PHYSICS

BOOKS - CBSE MODEL PAPER

SAMPLE PAPER 2022

Section A

1. Which of the following is NOT the property of equipotential surface?

A. They do not cross each other.

B. The rate of change of potential with distance on them is zero.

C. For a uniform electric field they are concentric spheres.

D. They can be imaginary spheres.

Answer: C

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2. Two point charges $+8q$ and $-2q$ are located at $x = 0$ and $x = L$ respectively. The location of a point on the x axis at which the net electric field due to these two point charges is zero is

A. 8L

B. 4L

C. 2L

D. L

Answer: C

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3. An electric dipole of moment $\vec{P}$ is lying along a uniform electric field $\vec{E}$. The work done in rotating the dipole by 90° is:

A. 2pE

B. $\sqrt{2}$pE

C. pE/2

D. pE

Answer: D

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4. Three capacitors $2\mu F, 2\mu F$ and $6\mu F$ are joined in series with each other.

The equivalent capacitance is-

A. $\frac{1}{2}\mu F$

B. $1\mu F$

C. $2\mu F$

D. $11\mu F$

Answer:

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5. Two point charges placed in a medium of dielectric constant 5 are at a distance r between them, experience an electrostatic force 'F'. The electrostatic force between them in vacuum at the same distance r will be-

A. 5F

B. F

C. F/2

D. F/5

Answer: A

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6. Which statement is true for Gauss law-

A. All the charges whether inside or outside the gaussian surface contribute to the electric flux.

B. Electric flux depends upon the geometry of the gaussian surface.

C. Gauss theorem can be applied to non-uniform electric field

D. The electric field over the gaussian surface remains continuous and uniform at every point

Answer: D

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7. A capacitor plates are charged by a battery with 'V' volts. After charging battery is disconnected and a dielectric slab with dielectric constant 'K' is inserted between its plates, the potential across the plates of a capacitor will become

A. Zero

B. V/2

C. V/K

D. KV

Answer: C

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8. The best instrument for the accurate measurement of the e.m.f. of a cell is

A. Potentiometer

B. metre bridge

C. Voltmeter

D. ammeter and voltmeter

Answer: A

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9. An electric current is passed through a circuit containing two wires of same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 3:2 and 2:3, then the ratio of the current passing through the wire will be

A. $2:3$

B. $3:2$

C. $8:27$

D. $27:8$

Answer:

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10. By increasing the temperature, the specific resistance of a conductor and a semiconductor

A. increases for both

B. decreases for both.

C. increases for a conductor and decreases for a semiconductor.

D. decreases for a conductor and increases for a semiconductor

Answer:

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11. We use alloys for making standard resistors because they have

A. low temperature coefficient of resistivity and high specific resistance

B. high temperature coefficient of resistivity and low specific resistance

C. low temperature coefficient of resistivity and low specific resistance

D. high temperature coefficient of resistivity and high specific resistance

Answer:

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12. A constant voltage is applied between the two ends of a uniform metallic wire, heat 'H' is developed in it. If another wire of the same material, double the radius and twice the

length as compared to original wire is used then the heat developed in it will be-

A. H/2

B. H

C. 2H

D. 4H

Answer:

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13. If the potential difference V applied across a conductor is increased to 2V with its temperature kept constant, the drift velocity of the free electrons in a conductor will-

A. remain the same

B. become half of its previous value

C. be double of its initial value

D. become zero.

Answer: C

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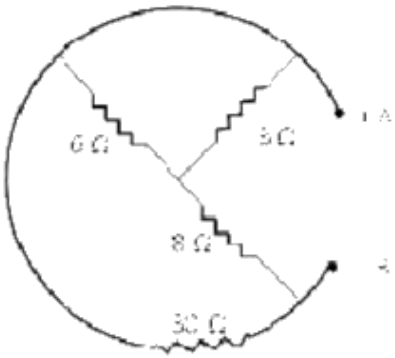
14. The equivalent resistance between A and B is :



A. 3 ohms

B. 5.5 ohms

C. 7.5 ohms

D. 9.5 ohms

Answer: C

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15. The SI unit of magnetic field intensity is

A. AmN^{-1}

B. $NA^{-1}m^{-1}$

C. $NA^{-2}m^{-2}$

D. $NA^{-1}m^{-2}$

Answer:

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16. The coil of a moving coil galvanometer is wound over a metal frame in order to

A. reduce hysteresis

B. increase sensitivity

C. increase moment of inertia

D. provide electromagnetic damping

Answer:

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17. Two wires of the same length are shaped into a square of side 'a' and a circle with radius 'r'. If they carry same current, the ratio of their magnetic moment is

A. $2:\pi$

B. $\pi:2$

C. $\pi:4$

D. $4 : \pi$

Answer:

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18. The horizontal component of earth's magnetic field at a place is $\sqrt{3}$ times the vertical component. The angle of dip at that place is

A. $\pi / 6$

B. $\pi / 3$

C. $\pi / 4$

D. 0

Answer:

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19. The small angle between magnetic axis and geographical axis at a place is called

A. Magnetic meridian

B. Geographic meridian

C. Magnetic inclination

D. Magnetic Declination

Answer:

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20. Two coil are placed close to each other. The mutual inductance of the pair of coils depends upon.

A. rate at which current change in the two coils

B. relative position and orientation of the coils

C. rate at which voltage induced across two coils

D. currents in the two coils

Answer:

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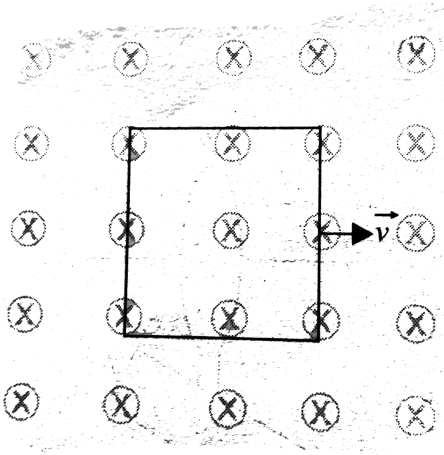
21. Conducting square loop of side L and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B, constant in time and space, pointing perpendicular and into the plane of the loop exists everywhere.

The current induced in the loop is



A. BLv/R Clockwise

B. BLv/R Anticlockwise

C. 2BLv/R Anticlockwise

D. Zero

Answer:

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22. The magnetic flux linked with the coil (in Weber) is given by the equation

$\phi = 5t^2 + 3t + 16$

The induced EMF in the coil at time, t=4 will be-

A. $-27V$

B. $-43V$

C. $-108V$

D. $210V$

Answer:

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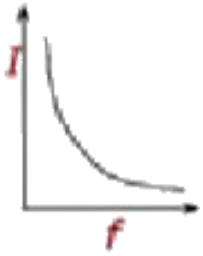
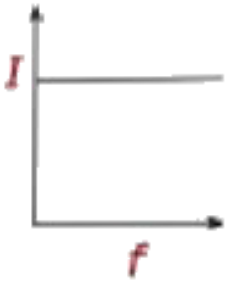
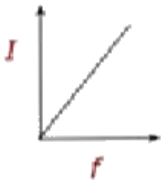
23. Which of the following graphs represent the variation of current(I) with frequency (f) in an AC circuit containing a pure capacitor?

A.



B.





(iii)

C.

D.

Answer:

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24. A 20volts AC is applied to a circuit consisting of a resistance and a coil with negligible resistance. If the voltage across the resistance is $12V$, the voltage across the coil is

A. 16V

B. 10V

C. 8V

D. 6V

Answer: A

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25. The instantaneous values of emf and the current in a series ac circuit are -

E = Eo Sin ω t and I = Io sin $(\omega t + \pi/3)$ respectively, then it is

A. Necessarily a RL circuit

B. Necessarily a RC circuit

C. Necessarily a LCR circuit

D. Can be RC or LCR circuit

Answer:

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26. In a pure semiconductor crystal of Si, if antimony is added then what type of extrinsic semiconductor is obtained. Draw the energy band diagram of this extrinsic semiconductor so formed.

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27. Consider two different hydrogen atoms. The electron in each atom is in an excited state. Is it possible for the electrons to have different energies but the same orbital angular momentum according to the Bohr model ?

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28. Explain how does (i) photoelectric current and (ii) kinetic energy of the photoelectrons

emitted in a photocell vary if the frequency of incident radiation is doubled, but keeping the intensity same? Show the graphical variation in the above two cases.

