

Maximum Marks: 60
Total No. of Questions: 60
Total Duration: 80 Minutes
Maximum Time for Answering: 70 Minutes
Time: 10.30 am to 11.50 am



A2

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot-13, Sector-18, Udyog Vihar,
Gurugram, Haryana-122015

Answers & Solutions

for

Karnataka Common Entrance Test-2025

Time : 80 Minutes

(PHYSICS)

M.M. : 60

Dos:

- 1 This question booklet is issued to you by the room invigilator after 10.30 am.
- 2 Check whether the CET Number has been entered and shaded in the respective circles on the OMR answer sheet.
- 3 The version code of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.
- 4 The Version Code and Serial Number of this question booklet should be entered on the Nominal Roll without any mistakes.
- 5 Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DONTs:

- 1) **THE TIMING AND MARKS PRINTED ON THE OMR ANSWER SHEET SHOULD NOT BE DAMAGED / MUTILATED / SPOILED.**
- 2) The 3rd Bell rings at 10.40 am, till then.
 - i. Do not remove the seal present on the right-hand side of this question booklet.
 - ii. Do not look inside this question booklet or start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

- 1 In case of usage of signs and symbols in the questions, the regular textbook connotation should be considered unless stated otherwise.
- 2 This question booklet contains 60 questions, and each question will have one statement and four different options / responses & out of which you have to choose one correct answer.
- 3 After the 3^d Bell rings at 10.40 am, remove the paper seal of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.
- 4 Completely **darken / shade** the relevant circle with a **blue or black ink ballpoint pen against the question number on the OMR answer sheet.**
- 5 Please note that even a minute unintended ink dot on the OMR answer sheet will also be recognized and recorded by the scanner. Therefore, avoid multiple markings of any kind on the OMR answer sheet.
- 6 Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
- 7 **Last Bell will ring at 11.50 am**, stop writing on the OMR answer sheet,
- 8 Hand over the OMR answer sheet to the room invigilator as it is.
- 9 After separating the top sheet (Office copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you.

NOTE: In case of any discrepancy between English and Kannada Versions, the English version will be taken as final.

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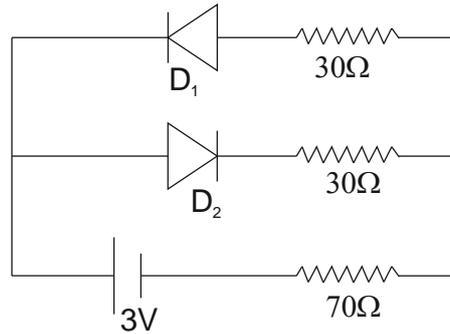
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1. The circuit shown in the figure contains two ideal diodes D_1 and D_2 . If a cell of emf 3V and negligible internal resistance is connected as shown, then the current through $70\ \Omega$ resistance (in ampere) is



- (1) 0.03
 (2) 0
 (3) 0.01
 (4) 0.02

Key: Answer (1)

Sol: D_1 is Reverse Biased : D_2 is Forward Biased

$$I = \frac{3V}{70\ \Omega + 30\ \Omega} = \frac{3}{100} \text{ A} = 0.03\text{A}$$

2. In determining the refractive index of a glass slab using a travelling microscope, the following readings are tabulated.
- (a) Reading of travelling microscope for ink mark = 5.123 cm
 (b) Reading of travelling microscope for ink mark through glass slab = 6.123 cm
 (c) Reading of travelling microscope for chalk dust on glass slab = 8.123 cm

From the data, refractive index of a glass slab is

- (1) 1.399 (2) 1.390
 (3) 1.500 (4) 1.601

Key : Answer (3)

Sol : Normal shift $\Delta t = 6.123 - 5.123 = 1\text{cm}$

$t =$ thickness of slab = $8.123 - 5.123 = 3\text{cm}$

$$\Delta t = t \left[1 - \frac{1}{\mu} \right]$$

$$1\text{cm} = 3\text{cm} \left[1 - \frac{1}{\mu} \right] \Rightarrow \frac{1}{3} = 1 - \frac{1}{\mu} \Rightarrow \mu = \frac{3}{2} = 1.5$$

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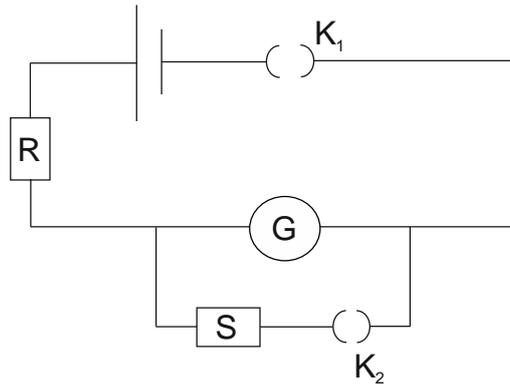


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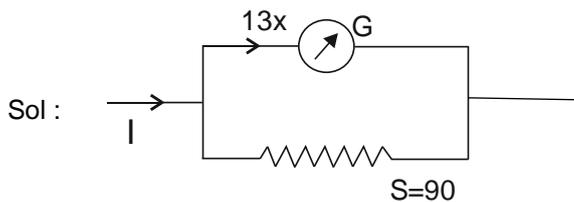
3. In an experiment to determine the figure of merit of a galvanometer by half deflection method, a student constructed the following circuit.



