PHYSICS

BOOKS - XII BOARD PREVIOUS YEAR PAPER ENGLISH

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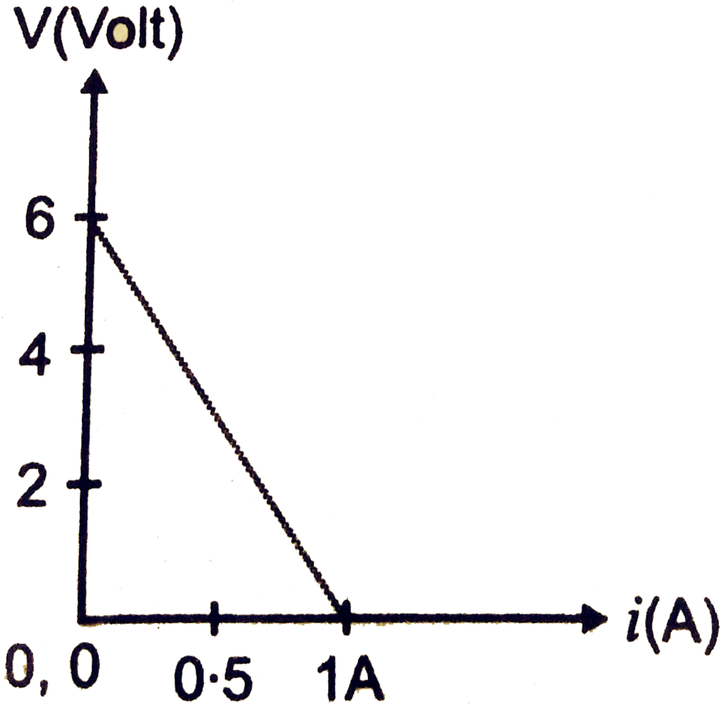
8. The plot of the variation of potential difference across a combination of three identical cells in series, versus current is as shown in figure. What is the emf and internal resistance of each cell?



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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,$\left(m\left(.^{23}_{10}Ne\right) = 22.994466amu\right.$ and $m\left(.^{23}_{11}Na = 22.989770amu\right.$. 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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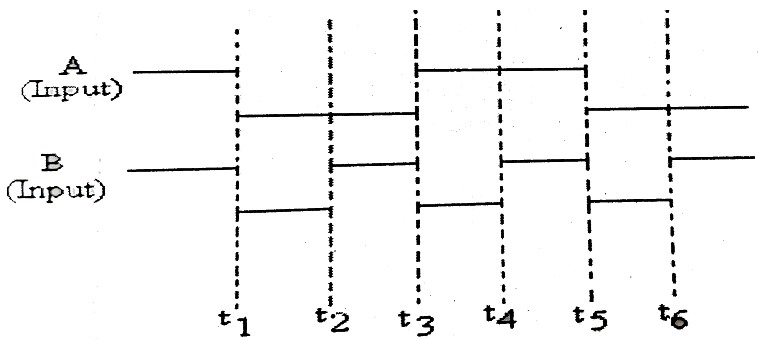
18.



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. 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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30. (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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31. (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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32. (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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33. State two characteristic properties of nuclear forces.

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34. 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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35. The instantaneous current and voltage of an a.c. circuit are given by $i=10 \sin 3000 t$ A and $v=200 \sin 300 t$ V.

What is the power dissipation in the circuit?

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

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

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

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

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40. 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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41. 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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42. Draw a block diagram of a simple amplitude modulation. Explain briefly how amplitude modulation is achieved.

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43. Calculate the energy released in MeV in the following nuclear reaction :

$._{92}^{238}U \rightarrow ._{90}^{234}Th + ._{2}^{4}He + Q \Big[\text{Mass of } ._{92}^{238}U = 238.05079u$

Mass of $._{90}^{238}Th = 234.043630u$

Massof $._{2}^{4}He = 4.002600u$

$1u = 931.5 MeV / c^{2}\Big]$

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

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46. 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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47. 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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48. 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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49. What does the term LOS communication mean? Name the types of waves that are used for this communication. Which of the two height of transmitting antenna and height of receiving antenna can effect the range over which this mode of communication remains effective?

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50. 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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51. 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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52. Draw the labelled circuit diagram of a common-emitter transistor amplifier : Explain clearly how the input and output signals are in opposite phase.

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53. 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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54. 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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55. For what kinetic energy of a proton, will the associated de-Broglie wavelength be 16.5 nm?

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56. 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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57. 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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58. 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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59. Derive the lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ 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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60. Answer the following:

(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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61. An a.c. source generating a voltage $v = v + (m)\sin \omega tisco \cap ected \rightarrow a \cap aci \rightarrow rof \cap aci \tan ceC. F \in dthe$

v and $Iversus$omegat $\rightarrow show\hat{tt}hecurrentis$pi//2

$aheadofthevo < a \geq . Aresis \rightarrow rof$200 Omega and $a \cap aci \rightarrow rof$

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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62. 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 rotating with a constant angular speed ω in a uniform magnetic field B. Write the expression for the emf produced.

A 100-turn coil of area $0.1m^2$ 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. 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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5. what type of wavefront will emerge from (i) a point source and (ii) distant light source ?

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

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7. (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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8. 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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9. 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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10. 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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11. 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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12. 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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13. Why are high frequency carrier waves used for transmission ?

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

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15. 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 72 respectively, what are these numbers for A_4.

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16. 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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17. 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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18. 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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19. (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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20. Derive the expression for force per unit length between two long straight parallel current carrying conductors. Hence define one ampere.

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21. (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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22. (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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23. (i) Draw a circuit diagram to study the input and output characteristics of an n-p-n 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-n transistor as a common emitter amplifier.

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24. Trace the rays 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 $n_1 \text{ and } n_2$. 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 lens maker's formula

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25. 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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26. 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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27. 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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28. Show on a graph, the variation of resistivity with temperature for a typical semiconductor.

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

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

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31. 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 ?

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32. State de-Broglie hypothesis.

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33. 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 ?

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34. Distinguish between 'Analog and Digital signals'.

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

(i) Transducer

(ii) Repeater

(iii) Transmitter

(iv) Bandpass Filter

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36. 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.

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

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38. 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 ?

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39. 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.

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40. 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 $= 3cm$.

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41. 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?

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42. 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.

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43. (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 ?

