K-CET EXAMINATION – 2026

PHYSICS – D4 with Key & Solutions

1. Instrument fitted in the carburetor of the automobile to provide the correct mixture of air and fuel necessary for combustion works on
   (1) Pascal's Law
   (2) Bernoulli's Principle
   (3) Newton's Law of Cooling
   (4) Archimedes' Principle

Ans. (2)

Sol. $p + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$

Carburetor works based on Bernoulli's principle. As velocity v increases, pressure p decreases and this pressure difference pulls fuel into air stream correct mixture for combustion.

2. There are two wires of same material and same length while the diameter of second wire is two times the diameter of the first wire. Then the ratio of extensions produced in the wires by applying same load will be
   (1) 1:1 (2) 1:2
   (3) 2:1 (4) 4:1

Ans. (4)

Sol. $\Delta L = \frac{FL}{AY}$

$\Delta L = \frac{4FL}{\pi D^2 Y}$

$\Delta L \propto \frac{1}{D^2}$

$\frac{\Delta L_1}{\Delta L_2} = \left(\frac{D_2}{D_1}\right)^2 = 4:1$

3. In a capillary tube experiment, a vertical 30 cm long capillary tube is dipped in water, water rises upto a height of 10 cm due to capillarity. If this experiment is conducted in a freely falling water in an elevator, then the length of the water column becomes
   (1) 10 cm (2) 20 cm
   (3) 30 cm (4) Zero

Ans. (3)

Sol. $h = \frac{2T\cos\theta}{r\rho g}, h \propto \frac{1}{g}$

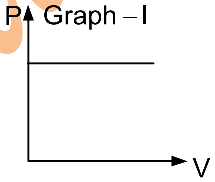
As elevator falls freely, $h \to \infty$ but liquid will not overflow as meniscus of liquid will be adjusted at the top.

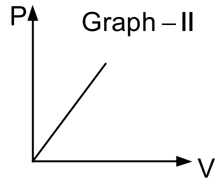
4. In thermodynamic processes, which of the following statements is not true?
   (1) In an isothermal process, the temperature remains constant
   (2) In an isobaric process, the volume remains constant
   (3) In an adiabatic process, the system is insulated from the surroundings
   (4) In an adiabatic process, PV^γ = a constant

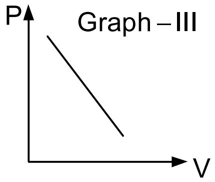
Ans. (2)

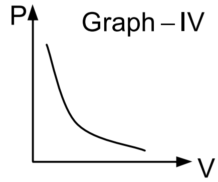
Sol. In isobaric process, pressure remains constant.

5. The graph of pressure P and volume V of 1 mole of an ideal gas at constant temperature is

(1)


(2)


(3)


(4)


Ans. (4)

Sol. Ideal gas equation pv = nRT

Here, n = 1, R and T are constants

$\therefore P \propto \frac{1}{V}$ (rectangular hyperbola).

6. A mass of 1 kg is executing SHM. Its displacement is given by x = 6.0 cos $(100t + \pi/4)$cm. What is the maximum kinetic energy?
   (1) 3 J
   (2) 6 J
   (3) 9 J
   (4) 18 J

Ans. (4)

Sol. $(KE)_{max} = \frac{1}{2}m\omega^2 A^2$

$= \frac{1}{2}(1)(100)^2(6 \times 10^{-2})^2$

$= 18J$.

7. A source of frequency ν gives 6 beats/second when sounded with a source of frequency 200 Hz. The second Harmonic of frequency 2ν of the source gives 8 beats/second when sounded with a source of frequency 420 Hz. The value of ν is

(1) 205 Hz (2) 206 Hz
(3) 195 Hz (4) 210 Hz

Ans. (2)

Sol. beats

$f_b = |f_1 - f_2|$

In 1st case, for frequency ν, beats = 6

f_1 = 206 or 194 Hz …..(1)

In 2nd case for frequency 2ν, beats = 8

$2f_1$= 412 or 388 Hz …..(2)

When compared with 420 Hz

The option is f_1 = 206 Hz.

8. Following are statements of a few processes taking place in nature.

I. Free expansion of a gas
II. The combustion of a mixture of petrol and air ignited by a spark
III. The leaking of gas from the kitchen cylinder
IV. The transfer of heat from one heated part of a liquid to the other colder part

Which amongst these processes are irreversible in nature?

(1) I and II (2) III and IV
(3) II, III and IV (4) I, II, III and IV

Ans. (4)

Sol. All these four processes are irreversible and are possible to occur in nature.

9. An electron falls through a distance 1.5 cm in a uniform electric field of magnitude 2.0×10^4 N/C from rest. The time taken to cover this distance in second is ________

($e = 1.6 \times 10^{-19}$ C, $m_e = 9.11 \times 10^{-31}$ kg)

(1) 2.9×10^{-9} (2) 2.9×10^{9}
(3) 4×10^{-6} (4) 4×10^{6}

Ans. (1)

Sol. Equations of motions

$$S = \frac{1}{2}at^2, a = \frac{F}{m} = \frac{Ee}{m}$$

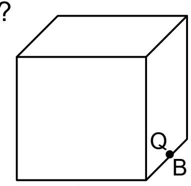
$$S = \frac{1}{2}\frac{eEt^2}{m}$$

$$t = \sqrt{\frac{2sm}{eE}} = \sqrt{\frac{2x1.5x10^{-2}x9.11x10^{-31}}{1.6x10^{-19}x2x10^4}}$$

$$= \sqrt{8.54x10^{-18}} = 2.9x10^{-9}s.$$

10. What will be the total electric flux through the faces of the cube as given in the figure with side of length 'a' if a charge Q is placed at B, midpoint of an edge of the cube (see figure)?

