CET – PHYSICS – 2011

VERSION CODE: A – 4

1. If C be the capacitance and V be the electric potential, then the dimensional formula of CV^2 is

   1) $M^1 L^{-3} T^1 A^1$ 2) $M^0 L^1 T^{-2} A^0$

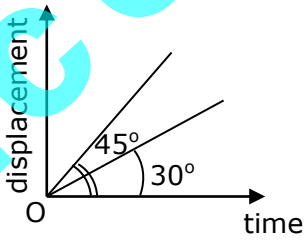
   3) $M^1 L^1 T^{-2} A^{-1}$ 4) $M^1 L^2 T^{-2} A^0$

Ans: (4)

CV^2 = Energy $\therefore$ The dimentional formula is

$ML^2 T^{-2}$

2. The displacement-time graphs of two moving particles make angles of 30^o and 45^o with the X-axis. The ratio of their velocities is .....



   1) 1: $\sqrt{3}$

   2) 1: 2

   3) 1: 1

   4) $\sqrt{3}$: 2

Ans: (1)

Slope of displacement time graph is velocity

$$\frac{v_1}{v_2} = \frac{Tan\theta_1}{Tan\theta_2} = \frac{Tan30^0}{Tan45^0} = 1 : \sqrt{3}$$

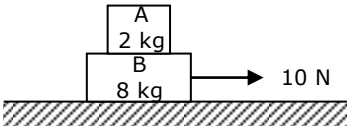
3. Block A of mass 2 kg is placed over block B of mass 8 kg. The combination is placed over a rough horizontal surface. Coefficient of friction between B and the floor is 0.5. Coefficient of friction between A and B is 0.4. A horizontal force of 10 N is applied on block B. The force of friction between A and B is .....

   1) zero

   2) 50 N

   3) 40 N

   4) 100 N



Ans: (1)

Net frictional force between block and surface is

$F = \mu (R) = 0.5 \times 10 \times 10 = 50$ N

Applied force is 10N and it is less than 50 N

$\therefore$System is at rest and No friction between A and B

4. The height y and the distance x along the horizontal plane of a projectile on a certain planet (with no surrounding atmosphere) are given by $y = 8t - 5t^2$ metre and $x = 6t$ metre, where t is in seconds. The velocity with which the projectile is projected is .....

   1) 14 ms^{-1} 2) 10 ms^{-1} 3) 8 ms^{-1} 4) 6 ms^{-1}

Ans: (2)

$x = (u \cos\theta)\, t = 6$

$u \cos\theta = \frac{x}{t} = 6$

$y = (u \sin\theta)t = -\frac{1}{2} gt^2$

$y = 8t - 5t^2 \Rightarrow u \sin\theta = 8$

$\therefore u = 10$ m/s

5. A body of mass 5 kg is thrown vertically up with a kinetic energy of 490 J. The height at which the kinetic energy of the body becomes half of the original value is .....

1) 12.5 m 2) 10 m 3) 2.5 m 4) 5 m

Ans: (4)

According to law of conservation of energy

$\frac{1}{2} mu^2 = \frac{1}{2} mv^2 + mgh$

$490 = 245 + 5 \times 9.8 \times h$

$h = \frac{245}{49} = 5$m

6. A solid sphere of mass m rolls down an inclined plane without slipping, starting from rest at the top of an inclined plane. The linear speed of the sphere at the bottom of the inclined plane is v. The kinetic energy of the sphere at the bottom is .....

1) $\frac{7}{10} mv^2$ 2) $\frac{2}{5} mv^2$ 3) $\frac{5}{3} mv^2$ 4) $\frac{1}{2} mv^2$

Ans: (1)

Total KE at bottom: $\frac{1}{2} mv^2 \left[1 + \frac{K^2}{R^2}\right] = \frac{1}{2} mv^2 \left[1 + \frac{2}{5}\right] = \frac{7}{10} mv^2$

7. Two satellites of mass m and 9 m are orbiting a planet in orbits of radius R. Their periods of revolution will be in the ratio of .....

1) 1: 3 2) 1: 1 3) 3: 1 4) 9: 1

Ans: (2)

Time period is independent of mass

8. The following four wires of length L and radius r are made of the same material. Which of these will have the largest extension, when the same tension is applied?