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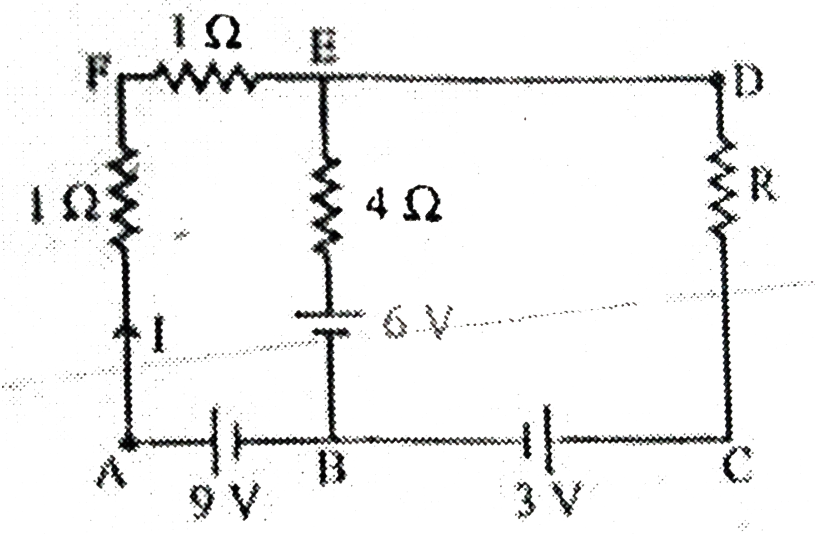
44. Using Kirchoff's rules determine the value of unknown resistance R in the circuit so that no current flows through 4Ω resistance. Also find the potential difference between A and D.



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45. (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.

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46. Write any two factors which justify the need for modulating a signal.

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47. Write Einstein's photoelectric equation.

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

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48. (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 $\lambda/3$.

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49. 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 ?

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50. 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.

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51. (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 ?

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52. 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 km away, find the height of the final image when it is formed 25 cm away from the eye piece.

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53. 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.

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54. 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 ?

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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 ?

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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.

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

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

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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. 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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8. 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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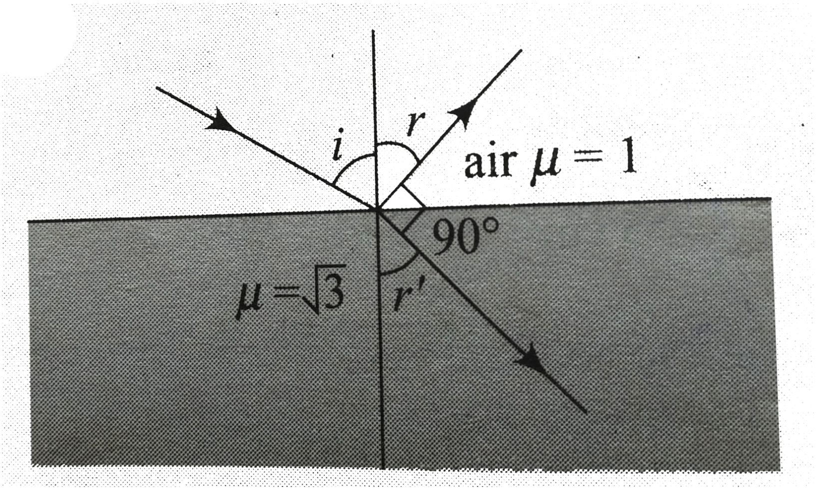
Set Iii

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.

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

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5. Differential between a ray and a wavefront.

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6. (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 $(-5, 0, 0)$?

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7. 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}

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Set I

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

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

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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 ?

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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 ?

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

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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?

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

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8. Give the logic symbol of NOR gate.

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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 ?

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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 ?

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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.

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12. 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 ?

Watch Video Solution

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

Watch Video Solution

14. 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 ?

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15. 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 .

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16. (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.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

19. 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.

Watch Video Solution

20. 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

21. (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.

Watch Video Solution

22. (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° ?

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23. 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 $7.2 mm$. Calculate the wavelength of second light.

Watch Video Solution

24. 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.

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

waves are propagated.

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26. The ratio of root mean square speed ,average speed and most probable speed for gas ?

Watch Video Solution

27. (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.

Watch Video Solution

28. (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

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

Watch Video Solution

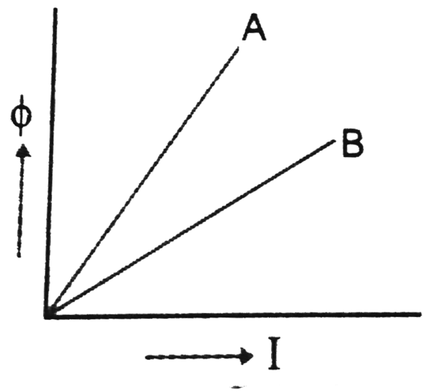
30. In which orientation,a diole placed, in a uniform field is in (i) stable (ii) unstable equilibrioum?

Watch Video Solution

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

Watch Video Solution

32. 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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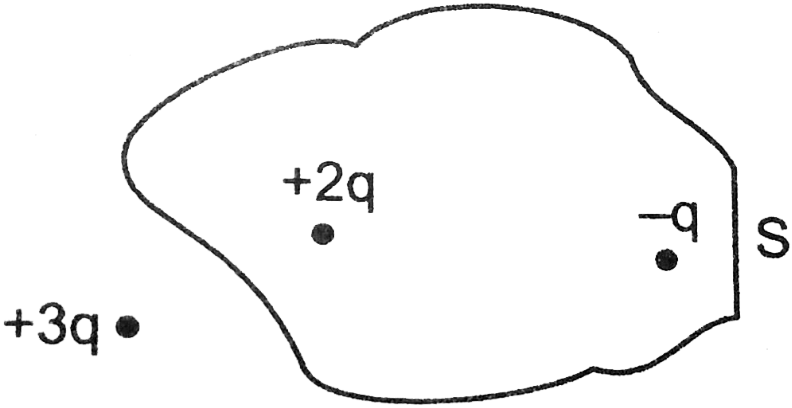
33. Fig shows three point charges $+2q$, $-q$ and $+3q$, What is the electric flux due to this configuration through the surface S ?



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34. 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

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

Watch Video Solution

36. 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

37. Conditions Of Total Internal Reflection

Watch Video Solution

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

Watch Video Solution

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

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

Watch Video Solution

40. 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 ?

Watch Video Solution

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

Watch Video Solution

42. 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

43. 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

44. 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

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

Watch Video Solution

46. (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.

Watch Video Solution

47. 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 $W_2(W_1 > W_2)$. On what factors does the (i) slope and (ii) intercept of the lines depend ?