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29. Name the device which converts the change in intensity of illumination to change in electric current flowing through it. Plot I-V characteristics of this device for different

intensities. State any two applications of this device.

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Section B

1. A cylinder of radius r and length l is placed in an uniform electric field parallel to the axis of the cylinder. The total flux for the surface of the cylinder is given by-

A. zero

B. πr^2

C. $E\pi r^2$

D. $2E\pi r^2$

Answer: A

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2. Two parallel large thin metal sheets have equal surface densities $26 \times 10^{-12} C/m^2$ of

opposite signs. The electric field between these sheets is -

A. 1.5N/C

B. $1.5 \times 10^{-16} N/C$

C. $3 \times 10^{-10} N/C$

D. $3N/C$

Answer:

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3. Conisder a neutral conducting sphere. A poistive point charge is placed outisde the sphere. The net charge on the sphere is then

A. negative and uniformly distributed over the surface of sphere

B. positive and uniformly distributed over the surface of sphere

C. negative and appears at a point the surface of sphere closest to point charge

D. Zero

Answer: D

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4. Three Charges 2q, -q and -q lie at vertices of a triangle. The value of E and V at centroid of triangle will be-

A. $E\#0$ and $V\#0$

B. $E = 0$ and $V = 0$

C. $E\#0$ and $V = 0$

D. $E = 0$ and $V\#0$

Answer:

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5. Two parallel plate capacitors X and Y, have the same area of plates and same separation between plates. X has air and Y with dielectric of constant 2 , between its plates. They are connected in series to a battery of 12 V. The ratio of electrostatic energy stored in X and Y is-

A. $4:1$

B. $1:4$

C. $2:1$

D. $1:2$

Answer:

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6. Which among the following, is not a cause for power loss in a transformer-

A. Eddy currents are produced in the soft iron core of a transformer.

B. Electric Flux sharing is not properly done in primary and secondary coils

C. Humming sound produed in the tranformers due to magnetostriction.

D. Primary coil is made up of a very thick copper wire.

Answer:

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7. An AC voltage source of variable angular frequency ω and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance R (inductance Zero). When ω is increase.

A. The bulb glows dimmer.

B. The bulb glows brighter.

C. Net impedance of the circuit remains unchanged.

D. Total impedance of the circuit increases.

Answer:

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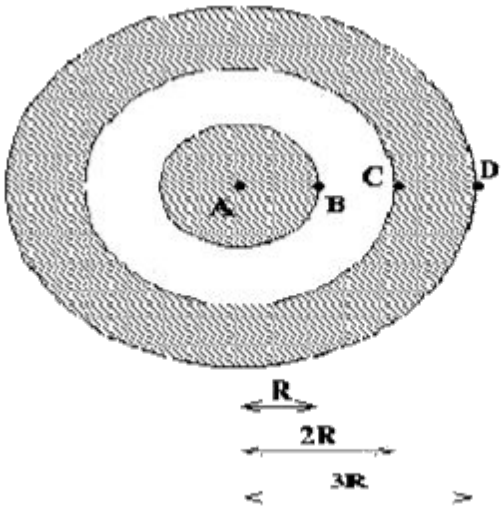
8. A solid spherical conductor has charge +Q and radius R. It is surrounded by a solid spherical shell with charge -Q, innerradius 2R, and outer radius 3R. Which of the following

statements is true?



A. The electric potential has a maximum magnitude at C and the electric field has a maximum magnitude at A

B. The electric potential has a maximum magnitude at D and the electric field has a maximum magnitude at B.

C. The electric potential at A is zero and the electric field has a maximum magnitude at D.

D. Both the electric potential and electric field achieve a maximum magnitude at B.

Answer: D

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9. A Steady current flows in a metalic conductor of non uniform cross section. The quantity/quantities which remain constant along the length of the conductor is/are

A. electric field only

B. drift speed and electric field

C. electric field and current

D. current only

Answer:

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10. Three resistors having values R_1, R_2 and R_3 are connected in series to a battery.Suppose R_1 carries a current of 2.0 A, R_2 has resistance of 3.0 ohms, and R_3 dissipates. 6.0 watts of power. Then the voltage across R_3 is

A. 1V

B. 2V

C. 3V

D. 4V

Answer:

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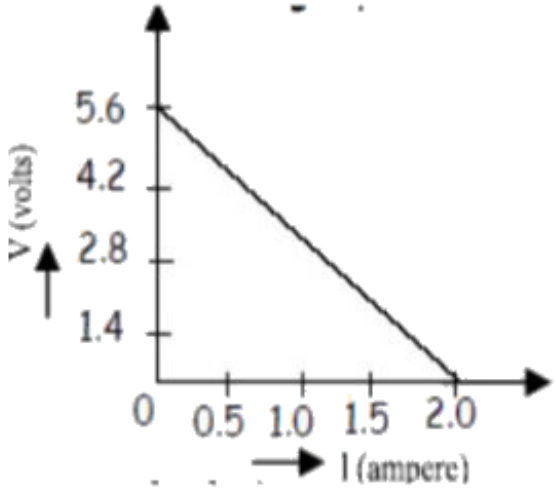
11. A straight line plot showing the terminal potential difference (V) of a cell as a function of current (I) drawn from it, is shown in the figure. The nternal resistance of the cell would

be then-



A. 2.8 ohms

B. 1.4 ohms

C. 1.2 ohms

D. zero

Answer:

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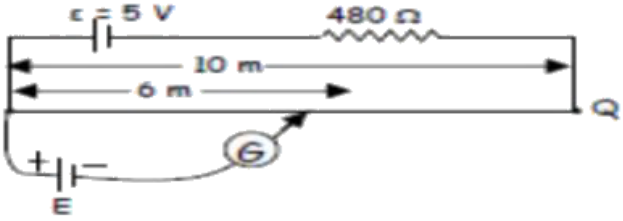
12. A 10 m long wire of uniform cross section and 20 Ω resistance is used in a potentiometer. The wire is connected in series with a battery of 5 V along with an external resistance of 480 Ω. If and unknown emf E is balanced at 6.0 m length of the wire,then the

value of unknown emf is



A. 1.2V

B. 1.02V

C. 0.2V

D. 0.12V

Answer: D

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13. The current sensitivity of a galvanometer increases by 20%. If its resistance also increases by 25%, the voltage sensitivity will

A. decrease by 1%

B. increased by 5%

C. increased by 10%

D. decrease by 4%

Answer:

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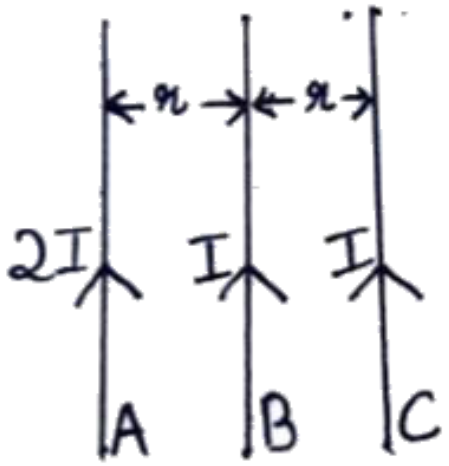
14. Three infinitely long parallel straight current carrying wires A, B and C are kept at equal distance from each other as shown in the figure . The wire C experiences net force F .The net force on wire C, when the current in

wire A is reversed will be



A. Zero

B. $F/2$

C. F

D. $2F$

Answer:

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15. In a hydrogen atom the electron moves in an orbit of radius 0.5 Ao making 10 revolutions per second, the magnetic moment associated with the orbital motion of the electron will be

A. $2.512 \times 10^{-38} Am^2$

B. $1.256 \times 10^{-38} Am^2$

C. $0.628 \times 10^{-38} Am^2$

D. Zero

Answer:

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16. An air-cored solenoid with length 30 cm, area of cross-section 25 cm2 and number of turns 800, carries a current of 2.5 A. The current is suddenly switched off in a brief time of 10-3s. Ignoring the variation in magnetic field near the ends of the solenoid, the

average back emf induced across the ends of the open switch in the circuit would be

A. zero

B. 3.125 volts

C. 6.54 volts

D. 16.74 volts

Answer:

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17. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which $R = 3\Omega, L = 25.48mH,$ and $C = 796\mu F,$ then the power dissipated at the resonant condition will be-

A. 39.70 kW

B. 26.70 kW

C. 13.35 kW

D. Zero

Answer:

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18. A circular loop of radius 0.3 cm lies parallel to amuch bigger circular loop of radius 20 cm. The centre of the small loop is on the axis of the bigger loop. The distance between their centres is 15 cm. If a current of 2.0 A flows through the smaller loop, then the flux linked with bigger loop is

A. 3.3×10^{-11} weber

B. 6×10^{-11} weber

C. 6.6×10^{-9} weber

D. 9.1×10^{-11} weber

Answer:

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19. If both the number of turns and core length of an inductor is doubled keeping

other factorsconstant, then its self-inductance will be

A. Unaffected

B. doubled

C. halved

D. quadrupled

Answer:

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20. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): To increase the range of an ammeter, we must connect a suitable high resistance in series to it.

Reason (R): The ammeter with increased range should have high resistance

Select the most appropriate answer from the options given below :

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A.

C. A is true but R is false

D. A is false and R is also false.

Answer: D

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21. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): An electron has a high potential

energy when it is at a location associated with a more negative value of potential, and a low potential energy when at a location associated with a more positive potential.

Reason (R):Electrons move from a region of higher potential to region of lower potential.

Select the most appropriate answer from the options given below :

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is also false.

Answer:

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22. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A): A magnetic needle free to rotate

in a vertical plane, orients itself (with its axis) vertical at the poles of the earth.

Reason (R): At the poles of the earth the horizontal component of earth's magnetic field will be zero.

Select the most appropriate answer from the options given below:

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is also false

Answer:

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23. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A): A proton and an electron, with same momenta, enter in a magnetic field in a direction at right angles to the lines of the

force. The radius of the paths followed by them will be same.

Reason(R): Electron has less mass than the proton.

Select the most appropriate answer from the options given below:

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is also false.

Answer:

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24. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A):On Increasing the current sensitivity of a galvanometer by increasing the number of turns, may not necessarily increase its voltage sensitivity.

Reason(R): The resistance of the coil of the galvanometer increases on increasing the number of turns.

Select the most appropriate answer from the options given below:

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A.

C. A is true but R is false

D. A is false and R is also false

Answer:

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25. Derive an expression for the frequency of radiation emitted when a hydrogen atom de-excites from level n to level (n – 1). Also show that for large values of n, this frequency equals to classical frequency of revolution of an electron.

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26. Explain with a proper diagram how an ac signal can be converted into dc (pulsating)signal with output frequency as double than the input frequency using pn junction diode. Give its input and output waveforms.

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27. How long can an electric lamp of 100 W be kept glowing by fusion of 2 kg of deuterium?

Take the fusion reaction as

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

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28. Define wavefront. Draw the shape of refracted wavefront when the plane incident wave undergoes refraction from optically denser medium to rarer medium. Hence prove Snell's law of refraction

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29. Draw a ray diagram of compound microscope for the final image formed at least distance of distinct vision?

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30. An angular magnification of 30X is desired using an objective of focal length 1.25 cm and an eye piece of focal length 5 cm. How will you set up the compound microscope for the final image formed at least distance of distinct vision?

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31. Draw a ray diagram of Astronomical Telescope for the final image formed at infinity.

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32. A small telescope has an objective lens of focal length 140 cm and an eyepiece of focal length 5.0 cm. what is the magnifying power of the telescope for viewing distant objects when

(a) the telescope is in normal adjustment (i.e, when the final image is at infinity),

(b) The final image is formed at the least distance of distinct vision (25 cm)

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33. Light of wavelength 2000 Å falls on a metal surface of work function 4.2 eV.

(a) What is the kinetic energy (in eV) of the fastest electrons emitted from the surface?

(b) What will be the change in the energy of

the emitted electrons if the intensity of light with same wavelength is doubled?

(c) If the same light falls on another surface of work function 6.5 eV, what will be the energy of emitted electrons?

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34. The focal length of a convex lens made of glass of refractive index (1.5) is 20 cm. What will be its new focal length when placed in a medium of refractive index 1.25 ? Is focal

length positive or negative? What does it signify?

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35. Name the em waves which are suitable for radar systems used in aircraft navigation. Write the range of frequency of these waves.

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36. If the earth did not have atmosphere, would its average surface temperature be higher or lower than what it is now? Explain

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37. An em wave exers pressure on the surface on which it is incident. Justify?