1) L = 400 cm, r = 0.8 mm 2) L = 300 cm, r = 0.6 mm

2) L = 200 cm, r = 0.4 mm 4) L = 100 cm, r = 0.2 mm

Ans: (4)

$y = \frac{F}{A} \times \frac{\ell}{e}$

$e \alpha \frac{\ell}{r^2}$

(1) $e_1 = \frac{1}{10}$

(2) $e_2 = \frac{1}{12}$

(3) $e_3 = \frac{1}{8}$

(4) $e_4 = \frac{1}{4}$

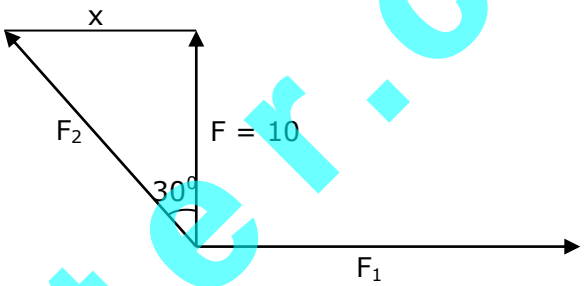
9. The resultant of two forces acting at an angle of 120° is 10 kg wt and is perpendicular to one of the forces. That force is .....

1) $\frac{10}{\sqrt{3}}$ kg wt 2) 10 kg wt 3) 20 $\sqrt{3}$ kg wt 4) 10 $\sqrt{3}$ kg wt

Ans: (1)

$\text{Tan } 30 = \frac{1}{\sqrt{3}} = \frac{x}{10}$

$x = \frac{10}{\sqrt{3}}$



10. Eight equal drops of water are falling through air with a steady velocity of 10 cm s^{-1}. If the drops combine to form a single drop big in size, then the terminal velocity of this big drop is .....

1) 80 cm s^{-1} 2) 30 cm s^{-1} 3) 10 cm s^{-1} 4) 40 cm s^{-1}

Ans: (4)

$V \alpha r^2$ $\quad \frac{10}{v^2} = \frac{r^2}{8^{2/3} r^2} = \frac{1}{4}$

$\frac{v_1}{v_2} = \frac{r_1^2}{r_2^2}$ $\quad v_2 = 40$ cm/s

11. Two capillary tubes of different diameters are dipped in water. The rise of water is .....

1) independent of the diameter of the tube
2) greater in the tube of smaller diameter
3) greater in the tube of larger diameter
4) the same in both tubes

Ans: (2)

$h \alpha \frac{1}{r}$

$\therefore$ greater for the tube of smaller diameter

12. A perfect gas at 27°C is heated at constant pressure so as to double its volume. The increase in temperature of the gas will be .....

1) 300°C 2) 54°C 3) 327°C 4) 600°C

Ans: (1)

$\frac{V_1}{V_2} = \frac{T_1}{T_2}$ $T_2 = 600\ K = 327^0\ C$

$\frac{1}{2} = \frac{300}{T_2}$ $\Delta t = 327 - 27 = 300^0\ C$

13. Three identical rods A, B and C are placed end to end. A temperature difference is maintained between the free ends of A and C. The thermal conductivity of B is THRICE that of C and HALF of that of A. The effective thermal conductivity of the system will be ..... (K_A is the thermal conductivity of rod A).

1) $\frac{2}{3}\ K_A$ 2) $2\ K_A$ 3) $3\ K_A$ 4) $\frac{1}{3}\ K_A$

Ans : (4)

A	B	C

$K_B = K_A/2$

$K_B = 3K_C \Rightarrow K_C = K_A/6$

$$\frac{\ell}{K_C} = \frac{\ell_1}{K_A} + \frac{\ell_2}{K_B} + \frac{\ell_3}{K_3}$$

$$\frac{3\ell}{K_C} = \frac{\ell}{K_A} + \frac{\ell}{\frac{K_A}{2}} + \frac{\ell}{\frac{K_A}{6}}$$

$$\frac{3\ell}{K_S} = \frac{9\ell}{K_A}$$

$$K_S = \frac{K_A}{3}$$

14. The quantities of heat required to raise the temperatures of two copper spheres of radii r_1 and r_2 ($r_1 = 1.5\ r_2$) through 1 K are in the ratio of .....

1) 1 2) $\frac{3}{2}$ 3) $\frac{9}{4}$ 4) $\frac{27}{8}$

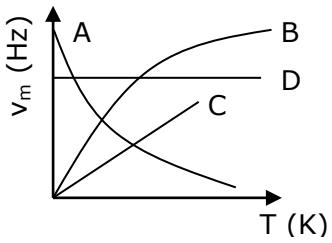
Ans: (3)

Heat required is proportional to square of radius

$$\frac{Q_1}{Q_2} = \frac{r_1^2}{r_2^2} = \left(\frac{1.5}{1}\right)^2 = \frac{9}{4}$$

15. Which one of the following is $v_m - T$ graph for perfectly black body? V_m is the frequency of radiation with maximum intensity. T is the absolute temperature.

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



Ans : (2)

Intensity is directly proportional to energy.