Watch Video Solution

48. 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.

Watch Video Solution

49. (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 $\vec{E}$.

Watch Video Solution

50. Define first order phase transition?

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51. 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) $r > a$.

Watch Video Solution

52. 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.

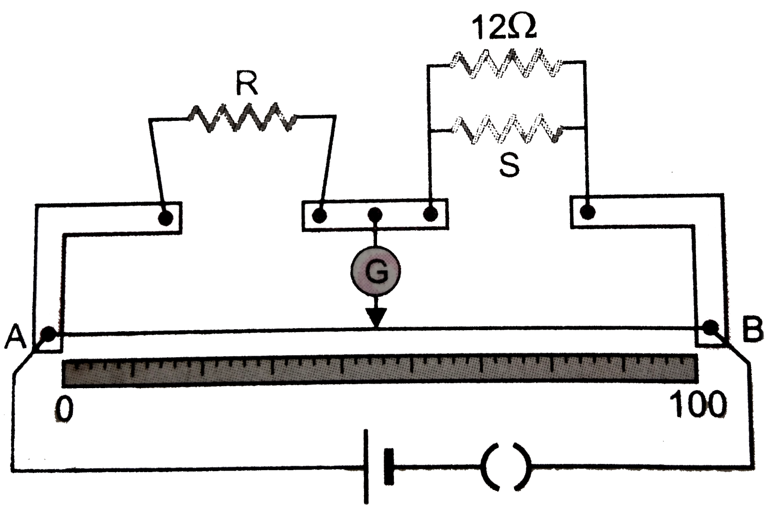
Watch Video Solution

53. 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.

Watch Video Solution

54. 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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55. Heat is flowing through two cylindrical rods of the same material . The diameters of the rods are in the ratio 1:2 and the lengths in the ratio 2:1.If the temperature difference between the ends be the same ,then the ratio of the rate of flow if heat through them will be ?

Watch Video Solution

56. 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.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

60. 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

61. How are radio waves produced?

Watch Video Solution

62. State two characteristic properties of nuclear forces.

Watch Video Solution

63. 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

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

Watch Video Solution

65. A thin straight infinitely long conducting wire having charge density λ enclosed bya cylindrical surface of radius rand 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

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

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68. If χ stands for the magnetic susceptibility of a given material, identify the class of material for which (i)$-1 \geq \chi < 0$

(ii) $0\chi < \in$ ($\in$ stands for a small positive number)

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

71. 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?

Watch Video Solution

72. 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

73. 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 ?

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74. 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.

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75. 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?

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76. 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 convex 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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77. (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?

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78. 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.

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79. 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 ?

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80. 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

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

Watch Video Solution

82. (a)Using Ampere's circuital law, obtain the expression for the magnetic field due to a long solenoid at a point inside the solenoid on its axis.

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

Watch Video Solution

83. 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?

Watch Video Solution

84. (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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85. 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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86. 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.

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87. 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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88. 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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89. Define the activity of a radionuclide. Write its SI unit. Give a plot of the activity of a radioactive species versus time.

Watch Video Solution

90. 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.

Watch Video Solution

91. 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.

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

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93. 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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94. 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

95. 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.

Watch Video Solution

96. 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'.

Watch Video Solution

97. 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

98. 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.

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99. 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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100. 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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101. 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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102. 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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103. 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.

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

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105. 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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106. (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?

Watch Video Solution

107. 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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108. (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.

Watch Video Solution

109. (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 ?

Watch Video Solution

110. (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.

Watch Video Solution

111. 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)

Watch Video Solution

112. 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.

Watch Video Solution

113. (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?

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

120. 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.

Watch Video Solution

121. 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?

Watch Video Solution

122. 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.

Watch Video Solution

123. 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.

Watch Video Solution

124. 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.

Watch Video Solution

125. 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 $9 \times 10^{28} m^{-3}$.

Watch Video Solution

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

Watch Video Solution

127. 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

128. (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

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

Watch Video Solution

130. 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?

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131. 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

132. 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

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

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134. 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?

Watch Video Solution

135. 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.

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136. 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

137. 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.

Watch Video Solution

138. Deduce the expression for the torque acting on a dipole of dipole moment $\overrightarrow{P}$ in the presence of uniform electric field $\overrightarrow{E}$.

Watch Video Solution

139. 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

140. 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

141. (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.

Watch Video Solution

142. (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 ?

Watch Video Solution

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 ?

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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.

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

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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.

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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.

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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 sunlight by ozone layer?

Watch Video Solution

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

Watch Video Solution

14. 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

15. (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 ?

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16. (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 ?

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17. 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

18. How are X-rays produced?

Watch Video Solution

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

Watch Video Solution

20. 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.

Watch Video Solution

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

Watch Video Solution

22. 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

Then Will it behave as converging or diverging lens in the two cases ?

Watch Video Solution

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

Watch Video Solution

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

View Text Solution

25. 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.

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26. A wire 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

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

Watch Video Solution

28. 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

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

Watch Video Solution

30. 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

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

(i). Receiver

(ii). Demodulator

Watch Video Solution

32. 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.

Watch Video Solution

33. 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.

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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 ?

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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 $20 cm$ 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. 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

15. 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

16. 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

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

Watch Video Solution

18. To which part of the electromagnetic spectrum does a wave of frequency 5×10^{11}Hz belong ?

Watch Video Solution

19. 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

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

(i). Receiver

(ii). Demodulator

Watch Video Solution

21. 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

22. (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.

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Set Iii Delhi Board

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

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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. 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

6. 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

7. 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

8. 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 .

Watch Video Solution

9. What is line of sight communication? 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

10. A proton and an α-particle are accelerated through the same potential difference. The ratio of Broglie wavelength λ_p to that of λ_α is

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

Watch Video Solution

3. 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

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

Watch Video Solution

5. 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

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

Watch Video Solution

7. 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

8. 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

9. 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 (with no charge) zero, even if the shell is not spherical, but has any irregular shape ? Explain.

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10. 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

11. 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

12. 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

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

Watch Video Solution

Watch Video Solution

14. 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

15. 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

16. 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

17. Draw a plot of the binding energy per nucleon as a function of mass number for a large number of nuclei , $2 \le A \le 240$. 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 ?