He unplugged a resistance of $5200\ \Omega$ in R. When K_1 is closed and K_2 is open, the deflection observed in the galvanometer is 26 div. When K_2 is also closed and a resistance of $90\ \Omega$ is removed in S, the deflection becomes 13 div. The resistance of galvanometer is nearly

- (1) $91.6\ \Omega$
- (2) $116.0\ \Omega$
- (3) $45.0\ \Omega$
- (4) $103.0\ \Omega$

Key : Answer (1)



$$26x = \frac{E}{5200 + G} \dots (1)$$

$$12x = I \frac{90}{G + 90}$$

$$I = \frac{E}{5200 + \frac{GS}{g + s}}$$

$$13x = \frac{E}{5200 + \frac{G90}{90 + G}} \left[\frac{90}{G + 90} \right] \dots (2)$$

By solving (1) & (2) $G = 91.6\ \Omega$

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4. While determining the coefficient of viscosity of the given liquid, a spherical steel ball sinks by a distance $h = 0.9\text{m}$. The radius of the ball is $r = \sqrt{3} \times 10^{-3}\text{m}$. The time taken by the ball to sink in three trials are tabulated as follows.

Trail No.	Time taken by the ball to fall by h (in second)
1.	2.75
2.	2.65
3.	2.70

The difference between the densities of the steel ball and the liquid is 7000kgm^{-3} . If $g = 10.0\text{ms}^{-2}$, then the coefficient of viscosity of the given liquid at room temperature is

- (1) 14 Pa.s (2) 0.28 Pa.s (3) 0.14 Pa.s (4) $0.14 \times 10^{-3}\text{Pa.s}$

Key : Answer (3)

Sol : $6\pi\eta r v = \frac{4}{3}\pi r^3 g(\rho_s - \rho_L)$

$$\eta = \frac{2r^2 g(\rho_s - \rho_L)}{9v}$$

5. Which of the following expressions can be deduced on the basis of dimensional analysis?
(All symbols have their usual meanings)

- (1) $F = 6\pi\eta r v$ (2) $s = ut + \frac{1}{2}at^2$ (3) $x = A \cos \omega t$ (4) $N = N_0 e^{-\lambda t}$

Key : Answer (1)

Sol : $F \propto \eta^a r^b v^c$

6. Two stones begin to fall from rest from the same height, with the second stone starting to fall ' Δt ' seconds after the first falls from rest. The distance of separation between the two stones becomes ' H ', ' t_0 ' seconds after the first stone starts its motion. Then t_0 is equal to

- (1) $\frac{H}{g\Delta t} + \frac{\Delta t}{2}$ (2) $\frac{H}{g\Delta t}$ (3) $\frac{H}{\Delta t} + \frac{\Delta t}{2g}$ (4) $\frac{H}{g\Delta t} - \frac{\Delta t}{2}$

Key: Answer (1)

Sol : $H = \frac{1}{2}gt_0^2 - \frac{1}{2}g(t_0 - \Delta t)^2$

7. In the projectile motion of a particle on a level ground, which of the following remains constant with reference to time and position?

- (1) Angle between the instantaneous velocity with the horizontal
(2) Vertical component of the velocity of the projectile
(3) Average velocity between any two points on the path
(4) Horizontal component of velocity

Key : Answer (4)

Sol : Horizontal acceleration = 0
 \Rightarrow Horizontal velocity is constant

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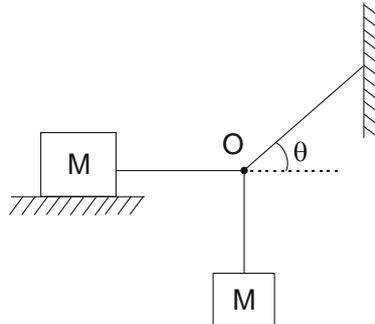
8. A particle is in uniform circular motion. The equation of its trajectory is given by $(x - 2)^2 + y^2 = 25$, where x and y are in meter. The speed of the particle is 2 ms^{-1} . When the particle attains the lowest 'y' co-ordinate, the acceleration of the particle is (in ms^{-2})

- (1) $0.8 \hat{j}$ (2) $0.4 \hat{i}$ (3) $0.4 \hat{j}$ (4) $0.8 \hat{i}$

Key : Answer (1)

Sol : $a_c = \frac{v^2}{r} \hat{j} = 0.8 \hat{j}$

9. A wooden block of mass M lies on a rough floor. Another wooden block of the same mass is hanging from the point O through strings as shown in the figure. To achieve equilibrium, the co-efficient of static friction between the block on the floor with the floor itself is



- (1) $\mu = \tan \theta$ (2) $\mu = \cos \theta$ (3) $\mu = \cot \theta$ (4) $\mu = \sin \theta$

