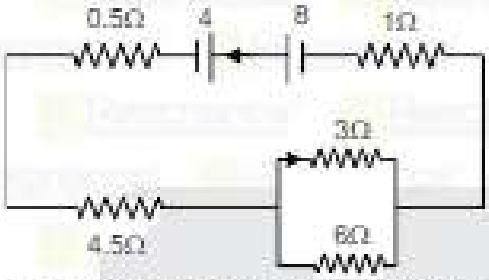
PART : PHYSICS

1.



The current in the 3Ω is x/3, then the value of x will be

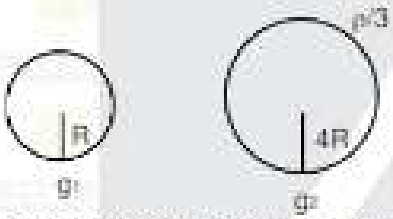
(1) $\frac{1}{3}$A (2) $\frac{1}{6}$A (3) $\frac{1}{2}$A (4) $\frac{1}{4}$A

Ans. **(1)**

Sol. $i = \frac{4}{8} = \frac{1}{2}$

$I_1 = \frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$A

2.



Ratio of acceleration due to gravity at the surface of two planets of radius R and 4R and densities ρ and $\frac{\rho}{3}$

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

Ans. **(2)**

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

$\frac{g_1}{g_2} = \frac{\rho_1}{\rho_2} \times \frac{R_1}{R_2} = 3 \times \frac{1}{4} = \frac{3}{4}$

3. Two identical heating coils are in series in one case & in parallel in the other case under the same voltage. Find the ratio of heat generated in the combination in two cases :

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

Ans. **(1)**

Sol. $\frac{H_1}{H_2} = \frac{V^2/2R}{2V^2/R} = \frac{1}{4}$

4. A capacitor of capacity 2F is charged to voltage V & energy stored is E_1. Now another identical uncharged capacitor is connected in parallel to the first capacitor finally energy stored in second capacitor is E_2. Find $\frac{E_2}{E_1}$

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

Ans. (1)

Sol. $E_1 = \frac{1}{2}CV^2$

$E_2 = \frac{1}{2}C\left(\frac{CV+0}{C+C}\right)^2 = \frac{1}{2}C\frac{V^2}{4}$

$\frac{E_2}{E_1} = \frac{1}{4}$

5. On some new scale boiling point of water is 65°X & Freezing point is –15°X. Find the value of –95°X in Fahrenheit scale :

(1) 65 (2) 14 (3) 35 (4) 23

Ans. (4)

Sol. $\frac{F-32}{9} = \frac{(-95)+15}{65+15}$

$F = 23$

6. A projectile is projected at 30° angle from horizontal. It is at same height from ground at t = 3 and t = 5 seconds respectively. Find the speed of projection

(1) 80 m/s (2) 40 m/s (3) 20 m/s (4) 100 m/s

Ans. (1)

Sol. $8 = \frac{2u\sin 30^\circ}{9}$

$u = 80$ m/s

7. A lens is made of material of refractive index 1.8. It is immersed in liquid of refractive index 1.5. Radius of curvature of each face is 20 cm. Find the ratio of power of lens in air & power of lens in liquid :

(1) 4 cm (2) 8 cm (3) 6 cm (4) 2 cm

Ans. (1)

Sol. $P_1 = (1.8-1)\left(\frac{2}{20}\right)$

$P_2 = \left(\frac{1.8}{1.5}-1\right)\left(\frac{2}{20}\right)$

$\frac{P_1}{P_2} = 4$ cm

8. If wavelength of light incident on a metallic is λ then stopping potential is V_0, and if wavelength is 2λ, then stopping potential is $V_0/4$ then find threshold wavelength of metal :

(1) 9λ (2) 7λ (3) 5λ (4) 3λ

Ans. (4)

Sol. Let λ_0 is the threshold wavelength

$$ev = hc\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)$$

$$ev_0 = hc\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right) \quad ...(1)$$

$$\frac{ev_0}{4} = hc\left(\frac{1}{2\lambda} - \frac{1}{\lambda_0}\right) \quad ...(2)$$

eq (1)/eq (2)

$$= \frac{hc\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)}{hc\left(\frac{1}{2\lambda} - \frac{1}{\lambda_0}\right)}$$

$$\left(\frac{1}{2\lambda} - \frac{1}{\lambda_0}\right) = \left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)$$

$$\frac{2}{\lambda} - \frac{4}{\lambda_0} = \frac{1}{\lambda} - \frac{1}{\lambda_0}$$

$$\frac{2}{\lambda} - \frac{1}{\lambda} = \frac{4}{\lambda_0} - \frac{1}{\lambda_0}$$

$$\frac{2-1}{\lambda} = \frac{4-1}{\lambda_0}$$

$$\frac{1}{\lambda} = \frac{3}{\lambda_0}$$

$\lambda_0 = 3\lambda$

threshold wavelength in terms of $\lambda_0 = 3\lambda$

9. Critical angle of a material w.r.t. vacuum is 45°. If speed of light in vacuum is 3×10^8 m/s. Find speed of light in that medium.