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18. 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

19. (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

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

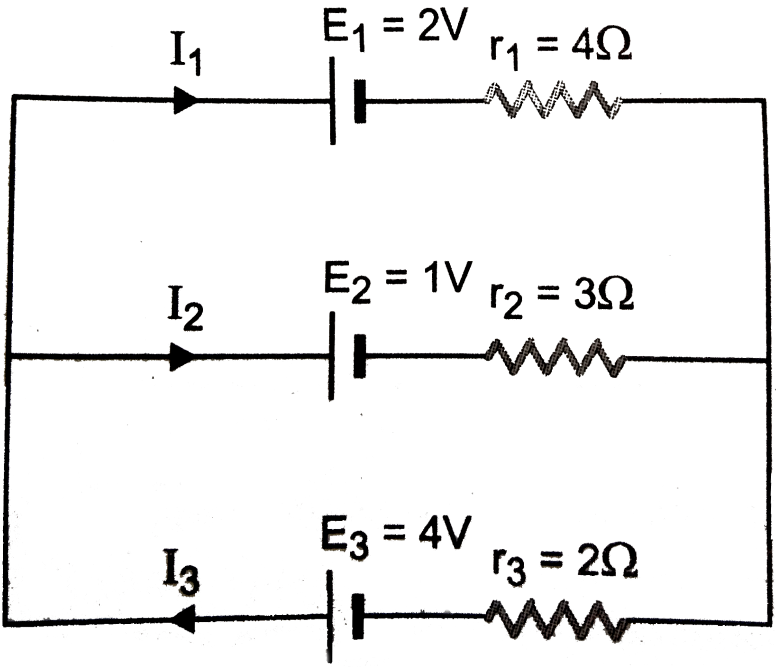
(ii) Why must both the objective and the eye-piece of a compound microscope have short focal lengths ?

Watch Video Solution

21. 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

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



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23. (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

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

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 ?

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25. 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

26. Answer the following:

(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

27. (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 ?

Watch Video Solution

28. 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 ?

Watch Video Solution

29. (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 .

Watch Video 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?

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3. Which of the following has the shortest wavelength ? A) Cosmic rays B) γ rays C) Microwave rays

Watch Video 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 .

Watch Video Solution

5. A network of four capacitors each of $15\mu F$ 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 ?

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8. State Kirchhoff's rules.

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. 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

4. 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

1. 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

2. 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

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

Watch Video Solution

4. 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

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

Watch Video Solution

6. Define the term 'wattles current'.

Watch Video Solution

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

Watch Video Solution

8. In the youngs double slit experiment ,the slit sepration is 1mm ,the distance between source and screen is 1m ,wavelength of light used is 6500 angstrom.Find the distance between fifth maxima and third minima in (mm)?

Watch Video Solution

9. 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

10. 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.

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11. 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

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

Watch Video Solution

13. 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

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

Watch Video Solution

15. 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

16. 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

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

(i) their momentum,

(ii) the energy of the photon and

(iii) the kinetic energy of electron.

Watch Video Solution

18. 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

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

Watch Video Solution

20. (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?

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21. 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

22. 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?

Watch Video Solution

23. (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

24. (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.

Watch Video Solution

25. (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.

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

Watch Video Solution

4. 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. 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?

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2. 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.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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.

Watch Video Solution

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

Watch Video Solution

3. 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

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. 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

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

Watch Video Solution

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

Watch Video Solution

7. 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

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°.

Watch Video Solution

9. 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.

Watch Video Solution

Watch Video Solution

10. Explain the scattering of light with an example.

Watch Video Solution

11. 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 biased and base-collector junction reverse biased.

Watch Video Solution

12. 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

13. 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

14. 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

15. 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

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

Watch Video Solution

17. 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

18. 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

19. 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.

Watch Video Solution

20. 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

21. 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

22. 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.

Watch Video Solution

23. Answer the following:

(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 fringes 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

24. (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

25. (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 $\vec{E}$ and magnetic field $\vec{B}$. 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 $\vec{B}$. Prove that the torque $\vec{\tau}$ acting on the loop is given by

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

Watch Video Solution

26. (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.

Watch Video Solution

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 ?

Watch Video Solution

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 ?

Watch Video Solution

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.

Watch Video Solution

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.

Watch Video Solution

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 ?

Watch Video Solution

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?

Watch Video Solution

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 ?

Watch Video Solution

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 ?

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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.

Watch Video Solution

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.

Watch Video Solution

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°.

Watch Video Solution

Watch Video Solution

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

(i) Transducer

(ii) Repeater

Watch Video Solution

Set I

1. What are permanent magnets? Give one example.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

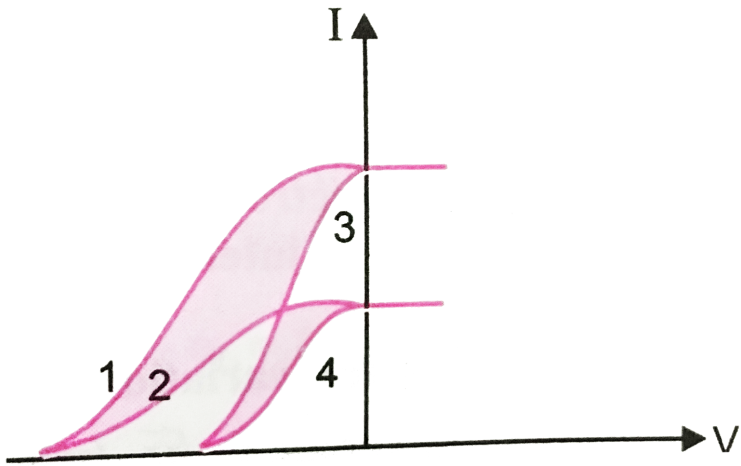
4. A capacitor has been charged by ad.c. source. What are the magnitudes of conduction and displacement currents, when it is fully charged?

Watch Video Solution

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

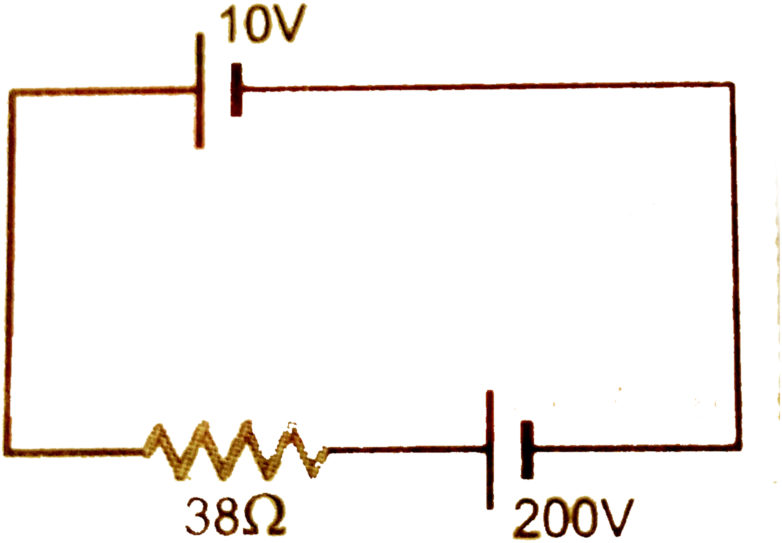
Watch Video Solution

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.



