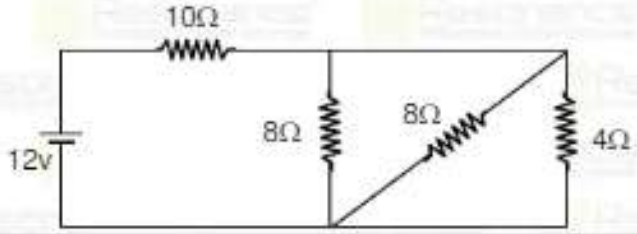
PART : PHYSICS

1. Find current passing through battery.



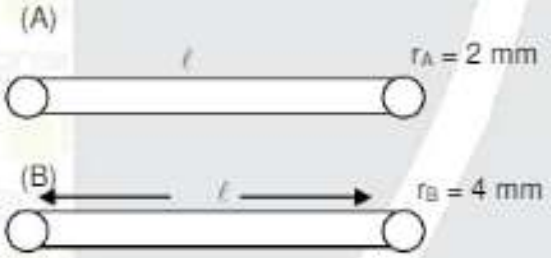
(1) 6A (2) 1A (3) 2A (4) 5A

Ans. **(2)**

Sol. Req. = 10 + 2 = 12Ω

and $i = \frac{V}{R_{eq}} = \frac{12}{12} = 1A$

2.



Find R_A?

$R_B = 2\Omega$

(1) 8 Ω (2) 12 Ω (3) 7 Ω (4) 5 Ω

Ans. **(1)**

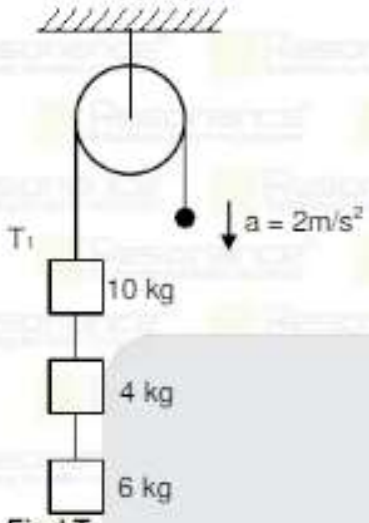
Sol. $R_B = \frac{\rho\ell}{\pi(4)^2} = 2\Omega$

$R_A = \frac{\rho\ell}{\pi(2)^2}$

$\frac{R_A}{R_B} = \frac{(4)^2}{(2)^2} = 4$

$R_A = 4R_B = 8\Omega$

3.



Find T_1

(1) 240 N (2) 200 N (3) 500 N (4) 640 N

Ans. **(1)**

Sol. $T_1 - 20g = 20a$

$\Rightarrow \quad T_1 = 200 + 20 \times 2$

$\Rightarrow \quad T_1 = 200 + 40 = 240$ N

4. An electron is revolving around a nucleus of charge Ze in a circular orbit. Find relation between total energy of electron & potential energy of electron

(1) E = U (2) E = 2U (3) 2E = U (4) 3E = 2U

Ans. **(3)**

Sol. We know that

$$E = -k = \frac{U}{2}$$

$$E = \frac{U}{2} \Rightarrow$$

$$U = 2E$$

5.

Case -I Case -II

Find ratio of work done by gravitational force to lift the block of mass 50 kg by 20 m height in case I and case II.

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

Ans. **(1)**

Sol. In both the cases

$W = -mgh$

So $\frac{W_1}{W_2} = 1$

6. A particle starts from rest with constant acceleration along straight line path. If s_n is the distance covered by the particle in time interval from t = n–1 to t = n then find value of $\frac{S_{n-1}}{S_n}$. For n = 10

(1) $\frac{17}{19}$ (2) $\frac{14}{19}$ (3) $\frac{12}{18}$ (4) $\frac{15}{14}$

Ans. **(1)**

Sol. we know that

$S_n = 0 + \frac{a}{2}(2n-1) = \frac{a}{2}(2n-1)$ .....(i) (u = 0)

$S_{n-1} = 0 + \frac{a}{2}[2(n-1)-1]$

$= \frac{a}{2}(2n-2-1) = \frac{a}{2}(2n-3)$ .....(ii)

So $\frac{S_{n-1}}{S_n} = \frac{2n-3}{2n-1} = \frac{17}{19}$

7. Find ratio of time period of a simple pendulum at height R and 2R from surface of earth

(1) $\frac{2}{3}$ (2) $\frac{3}{4}$ (3) $\frac{5}{4}$ (4) $\frac{7}{4}$

Ans. **(1)**

Sol. $T_1 = 2\pi\sqrt{\frac{\ell}{g_1}}$

$T_2 = 2\pi\sqrt{\frac{\ell}{g_2}}$

$\frac{T_1}{T_2} = \sqrt{\frac{g_2}{g_1}} = \frac{R_1^2}{R_2^2} = \sqrt{\frac{(R+h_1)^2}{(R+h_2)^2}} = \sqrt{\frac{(2R)^2}{(3R)^2}}$