16. A particle executing a simple harmonic motion has a period of 6 sec. The time taken by the particle to move from the mean position to half the amplitude, starting from the mean position is

1) $\frac{1}{4}$ sec 2) $\frac{3}{4}$ sec 3) $\frac{1}{2}$ sec 4) $\frac{3}{2}$ sec

Ans : (3)

$y = A \sin\left(\frac{2\pi}{T}\right)t$

$\frac{A}{2} = A \sin\left(\frac{2\pi}{T}\right)t = \frac{2\pi}{T}t = \pi/6$

$t = \frac{T}{12} = \frac{6}{12} = \frac{1}{2}$

17. The equation of a wave is given by $y = 10 \sin\left(\frac{2\pi}{45}t + \alpha\right)$. If the displacement is 5 cm at t = 0, then the total phase at t = 7.5 sec. is

1) π 2) $\frac{\pi}{6}$ 3) $\frac{\pi}{2}$ 4) $\frac{\pi}{3}$

Ans : (3)

$y = 10 \sin\left[\frac{2\pi}{45}t + \alpha\right]$

If t = 0, y = 5 cm

$5 = 10(\sin \alpha)$

$\sin \alpha = \frac{1}{2}$

$\alpha = \frac{\pi}{6}$

If t = 7.5 s

Then total phase = $\frac{2\pi}{45} \times \frac{15}{2} + \frac{\pi}{6} = \frac{\pi}{3} + \frac{\pi}{6} = \frac{\pi}{3}$

18. Two tuning forks, A and B, produce notes of frequencies 258 Hz and 262 Hz. An unknown note sounded with A produces certain beats. When the same note is sounded with B, the beat frequency gets doubled. The unknown frequency is

1) 256 Hz 2) 254 Hz 3) 300 Hz 4) 250 Hz

Ans: (2)

η_A = 258 Hz

η_B = 262 Hz

Let η is the frequency of unknown tuning fork.

It produces x beats with 258 and 2x with 262

$262 - (258 - x) = 2x$

$262 - 268 + x = 2x$

$x = 4$

η = 254 Hz

19. A wire under tension vibrates with a fundamental frequency of 600 Hz. If the length of the wire is doubled, the radius is halved and the wire is made to vibrate under one-ninth the tension. Then the fundamental frequency will become

1) 400 Hz 2) 600 Hz 3) 300 Hz 4) 200 Hz

Ans: (4)

$$f = \frac{1}{2\ell r}\sqrt{\frac{T}{\pi\rho}} \Rightarrow \frac{f_1}{f_2} = \frac{\ell_2}{\ell_1} x \frac{r_2}{r_1} \times \sqrt{\frac{T_1}{T_2}}$$

$$\frac{600}{f_2} = \frac{2}{1} x \frac{1}{2} \times \sqrt{\frac{T}{T/9}} = 3 \Rightarrow f_2 = 200 \text{ Hz}$$

20. Faintest stars are called

1) dwarfs 2) sixth magnitude stars

3) second magnitude stars 4) zero magnitude stars

Ans: (2)

21. Wavelength of given light waves in air and in a medium are 6000 $\overset{0}{A}$ and 4000 $\overset{0}{A}$ respectively. The critical angle is .....

1) $\text{Sin}^{-1}\left(\frac{3}{2}\right)$ 2) $\text{Sin}^{-1}\left(\frac{2}{3}\right)$ 3) $\text{Tan}^{-1}\left(\frac{3}{2}\right)$ 4) $\text{Tan}^{-1}\left(\frac{2}{3}\right)$

Ans: (2)

$$\frac{\eta_2}{\eta_1} = \frac{1}{\sin C}$$

$$\frac{1}{\sin C} = \frac{\lambda_1}{\lambda_2} = \frac{6000}{4000} = \frac{3}{2}$$

$C = \sin^{-1}(2/3)$

22. The time required for the light to pass through a glass slab (refractive index = 1.5) of thickness 4 mm is ……. ($c = 3 \times 10^8$ ms^{-1}, speed of light in free space).

1) 2×10^{-5} sec 2) $2 \times 10^{+11}$ sec 3) 2×10^{-11} sec 4) 10^{-11} sec

Ans: (3)

$\frac{n_g}{n_a} = \frac{c_a}{c_g}$ $\qquad t = \frac{\text{distance}}{\text{speed}}$

$\frac{3}{2} = \frac{3 \times 10^8}{c_g}$ $\qquad = \frac{4 \times 10^{-3}}{2 \times 10^8}$

$c_g = 2 \times 10^8$ $\qquad = 2 \times 10^{-11}$ s

23. A prism having refractive index 1.414 and refracting angle 30^0 has one of the refracting surfaces silvered. A beam of light incident on the other refracting surface will retrace its path, if the angle of incidence is ……..