(1) $\sqrt{2} \times 10^8$ m/s (2) 5×10^7 m/s (3) 3.12×10^8 m/s (4) 2.12×10^8 m/s

Ans. (4)

Sol. $n = \sqrt{2}$

$$V = \frac{C}{n} = \frac{3}{\sqrt{2}} \times 10^8 = 2.12 \times 10^8 \text{ m/s}$$

10. A machine gun fires bullets of mass 10 gm each with 250 m/s. If 125 N force acts to hold it. Find the number of bullets fired per seconds :

(1) 55 (2) 45 (3) 40 (4) 65

Ans. (1)

Sol. $$F = \frac{\Delta P}{\Delta t} = \frac{N}{t} \times \frac{10}{1000} \times 250$$

$$125 = \frac{5}{2} \times \frac{N}{t} \Rightarrow \frac{N}{t} = 50$$

11. $F = 2 + 3x$ N acting on a particle. Then work done by force when particle displaced from $x = 0$ to $x = 4$:

(1) 32 J (2) 22 J (3) 16 J (4) 12 J

Ans. **(1)**

Sol. $W = \int_{x=0}^{x=4} F dx = 2x + \frac{3x^2}{2}$

$= 2(4) + \frac{3}{2}(16) = 8 + 24 = 32$ J

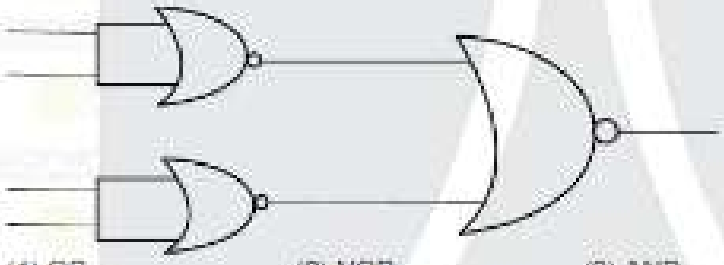
12. Three gases Ne, Cu_2 and XeF_6 (monoatomic, diatomic and polyatomic) are at same temperature. Find the order of v_{rms} of gases

(1) $v_{mono} > v_{dia} > v_{poly}$ (2) $v_{mono} = v_{dia} > v_{poly}$ (3) $v_{mono} < v_{dia} < v_{poly}$ (4) $v_{mono} = v_{dia} = v_{poly}$

Ans. **(1)**

Sol. $\sqrt{\frac{3RT}{M}}$

13.



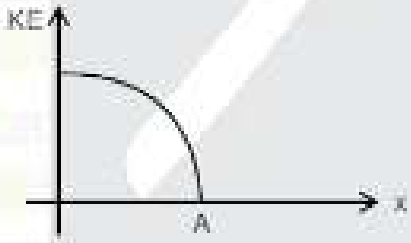
(1) OR (2) NOR (3) AND (4) NAND

Ans. **(3)**

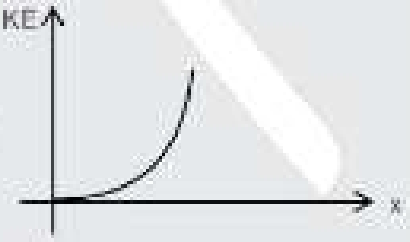
Sol. A . B is the Boolean equation

14. Which is the correct graph for K.E. v/s position in SHM.

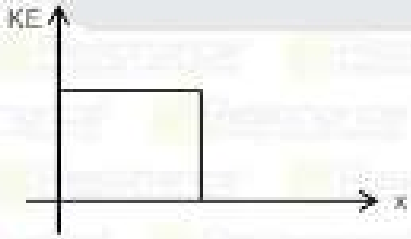
(1)



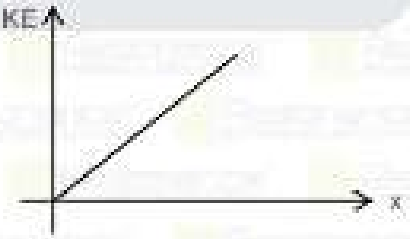
(2)



(3)



(4)



Ans. **(1)**

15. A coin placed on a rotating turntable just slips at 1 cm distance from axis at angular speed ω. At what distance will it slip at speed $\frac{\omega}{2}$:

(1) 4 cm (2) 2 cm (3) 1 cm (4) 6 cm

Ans. **(1)**

Sol. $m\omega^2 r = \mu mg$

$$m\left(\frac{\omega}{2}\right)^2 r' = \mu mg$$

$$r = \frac{r'}{4}$$

$r' = 4$ cm

16. Half-life of a radioactive sample A is equal to average life of sample B, then which of the following options is correct

(1) $\lambda_A = m\lambda_B$ (2) $\lambda_B = 2/m2\lambda_A$ (3) $\lambda_A = 2/m2\lambda_B$ (4) $\lambda_A = /m2\lambda_B$

Ans. (4)

Sol. $\lambda_A = \frac{/m2}{t_{A_{1/2}}} = \frac{/m2}{t_B} = m2\lambda_B$

17. If a wire is stretched with force 100 N, its length is ℓ_1. If force applied is 120 N, its length is ℓ_2. If $10\ell_2 = 11\ell_1$ & natural length $\ell_0 = \frac{1}{x}\ell_1$. Find x

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

Ans. (2)

Sol. $100 = K(\ell_1 - \ell_0)$

$120 = K(\ell_2 - \ell_0)$

$$\frac{6}{5} = \frac{\ell_2 - \ell_0}{\ell_1 - \ell_0}$$

$\Rightarrow 6\ell_1 - 6\ell_0 = 5\ell_2 - 5\ell_0$

$\rightarrow \quad 6\ell_1 - 5\ell_2 = \ell_0 \quad \rightarrow \quad 6\ell_1 - \frac{11}{2}\ell_1 = \ell_0 \quad \rightarrow \quad \frac{1}{2}\ell_1 = \ell_0$

18. 1 g water at 100°C is converted to 1g steam at 100°C and 1atm pressure. If volume of water is 1×10^{-6} m³ and that of steam is 1.671×10^{-3} m³ and latent heat of vaporization is 2456 $\frac{KJ}{kg}$. Find the increase in internal average of water :

(1) 2050 J (2) 2250 J (3) 2289 J (4) 2089 J

Ans. (3)

Sol. $\Delta W = P\Delta V = 1.670 \times 10^2 = 167$ J

$\Delta Q = mL = 2456$ J

$\Delta u = \Delta Q - \Delta W = 2289$ J

19. Range of a tower for transmitting signals on earth surface is 4 km. If radius of earth is 6400 km, the height of the tower is $x \times 10^{-2}$m, find x

(1) 125 (2) 100 (3) 50 (4) 150

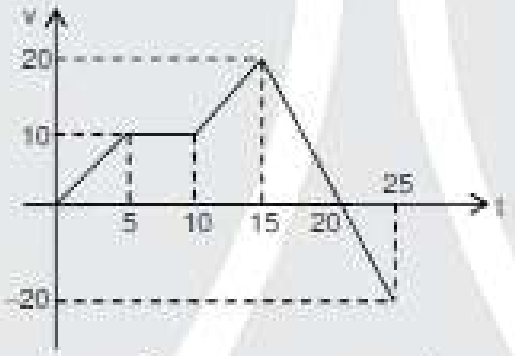
Ans. (1)

Sol. $h = \frac{d^2}{2R} = 125 \times 10^{-2}$m

20. **Statement-1 :** AU, Parsec & light year are used to measure large distance.
Statement-2 : AU < Parsec < Light year.
(1) Statement-1 and statement-2 both are correct
(2) Statement-1 and statement-2 both are incorrect
(3) Statement-1 is correct but statement-2 is incorrect
(4) Statement-1 is incorrect and statement-2 is correct

Ans. **(3)**
Sol. 1 Parsec = 2.06×10^5 AU = 3.26 light year
AU < Light Year < Parsec

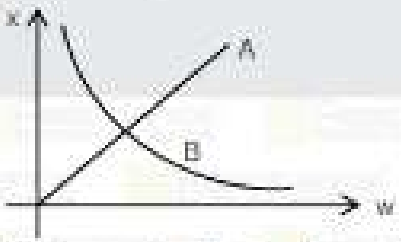
21. Velocity time curve for a particle moving in a straight line is shown, find the ratio of distance and displacement in the shown time interval.



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

Ans. **(1)**
Sol. Distance = 25 + 50 + 75 + 50 + 50 = 250
Displacement = 25 + 50 + 75 + 50 − 50 = 150
$\Rightarrow \frac{250}{150} = \frac{5}{3}$

22. Graph A and B shown are for inductor L, capacitor C or resistor R.



Choose the right option matching the graph with the element (Here ω = angular frequency and x is reactant).
(1) A → L ; B → C (2) A → C ; B → L (3) A → R ; B → L (4) A → C ; B → R

Ans. **(1)**
Sol. $X_L = \omega L$
$X_C = \frac{1}{\omega C}$