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38. "If the slits in Young's double slit experiment are identical, then intensity at any point on the screen may vary between zero and four times to the intensity due to single slit". Justify the above statement through a relevant mathematical expression.

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39. Draw the intensity distribution as function of phase angle when diffraction of light takes

place through coherently illuminated single slit.

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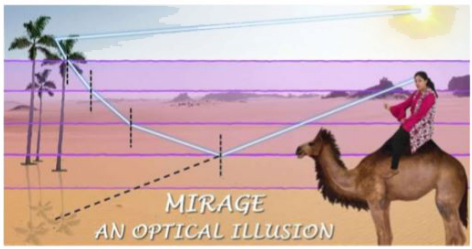
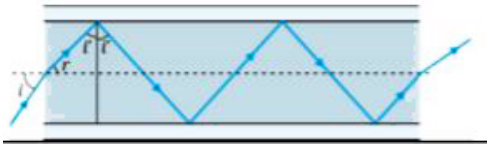
40. CASE STUDY: MIRAGE IN DESERTS



To a distant observer, the light appears to be coming from somewhere below the ground. The observer naturally assumes that light is being reflected from the ground, say, by a pool

of water near the tall object.

Such inverted images of distant tall objects cause an optical illusion to the observer. This phenomenon is called mirage. This type of mirage is especially common in hot deserts. Based on the above facts, answer the following questions:



(a) Which of the following phenomena is prominently involved in the formation of mirage in deserts?

(b) A driver at a depth 12m inside water sees

the sky in a cone of semi vertical angle ?

(c) In an optical fibre, if n_1 and n_2 are refractive indices of the core and cladding, then which among the following would be a correct equation?

(d) A diamond is immersed in such a liquid which has its refractive index with respect to air as greater than the refractive index of water with respect to air. Then the critical angle of diamond liquid interface as compared to critical angle of diamond water interface will?

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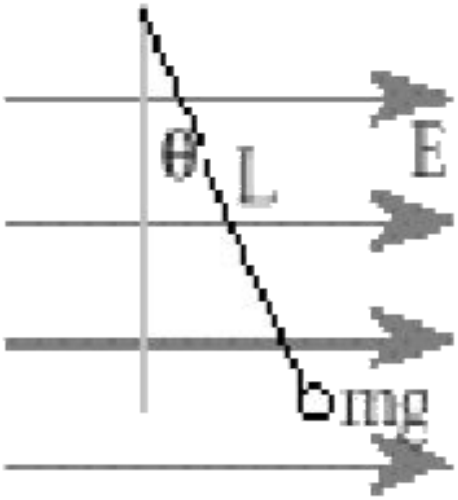
Section C

1. A small object with charge q and weight mg is attached to one end of a string of length 'L' attached to a stationary support. The system is placed in a uniform horizontal electric field 'E', as shown in the accompanying figure. In the presence of the field, the string makes a constant angle θ with the vertical. The sign

and magnitude of q-



A. positive with magnitude mg/E

B. positive with magnitude (mg/E)tan θ

C. negative with magnitude mg/E tan θ

D. positive with magnitude E tan θ /mg

Answer:

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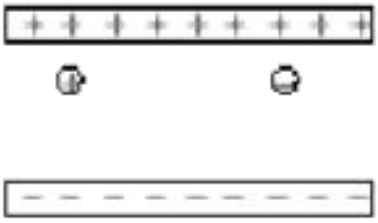
2. A free electron and a free proton are placed between two oppositely charged parallel plates. Both are closer to the positive plate than the negative plate



Which of the following statements is true?

I. The force on the proton is greater than the force on the electron.

II. The potential energy of the proton is greater than that of the electron.

III. The potential energy of the proton and the electron is the same.

A. I only

B. II only

C. III and I only

D. II and I only

Answer:

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3. Case study :

Read the following paragraph and answers the questions :

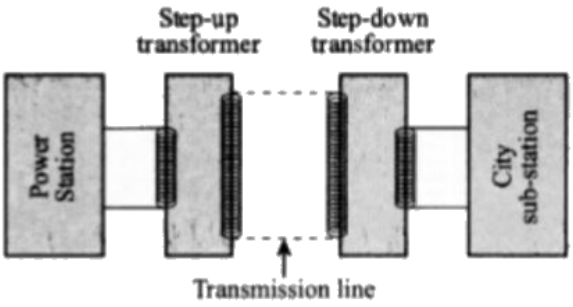

Figure: Long distance power transmissions

The large-scale transmission and distribution

of electrical energy over long distances is done with the use of transformers. The voltage output of the generator is stepped-up. It is then transmitted over long distances to an area sub-station near the consumers. There the voltage is stepped down. It is further stepped down at distributing sub-stations and utility poles before a power supply of 240 V reaches our homes.