Watch Video Solution

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.

Watch Video Solution

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

Watch Video Solution

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.

Watch Video Solution

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?

Watch Video Solution

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.

Watch Video Solution

14. (a) An EM wave is travelling in a medium with a velocity $\vec{v} = v\hat{i}$.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?

Watch Video Solution

15. 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.

Watch Video Solution

16. 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.

Watch Video Solution

17. 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.

Watch Video Solution

18. 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

Watch Video Solution

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

$${}_1^2H + {}_1^2H \rightarrow {}_2^3He + n + 3.27MeV,$$

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.

Watch Video Solution

20. (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.

Watch Video Solution

21. Using Bohr'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.

Watch Video Solution

22. 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.

Watch Video Solution

23. 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.

Watch Video Solution

24. 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.

Watch Video Solution

25. (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?

Watch Video Solution

26. 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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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.

Watch Video Solution

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 ?

Watch Video Solution

4. An ammeter of resistance 1 Ohm 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?

Watch Video Solution

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 ?

Watch Video Solution

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. 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?

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Set Iii Delhi Board

1. Which of the following substances are para-magnetic?

Bi, Al, Cu, Pb, Ni

Watch Video Solution

2. 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.

Watch Video Solution

3. 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?

Watch Video Solution

4. 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?

Watch Video Solution

5. 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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6. (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.

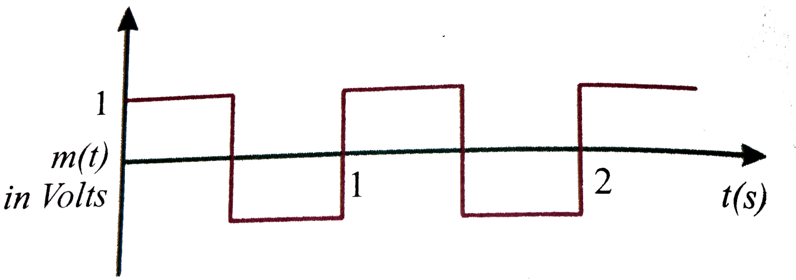
Watch Video Solution

Set I

1. Define the term 'mobility' of charge carriers. Write its S.I. unit.

Watch Video Solution

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

Watch Video Solution

3. For any charge configuration, equipotential surface through a point is normal to the electric field. Justify.

Watch Video Solution

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 ?

Watch Video Solution

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 ?

Watch Video Solution

7. Write an expression in a vector form for the Lorentz magnetic force $\vec{F}$ on a charge Q moving with velocity $\vec{V}$ in a magnetic field $\vec{B}$. What is the direction of the magnetic force?

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8. 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?

Watch Video Solution

9. Given a uniform electric field $\vec{E} = 5 \times 10^3 \hat{i} N / C$, 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?

Watch Video Solution

10. 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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11. Write the truth table for the combination of the getes shown. Name the gates used.

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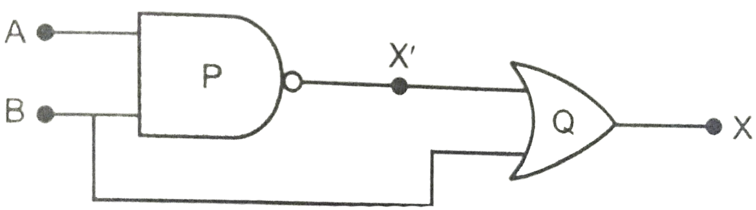
12. Identify the logic gates marked P and Q in the circuit Fig. Write the truth table for this combination.



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13. A proton and deuteron 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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14. (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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15. 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.

Watch Video Solution

16. 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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17. 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.

Watch Video Solution

18. (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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19. (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.

Watch Video Solution

20. Derive an expression for the magnetic moment $\left(\vec{\mu}\right)$ of an electron revolving around the nucleus in termsof its angular momentum $\left(\vec{l}\right)$. What is the direction of the magnetic moment of the electron with respect to its angular momentum?

Watch Video Solution

21. (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.

View Text Solution

22. 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

Watch Video Solution

23. Deduce the expression, $N = N_0^{-\lambda t}$ for the law of radioactive decay.

Watch Video Solution

24. (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.

Watch Video Solution

25. (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.

Watch Video Solution

26. 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?

Watch Video Solution

27. 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?

Watch Video Solution

28. (a) Differentiate between three segments of a transistor on the basis of their size and level of doping.

(b) How is a transistor biased to be in active state?

(c) With the help of a necessary circuit diagram, describe briefly how n-p-n transistor 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.

Watch Video Solution

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.

Watch Video Solution

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?

Watch Video Solution

4. A $12.9 eV$ 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?

Watch Video Solution

Set Iii Delhi Board

1. 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'.

Watch Video Solution

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.

Watch Video Solution

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.

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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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Watch Video Solution

Section A

1. Name the two basic modes of communication. Which one is used for telephonic communication?

Watch Video Solution

2. Why do the electrostatic field lines not form closed loops ?

Watch Video Solution

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.

Watch Video Solution

2. Write two factors which justify the need of modulating a low frequnecy signal into high frequencies before transmission .

Watch Video Solution

3. 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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4. 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. 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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2. A carrier wave of frequency 1.5 MHz and amplitude 50 V is modulated by a sinusoidal wave of frequency 10KHz producing 50% amplitude modulation. Calculate the amplitude of the AM wave and frequencies of the side bands produced.

Watch Video Solution

3. 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.

Watch Video Solution

4. 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.

Watch Video Solution

5. write two characteristic properties of nuclear force.

Watch Video Solution

6. (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 ?

(ii) Can a transformer be used to step up d.c. voltage ?

(iii) 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.

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) Write, using Biot-Savart law, the expression for the magnetic field $\vec{B}$ due to an element $\vec{d} \, l$ carrying current I at a distance $\vec{r}$ 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.