1) 45^0 2) 60^0 3) 30^0 4) 0^0

Ans: (1)

$r_2 = 0$ ($\because$ No refraction is there at second surface)

$\therefore r_1 = A = 30^o$

$n = \frac{\sin i_1}{\sin r_1} = \frac{\sin i_1}{\sin 30^o} = \sqrt{2} \times \frac{1}{2} = \frac{1}{\sqrt{2}}$

$\sin i_1 = \frac{1}{\sqrt{2}}$

$i_1 = 45^o$

24. A planoconvex lens has a maximum thickness of 6 cm. When placed on a horizontal table with the curved surface in contact with the table surface, the apparent depth of the bottommost point of the lens is found to be 4 cm. If the lens is inverted such that the plane face of the lens is in contact with the surface of the table, the apparent depth of the center of the plane face is found to be $\left(\frac{17}{4}\right)$ cm. The radius of curvature of the lens is …….

1) 34 cm 2) 128 cm 3) 75 cm 4) 68 cm

Ans: (1)

$n = \frac{\text{real depth}}{\text{apparent depth}} = \frac{6}{4} = \frac{3}{2}$

$\frac{n_1}{u} + \frac{n_2}{v} = \frac{n_1 \sim n_2}{R}$

$\frac{1.5}{6} - \frac{4}{17} = \frac{1.5 - 1}{R}$

R = 34 cm

25. Two thin lenses have a combined power of +9 D. When they are separated by a distance of 20 cm, their equivalent power becomes + $\frac{27}{5}$ D. Their individual powers (in diopters) are .....

1) 4, 5 2) 3, 6 3) 2, 7 4) 1, 8

Ans: (2)

$P_1 + P_2 = 9 \Rightarrow P = P_1 + P_2 - dP_1P_2$

$\frac{27}{5} = 9 - \frac{20}{100} \times P_1P_2$

The above equation is correct for $P_1 = 3$, $P_2 = 6$

26. Wavefront is the locus of all points, where the particles of the medium vibrate wit the same .....

1) period 2) frequency 3) amplitude 4) phase

Ans: (4)

Over the wave front all the points are in same.

27. Two monochromatic light waves of amplitudes 3A and 2A interfering at a point have a phase difference of 60^0. The intensity at the point will be proportional to .....

1) 19 A^2 2) 7 A^2 3) 13 A^2 4) 5 A^2

Ans: (1)

$A = \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\phi}$

$I = 9A^2 + 4A^2 + 2 \times 3A \times 2A \times \frac{1}{2} = 19A^2$

28. Consider the following statements in case of Young's double slit experiment.

a) A slit S is necessary if we use an ordinary extended source of light.

b) A slit S is not needed if we use an ordinary but well collimated beam of light.

c) A slit S is not needed if we use a spatially coherent source of light.

Which of the above statements are correct?

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

Ans: (1)

29. A parallel beam of light of wavelength 6000 $\overset{0}{A}$ gets diffracted by a single slit of width 0.3 mm. The angular position of the first minima of diffracted light is .....

1) 6×10^{-3} rad 2) 1.8×10^{-3} rad 3) 3×10^{-3} rad 4) 2×10^{-3} rad

Ans: (4)

$d\sin\theta = n\lambda$

$0.3 \times 10^{-3} \times \theta = 6000 \times 10^{-10}$

$\theta = 2 \times 10^{-3}$ rad

30. The critical angle of a certain medium is $\text{Sin}^{-1}\left(\frac{3}{5}\right)$. The polarizing angle of the medium is .....

1) $\text{Tan}^{-1}\left(\frac{4}{3}\right)$ 2) $\text{Tan}^{-1}\left(\frac{3}{4}\right)$ 3) $\text{Tan}^{-1}\left(\frac{5}{3}\right)$ 4) $\text{Sin}^{-1}\left(\frac{4}{5}\right)$

Ans: (3)

$\tan i = \frac{1}{\sin C}$

$\cot i = \sin\left(\sin^{-1}\left(\frac{3}{5}\right)\right)$

$\tan i = \frac{5}{3}$

$i = \tan^{-1}\left(\frac{5}{3}\right)$

31. Two identical charged spheres of material density ρ, suspended from the same point by inextensible strings of equal length make an angle θ between the strings. When suspended in a liquid of density σ the angle θ remains the same. The dielectric constant K of the liquid is .....

1) $\frac{\rho+\sigma}{\rho}$ 2) $\frac{\rho}{\rho+\sigma}$ 3) $\frac{\rho-\sigma}{\rho}$ 4) $\frac{\rho}{\rho-\sigma}$

Ans: (4)

$\varepsilon_r = \frac{F_a}{F_m} = \frac{mg}{(m-m_l)g} = \frac{\rho V}{(\rho-\sigma)V} = \frac{\rho}{\rho-\sigma}$

32. The electric field at a point due to an electric dipole, on an axis inclined at an angle θ ($< 90^0$) to the dipole axis, is perpendicular to the dipole axis, if the angle θ is .....