(1) $\frac{Q}{8\varepsilon_0}$ (2) $\frac{Q}{3\varepsilon_0}$
(3) $\frac{Q}{4\varepsilon_0}$ (4) $\frac{Q}{2\varepsilon_0}$



Ans. (3)

Sol. Gauss law

Total flux, $\phi_{total} = \frac{q_{net}}{\varepsilon_0}$

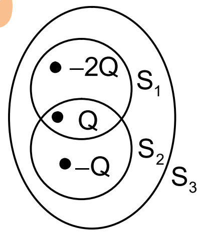
Here we need four similar cubes to enclose the charge.

$\therefore$ Flux through each cube will be $\frac{1}{4}^{th}$ of total flux

$$\phi = \frac{\phi_{total}}{4} = \frac{\frac{Q}{\varepsilon_0}}{4} = \frac{Q}{4\varepsilon_0}.$$

11. Consider three point charges - 2Q, Q and - Q and three surfaces S_1, S_2 and S_3 as shown in the figure. Match the entries of List-I with that of List-II.

List-I	List-II
(a) Net flux through S_1	(i) $\frac{-2Q}{\epsilon_0}$
(b) Net flux through S_2	(ii) $\frac{-Q}{\epsilon_0}$
(c) Net flux through S_3	(iii) Zero



Codes:

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

Ans. (4)

Sol. Electric flux = $\frac{Q_{enclosed}}{\varepsilon_0}$

a. Net flux through $S_1 = \frac{-2Q+Q}{\varepsilon_0} = -\frac{Q}{\varepsilon_0}$....(ii)

b. Net flux through $S_2 = \frac{Q-Q}{\varepsilon_0} = 0$...(iii)

c. Net flux through $S_3 = \frac{-2Q+Q-Q}{\varepsilon_0} = -\frac{2Q}{\varepsilon_0}$...(i)

12. A parallel plate capacitor has a uniform electric field 'E' in the space between the plates. If the distance between the plates is 'd' and area of each plate is 'A', the energy stored in the capacitor is

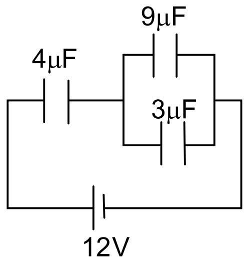
(1) $\frac{1}{2}\epsilon_0 E^2$ (2) $\epsilon_0 EAd$
(3) $\frac{1}{2}\epsilon_0 E^2Ad$ (4) $\frac{E^2Ad}{\epsilon_0}$

Ans. (3)

Sol. Energy stored in capacitor = $\frac{1}{2}cv^2$

$$U = \frac{1}{2}\frac{\varepsilon_0 A}{d}(Ed)^2 = \frac{1}{2}\varepsilon_0 E^2 Ad$$

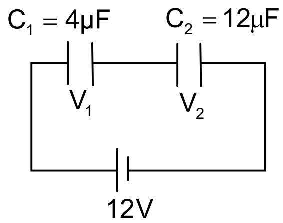
13. In the circuit shown in the figure, the potential difference across the 4μF capacitor is



(1) 3V (2) 4V
(3) 9V (4) 12 V

Ans. (3)

Sol. Q = CV



For parallel C_2 = 9 + 3 = 12 μF

$$V_1 = \frac{C_2 V}{C_1 + C_2} = \frac{12 \times 12}{16} = 9V$$

P.D. across 4μF = 9V

14. An electric dipole of dipole moment $\vec{P}$ is placed in the uniform electric field $\vec{E}$. Then which of the following statements are correct?

Statement I: The torque on the dipole is $\vec{P}\times\vec{E}$

Statement II: The potential energy of the dipole is $-\vec{P}.\vec{E}$

Statement III: The net force on the dipole is non zero

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

Ans. (2)

Sol. For dipole $\tau = \vec{P}\times\vec{E}$ and $U = -\vec{P}.\vec{E}$

Statement I: The torque on the dipole is $\vec{P}\times\vec{E}$ - correct

Statement II: The potential energy of the dipole is $-\vec{P}.\vec{E}$ correct

Statement III: In uniform electric field net force on the dipole is zero hence --- incorrect

15. A 200 J of work is done in moving a charge 5C from a point A where the potential is - 20V to another point B where potential is V volt. The value of V at B is

(1) 10 V (2) 20 V
(3) 40 V (4) 60 V

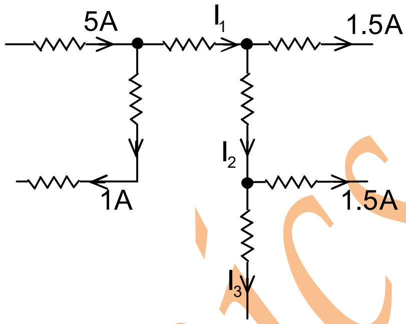
Ans. (2)