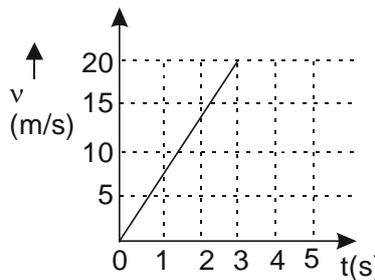
Key : Answer (3)

Sol : $T \cos \theta = \mu Mg$

$T \sin \theta = Mg$

$\cot \theta = \mu$

10. A block of certain mass is placed on a rough floor. The coefficients of static and kinetic friction between the block and the floor are 0.4 and 0.25 respectively. A constant horizontal force $F = 20 \text{ N}$ acts on its so that the velocity of the block varies with time according to the following graph. The mass of the block is nearly (Take $g = 10 \text{ ms}^{-2}$)



- (1) 1.0 kg (2) 2.2 kg (3) 4.4 kg (4) 1.2 kg

Key : Answer (2)

Sol : $a = \frac{v - u}{t} = \frac{20}{3} \text{ ms}^{-2}$

$F - \mu mg = ma$

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$$m = 2.2\text{kg (nearly)}$$

11. A body of mass 0.25 kg travels along a straight line from $x = 0$ to $x = 2$ m with a speed $v = kx^{3/2}$ where $k = 2$ SI units. The work done by the net force during this displacement is

- (1) 32 J (2) 4 J (3) 8 J (4) 16 J

Key : Answer (2)

$$\text{Sol : } W = \frac{1}{2}m(v^2 - u^2)$$

$$u = 0; v = 2(2)^{3/2} = 2(2\sqrt{2})$$

$$v = 4\sqrt{2}\text{ms}^{-1}$$

$$v^2 = 32\text{m}^2\text{s}^{-2}$$

12. During an elastic collision between two bodies, which of the following statements are correct?

- I. The initial kinetic energy is equal to the final kinetic energy of the system.
 II. The linear momentum is conserved.
 III. The kinetic energy during Δt (the collision time) is not conserved

- (1) I, II and III (2) I and II only (3) II and III only (4) I and III only

Key : Answer (1)

Sol : All statements are true

13. Three particles of mass 1 kg, 2 kg and 3 kg are placed at the vertices A, B and C respectively of an equilateral triangle ABC of side 1 m. The centre of mass of the system from vertex A (located at origin) is

- (1) $\left(\frac{7}{12}, \frac{6+3\sqrt{3}}{12}\right)$ (2) (0,0) (3) $\left(\frac{7}{12}, \frac{3\sqrt{3}}{12}\right)$ (4) $\left(\frac{9}{12}, \frac{3\sqrt{3}}{12}\right)$

Key : Answer (3)

$$\text{Sol : } m_1 = 1 \quad m_2 = 2 \quad m_3 = 3$$

$$x_1 = 0 \quad x_2 = 1 \quad x_3 = \frac{1}{2}$$

$$y_1 = 0 \quad y_2 = 0 \quad y_3 = \frac{\sqrt{3}}{2}$$

$$x_{\text{cm}} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1 + m_2 + m_3}$$

$$y_{\text{cm}} = \frac{m_1y_1 + m_2y_2 + m_3y_3}{m_1 + m_2 + m_3}$$

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17. Two wires A and B are made of same material. Their diameters are in the ratio of 1 : 2 and lengths are in the ratio of 1 : 3. If they are stretched by the same force, then increase in their lengths will be in the ratio of

- (1) 3 : 2 (2) 4 : 3 (3) 3 : 4 (4) 2 : 3

Key : Answer (2)

Sol : $\Delta l \propto \frac{l}{r^2}$

18. A horizontal pipe carries water in a streamlined flow. At a point along the pipe, where the cross-sectional area is 10 cm^2 , the velocity of water is 1 ms^{-1} and the pressure is 2000 Pa. What is the pressure of water at another point where the cross-sectional area is 5 cm^2 ?

[Density of water = 1000 kgm^{-3}]

- (1) 500 Pa (2) 200 Pa (3) 300 Pa (4) 400 Pa

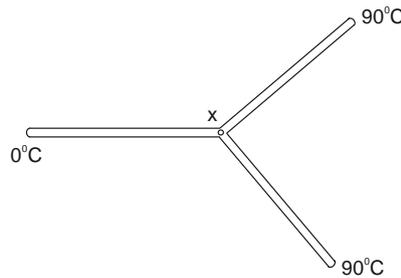
Key : Answer (1)

Sol : $A_1 V_1 = A_2 V_2$

$V_2 = 2 \text{ ms}^{-1}$

$P_1 + \frac{1}{2} \rho V_1^2 = P_2 + \frac{1}{2} \rho V_2^2$

19. Three metal rods of the same material and identical in all respects are joined as shown in the figure. The temperatures at the ends of these rods are maintained as indicated. Assuming no heat energy loss occurs through the curved surfaces of the rods, the temperature at the junction x is



- (1) 20°C (2) 45°C (3) 60°C (4) 30°C

Key : Answer (3)

Sol : $(90 - x) + (90 - x) = (x - 0)$

20. A gas is taken from state A to state B along two different paths 1 and 2. The heat absorbed and work done by the system along these two paths are Q_1 and Q_2 and W_1 and W_2 respectively. Then

