire of n turns per metre. When the current in the windings is I, find the expression for the magnetic field in the ring.

(b) The susceptibility of a magnetic material is

0.9853. Identify the type of magnetic material. Draw the modification of the field pattern on keeping a piece of this material in a uniform magnetic field.

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6. (a) Show using a proper diagram how unpolarised light can be linearly polarised by reflection from a transparent glass surface.

(b) The figure shows a ray of light falling normally on. the face AB of an equilateral glass prism having refractive index 3/2, placed A in water ofrefractive index 4/3. Will this ray suffer total internal reflection on striking the face AC? Justify your answer.

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7. (a) If one of two identical slits producing interference in Young's experiment is covered with glass so that the light intensity passing through it is reduced to 50%, find the ratio of the maximu and minimum intensity of the fringe in the interference pattern.

(b) What kind of fringes do you expect to observe if white light is used instead of monochromatic light ?

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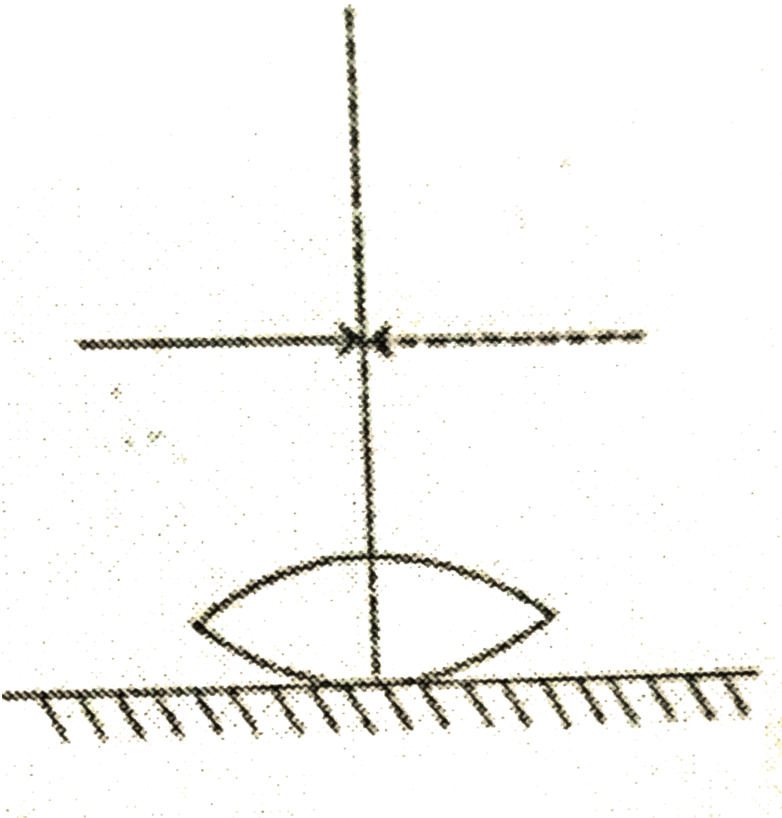
8. A synunetdc bionvex fens of radius of curvature Rand made of glass of refractive index 1.5, is placed on a placed on top of a plane mirror as shown in the figure.An optical needle with with its tip on the principal axis of the lens is moved along the axis until its real, inverted images conicides with the needle itself. The distance from the lens in measured to be x. On removing the liquid layer and repeating the experiment, the distance is found to be y . Obtain the expression for the refractive index of the liquid in terms of x and y.



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9. (a) State Bohr's postulate to define stable orbits in hydrogen atom. How does de Broglie's hypothesis explain the stability of these orbits ?

(b) A hydrogen atom initially in the ground state absorbs a photon which excites it to then n = 4 level . Estimate the frequeny of the photon.

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10. (a) Explain the processes of nuclear fission and nuclear fusion by using the plot of binding energy per nucleon (BE/A) versus the mass number A.

(b) A radioactive isotope has a hald -life of 10 years.

How long will it take for the activity to reduce to 3.125%.

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11. (a) Students wants to use tow p-m jusnction diodes to convnet alternating current into direct current . Draw the labelled circuit she would use and explain how it works.

(b) Give the truth table and circuit symbol for NAND gate.

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12. Draw the typical input and output characterisitics of an n-p-n transistor in CE configurtion . Show how these characteristic can be used to determine (a) the input resistance (r_1) and (b) current amplification factor (β).

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13. (a) Give three reasons why modulation of a message signal is necessary for long distance transmission.

(b) Show graphically an audio singal, a carrier wave and an amplitude modulation wave.

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SECTION - A

1. Two identical conducting balls A and B have charges- Q and + 3Q respectively. They are brought in contact with each other and then separated by a distance d part. Find the nature of the Coulomb force between them.

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2. A metal spherical shell has an inner radius R_1 and outer radius R_2. A charge Q is placed at the center of the spherical cavity. What will be surface charge density on (i) the inner surface, and (ii) the outer surface ?

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3. Under what condition will the current in a wire be the same when connected in series and in parallel on n identical cells each having internal resistance r and external resistance R?