Sol. $W = Q(\Delta V)$

$$200 = 5(V_B - V_A) = 5(V_B - (-20))$$

$V + 20 = 40$ or, V =20

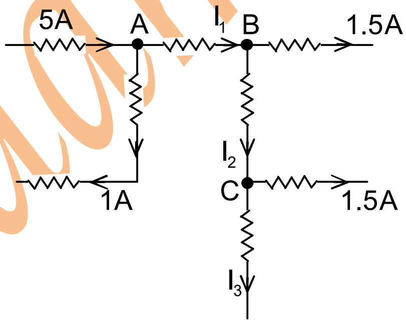
16. In the figure, the values of currents I_1, I_2 and I_3 respectively are



(1) 6A, 1.5A and 1A (2) 4A, 2.5A and 2A
(3) 4A, 2.5A and 1A (4) 6A, 4.5A and 1.5A

Ans. (3)

Sol. Kirchhoff current rule:-



At junction A

$5 = I + I_1 \Rightarrow I_1 = 4A$

at junction B

$I_1 = I_2 + 1.5$

$4 = I_2 + 1.5$

$I_2 = 2.5A$

At junction C

$I_2 = I_3 + 1.5$

$2.5 = I_3 + 1.5$

$I_3 = 1A$

17. The number of electrons moving per second through the filament of a lamp of 60 W operating at 120 V is nearly ($e = 1.6\times10^{-19}$ C)________

(1) 6.2×10^{18}

(2) 6.2×10^{19}

(3) 3.1×10^{18}

(4) 3.1×10^{19}

Ans. (3)

Sol. P = VI

$$I = \frac{P}{V} = \frac{60}{120} = 0.5\ A \Rightarrow \quad n = \frac{It}{e}$$

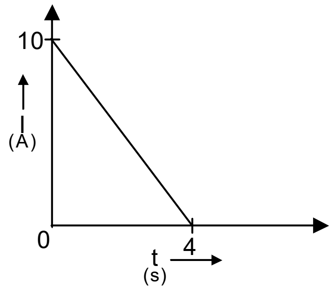
$$n = \frac{0.5\times1}{1.6\times10^{-19}} = \frac{5}{1.6}\times10^{18} = 3.1\times10^{18}$$

18. Given below are two statements:
Statement I: The resistivity of a conductor is independent of its temperature
Statement II: The resistivity of a semiconductor decreases with increase in temperature
Select the correct option.
(1) Both Statement I and Statement II are false
(2) Both Statement I and Statement III are true
(3) Statement I is true but Statement II is false
(4) Statement I is false but Statement II is true

Ans. (4)

Sol. Statement I: the resistivity of a conductor is increase with increasing temperature
Statement II: The resistivity of semiconductor decreases with increase in temperature due to charge current (electron-hole pair) increase

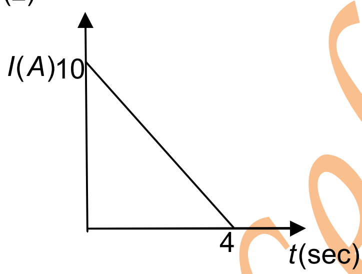
19. Current flowing through a wire decreases linearly from 10 A to zero in 4s as shown in the graph. Find the total charge flowing through the wire in the given time interval.



(1) 40 C (2) 20 C
(3) 10 C (4) 80 C

Ans. (2)

Sol.



Q = Area of I–t graph

$Q = \frac{1}{2} \times 10 \times 4 = 20\,C$

20. In a conducting region, 10^{19} electrons and 10^{19} protons move to the left, while 10^{19} $\alpha-$ particles move to the right per second. The resulting electric current is $(e = 1.6 \times 10^{-19} C)$
(1) 3.2 A towards left
(2) 3.2 A towards right
(3) 1.6 A towards left
(4) 1.6 A towards right

Ans. (2)

Sol. $I = (I_e + I_\alpha)_{Right} - (I_p)_{Left}$

$= (e \times 10^{19} + 2e \times 10^{19})_{Right} - (e \times 10^{19})_{Left}$

$= (3e \times 10^{19})_{Right} - (e \times 10^{19})_{Left}$

$= (2e \times 10^{19})_{Right}$

= 3.2 A (the right)

21. A point charge is placed in a moving train. A passenger A sitting in the train and person B on the ground observe the fields due to this charge. Then
(1) A observes both electric and magnetic fields
(2) B observes both electric and magnetic field
(3) A observes only magnetic field
(4) B observes only electric field

Ans. (2)

Sol: With respect to 'B' Charge is moving, So, moving charge produces both electric and magnetic fields

22. A proton, an electron and an α-particle enter at right angles to a uniform magnetic field with the same velocity. If R_p, R_e and R_α are the radii of circular paths of these particles, then
(1) $R_\alpha = R_p = R_e$ (2) $R_\alpha > R_p > R_e$
(3) $R_\alpha < R_p < R_e$ (4) $R_\alpha > R_p = R_e$

Ans. (2)

Sol. $R = \frac{mv}{Bq}$, $R \; \alpha \; \frac{m}{q}$

$R_p \; \alpha \; \frac{m_p}{e}$, $R_e \; \alpha \; \frac{m_p}{1836e}$

$R_\alpha \; \alpha \; \frac{4m_p}{2e} \; \alpha \; \frac{2mp}{e}$

$R_\alpha > R_p > R_e$

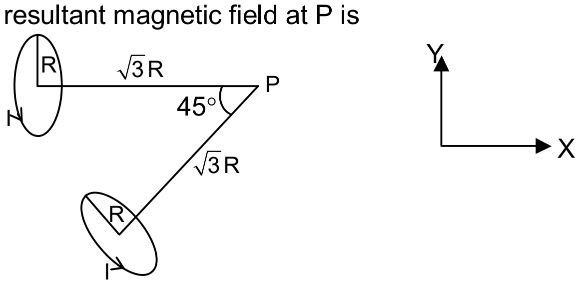
23. Biot-Savart law indicates that an electron moving with a velocity $\vec{V}$ produces a magnetic field $\vec{B}$ around it such that
(1) $\vec{B}$ is parallel to $\vec{V}$
(2) $\vec{B}$ is perpendicular to $\vec{V}$
(3) $\vec{B}$ is anti- parallel to $\vec{V}$
(4) $\vec{B}$ is inclined to $\vec{V}$ by 45^0