- (1) $Q_1 + W_1 = Q_2 + W_2$ (2) $Q_1 = Q_2$
 (3) $W_1 = W_2$ (4) $Q_1 - W_1 = Q_2 - W_2$

Key : Answer (4)

Sol : $Q = \Delta U + W$

$\Delta U = Q - W = \text{same for two processes}$

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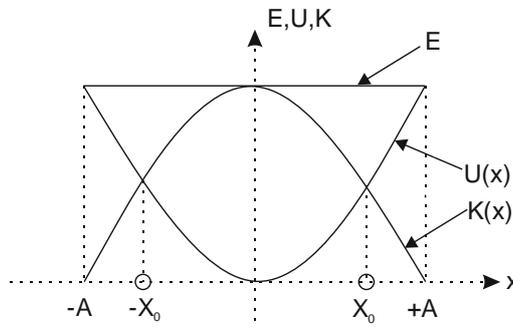
21. At 27°C temperature, the mean kinetic energy of the atoms of an ideal gas is E_1 . If the temperature is increased to 327°C, then the mean kinetic energy of the atoms will be

- (1) $2E_1$ (2) $\frac{E_1}{2}$ (3) $\frac{E_1}{\sqrt{2}}$ (4) $\sqrt{2}E_1$

Key : Answer (1)

Sol : $E \propto T$

22. The variation of kinetic energy $K(x)$, potential energy $U(x)$ and total energy as a function of displacement of a particle in SHM is as shown in the figure. The value of $|x_0|$ is



- (1) $\sqrt{2} A$ (2) $\frac{A}{2}$ (3) $2A$ (4) $\frac{A}{\sqrt{2}}$

Key : Answer (4)

Sol : $K = U \Rightarrow \frac{1}{2}m\omega^2(A^2 - x^2) = \frac{1}{2}mx^2\omega^2$

23. The angle between the particle velocity and wave velocity in a transverse wave is [except when the particle passes through the mean position]

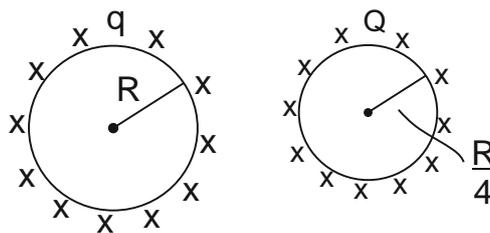
- (1) π radian (2) Zero radian (3) $\frac{\pi}{4}$ radian (4) $\frac{\pi}{2}$ radian

Key : Answer (4)

Sol : Transverse wave

\Rightarrow direction of particle vibration and wave velocity is perpendicular

24. A metallic sphere of radius R carrying a charge q is kept at certain distance from another metallic sphere of radius $R/4$ carrying a charge Q . What is the electric flux at any point inside the metallic sphere of radius R due to the sphere of radius $R/4$?



- (1) $\frac{q}{\epsilon_0} - \frac{Q}{\epsilon_0}$ (2) $\frac{Q}{\epsilon_0}$ (3) $\frac{Q}{\epsilon_0} - \frac{q}{\epsilon_0}$ (4) Zero

Key : Answer (4)

Sol : Inside the metal surface $E = 0$

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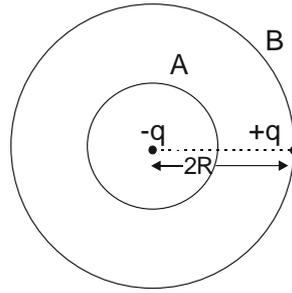


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25. You are given a dipole of charge $+q$ and $-q$ separated by a distance $2R$. A sphere 'A' of radius ' R ' passes through the centre of the dipole as shown below and another sphere 'B' of radius ' $2R$ ' passes through the charge $+q$. Then the electric flux through the sphere A is



- (1) $2q / \epsilon_0$ (2) $-q / \epsilon_0$ (3) q / ϵ_0 (4) Zero

Key : Answer (2)

Sol : $\phi = \frac{q_{net}}{\epsilon_0} = -\frac{q_0}{\epsilon_0}$

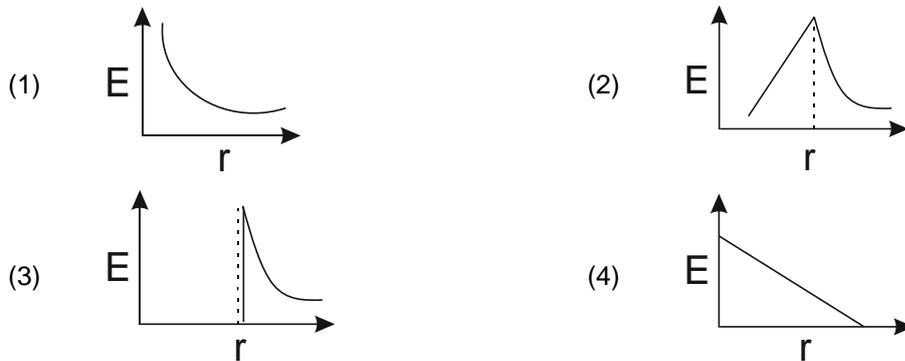
26. A potential at a point A is -3 V and that at another point B is 5 V . What is the work done in carrying a charge of 5 m C from B to A?