Which of the following statement is true?

A. Energy is created when a transformer steps up the voltage

B. A transformer is designed to convert an AC voltage to DC voltage

C. Step–up transformer increases the power for transmission

D. Step–down transformer decreases the AC voltage

Answer: D

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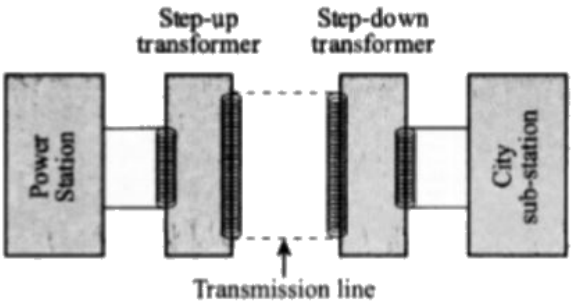
4. Case study :

Read the following paragraph and answers the questions :



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If the secondary coil has a greater number of turns than the primary,

A. the voltage is stepped-up $(Vs > Vp)$ and arrangement is called a step-up transformer

B. the voltage is stepped-down $(Vs < Vp)$ and arrangement is called a step- down transformer

C. the current is stepped-up $(Is > Ip)$ and arrangement is called a step-up

D. the current is stepped-down $(Is < Ip)$ and arrangement is called a step- down transformer

Answer: A

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5. Case study :

Read the following paragraph and answers the questions :

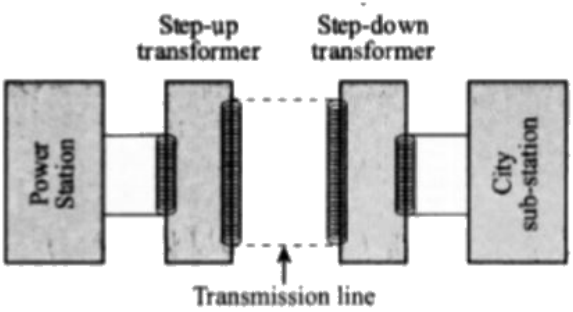

Figure: Long distance power transmissions

The large-scale transmission and distribution of electrical energy over long distances is done with the use of transformers. The voltage output of the generator is stepped-up.

It is then transmitted over long distances to an area sub-station near the consumers. There the voltage is stepped down. It is further stepped down at distributing sub-stations and utility poles before a power supply of 240 V reaches our homes.

We need to step-up the voltage for power transmission, so that

A. the current is reduced and consequently, the I^2R loss is cut down

B. the voltage is increased , the power losses are also increased

C. the power is increased before transmission is done

D. he voltage is decreased so V^2/R losses are reduced

Answer:

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6. Case study :

Read the following paragraph and answers the questions :

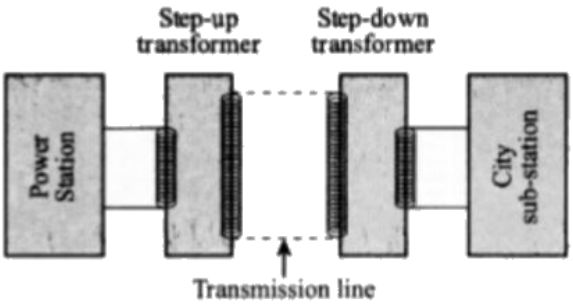

Figure: Long distance power transmissions

The large-scale transmission and distribution of electrical energy over long distances is done with the use of transformers. The voltage output of the generator is stepped-up. It is then transmitted over long distances to

an area sub-station near the consumers. There the voltage is stepped down. It is further stepped down at distributing sub-stations and utility poles before a power supply of 240 V reaches our homes.

A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. The number of turns in the secondary in order to get output power at 230 V are

A. 4

B. 40

C. 400

D. 4000

Answer: C

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