Ans. (2)

Sol. $\vec{B} = \frac{\mu_0}{4\pi} q \frac{(\vec{v} \times \vec{r})}{r^3}$,

$\vec{B}$ is perpendicular to $\vec{v}$

24. Two identical circular current loops carrying equal currents are placed with their axes inclined at 45^0 to each other as shown in the figure. The resultant magnetic field at P is



(1) $\frac{\mu_0 I}{16\sqrt{2}R}\left[(\sqrt{2}+1)\hat{i}+\hat{j}\right]$

(2) $\frac{\mu_0 I}{16\sqrt{2}R}\left[(\sqrt{2}\hat{i}+\hat{j}\right]$

(3) $\frac{\mu_0 I}{16R}\left[(\sqrt{2}+1)\hat{i}+\hat{j}\right]$ (4) $\frac{\mu_0 I}{16R}\left[(\sqrt{2}\hat{i}+\hat{j}\right]$

Ans. (1)

Sol. $B = \dfrac{\mu_0 i R^2}{2(R^2 + x^2)^{3/2}}$

At $X = \sqrt{3}R$

$B_0 = \dfrac{\mu_0 i}{16R}$

$B_1 = B_0\,\hat{i}$

$B_2 = B_0(\text{Cos}45\,\hat{i} + \text{Sin}45\,\hat{j}) = \dfrac{B_o}{\sqrt{2}}\hat{i} + \dfrac{B_o}{\sqrt{2}}\hat{j}$

$B_{net} = B_1 + B_2$

$= \left(B_o + \dfrac{B_o}{\sqrt{2}}\right)\hat{i} + \dfrac{B_o}{\sqrt{2}}\hat{j}$

$= \dfrac{\mu_o i}{16\sqrt{2}R}\left[\left(\sqrt{2}+1\right)\hat{i} + \hat{j}\right]$

25. If a paramagnetic bar is brought near a bar magnet, then it is
(1) Attracted by both the poles of the bar magnet
(2) Repelled by both the poles of the bar magnet
(3) Attracted by the South-pole and repelled by the North-pole of the bar magnet
(4) Attracted by the North-pole and repelled by the South-pole of the bar magnet

Ans. (1)

Sol. If a paramagnetic bar is brought near a bar magnet, then it is attracted by both the poles of the bar magnet.

26. Pick our the WRONG statements about magnetic substances
(χ =magnetic susceptibility) (μ_r=relative permeability).
I. Substances with $-1 \le \chi < 0$ are diamagnetic
II. Substances with $\chi >> 1$ are paramagnetic
III. Substances with $\chi << 1$ are ferromagnetic
IV. Substances with $\mu_r >> 1$ are ferromagnetic

(1) I and II (2) III and IV
(3) II and III (4) II and IV

Ans. (3)

Sol. $-1 \le \chi < 0 \rightarrow$ Diamagnetic

$\chi >> 1 \rightarrow$ Ferromagnetic

$\chi << 1 \rightarrow$ Diamagnetic

$\mu_r >> 1 \rightarrow$ Ferromagnetic

27. Work function of the metal is
(1) Maximum possible energy acquired by an electron
(2) Equal for all metals
(3) Minimum energy required by an electron to just eject from metal surface
(4) Maximum energy which is given to electron to move out of metal surface

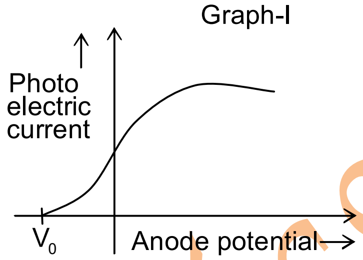
Ans. (3)

Sol. Work function of the metal is minimum energy required by an electron to just eject from metal surface

28. Variation of photoelectric current with anode potential is shown below. Choose the correct option (V_0 = stopping potential).

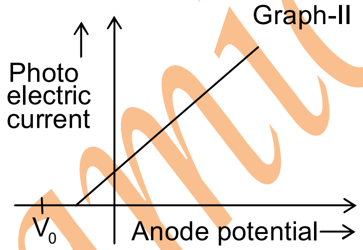
Graph-I

(1)



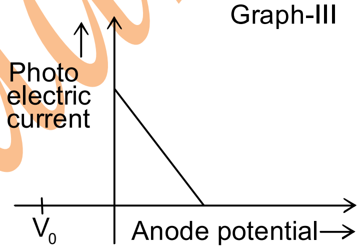
Graph-II

(2)



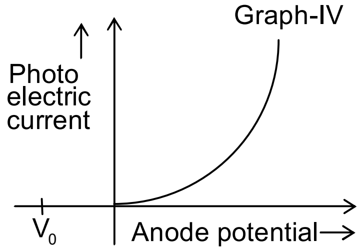
Graph-III

(3)



Graph-IV

(4)



Ans. (1)

Sol. As positive potential given to anode increases then photo current increases upto saturation level. When negative potential given to anode, then photo current decreases and become zero stopping potential.