- (1) -4 J (2) -40 J (3) -0.04 J (4) -0.4 J

Key : Answer (3)

Sol : $W = q(V_f - V_i)$
 $= 5 \times 10^{-3} [-3 - 5]$
 $= 5 \times (-8) \times 10^{-3}$
 $= -40 \times 10^{-3} = -0.04\text{ J}$

27. Charges are uniformly spread on the surface of a conducting sphere. The electric field from the centre of sphere to a point outside the sphere varies with distance r from the centre as



Key : Answer (3)

Sol : $E = 0$ (inside the conductor)

$E \propto \frac{1}{r^2}$ (outside the conductor)

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28. Match the Column-I with Column-II related to an electric dipole of dipole moment \vec{p} that is placed in a uniform electric field \vec{E} .

	Column-I Angle between \vec{p} and \vec{E}		Column-II Potential energy of the dipole
a)	180°	i)	$-pE$
b)	120°	ii)	pE
c)	90°	iii)	$\frac{1}{2}pE$
		iv)	Zero

(1) a – ii, b – i, c – iv

(2) a – ii, b – iii, c – iv

(3) a – i, b – ii, c – iii

(4) a – ii, b – iii, c – i

Key : Answer (2)

Sol : $U = -pE \cos \theta$

29. Which of the following statements is not true?

- (1) Equipotential surfaces for a uniform electric field are parallel and equidistant from each other
- (2) Electric field is always perpendicular to an equipotential surface
- (3) Work done to move a charge on an equipotential surface is not zero
- (4) Equipotential surfaces are the surfaces where the potential is constant

Key : Answer (3)

Sol : Work done by moving a charge on equipotential surface is zero, since all points have same potential

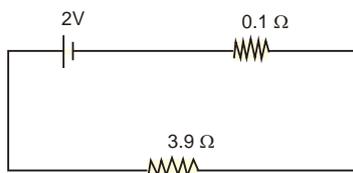
30. Which of the following is a correct statement?

- (1) Gauss's law does not hold good for a charge situated outside the Gaussian surface
- (2) Gauss's law is true for any closed surface
- (3) Gauss's law is true for any open surface
- (4) Gauss's law is not applicable when charges are not symmetrically distributed over a closed surface.

Key : Answer (2)

Sol : Gauss' law is only valid for closed surface

31. In the following circuit, the terminal voltage across the cell is



(1) 2.71 V

(2) 0.52 V

(3) 1.68 V

(4) 1.95 V

Key : Answer (4)

Sol : $i = \frac{V}{r} = \frac{2}{3.9 + 0.1} = 0.5$

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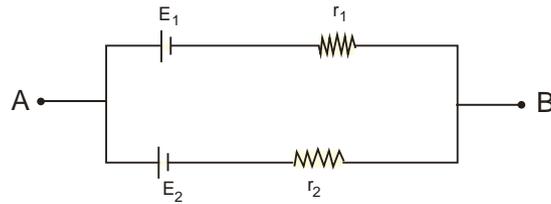
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$$v_T = 2 - 0.5 \times .1 = 1.95 \text{ V}$$

32. Two cells of emfs E_1 and E_2 and internal resistances r_1 and r_2 ($E_2 > E_1$ and $r_2 > r_1$) respectively, are connected in parallel as shown in figure. The equivalent emf of the combination is E_{eq} . Then



- (1) $E_{eq} < E_1$
- (2) $E_1 < E_{eq} < E_2$ and E_{eq} is nearer E_1
- (3) $E_1 < E_{eq} < E_2$ and E_{eq} is nearer E_2
- (4) $E_{eq} > E_2$

Key : Answer (2)

$$\begin{aligned} \text{Sol : } E_e - \frac{E_1 + E_2}{2} &= E_e - \langle E \rangle \\ &= \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} - \frac{(E_1 + E_2)}{2}; r_0 = r_1 + r_2 \\ &= \frac{2E_1 r_2 + 2E_2 r_1 - E_1 r_1 - E_2 r_1 - E_1 r_2 - E_2 r_2}{2r_0} \\ &= \frac{(E_1 - E_2)r_2 + (E_2 - E_1)r_1}{2r_0} \\ &= \frac{(E_2 - E_1)}{2r_0} [-r_2 + r_1] \\ &= \frac{(E_2 - E_1)(r_1 - r_2)}{2r_0} < 0 \end{aligned}$$

$$\Rightarrow E_e - \langle E_e \rangle < 0$$

$$\Rightarrow E_e < \langle E_e \rangle$$

E_e is closer to E_1

$$\begin{aligned} (1) \quad E_e - E_1 &= \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} - E_1 \\ &= \frac{E_2 r_1 - E_1 r_1}{r_0} \end{aligned}$$

$$E_e - E_1 = (E_2 - E_1) \frac{r_1}{r_0} > 0 \quad E_2 > E_1$$

So, $E_e > E_1$

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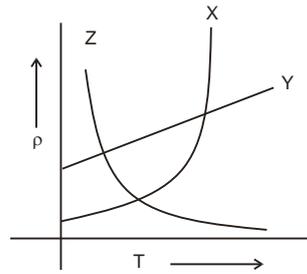


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33. The variations of resistivity ρ with absolute temperature T for three different materials X, Y and Z are shown in the graph below. Identify the materials X, Y and Z.