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4. The ozone layer on the top of the stratosphere is crucial for human survival.Explain why?

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5. Illustrate by giving suitable example, how you can show that electromagnetic waves carry both energy and momentum.

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6. The figure shows the variation of stopping potential V_Q with the frequency v of the incident radiations for two photosensitive metals P and Which metal has smaller threshold wavelength ? Justify your answer.

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7. Why is ground wave transmission of signals restricted to a frequency of 1500 kHz ?

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SECTION - B

1. Using Gauss's law obtain the expression for the electric field due to uniformly charged thin spherical shell of radius R at a point outside the shell. Draw a graph showing the variation of electric tield with r, for r gt R and r lt R.

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2. Two large parallel plane sheets have uniform charge densities $+\sigma$ and $-\sigma$. Determine the electric field (i) between the sheets, and (ii) outside the sheets.

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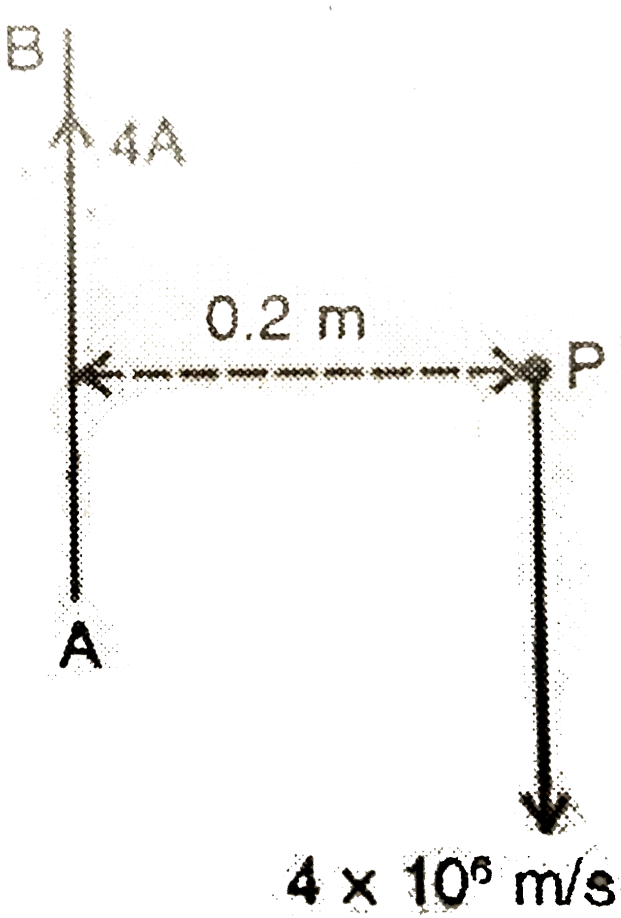
3. A long straight wire AB carries a current of 4 A. A proton P travels at $4 \times 10^6 ms^{-1}$ parallel to the wire 0.2 m from it and in a direction opposite to the current as shown in the figure. Calculate the force which the magnetic field due to the current carrying wire exerts on the proton. Also specify its direction.



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4. A capacitor, made of two parallel plates each of plate area A and separation d, is being charged by an external ac socurce. Show that the displacement current inside the same as the current charging the capacitor.

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5. A beam of light converges at a point P. Now a convex lens is placed in the part of the converngent beam at 15 cm from P. At what point does a beam converge if the convex lens has a focad length 10 cm ?

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6. An object is kept in front of a concave mirror of focal length 15 cm. The image formed is three times the size of the object. Calculate the two possible distances of the object from the mirror.

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7. Explain giving reason, how the resolving power of a compound microscope depends on the

(a) frequency of the incident light, (b) focal length of the objectives lens.

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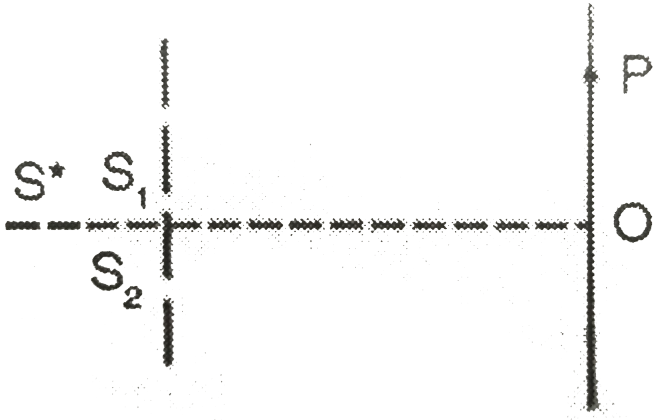
8. The figure shows a modified Young's double slit experimental set-up.

Here $SS_2 - SS1 = \lambda/4$.

(a) Write the condition for constructive interference.

(b) Obtain an expression for the fringe width.



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9. A certain n-p-n transistor has the common emitter output characteristics as shown in the figure.

(a) Find the emitter current at

$V_{CE} = 12.5V$ and $I_b = 60\mu A$, and

(b) Current gain $'\beta'$ at this point.

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