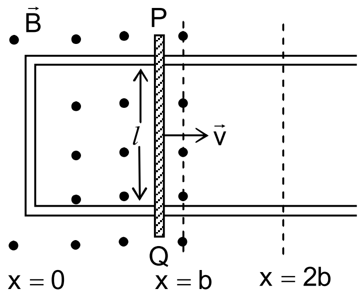
29. In Faraday-Henry's experiment, a coil is connected to a galvanometer. For the deflection of pointer in the galvanometer, which of the following statement/s is/are WRONG?
The pointer in the galvanometer deflects –
(a) When the bar magnet is moved towards the stationary coil along its axis
(b) When the bar magnet is moved away from the stationary coil along its axis
(c) When the coil is moved towards the stationary bar magnet along its axis
(d) When the coil and the magnet are moved without relative motion between them

(1) a and b (2) b and c
(3) a, b and c (4) only d

Ans. (4)

Sol. The pointer in the galvanometer does not deflects when the coil and the magnet are moved without relative motion between them.

30. In the figure shown, the conductor PQ of length l is moved from x = 0 to x = b and then up to x = 2b with a constant velocity $\vec{v}$. A uniform magnetic field $\vec{B}$ is perpendicular to the plane of the paper and extends from x = 0 to x = b and it is zero from x > b. The magnitude of emf induced in the conductor is



(1) $B\,l\,x\,;\,0 \le x < b$ (2) Zero ; $0 \le x < b$

(3) $B\,l\,v\,;\,0 \le x \le b$ (4) $B\,l\,v\,;\,b \le x < 2b$

Ans. (3)

Sol. e = Blv

for a conductor moving through a uniform magnetic field region, $(0 \le x \le b)$ the magnitude of the e.m.f remains constant as long as B, l and v are constant. If the conductor is outside the field, emf is zero.

31. In a circuit containing a pure resistor connected to an AC source,

(1) Voltage leads the current by 90°
(2) Current leads the voltage by 90°
(3) Voltage and current are in same phase with each other
(4) Current leads the voltage by 180°

Ans. (3)

Sol. Pure resistor. No phase difference between Voltage and Current.

32. A light bulb rated 100W is connected to an AC source of 220 V, 50 Hz. The rms current through the bulb is

(1) 0.454A (2) 0.545A
(3) 2.20A (4) 0.22A

Ans. (1)

Sol. P= VI$\Rightarrow$ 100= 220I$\Rightarrow$ $I = \frac{100}{220} = 0.454A$

33. A small town with a demand of 900 kW of electric power at 220V is situated 20 km away from an electric power generating station. The two–wires line has resistance per unit length of $5\times10^{-4}\,\Omega m^{-1}$. The town gets power from the line through 45000 V to 220V step down transformer at a substation in the town. The line power loss in the form of heat is

(1) 4 kW (2) 8 kW
(3) 40 kW (4) 80 kW

Ans. (2)

Sol. $\frac{R}{L} = 5x10^{-4}\,\Omega m^{-1}$

$R = 5x10^{-4}\,x2L$

$R = 5\times10^{-4}\times20\times10^{3}\times2$

$R = 20\Omega$

$P = VI$

$I = \frac{P}{V} = \frac{900x10^{3}}{45000} = 20A$

$P = I^2\times R$

$P = (20)^2\times20$

$P = 400\times20$

$P = 8\times10^{3}$

P= 8 kW

34. Match the following Maxwell's equations: (The symbols used here have their usual meanings)

List – I		List – II	
(a)	Gauss's law for electrostatics	(i)	$\oint\vec{E}.d\vec{A} = \frac{Q}{\varepsilon_0}$
(b)	Gauss's law for magnetism	(ii)	$\oint\vec{B}.d\vec{l} = \mu_0\left[i_c + \varepsilon_0\frac{d\phi_E}{dt}\right]$
(c)	Faraday's law	(iii)	$\oint\vec{B}.d\vec{A} = 0$
(d)	Ampere–Maxwell's law	(iv)	$\oint\vec{E}.d\vec{l} = -\frac{d\phi_B}{dt}$

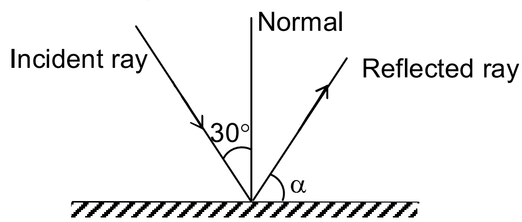
Codes:

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

Ans. (1)

Sol. According to Maxwell equations of E.M. theory.

35. With reference to the figure shown below, match the following:



List – I		List – II	
(a)	Angle of reflection	(i)	60°
(b)	Value of α	(ii)	120°
(c)	Angle of deviation	(iii)	30°

Codes:

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

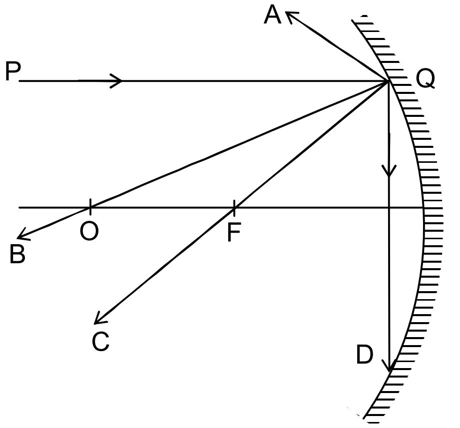
Ans. (3)

Sol. $\angle i = \angle r = 30^0$

$\alpha = 90^0 - 30^0 = 60^0$

$\delta = 180^\circ - 2I = 180^\circ - 2(30^\circ) = 120^\circ$

36. The direction of a ray of light incident on a concave mirror is shown by PQ, while direction in which the ray would travel after reflection is shown by four rays marked as A, B, C and D as shown in the figure. Which of the four rays correctly shows the direction of the reflected ray?