- (1) X – nichrome, Y–copper, Z – semiconductor
- (2) X – copper, Y – nichrome, Z – semiconductor
- (3) X – copper, Y – semiconductor, Z - nichrome
- (4) X – semiconductor, Y – nichrome, Z – copper

Key : Answer (2)

Sol : Conceptual

34. Given, a current carrying wire of non-uniform cross-section, which of the following is constant throughout the length of wire?

- (1) Current only
- (2) Current, electric field and drift speed
- (3) Drift speed
- (4) Current and drift speed

Key : Answer (1)

Sol : Conceptual

35. The graph between variation of resistance of a metal wire as a function of its diameter keeping other parameters like length and temperature constant is



Key : Answer (1)

Sol : $R = \frac{\rho l}{A} = \frac{\rho l}{\pi D^2}$

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36. Two thin long parallel wires separated by a distance 'r' from each other in vacuum carry a current of 1 ampere in opposite directions. Then, they will

- (1) Repel each other with a force per unit length of $\frac{\mu_0 I^2}{2\pi r^2}$
- (2) Attract each other with a force per unit length of $\frac{\mu_0 I^2}{2\pi r^2}$
- (3) Attract each other with a force per unit length of $\frac{\mu_0 I^2}{2\pi r}$
- (4) Repel each other with a force per unit length of $\frac{\mu_0 I^2}{2\pi r}$

Key : Answer (4)

Sol : $F = i l B$

$$\frac{F}{l} = i B$$

$$\frac{F}{l} = i \frac{\mu_0 i}{2\pi r} = \frac{\mu_0 i^2}{2\pi r}$$

37. A solenoid is 1 m long and 4 cm in diameter. It has five layers of windings of 1000 turns each and carries a current of 7A. The magnetic field at the centre of the solenoid is

- (1) $43.96 \times 10^{-2} \text{ T}$
- (2) 439.6 T
- (3) $0.4396 \times 10^{-5} \text{ T}$
- (4) $4.396 \times 10^{-2} \text{ T}$

Key : Answer (4)

Sol : $B = \mu_0 n i$

$$= 4\pi \times 10^{-7} \times \frac{5 \times 1000}{1} \times 7$$

$$= 439 \times 10^{-4} = 4.39 \times 10^{-2} \text{ T}$$

38. Two similar galvanometers are converted into an ammeter and a milliammeter. The shunt resistance of ammeter as compared to the shunt resistance of milliammeter will be

- (1) Less
- (2) Equal
- (3) Zero
- (4) More

Key : Answer (1)

Sol : In case of ammeter we want most of the current to flow through the shunt resistance, to maintain the safe ig

39. Which of the following statements is true in respect of diamagnetic substances?

- (1) Susceptibility decreases with temperatures.
- (2) Susceptibility is small and negative
- (3) They are feebly attracted by magnets
- (4) Permeability is greater than 1000

Key : Answer (2)

Sol : Conceptual

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40. Identify the correct statement

- (1) The direction of magnetic field due to a current element is given by Flemings Left Hand Rule
- (2) The magnetic field inside a solenoid is non-uniform
- (3) A current carrying conductor produces an electric field around it.
- (4) A straight current carrying conductor has circular magnetic field lines around it.

Key : Answer (4)

Sol : Conceptual

41. Which of the following graphs represents the variation of magnetic field B with perpendicular distance 'r' from an infinitely long, straight conductor carrying current?



Key : Answer (4)

Sol : $B = \frac{\mu_0 i}{2\pi r}$

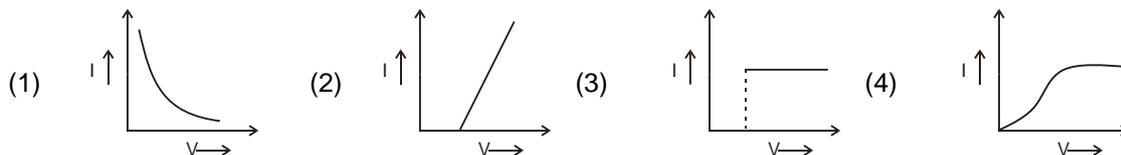
42. If we consider an electron and a photon of same de-Broglie wavelength, then they will have same

- (1) Velocity
- (2) Momentum
- (3) Angular momentum
- (4) Energy

Key : Answer (2)

Sol : $\lambda = \frac{h}{mv} = \frac{h}{P}$, if λ is same then P is also same.