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2. (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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3. 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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4. 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 1100w. 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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5. (i) In Young's double slit experiment the condition for (a) constructive and (b) destructive interference at a point on the screen .

Watch Video Solution

6. Answer the following:

(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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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 power is zero :

(ii) Average power over full cycle of the ac voltage source.

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3. What is the angle of incidence when incident Ray is normal to the interface between the 2 media?

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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. Which basic mode of communication is used for telephonic communication ?

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6. 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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7. Essential elements of a communication system are

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8. 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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9. 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

10. State one factor which determines the intensity of light in the photon picture of light.

Watch Video Solution

11. 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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12. An object is kept in front of a concave lens.What is the nature of the image formed?

Watch Video Solution

13. 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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14. A point charge +Q is placed in the vicinity of a conducting surface. Draw the eletric field lines between the surface and the charge

Watch Video Solution

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

Watch Video Solution

16. 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.

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17. (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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18. 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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Watch Video Solution

19. Do electromagnetic waves carry energy and momentum?

Watch Video Solution

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

Watch Video Solution

21. Name the phenomenon which shows the quantum nature of electromagnetic radiation.

Watch Video Solution

22. Draw the pattern of electric lines, when a point charge - Q is kept near an uncharged coducting plate.

Watch Video Solution

23. 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 ?

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24. Define the term "threshold frequency", in the context of photolelectric emission.

Watch Video Solution

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

Watch Video Solution

26. What is the speed of light in a denser medium of polarising of polarising angle 30°?

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27. Why is the transmission of signals using sky waves restricted to frequencies upto 30 mega hertz?

Watch Video Solution

28. 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?

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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.

Watch Video Solution

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.

Watch Video Solution

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

Watch Video Solution

8. Calculate the de-Brogile wavelength of the elctron orbiting in the $n = 2$ state of hydrogen atom.

Watch Video Solution

9. 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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10. Calculate the shortest wavelength of the spectral emitted in Balmer series.

[Given Rydberg constant, $R = 10^7 m^{-1}$]

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11. 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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12. A charge q of mass m is moving with a velocity of V, at right angles to a uniform magnetic field B. Deduce the expression for the radius of the circular path it describes.

Watch Video Solution

13. 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 = $1.1 \times 10^7 m^{-1}$

Watch Video Solution

14. 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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15. 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.

Watch Video Solution

16. Define refractive index of a medium.

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17. 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

Watch Video Solution

18. Derive Bohr's quantisation condition for angular momentum of orbiting electron in hydrogen atom using De Broglie's hypothesis.

Watch Video Solution

19. Write two characteristic features of nuclear force.

Watch Video Solution

20. Distinguish between Sky wave and Space wave modes of propagation in a communication system.

Watch Video Solution

21. Draw the intensity patten for single slit diffraction and double slit interference. Hence ,

state two differences between interference and diffraction patterns.

Watch Video Solution

22. 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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23. 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.

Watch Video Solution

24. Find the condition under which the charged particles moving with different speeds in the presence of electric and magnetic field vectors can be used to select charged particles of a particular speed.

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25. 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.

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26. Write two properties of a material suitable for making (a) a perment magnet,

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27. 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 ?

Watch Video Solution

28. Using photon picture of light, show how Einstein's photoelectic equation can be established.

Watch Video Solution

29. 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 .

Watch Video Solution

30. Define mutual inductance between a pair of coils. Derive expression for the mutual inductance of two long coaxial solenoids of same length wound one over the other.

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31. Define self-inductance of a coil. Obtain the expression for the energy stored in an inductor L connected across a source of emf.

Watch Video Solution

32. 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

33. Answer the following:

(a) State Biot - Savart's law and express this law in the vector 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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34. 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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35. (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.

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36. (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.

Watch Video Solution

37. (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 $\hat{}(-1)$ 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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38. Answer the following:

(a) Define wavefront. 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 Brewster angle for air-glass interface, when the refractive index of glass is 1.5 .

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39. (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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40. 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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41. 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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42. (a) Why are infrared waves often called heat waves? Explain.

(b) What do you understand by the statement, "Electromagnetic waves transport momentum"?

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43. 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%.

Watch Video Solution

44. Two bulbs are reled (P_1, V) and (P_2, V). If they are connected (i) in 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.

Watch Video Solution

45. 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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46. An equilateral glass prism has a refractive index 1.6 in air. Calculate the angle of minimum deviation of the prism, when kept in a medium of refractive index $4\frac{\sqrt{2}}{5}$.

Watch Video Solution

47. An α $-$ 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.

Watch Video Solution

48. 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

49. Calculate the orbital period of the electron in the first excited state of hydrogen atom.

Watch Video Solution

50. Why a signal transmitted from a TV tower cannot be received beyond a certain distance? Write the expression for the optimum separation between the receiving and the transmitting antenna.

Watch Video Solution

51. Why is wave theory of electromagnetic radiation not able to explain photo electric effect? How does photon picture resolve this problem ?

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52. 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.

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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.

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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?

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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:

$$\cdot_6 C^{11} \rightarrow \cdot_y B^z + x + v$$

$$\cdot_6 C^{12} + \cdot_6 C^{12} \rightarrow \cdot_a Ne^{20} + \cdot_b He^c$$

Find the values of x,y,z and a,b,c.

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6. Answer the following:

(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.

Watch Video Solution

7. 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

8. (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 ?

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9. (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.

Watch Video Solution

10. 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

11. Define the term wave front. State Huygen's principles.

Watch Video Solution

12. 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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13. 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

14. Depict the behaviour of magnetic field lines near(i) diamagnetic and (ii) paramagnetic substances. Justify, giving reasons.

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15. 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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16. For an amplitude modulated wave, the maximum amplitude is 10 V and the minimum amplitude is 2 V. Calculate the modulation index.

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17. 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'.

Watch Video Solution

18. 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.

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19. Explain the two processes involved in the formation of a p-n junction diode. Hence, define the term 'barrier potential'.

Watch Video Solution

20. (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 air. Derive an expression for the potential energy of the system of two charges .

Watch Video Solution

21. Answer the following:

State Gauss' law in electrostatics. Derive an expression for the electric field due to an infinitely long straight uniformly charged wire.

Watch Video Solution

22. State Lenz's law.

Watch Video Solution

23. 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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24. 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.

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25. 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.

Watch Video Solution

26. A parallel plate capacitor of capacitance C is charged to a potential V by a battery. Without disconnecting the battery, distance between the plates of capacitor is tripled 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

27. 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

28. Answer the following:

(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 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.