$\frac{T_1}{T_2} = \sqrt{\frac{4}{9}} = \frac{2}{3}$

8. Whole system is moving downwards with constant acceleration 0.1 m/s^2 . Find normal reaction on the block of mass 5 kg

(1) 200N (2) 297 N (3) 400 N (4) 594 N

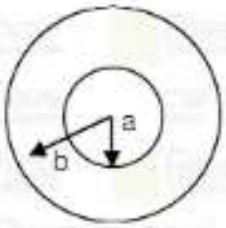
Ans. **(2)**

Sol. $30g - N = 30 \times 0.1$

$\Rightarrow N = 300 - 3$

$= 297$ N

9. Find Mutual induction of two loops?



(1) $\frac{\mu_0\pi^2a^2}{2b}$ (2) $\frac{2\mu_0\pi a^2}{3b}$ (3) $\frac{\mu_0\pi a^2}{2b}$ (4) $\frac{\mu_0\pi^2a^2}{b}$

Ans. (3)

Sol. $\phi = = MI$

$\left(\frac{\mu_0 I}{2b}\right)\pi a^2 = MI$

$M = \frac{\mu_0\pi a^2}{2b}$

10. 3 Helium Atoms fuse together to give one carbon atom, Find Q value of reaction?

(1) 7.1618 Mev (2) 7.2618 Mev (3) 7.1518 Mev (4) 8.2617 Mev

Ans. (2)

Sol. $3\ {}_2He^4 \rightarrow {}_6C^{12} + Q$

(Atomic weight of ${}_2He^4 = 4.00264$)

(Atomic weight of ${}_6C^{12} = 124$)

$\Delta m = 3(4.0026) - 12 = 0.00784$

$Q = \Delta mc^2 = (00078) \times 931$ Mev

Q = 7.2618 Mev Ans

11. In YDSE $\lambda = 5000$ Å, D = 200 cm, d = 0.3 mm.
Find distance of third maxima.

(1) 15 mm (2) 10 mm (3) 20 mm (4) 25 mm

Ans. (2)

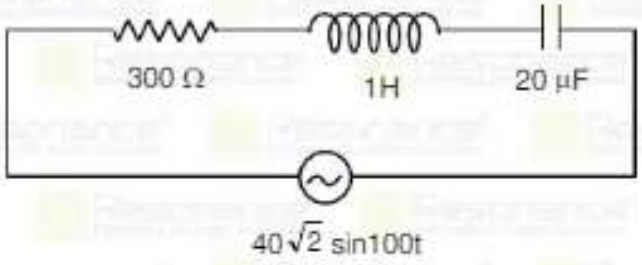
Sol. d << D, and λ << d

$\Rightarrow \quad \beta = \frac{\lambda D}{d} = \frac{5\times10^{-7}\times2}{3\times10^{-4}}$

$\beta = \frac{10}{3}\times10^{-3} = \frac{10}{3}$ mm

$Y_{3rd\ maxima} = 3\beta = 10$ mm

12.



Find V_{rms} across capacitor ?

(1) 10 volt (2) 20 volt (3) 30 volt (4) 40 volt

Ans. (4)

Sol. $X_C = \dfrac{1}{100 \times 20 \times 10^{-6}} = 500\ \Omega$

$[X_L = \omega L = (100)(1) = 100\ \Omega]$

$Z = \sqrt{R^2 + (X_C - X_L)^2} = \sqrt{(300)^2 + (500 - 100)^2}$

$Z = 500\ \Omega$

$\left[i_{rms} = \dfrac{v_{rms}}{2} = \dfrac{40}{500} = \dfrac{2}{25}\ \text{Amp}\right]$

$v_{rms} = i_{rms} X_C = \dfrac{2}{25} \times 500 = 40$ volt Ans.

(Across capacitor)

13. Three capacitors of capacitances 25 μF, 30 μF & 45μF are connected in parallel with a battery. Total energy stored in the capacitors is E. If all the three capacitors are now connected in series with same battery then total energy stored in the capacitors is $U = \dfrac{9}{x} E$. Find value of x.