1) $\text{Tan}^{-1}\left(\frac{1}{\sqrt{2}}\right)$ 2) $\text{Tan}^{-1}\left(\sqrt{2}\right)$ 3) $\text{Tan}^{-1}\left(\frac{1}{2}\right)$ 4) $\text{Tan}^{-1}(2)$

Ans: (2)

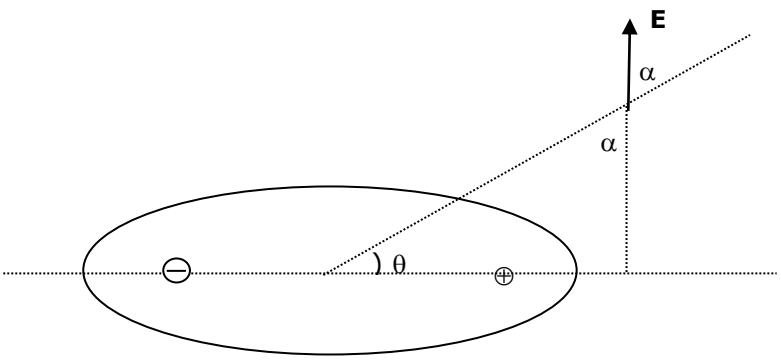
$\alpha + \theta = 90^o$

$\tan\alpha = \frac{1}{2}\tan\theta$

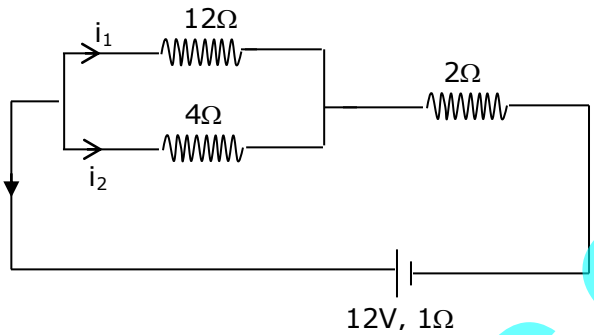
$\tan\theta = 2\tan(90-\theta)$

$\tan^2\theta = 2$

$\theta = \tan^{-1}(\sqrt{2})$



33. In the circuit shown, the currents i_1 and i_2 are .....



1) $i_1 = 3$ A, $i_2 = 1$ A
2) $i_1 = 1$ A, $i_2 = 3$ A
3) $i_1 = 0.5$ A, $i_2 = 1.5$ A
4) $i_1 = 1.5$ A, $i_2 = 0.5$ A

Ans: (3)

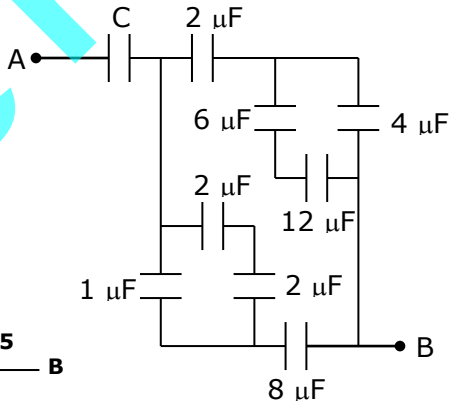
$R = \frac{12 \times 4}{12+4} + 2 = 5\ \Omega$

$I = \frac{E}{R+r} = \frac{12}{6} = 2$ A

$I_1 + I_2 = 2A$

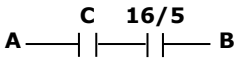
$I \propto \frac{1}{R}$ $\therefore I_1 = 0.5A, I_2 = 1.5$ A

34. In the given network, the value of C, so that an equivalent capacitance between A and B is 3μF, is .....



1) 36 μ F
2) 48 μ F
3) $\frac{31}{5}$ μ F
4) $\frac{1}{5}$ μ F

Ans: (2)



$3 = \frac{\frac{16}{5}C}{\frac{16}{5}+C} \Rightarrow C = 48\ \mu F$

35. A conductor wire having 10^{29} free electrons/m^3 carries a current of 20 A. If the cross-section of the wire is 1 mm^2, then the drift velocity of electrons will be .....

1) $6.25 \times 10^{-3}\ ms^{-1}$
2) $1.25 \times 10^{-5}\ ms^{-1}$
3) $1.25 \times 10^{-3}\ ms^{-1}$
4) $1.25 \times 10^{-4}\ ms^{-1}$

Ans: (3)

$v_d = \frac{I}{nAe} = \frac{20}{10^{29} \times 10^{-6} \times 1.6 \times 10^{-19}} = 1.25 \times 10^{-3}\ ms^{-1}$

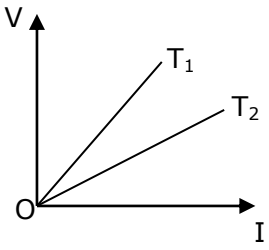
36. A resistor has a colour code of green, blue, brown and silver. What is its resistance?