(1) D (2) C
(3) B (4) A

Ans. (2)

Sol. The parallel light ray, after reflection it must be process through focus point.

37. The incorrect statement about refractive index for a pair of media is
(1) It depends upon nature of the first medium
(2) It depends upon nature of the second medium
(3) It depends upon wavelength of light
(4) It depends upon angle of incidence

Ans. (4)

Sol. $\mu = \frac{c}{\upsilon} \Rightarrow \frac{\mu_1}{\mu_2} = \frac{\lambda_2}{\lambda_1}$

So, independent of angle of incidence

38. The critical angle for a monochromatic light going from medium A to medium B is θ. If the speed of light in medium A is V, then the speed of light in medium B is
(1) $V(1-\cos\theta)$
(2) $\frac{V}{\cos\theta}$
(3) $\frac{V}{\sin\theta}$
(4) $V(1-\sin\theta)$

Ans. (3)

Sol. $\sin\theta_c = \frac{\mu_R}{\mu_D} = \frac{V_D}{V_R}$ $\sin\theta_c = \frac{V}{V_B}$

$V_B = \frac{V}{\sin\theta}$

39. What range of electromagnetic spectrum is considered as light?
(1) 1 mm to 700 nm
(2) 400 nm to 1 nm
(3) 400 nm to 700 nm
(4) 1 nm to 10^{-3} nm

Ans. (3)

Sol. Wavelength of visible light 400 nm to 700 nm

40. In Young's double slit experiment, how many maxima can be seen on a screen (including central maxima) if $d = \frac{5\lambda}{2}$ (where λ is wavelength of light and 'd' is distance between the two slits)
(1) 5 (2) 4
(3) 7 (4) 1

Ans. (1)

Sol. $d\sin\theta = n\lambda$

for maximum $\theta = 90^0$ $\sin 90^0 = 1$

$d = n\lambda$ $\frac{5\lambda}{2} = n\lambda \Rightarrow n = \frac{5}{2}$

No. of maximas N= 2(n)

2 (5/2) = 5

$0, \pm1, \pm2$

41. The radius of first orbit in hydrogen atom is 5.3 × 10^{-11} m. The kinetic energy E_K, potential energy E_P, and total energy E_T of electron in first orbit are
(1) $E_K = -13.6$eV, $E_P = 27.2$ eV, $E_T = 13.6$eV
(2) $E_K = 13.6$eV, $E_P = -27.2$ eV, $E_T = -13.6$eV
(3) $E_K = -27.2$ eV, $E_P = -13.6$ eV, $E_T = 13.6$ eV
(4) $E_K = 13.6$ eV, $E_P = -6.8$ eV, $E_T = -13.6$ eV

Ans. (2)

Sol. * for 1st orbit of H–atom TE=–13.6eV

*Relation between KE ,PE and TE is

KE: PE: TE = 1: –2 : –1

∴ KE = 13.6 eV

PE = –27.2 eV

TE = –13.6 eV

42. Bohr's second postulate implies quantization of
(1) Charge of an electron
(2) Energy of an electron
(3) Angular momentum of electron
(4) Radiated energy by an electron

Ans. (3)

Sol. Bohr's 2nd postulate implies quantization angular momentum of electrons

43. An electron transition takes place from excited state to ground state in hydrogen atom, then
(1) Its kinetic energy increases but potential energy and total energy decrease
(2) Its kinetic energy, potential energy and total energy decrease
(3) Kinetic energy decreases, potential energy increases but total energy remains same
(4) Kinetic energy and total energy decrease but potential energy increases

Ans. (1)

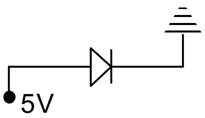
Sol. Kinetic energy increases and PE and Total energy decreases.

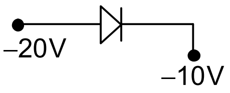
44. An n–type and p–type semiconductor can be obtained by respectively doping pure silicon with
(1) Arsenic and Phosphorous respectively
(2) Indium and Aluminium respectively
(3) Phosphorous and Indium respectively
(4) Aluminium and Boron respectively

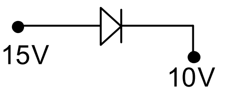
Ans. (3)

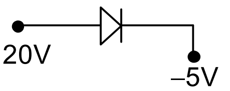
Sol. * n–type formed due to doping with penta valent impurity atoms
Ex: Phosphorous
- p–Type formed by doping with trivalent impurity atoms
Ex: Indium

45. In which of the following figures, diode is reverse biased?

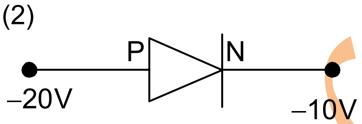
(1) 

(2) 

(3) 

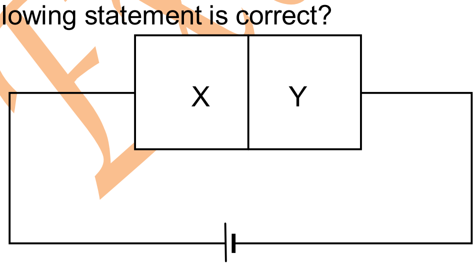
(4) 

Ans. (2)

Sol. 