(1) 80 (2) 90 (3) 86 (4) 50

Ans. **(3)**

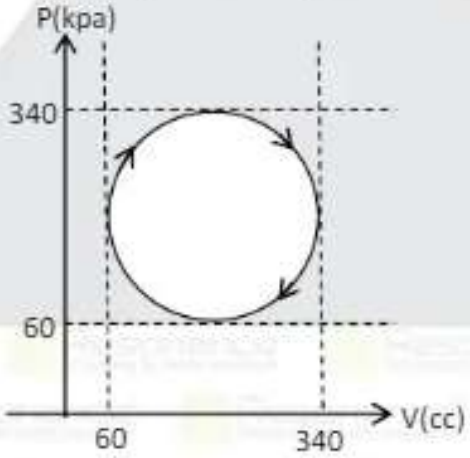
Sol. $E = \dfrac{1}{2} C_{eq} V^2 = \dfrac{1}{2} 100V^2$

$\& \ U = \dfrac{1}{2} C_{eq} V^2 = \dfrac{1}{2} \dfrac{900}{86} V^2$

$\dfrac{U}{E} = \dfrac{900}{86 \times 100}$

$\Rightarrow \dfrac{U}{E} = \dfrac{9}{86} \Rightarrow U = \dfrac{9}{86} E$

14. In the given p.v. diagram find the heat given to the system



(1) 50.544 (2) 40.544 (3) 30.544 (4) 61.544

Ans. **(4)**

Sol. This is cyclic process so $\Delta U = 0$

From 1st law of T.D $\Delta Q = \Delta U + \Delta W$

$\Delta Q = \Delta W$

ΔW = Area enclosed by the cycle

$R = \frac{(340 - 60)}{2}$

$R = \frac{280}{2} = 140$

ΔW = Area

$\Delta W = 3.14 \times (140)^2 \times 10^3 \times 10^{-6}$

$\Delta W = 3.14 \times 140 \times 140 \times 10^{-3}$

$= 61.544$

$\Delta Q = 61.544$

15. An ideal gas is filled in a container. What will be the ratio of frequency of collisions for T = 27°C and 127° C?

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

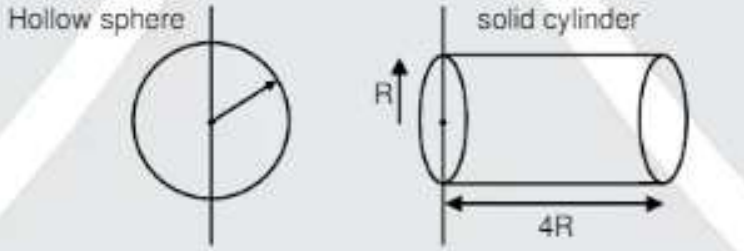
Ans. **(4)**

Sol. $f \propto v_{rms}$

$f \propto \sqrt{T}$

$\frac{f_{27}}{f_{127}} = \frac{\sqrt{300}}{\sqrt{400}} = \frac{\sqrt{3}}{2}$

16. Ratio of radius of gyration of both the bodies about given is $\sqrt{\frac{8}{x}}$, find value of x.



(1) 25 (2) 45 (3) 51 (4) 60

Ans. **(3)**

Sol. $mk_1^2 = \frac{mR^2}{4} + \frac{m(4R)^2}{3}$

$mk_2^2 = \frac{mR^2}{4} + \frac{m(4R)^2}{3}$

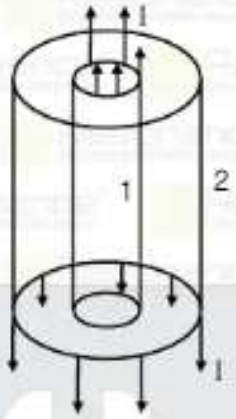
$= \frac{mR^2}{4} + \frac{16}{3}mR^2 = \frac{(3+48)mR^2}{12} = \frac{51}{12}mR^2$

$\frac{K_1^2}{K_2^2} = \frac{2}{3} \times \frac{12}{51} = \frac{8}{51}$

$\frac{K_1}{K_2} = \sqrt{\frac{8}{51}} = \sqrt{\frac{8}{x}}$

$\therefore\ x = 51$

17. Two co-axial long hollow wires are carrying same current but in opposite direction, at which points magnetic field will be zero?

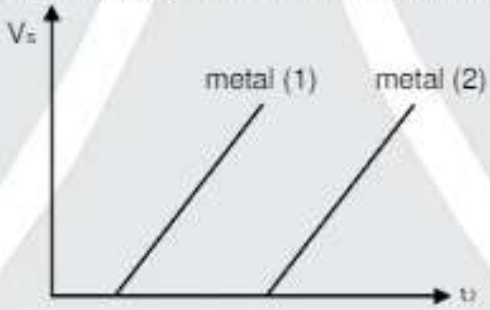


(1) only inside wire-1
(2) in between wire-1 and wire-2
(3) inside wire-1and outside wire-2
(4) None of these

Ans. **(3)**

Sol. We know that magnetic field inside along hollow cylinder is zero.

18. **Statement-1 :** Slope is given by h/e.
Statemetn-2 : At constant frequency, order of maximum kinetic energy is $K_1 > K_2$.