1) 5600 Ω ± 10%
2) 560 Ω ± 5%
3) 560 Ω ± 10%
4) 56 Ω ± 5%

Ans: (3)

R = 56 x 10 ± 10% = 560 ± 10%

37. The voltage V and current I graphs for a conductor at two different temperatures T_1 and T_2 are shown in the figure. The relation between $T_1$and T_2 is .....



1) $T_1 = \frac{1}{T_2}$

2) $T_1 = T_2$

3) $T_1 < T_2$

4) $T_1 > T_2$

Ans: (4)

Slope of V – I graph = Resistance

Resistance α temperature

$R_1 > R_2 \Rightarrow T_1 > T_2$

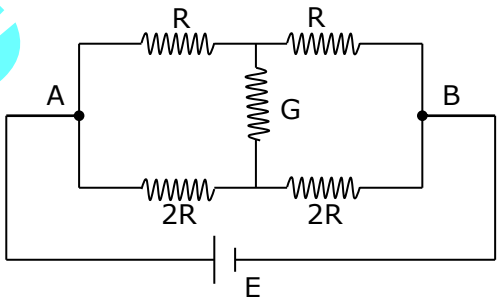
38. Consider the following statements regarding the network shown in the figure.

a) The equivalent resistance of the network between points A and B is independent of value of G.

b) The equivalent resistance of the network between points A and B is $\frac{4}{3}$ R.

c) The current through G is zero.

Which of the above statements is/are TRUE?



1) (a), (b) and (c)

2) (b) and (c)

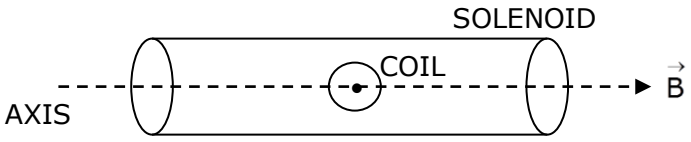
3) (b) alone

4) (a) alone

Ans: (1)

$R_{eff} = \frac{(P+Q)(R+G)}{(P+Q+R+G)} = \frac{4}{3}R$

39. The torque required to hold a small circular coil of 10 turns, area 1 $mm^2$and carrying a current of $\left(\frac{21}{44}\right)$ A is the middle of a long solenoid of 10^3 turns/m carrying a current of 2.5 A, with its axis perpendicular to the axis of the solenoid is .....



1) 1.5 x 10^{+8} N-m

2) 1.5 x 10^{+6} N-m

3) 1.5 x 10^{-8} N-m

4) 1.5 x 10^{-6} N-m

Ans: (3)

$c = MB = (n_1 I_1 A)(\mu_0 n_2 I_2)$

$= \left(10 \times \frac{21}{44} \times 10^{-6}\right)\left(4 \times \frac{22}{7} \times 10^{-7} \times 10^3 \times 2.5\right) = 1.5 \times 10^{-8}$ Nm

40. A particle of charge e and mass m moves with a velocity υ in a magnetic filed B applied perpendicular to the motion of the particle. The radius r of its path in the field is .....

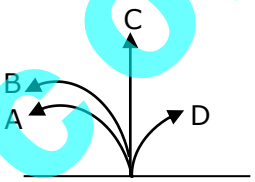
1) $\frac{B\upsilon}{em}$ 2) $\frac{e\upsilon}{Bm}$ 3) $\frac{Be}{m\upsilon}$ 4) $\frac{m\upsilon}{Be}$

Ans: (4)

$r = \frac{mv}{Bq} = \frac{mv}{Be}$

41. A neutron, a proton, an electron and an α - particle enter a region of uniform magnetic field with the same velocities. The magnetic field is perpendicular and directed into the plane of the paper. The tracks of the particles are labelled in the figure. The electron follows the track

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



Ans: (1)

$r = \frac{mv}{Bq}$

r is least when $\left(\frac{m}{q}\right)$ is least

$\left(\frac{m}{q}\right)$ is least for electron. i.e. path is D

42. The deflection in a moving coil galvanometer is reduced to half when it is shunted with a 40 Ω coil. The resistance of the galvanometer is

1) 15 Ω 2) 20 Ω 3) 40 Ω 4) 80 Ω

Ans: (3)

$I \alpha \theta$

$\frac{I_g}{I} = \frac{1}{2}$

$\frac{S}{G+S} = \frac{1}{2}$

$\frac{40}{G+40} = \frac{1}{2}$

$G = 40\ \Omega$

43. A current of $\left(\frac{2}{\sqrt{3}}\right)$A produces a deflection of 60^o in a tangent galvanometer. The reduction factor is

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

Ans: (3)

$$K = \frac{I}{\tan\theta} = \frac{\frac{2}{\sqrt{3}}}{\tan 60} = \frac{2}{3} A$$