43. The anode voltage of a photocell is kept fixed. The frequency of the light falling on the cathode is gradually increased. Then the correct graph which shows the variation of photo current I with the frequency ν of incident light is



Key : Answer (3)

Sol : Conceptual

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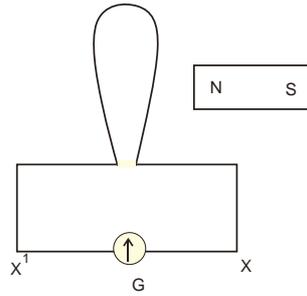
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44. When a bar magnet is pushed towards the coil, along its axis, as shown in the figure, the galvanometer pointer deflects towards X. When this magnet is pulled away from the coil, the galvanometer pointer.



- (1) oscillates
 (2) deflects towards X
 (3) deflects towards X'
 (4) does not deflect

Key : Answer (3)

Sol : Conceptual

45. A square loop of side 2m lies in the Y-Z plane in region having a magnetic field $\vec{B} = (5\hat{i} + 3\hat{j} - 4\hat{k})T$. The magnitude of magnetic flux through the square loop is

- (1) 16 Wb (2) 10 Wb (3) 20 Wb (4) 12 Wb

Key : Answer (3)

Sol : $\hat{a} = 4\hat{i}$ & $\vec{b} = (5\hat{i} + 3\hat{j} - 4\hat{k})$

$$\phi = \vec{b} \cdot \vec{a} = 20$$

46. In domestic electric mains supply, the voltage and the current are

- (1) DC voltage and AC current (2) AC voltage and AC current
 (3) AC voltage and DC current (4) DC voltage and DC current

Key : Answer (2)

Sol : In domestic electric mains supply, the voltage and the current are AC voltage and AC current

47. A sinusoidal voltage produced by an AC generator at any instant t is given by an equation $V = 311 \sin 314 t$. The rms value of voltage and frequency are respectively

- (1) 220 V, 50 Hz (2) 200 V, 100 Hz
 (3) 200 V, 50 Hz (4) 220 V, 100 Hz

Key : Answer (1)

Sol : $v = 311\sin(314t)$

$$v_{rms} = \frac{V_0}{\sqrt{2}} = \frac{312}{\sqrt{2}} = 220v$$

$$w = 314$$

$$\Rightarrow 2\pi f = 100\pi$$

$$\Rightarrow f = 50Hz$$

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48. A series LCR circuit containing an AC source of 100 V has an inductor and a capacitor of reactances 24Ω and 16Ω respectively. If a resistance of 6Ω is connected in series, then the potential difference across the series combination of inductor and capacitor only is

- (1) 8 V (2) 40 V (3) 80 V (4) 400 V

Key : Answer (3)

Sol : $v_{rms} = 100v, x_L = 24\Omega, x_C = 16\Omega, R = 6\Omega$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$= \sqrt{6^2 + (24 - 16)^2}$$

$$= 10\Omega$$

$$I_{rms} = \frac{V_{rms}}{Z} = \frac{100}{10} = 10A$$

$$\therefore \text{Voltage across inductor \& capacitor} = I_{rms}(X_L - X_C)$$

$$= 10(24 - 16)$$

$$= 10 \times 8$$

$$= 80V$$

49. Match the following types of waves with their wavelength ranges

Waves		Wavelength ranges	
i.	Microwave	(a)	700 nm to 400 nm
ii.	Visible light	(b)	1 nm to 10^{-3} nm
iii.	Ultraviolet	(c)	0.1 m to 1mm
iv.	X-rays	(d)	400 nm to 1nm

- (1) i – b, ii - , iii - , iv – c (2) i – a, ii -d , iii -b, iv -c
 (3) i –c, ii -a, iii -d, iv -b (4) i –d, ii -b, iii -c, iv – a

Key : Answer (3)

Sol : Fact

50. A ray of light passes from vacuum into a medium of refractive index n. If the angle of incidence is twice the angle of refraction, then the angle of incidence in terms of refractive index is

- (1) $2\sin^{-1}\left(\frac{n}{2}\right)$ (2) $\cos^{-1}\left(\frac{n}{2}\right)$ (3) $\sin^{-1}\left(\frac{n}{2}\right)$ (4) $2\cos^{-1}\left(\frac{n}{2}\right)$

Key : Answer (4)

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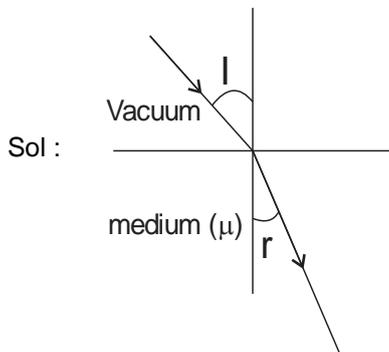


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$$i = 2r$$

Using Snell's law

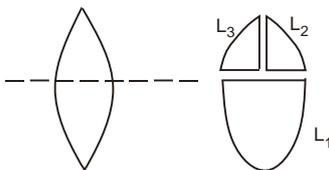
$$U_i \sin i = U_r \sin r$$

$$\Rightarrow 1 \sin(2r) = n \sin r \Rightarrow 2 \sin r \cos r = n \sin r$$

$$\Rightarrow 2 \cos r = n \Rightarrow \cos r = \frac{n}{2} \Rightarrow r = \cos^{-1}\left(\frac{n}{2}\right)$$

$$\therefore i = 2r = 2 \cos^{-1}\left(\frac{n}{2}\right)$$

51. A convex lens has power P. It is cut into two halves along its principal axis. Further one piece (out of two halves) is cut into two halves perpendicular to the principal axis as shown in figure. Choose the incorrect option for the reported lens pieces.