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29. 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, $R = 1.1 \times 10^{7} m^{1}$

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30. Name the e.m. waves in the wavelength range $10nm \rightarrow 10^{-3}nm$. How are these waves generated ? Write their two uses.

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31. Draw the pattern of magnetic field lines for a circular coil carrying current.

Watch Video Solution

32. 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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33. 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°

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34. 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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35. Briefly explain the three factors which justify the need of modulating low frequency signal into high frequencies.

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36. 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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37. 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.

Watch Video Solution

38. (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

39. Identiy the part of the electromagnatic spectrum used in (i) radar and (ii) eye surgery. Write their frequency range.

Watch Video Solution

40. Define the term wavefront. Using Huygens' wave theory, verify the laws of reflection.

Watch Video Solution

41. Define term, "refreactive index " of a medium.

Watch Video Solution

42. (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.

Watch Video Solution

43. 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 ?

Watch Video Solution

44. (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.

Watch Video Solution

45. Write three points of differences between para, dia-and ferro-mangetic materials, giving one example for each.

Watch Video Solution

46. Define the term 'decay constant' of a radioactive sample. The disintegration of a given radioactive nucleus is 10000 disintegrations/s and $5,000$ disintegration/s after $20hr$ and $30hr$ respectively from start. Calculate the half life and initial number of nuclei at $t = 0$.

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47. Three photo diodes $D_1, D_2, \text{ and } D_3$ are made of semiconductors having band gap of 2.5 eV, 2 eV and 3 eV, respectively. Which one will be able to detect light of wavelength 6000 Å ?

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48. Describe briefly the functions of the three segments of n-p-n transistor.

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49. 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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50. 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 change 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) $r > a$.

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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 $\overrightarrow{m} = \overrightarrow{I} A$.

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5. Define self-inductance of a coil and hence write the definition of 'Henry'.

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6. 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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7. 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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8. 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.

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9. 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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10. A convex lens, of focal length 25 cm, and a concave mirror, of radius of curvature 20 cm. are placed co-axially 40 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.

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11. A 200 mH (pure) inductor, and a $5\mu F$ (pure) capacitor , are connected , one by across a sinusoidal ac voltage source $V = [70.7\sin(1000t)]$

voltage. Obtain the expressions for the current in each case.

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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 and A in vector form.

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

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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 ?

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5. Write the full forms of the terms:

(i) LAN

(ii) WWW.

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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. 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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4. 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) $b \le x < \infty$

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2. 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 term "Wattless current". State under what condition it can be realized in a circuit.

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3. 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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4. 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

5. 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.

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6. 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 $\left(\frac{2}{\pi}\right)A$.

Watch Video Solution

7. The temperature coefficient of resistance for two material A and B are $0.0031^{\circ}C^{-1}$ 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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8. Two Polaroids, P_1 and P_2 are set-up so that their pass-axis are crossed with respect to each other. A third Polaroids, P_3 is now introduced between these two so that its pass-axis makes and angle 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.

$(i)30^\circ$ $(ii)45^\circ$

Watch Video Solution

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?

Watch Video Solution

2. Obtain an expression for the instantaneous value of the induced emf in an ac generator.

Watch Video 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.

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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.

Watch Video 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.

Watch Video Solution

4. (c) Derive the expression for the affective capacitance of a series combination of n capacitors.

Watch Video 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.

Watch Video Solution

2. Answer the following:

With a diagram showing the Young's arrangement for producing 'a sustained interference pattern, obtain the expression for the width of the interference fringes obtained in this pattern.

Watch Video Solution

3. 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.

Watch Video Solution

Section A

1. 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

2. Write the underlying principle of a moving coil galvanometer.

Watch Video Solution

3. Why are microwaves considered suitable for radar system used in aircraft navigation?

Watch Video Solution

4. Define quality factor of resonance in series LCR circuit.What is its SI unit ?

Watch Video Solution

5. Draw a labelled graph to show variation in intensity of diffracted light with angular position, in a single slit diffraction experiment.

Watch Video Solution

6. 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.

Watch Video Solution

7. Define power of a lens and write its unit

Watch Video Solution

8. Write the range of frequencies of electromagnetic waves which propagate through sky wave mode.

Watch Video Solution

9. 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

10. 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

11. Name the electromagentic readiations used for (a) water puification, and (b) eye surgery.

Watch Video Solution

12. 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

13. 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

14. Which mode of propagation is used by short wave broadcast services ?.

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Section B

1. Explain the terms (i) Attenuation and (ii) Demodulation used in Communication System.

Watch Video 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 .

$\overset{2}{\underset{1}{.}}H + \overset{2}{\underset{1}{.}}H \rightarrow \overset{4}{\underset{2}{.}}He + n$ " where BE of " $\overset{2}{\underset{1}{.}}H = 2.23MeV$" and of " $\overset{4}{\underset{2}{.}}He = 7.73MeV$

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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.

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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 .

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8. Two magnetic materials A and B have relative magnetic permeabilities of 0.96 and 500 . Identify the magnetic materials A and B .

Watch Video Solution

9. 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

10. 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 $h = 6.63 \times 10^{-34} Js$

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11. Give one use of electromagnetic radiations obtained in nuclear disintegrations.

Watch Video 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 points at large distances from the ring it behaves like a point charge .

Watch Video 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. (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 ?

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4. 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

5. Write two advantages of frequency modulation over amplitude modulation.

Watch Video Solution

6. (i) Calculate the distance of an object 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

7. 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.

Watch Video Solution

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 of working of dynamo.

(ii) Write two values each displayed by Ram and his school teacher.

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2. 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.

Watch Video Solution

3. 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) How is mean life of a radioactive element related to its half life?

(2) 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

4. Prove that the current flowing through an ideal inductor connected across a.c. source, lags the voltage in phase by $\frac{\pi}{2}$.

Watch Video Solution

5. 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.

Watch Video Solution

6. 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. Find the distance of the third bright fringe on the screen from the central maximum for wavelengths 650 nm.

Watch Video Solution

7. (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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8. (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

View Text Solution

9. 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.

Watch Video Solution

10. 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.

Watch Video Solution

11. (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.

Watch Video Solution

12. (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

13. 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

14. Answer the following:

(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 connected to a battery of potential difference V. It is disconnected from battery and then connected to another uncharged capacitor of the same capacitance. Calculate the ratio of the energy stored in the combination to the initial energy on the single capacitor.

Watch Video Solution

15. Answer the following:

(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.