44. In an A.C. circuit, V and I are given by V = 150 Sin (150t) volt and I = 150 Sin $\left(150t + \frac{\pi}{3}\right)$ ampere. The power dissipated in the circuit is

1) zero 2) 5625 W 3) 150 W 4) 106 W

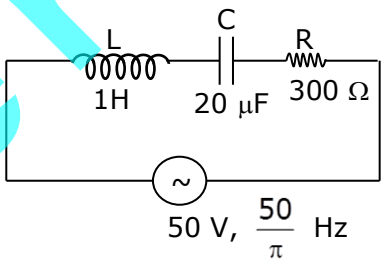
Ans: (2)

$$P = \frac{1}{2} V_0 I_0 \cos\phi$$

$$= 0.5 \times 150 \times 150 \times \cos 60^0 = \frac{2250}{4} = 5625 \text{ w}$$

45. In the L-C-R circuit shown, the impedance is

1) 500 Ω
2) 300 Ω
3) 100 Ω
4) 200 Ω



Ans: (1)

$$X_L = 2\pi fL = 2\pi \left(\frac{50}{\pi}\right) \times 1 = 100\ \Omega$$

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi\left(\frac{50}{\pi}\right)20\times10^{-6}} = 500\ \Omega$$

$$Z = \sqrt{R^2 + (X_C - X_L)^2} = \sqrt{(300)^2 + (400)^2} = 500\ \Omega$$

46. The energy stored in an inductor of self inductance L henry carrying a current of I ampere is

1) L^2I 2) LI^2 3) $\frac{1}{2}LI^2$ 4) $\frac{1}{2}L^2I$

Ans: (3)

$$u = \frac{1}{2}LI^2$$

47. A transformer works on the principle of

1) magnetic effect of the electrical current 2) mutual induction
3) electrical inertia 4) self induction

Ans: (2)

Mutual induction

48. Flash spectrum confirms a/an

1) magnetic storm 2) earthquake 3) lunar eclipse 4) total solar eclipse

Ans: (4)

Total solar eclipse

49. The photoelectric threshold wavelength for silver is λ_0. The energy of the electron ejected from the surface of silver by an incident wavelength $\lambda(\lambda < \lambda_0)$ will be

1) $hc\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)$ 2) $\frac{h}{c}\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)$ 3) $\frac{hc}{\lambda_0 - \lambda}$ 4) $hc(\lambda_0 - \lambda)$

Ans: (1)

$E = W + K.E$

$K.E. = E - W$

$= \frac{hC}{\lambda} - \frac{hC}{\lambda_o}$

$= hC\left[\frac{1}{\lambda} - \frac{1}{\lambda_o}\right] = hC\left[\frac{\lambda_o - \lambda}{\lambda\lambda_o}\right]$

50. Rutherford's atomic model could account for

1) concept of stationary orbits

2) the positively charged central core of an atom

3) origin of spectra

4) stability of atoms

Ans: (2)

The positively charged central core of an atom

51. When an electron jumps from the orbit n = 2 to n = 4, then wavelength of the radiations absorbed will be _____ (R is Rydberg's constant).

1) $\frac{3R}{16}$ 2) $\frac{5R}{16}$ 3) $\frac{16}{5R}$ 4) $\frac{16}{3R}$

Ans: (4)

$\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$n_1 = 2, n_2 = 4$

$\frac{1}{\lambda} = R\left[\frac{1}{4} - \frac{1}{16}\right] = R\left[\frac{4-1}{16}\right] = \frac{3R}{16}$

$\lambda = \frac{16}{3R}$

52. The thermonuclear reaction of hydrogen inside the stars is taking place by a cycle of operations. The particular element which acts as catalyst is

1) carbon 2) helium 3) oxygen 4) nitrogen

Ans: (1)

In carbon cycle carbon is a reactant as well as end product

53. The ratio of minimum wavelength of Lyman and Balmer series will be

1) 10 2) 5 3) 0.25 4) 1.25

Ans: (3)

$\lambda \propto n^2$

$$\frac{\lambda_{Lymann}}{\lambda_{Balmer}} = \left(\frac{1}{2}\right)^2 = \frac{1}{4} = 0.25$$

54. The fraction of the initial number of radioactive nuclei which remain undecayed after half of a half-life of the radioactive sample is

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

Ans: (1)

$$N = \frac{N_0}{2^n} = \frac{N_0}{2^{1/2}} = \frac{N_0}{\sqrt{2}}$$

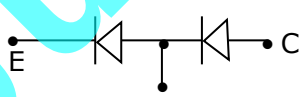
55. 1 curie represents

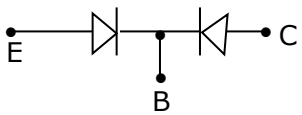
1) 1 disintegration per second
2) 10^6 disintegrations per second
3) 3.7×10^{10} disintegrations per second
4) 3.7×10^7 disintegrations per second

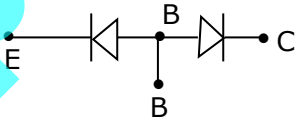
Ans: (3)

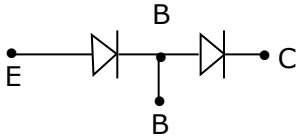
1 ci = 3.7×10^{10} dis / sec

56. An n-p-n transistor can be considered to be equivalent to two diodes, connected. Which of the following figures is the CORRECT ONE?