For reverse bias P–type $\rightarrow$ low potential
n–type $\rightarrow$ high potential
i.e, –10 V > –20 V

46. A wafer of pure germanium crystal has two parts X and Y. The end X is obtained by doping with arsenic and Y with indium. It is connected to a battery as shown in the figure. Which of the following statement is correct?

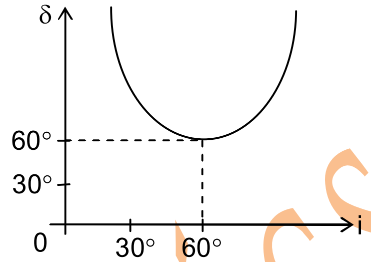


(1) X is p–type, Y is n–type and the junction is forward biased
(2) X is n–type, Y is p–type and the junction is forward biased
(3) X is p–type, Y is n–type and the junction is reverse biased
(4) X is n–type, Y is p–type and the junction is reverse biased

Ans. (4)

Sol. $\rightarrow$ X with arsenic i.e. X $\rightarrow$ n–type
$\rightarrow$ Y with indium i.e, Y $\rightarrow$ p–type
$\therefore$ Junction is Reversebiased

47. From the graph of angle of deviation versus angle of incidence for an equilateral prism, the refractive index of material of prism is



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

Ans. (3)

Sol. * $A = 60^0$

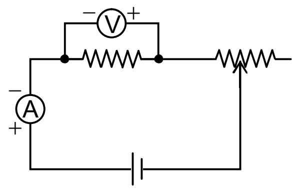
$\delta_{min} = 60^0$

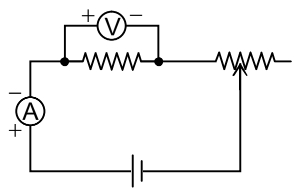
$$\mu = \frac{\sin\left(\frac{A+\delta_{min}}{2}\right)}{\sin\left(A/2\right)}$$

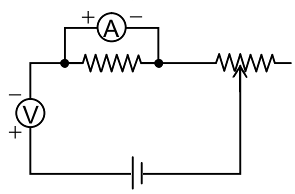
$$\frac{\sin 60^0}{\sin 30^0} = \frac{\sqrt{3}/2}{1/2}$$

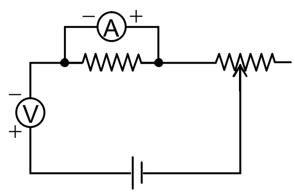
$\mu = \sqrt{3}$

48. Which of the following circuits is correct for verification of Ohm's law?

(1) 

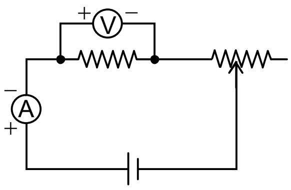
(2) 

(3) 

(4) 

Ans. (2)

Sol. * Ohms Law
Ammeter in series, voltameter in parallel so



49. Match the physical quantities given in List–I with dimensions expressed in terms of mass(M), length (L), time (T) and electric current (A) given in List–II.

List–I		List–II	
a	Torque	i	$[M^{-1}L^{-2}T^{4}A^{2}]$
b	Gravitational constant	ii	$[M^{1}L^{2}T^{-1}]$
c	Capacitance	iii	$[M^{-1}L^{3}T^{-2}]$
d	Planck's constant	iv	$[M^{1}L^{2}T^{-2}]$

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

Ans. (2)

Sol. a) Torque $\to [M^{1}L^{2}T^{-2}]$
b) Gravitational constant $\to [M^{-1}L^{3}T^{-2}]$
c) Capacitance $\to [M^{-1}L^{-2}T^{4}A^{2}]$
d) Planck's constant $\to [M^{1}L^{2}T^{-1}]$
a $\to$ iv; b $\to$ iii, c $\to$ i; d $\to$ ii

50. A car covers the first half of the distance between two places at 40 km/h and another half at 50 km/h. The average speed of the car is
(1) 45.00 km/h (2) 44.44 km/h
(3) 43.14 km/h (4) 42.04 km/h

Ans. (2)

Sol. * $V_{avg} = \dfrac{2V_1V_2}{V_1+V_2}$

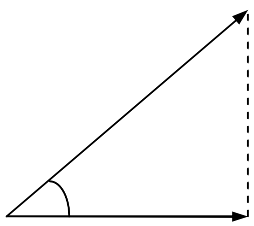
$\dfrac{2x40x50}{40+50}$

$= \dfrac{2x40x50}{90}$

$= \dfrac{400}{9}$

V_{avg} = 44.4 Km/h

51. Two bodies are projected with the same velocity. If one is projected at an angle of 30° and the other at 45° to the horizontal, then the ratio of maximum heights attained is



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

Ans. (2)

Sol. $H = \dfrac{u^2 \sin^2\theta}{2g}$

$\dfrac{H_1}{H_2} = \dfrac{\sin^2\theta_1}{\sin^2\theta_2}$

$\dfrac{H_1}{H_2} = \dfrac{\sin^2 30^\circ}{\sin^2 45^\circ}$

$= \dfrac{\frac{1}{4}}{\frac{1}{2}} = \dfrac{1}{2}$

52. The velocity of a particle moving along x – axis is given as V = x^2 – 5x + 4 (in m/s) where x denotes the x – coordinate of the particle in metres. The magnitude of the acceleration of the particle when the velocity of the particle zero is
(1) 2 m/s^2 (2) 3 m/s^2
(3) Zero (4) 1 m/s^2