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Section E

1. How much current is drawn by the primary of a transformer connected to $220V$ supply when it delivers power to a $110V - 550W$ refrigerator ?

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2. 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 $2\pi fNBA$.

Watch Video Solution

3. 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. 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 ?

Watch Video Solution

5. Answer the following:

(i) Use Gauss' 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 series combination of two capacitors C_1 and C_2 with their capacitance in the ratio $1:2$ so that the energy stored in the two cases becomes the same.

Watch Video Solution

6. Answer the following:

(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. Answer the following:

(a) State Gauss' law. Using this law, obtain the expression for the electric field due to an infinitely long straight conductor of linear charge density 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. Answer the following:

(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. Prove that an ideal capacitor in ac circuit does not dissipate power.

Watch Video Solution

10. 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.

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 $\sqrt{2}$

Watch Video Solution

13. (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 $r_2(r_2 > r_1)$.

Watch Video Solution

14. 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°.

15. 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.

16. (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.

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17. (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.

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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.

Watch Video Solution

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 ?

Watch Video Solution

4. How is the speed of EM waves in vacuum determined by the electric and magnetic fields ?

Watch Video Solution

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 ?

Watch Video Solution

3. Write two important limitations of Rutherford nuclear model of the atom.

Watch Video Solution

4. Find out the wavelength of the electron orbiting in the ground state of hydrogen atoms.

Watch Video Solution

5. Which basic mode of communcation 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.

Watch Video Solution

Set I Section C

1. 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.

Watch Video Solution

2. Answer the following:

(i) Obtain the expression for the cyclotron frequency.

(ii) A deuteron and a proton are accelerated by the cyclotron. Can both be accelerated with the same oscillator frequency ? Give reason to justify your answer.

Watch Video Solution

3. How does one explain the emission of electron from a photosensitive surface with te help of Einstein's photoelectric equation ?

Watch Video Solution

4. Define the term 'amplitude modulation'. Explain any two factors which justify the need for modulating a low frequency base-band signal.

Watch Video Solution

5. (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.

Watch Video Solution

6. (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 71 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

7. 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:

Watch Video Solution

8. Describe the working principle of a moving coil galvanometer. Why is necessary to use

(i) a radial magnetic field and

(ii) a cylindrical 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.

Watch Video Solution

9. Define the term 'self-inductance' and write the S.I. unit.

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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 ?

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Set I Section E

1. Derive the expression for the instantaneous value of the emf induced in the coil.

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2. 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 $220V$.

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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.

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4. A monochromatic light of wavelength $500 nm$ 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 $0.5 mm$, which can be accommodated within the region of total angular spread of the central maximum due to single slit.

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5. A wire whose cross-sectional area is increasing linearly from its one end to the other, is connected across a battery of 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.

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Set Ii Delhi Board Sec B

1. Distinguish between a transducer and a repeater.

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2. Why should the objective of a telescope have focal length and large apearture ? Justify your answer .

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Set Ii Delhi Board Sec C

1. 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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2. 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 dc voltage regulator with the help of a circuit diagram.

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3. 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 $\vec{\mu} = -\frac{e}{2m_e}\vec{L}$, where $\vec{L}$ is the orbital angular momentum of the electron. Give the signification of negative sign.

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4. (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.

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Set Iii Delhi Board Sec C

1. 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.

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2. Obtain the expression for the torque $\overrightarrow{\tau}$ experienced by an electric dipole of dipole moment $\overrightarrow{p}$ in a uniform electric field , $\overrightarrow{E}$

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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. Answer the following:

(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.

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Set Ii Outside Delhi

1. Write the relation for the speed of electromagnetic wave in terms of the amplitudes of electric and magnetic fields.

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2. 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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3. 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.

Watch Video Solution

4. Write two advantages of a reflecting telescope over a refracting telescope.

Watch Video Solution

5. Explain giving reasons for the following :

(a) Photoelectric current in a photocell increases with the increase 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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6. (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.

View Text Solution

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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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

$n + 235_{\underset{92}{U} \rightarrow} a_{\underset{54}{Xe} +} 94_{\underset{b}{Sr} + 2n}$ 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 briefly, 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.

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4. Answer the following:

(a)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.

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5. (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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6. 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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7. (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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8. (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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9. 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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10. A proton, a deuteron and an alpha particle, are accelerated through the same potential difference and then subjected to a unifrom magnetic field $\overrightarrow{B}$, 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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11. (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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12. (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 980Ω 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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13. 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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14. (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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15. (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. Answer the following:

(a) Derive an expression for the potential energy of an electric dipole in a uniform electric field. Explain conditions for stable 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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3. (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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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 $\overrightarrow{E}$, 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. 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. (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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2. 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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3. 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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4. (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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5. Answer the following:

(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 maximum 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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6. 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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7. (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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8. Give the truth table and circuit symbol for NAND gate.

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9. 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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10. (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. Do electromagnetic waves carry energy and momentum?

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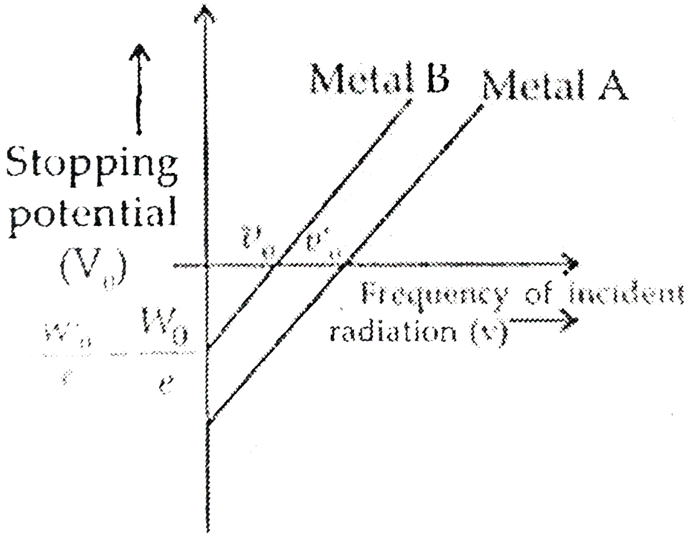
6. The graph shows variation of stopping potential V_0 versus frequency of incident radiation v for two photosensitive metals A and B. Which of the

two metals has higher threshold frequency and why?



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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 thin infinite parallel sheets have uniform surface charge densities of $+\sigma$ and $-\sigma$. Electric field is the space between the two sheets is :

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3. 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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4. 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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5. 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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6. 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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7. 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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