(1) Power of L_1 is P

(2) Power of L_1 is $\frac{P}{2}$

(3) Power of L_2 is $\frac{P}{2}$

(4) Power of L_3 is $\frac{P}{2}$

Key : Answer (2)

Sol : $f_{L_1} = f$

$$P_1 = \frac{1}{f} = P$$

$$f_{L_2} = f_{L_3} = 2f$$

$$\therefore P_{L_2} = P_{L_3} = \frac{1}{2f} = \frac{P}{2}$$

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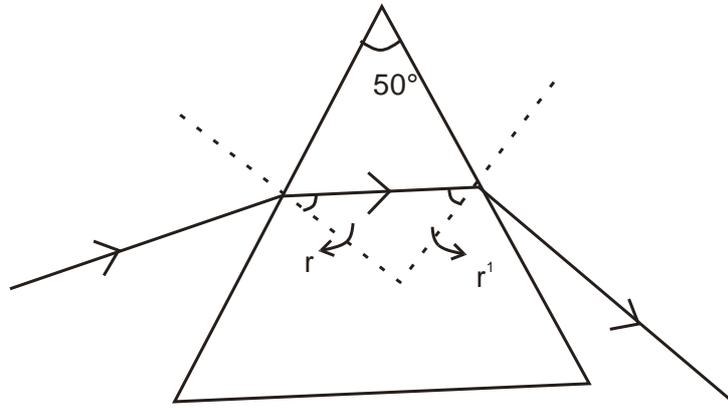
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52. The image formed by an objective lens of a compound microscope is
- (1) Virtual and enlarged (2) Virtual and diminished
 (3) Real and diminished (4) Real and enlarged

Key : Answer (4)

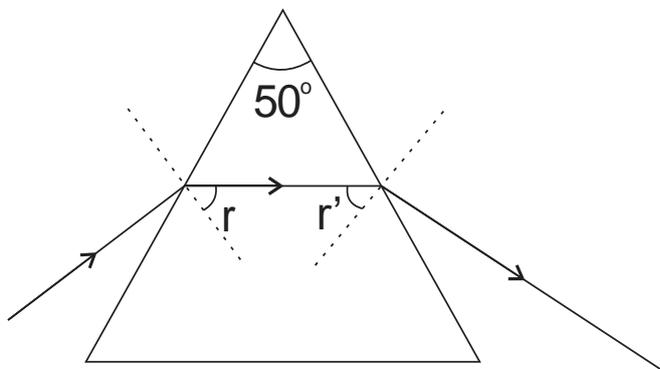
Sol : Image formed by objective lens of compound microscope real, inverted and enlarged

53. If r and r' denote the angles inside the prism having angle of prism 50° considering that during interval of time from $t = 0$ to $t = t$, r varies with time as $r = 10^\circ + t^2$. During this time r' will vary with time as



- (1) $50^\circ + t^2$
 (2) $40^\circ - t^2$
 (3) $40^\circ + t^2$
 (4) $50^\circ - t^2$

Key : Answer (2)



Sol :

$$\begin{aligned}
 r + r' &= A \\
 \Rightarrow r' &= A - r \\
 &= 50^\circ - (10^\circ + t^2) \\
 &= 40^\circ - t^2
 \end{aligned}$$

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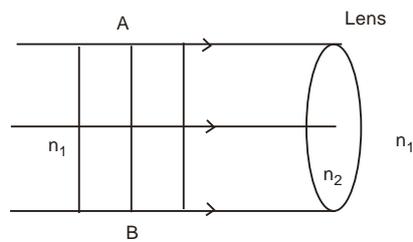


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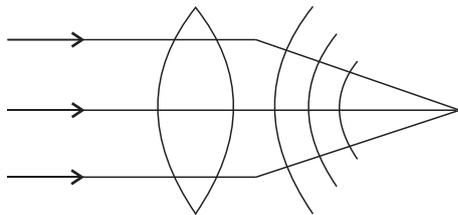
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54. If AB is incident plane wave front then refracted wave front is ($n_2 > n_1$)



- (1) (2) (3) (4)

Key : Answer (3)



Sol :

Refracted wave front

55. The total energy carried by the light wave when it travels from a rarer to a non-reflecting and non-absorbing medium

- (1) either increases or decreases depending upon angle of incidence
 (2) decreases
 (3) remains same
 (4) increases

KEY : Answer (3)

Sol : Since, the frequency of light rays remains the same, hence the total energy remains unchanged ($E = hf$)

56. If the radius of first Bohr orbit is r , then the radius of the second Bohr orbit will be

- (1) $2\sqrt{2}r$ (2) $2r$
 (3) $8r$ (4) $4r$

Key : Answer (4)

Sol : $r_n = r_0 \frac{n^2}{Z}$

$\therefore r_2 = \left(\frac{r_0}{Z}\right) 2^2$

$= 4r$

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