Ans. (3)

Sol. Given velocity = 0
i.e. x^2 – 5x + 5 = 0
(x – 4) (x – 1) = 0
x = 1, x = 4

$a = \dfrac{dv}{dt} = \dfrac{dv}{dx}\cdot\dfrac{dx}{dt}$

$= \dfrac{d}{dx}(x^2 - 5x + 4).V$

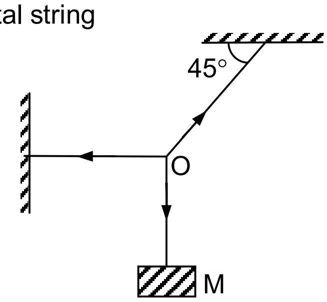
a = (2x – 5) (x^2 – 5x + 4)
at x = 1, a = 0
at x = 4, a = 0

53. A man weighs 80 kg. He stands on a weighing scale in the lift which is moving upwards with a uniform acceleration of 6 m/s^2. What would be his weight in Kg? (g = 10 m/s^2)
(1) Zero (2) 48 kg
(3) 120 kg (4) 128 kg

Ans. (4)

Sol. $W' = m(g+a)$
= 80 (10 + 6)
= 1280 N = 128 kg. wt

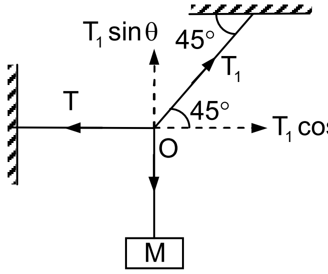
54. A mass M is hung with a light inextensible string as shown in figure. Find the tension of the horizontal string



(1) $\sqrt{2}$Mg (2) $\sqrt{3}$Mg
(3) Mg (4) 3 Mg

Ans. (3)

Sol.



$T_1 \sin \theta = Mg$

$T_1 = \sqrt{2} Mg$

Then $T = T_1 \cos\theta$

$= \sqrt{2} Mg \times \frac{1}{\sqrt{2}} = Mg$

55. Two bodies with kinetic energies in the ratio of 3 : 1 are moving with equal linear momentum. The ratio of their masses is

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

Ans. (2)

Sol. $K = \frac{P^2}{2m}$

$K \propto \frac{1}{m}$

$\frac{K_1}{K_2} = \frac{m_2}{m_1}$

$\frac{3}{1} = \frac{m_2}{m_1}$

$\therefore m_1 : m_2 = 1 : 3$

56. A horizontal force of 5N is applied on a stationary body of mass 5 kg, which is initially at rest on a frictionless table. The change in kinetic energy of the body in 10s is

(1) 25 J (2) Zero
(3) 125 J (4) 250 J

Ans. (4)

Sol. F = ma

$a = \frac{F}{m} = 1\, m/s^2$

From v = u + at

V = 10 m/s

$\Delta K = \frac{1}{2} mv^2 - \frac{1}{2} mu^2$

$\Delta K = 250\, J$

57. The angular momentum of a moving body remains constant, if

(1) net external force is applied
(2) net pressure is applied
(3) net external torque is applied
(4) net external torque is not applied

Ans. (4)

Sol. According to conservation of angular momentum

If $\tau = 0, \frac{dL}{dt} = 0 \Rightarrow L = \text{constant}$

58. If the earth were to suddenly contract to half of its present radius, what would be the duration of the day?

(1) 6 h (2) 18 h
(3) 24 h (4) 30 h

Ans. (1)

Sol. According to conservation of angular momentum

$I_1 \omega_1 = I_2 \omega_2$

$\Rightarrow \frac{2}{5} MR^2 \times \frac{2\pi}{T_1} = \frac{2}{5} M \left(\frac{R}{2}\right)^2 \times \frac{2\pi}{T_2}$

$\Rightarrow T_2 = \frac{T_1}{4} = \frac{24}{4} = 6\,\text{hours}$

59. Imagine a new planet having the same density as that of the earth, but it is two times bigger than the earth in size. If the acceleration due to gravity on the surface of the earth is g and that on the surface of the new planet is g', then

(1) $g' = \frac{g}{4}$ (2) $g' = 8g$
(3) $g' = 2g$ (4) $g' = 4g$

Ans. (3)

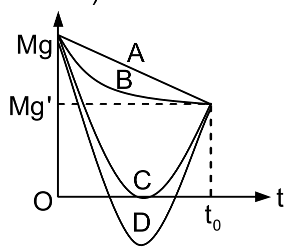
Sol. $g = \frac{4}{3} \pi G \rho R$

$g \propto R$

$\frac{g'}{g} = \frac{2R}{R}$

$g' = 2g$

60. Suppose the acceleration due to gravity at the earth's surface is g m/s^2 and at the surface of moon it is g' m/s^2. An M kg passenger goes from the earth to moon in the spaceship moving with a constant velocity (Neglect all other objects in the sky). Which curve best represents the weight (net gravitational force) as a function of time?



(1) A (2) B
(3) C (4) D

Ans. (3)

Sol. $g \propto \frac{1}{r^2}$

Initially w = mg and decreases to zero at null point, then increases to $w = mg'$