Ans. **(Both statements are true.)**

Sol. $KE_{max} = K = h\upsilon - \phi$

$\phi_1 < \phi_2$

for same υ

K_1 same υ

$K_1 = h\upsilon - \phi_1$

$K_2 = h\upsilon - \phi_2$

$K_1 > K_2$ statement-2 is correct

$eV_s = kE_{max} = h\upsilon - \phi$

$$V_s = \frac{h}{e}\upsilon - \frac{\phi}{e}$$

slope of $V_s - \upsilon$ graph $= \frac{h}{e}$ = constant (independent of metal) statement-1 is also true

19. Planet (m.r), sun (M), orbit radius of planet = a, match the column :

(i) Kinetic Energy of planet	1. $-\frac{GMm}{a}$
(ii) Total Energy of planet	2. $\sqrt{\frac{2Gm}{r}}$
(iii) Escape velocity of planet	3. $\frac{GMm}{2a}$
(iv) Potential Energy of system	4. $-\frac{GMm}{2a}$

(1) (i) – 3, (ii) – 4, (iii) – 2, (iv) – 1
(2) (i) – 2, (ii) – 4, (iii) – 3, (iv) – 1
(3) (i) – 1, (ii) – 4, (iii) – 2, (iv) – 3
(4) (i) – 3, (ii) – 1, (iii) – 2, (iv) – 4

Ans. **(1)**

Sol. (i) – 3, (ii) – 4, (iii) – 2, (iv) – 1

20. If μ represents energy density and G represent gravitational constant, then find the dimension of $\sqrt{\mu G}$

Ans. L^1T^{-2} (Force/mass)

Sol. $\mu = \frac{\text{Energy}}{\text{Volume}} = \frac{M^1L^2T^{-2}}{L^3} = M^1L^{-1}T^{-2}$

$G = \frac{M^1LT^{-2} \times L^2}{M^2} = M^{-1}L^3T^{-2}$

$\sqrt{\mu g} = (M^1L^{-1}T^{-2} \times M^{-1}L^3T^{-2})^{1/2}$

$= [L^2T^{-4}]^{1/2}$

$= L^1T^{-2}$

21. If magnetic field is perpendicular to the plane of rotation of rod, then find the potential difference between points P and Q in the given figure

(1) 2 (2) 3 (3) 4 (4) 0

Ans. **(4)**

Sol. $V_Q - V_P = \frac{Bw(L/2)^2}{2}$

$V_O - V_Q = \frac{Bw(L/2)^2}{2}$

$V_P - V_O = 0$

22. An electron is moving in an orbit. Total energy of electron is E, then find the potential energy.

(1) 3 E (2) 5 E (3) 4 E (4) 2 E

Ans. **(4)**

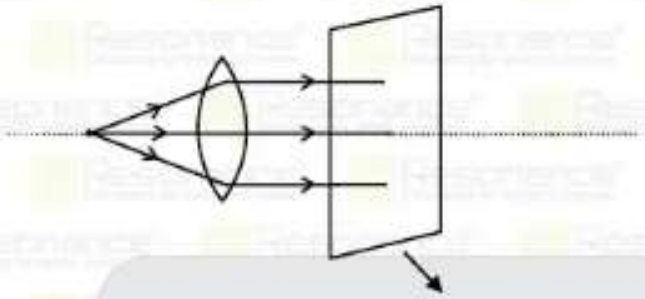
Sol. PE = 2 Total energy

PE = 2E

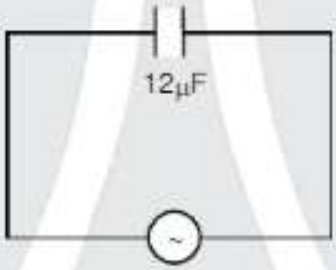
23. What will be the wavefront of refracted light when the light source is located at focus of convex lens.

Ans. Planer wavefront

Sol.



24. A capacitor of capacitance 12 μF is connected to an AC source of 40 V and frequency 40 KHz. Find displacement current.



V = 40 volt, f = 40 Kz

Ans. **38.4 π**

Sol. Displacement current = conduction current

$= \frac{V}{X_C} = V\omega C$

$= 40 \times 2\pi \times 4 \times 10^4 \times 12 \times 10^{-6}$

$= \frac{384\pi}{10}$

$= 38.4\ \pi$

$= 120.5$

25. Find arithmetic mean of 4.623, 4.6, 4.62 and 4.69 (Using significant figures)

(1) 4.633 (2) 4.63 (3) 4.6 (4) 4

Ans. **(3)**

Sol. $\frac{4.623 + 4.6 + 4.62 + 4.69}{4} = 4.633$

minimum number of digits after decimal = 1

So round off arithmetic mean to 1-digit after decimal.

arithmetic mean = 4.6