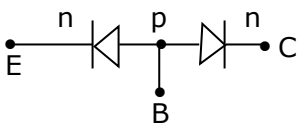
1)


2)


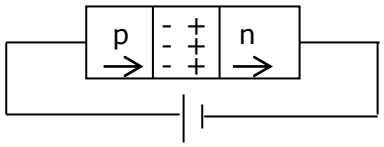
3)


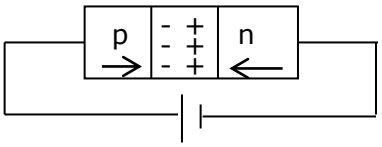
4)


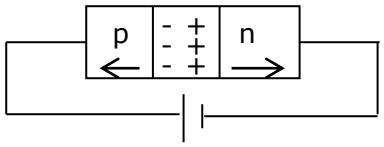
Ans: (3)

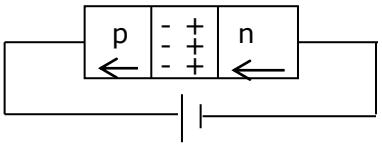


57. In the case of forward biasing of a p-n junction diode, which one of the following figures correctly depicts the direction of conventional current (indicated by an arrow mark)?

1) 

2) 

3) 

4) 

Ans: (1)

In p region direction of conventional current is same as flow of holes

In n region direction of conventional current is opposite to direction of flow e^{-1} s.

58. An electron of mass m_e and a proton of mass m_p are moving with the same speed. The ratio of their de-Broglie's wavelength λ_e/λ_p is

1) 918 2) $\frac{1}{1836}$ 3) 1836 4) 1

Ans: (3)

$$\frac{\lambda_e}{\lambda_p} = \frac{\frac{h}{m_e v}}{\frac{h}{m_p v}} = \frac{m_p}{m_e} = \frac{1.67 \times 10^{-27}}{9.1 \times 10^{-31}} = 0.18 \times 10^4 = 1836$$

OR

$$\lambda = \frac{h}{mv} \Rightarrow \lambda \propto \frac{1}{m}$$

$$\frac{\lambda_e}{\lambda_p} = \frac{m_p}{m_e}$$

mass of proton is near 1840 times of electron.

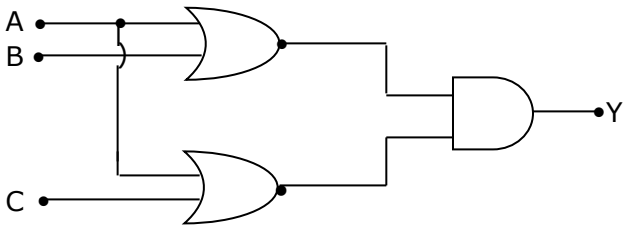
59. The output of given logic circuit is

1) A + B + C

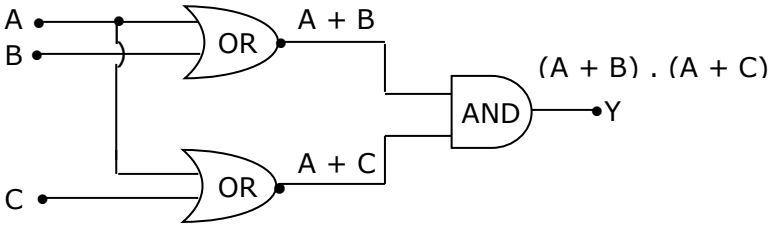
2) (A + B). (A + C)

3) A. (B. C)

4) A.(B + C)



Ans: (2)



60. If the scattering intensity of a liquid is 8 units at a wavelength of 500 nm, then the scattering intensity at a wavelength of 400 nm will be approximately

1) 24 units 2) 20 units 2) 16 units 4) 13 units

Ans: (2)

$$I \propto \frac{1}{\lambda^4}$$

$$\frac{I_2}{I_1} = \left(\frac{\lambda_1}{\lambda_2}\right)^4$$

$$\frac{I_2}{I_1} = \left(\frac{500}{400}\right)^4 \simeq 2.5$$

$I_2 = I_2\ (2.5) = 8 \times 2.5 = 20.5$