JEE Main September 2020

Question Paper With Text Solution

4 September| Shift-1

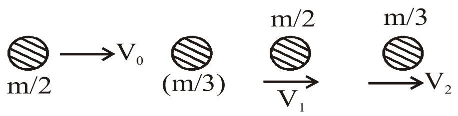
PHYSICS

JEE MAIN SEP 2020 | 4 SEP SHIFT-1

1. Particle A of mass $m_A = \frac{m}{2}$ moving along the x-axis with velocity v_0 collides elastically with another particle B at rest having mass $m_B = \frac{m}{3}$. If both particles move along the x-axis after the collision, the change $\Delta\lambda$ in de-Broglie wavlength of particle A, in de-Broglie wavlength of particle A, in terms of its de-Broglie wavelength (λ_0) before collision is :

(A) $\Delta\lambda = 2\lambda_0$ (B) $\Delta\lambda = \frac{5}{2}\lambda_0$ (C) $\Delta\lambda = \frac{3}{2}\lambda_0$ (D) $\Delta\lambda = 4\lambda_0$

Ans (D)

Sol.


Pi = Pf

$$\Rightarrow \frac{m}{2}V_0 + 0 = \frac{m}{2}V_1 + \frac{m}{3}V_2$$

$$\Rightarrow \frac{V_0}{2} = \frac{V_1}{2} + \frac{V_2}{3}$$

$$\Rightarrow 3V_1 + 2V_2 = 3V_0$$

$$\Rightarrow 3V_1 + 2V_1 = V_0$$

$$V_1 = \frac{V_0}{5}$$

as $\lambda \propto \frac{1}{P}$ so $\frac{\lambda_0}{\lambda} = \frac{P_f}{P_i} = \frac{(m/2)\left(\frac{V_0}{5}\right)}{\left(\frac{m}{2}\right)V_0} = \lambda = 5\lambda_0$

Change in de-brogile wavelength = $5\lambda_0 - \lambda_0 = 4\lambda_0$

2. The specific heat of water = 4200 $Jkg^{-1}K^{-1}$ and the latent heat of ice = 3.4×10^5 J kg^{-1}. 100 grams of ice at 0ºC is placed in 200g of water at 25ºC. The amount of ice that will melt as the temperature ofwater reaches 0ºC is close to (in grams).

(A) 63.8 (B) 61.7 (C) 69.3 (D) 64.6

Ans (B)

Sol. By using colorimetry principle

$H_{\text{loss by water}} = H_{\text{gain by ice}}$

$\Rightarrow \left(\frac{200}{1000}\right) \times 4200 \times 25 = x \times 3.4 \times 10^5$

$\Rightarrow 10500 = x \times 3.4 \times 10^5$

$x = 61.76\,\text{gm}$

3. For a transverse wave travelling along a straight line, the distance between two peaks (crests) is 5m, while the distance between one crest and one trough is 1.5 m. The possible wavelengths (in m) of the waves are :

(A) 1, 3, 5, ...

(B) 1, 2, 3, ...

(C) $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}$, ...

(D) $\frac{1}{1}, \frac{1}{2}, \frac{1}{4}$, ...

Ans (D)

Sol. Trough to crest distance

$1.5 = (2n_1 + 1)\,\frac{\lambda}{2}$ .... (1)

Trough to trough distance

$5 = (n_2\lambda)$ .... (2)

from (1) and (2)

$\frac{1.5}{5} = \frac{2n_1 + 1}{2(n_2)}$

$3n_2 = 10n_1 + 5$

n_1 and n_2 should be integers

(1) $n_1 = 1, n_2 = 5, \lambda = 1$

(2) $n_1 = 4, n_2 = 15, \lambda = \frac{1}{3}$

(3) $n_1 = 7, n_2 = 25, \lambda = \frac{1}{5}$

4. Choose the correct option relating wavelengths of different part of electromagnetic wave spectrum :

(A) $\lambda_{x-rays} < \lambda_{micro\ waves} < \lambda_{radio\ waves} < \lambda_{visible}$

(B) $\lambda_{visible} > \lambda_{x-rays} > \lambda_{radio\ waves} > \lambda_{micro\ waves}$

(C) $\lambda_{radio\ waves} > \lambda_{micro\ waves} > \lambda_{visible} > \lambda_{x-rays}$

(D) $\lambda_{visible} < \lambda_{micro\ waves} < \lambda_{radio\ waves} < \lambda_{x-rays}$

Ans (C)

Sol. Part of theory

5. A small bar magnet placed with its axis at 30º with an external field of 0.06 T experiences a torque of 0.018 Nm. The minimum work required to rotate it from its stable to unstable equilibrium position is :

(A) 9.2×10^{-3} J (B) 6.4×10^{-2} J (C) 7.2×10^{-2} J (D) 11.7×10^{-3} J

Ans (C)

Sol. $\tau = MB \sin\theta$

$0.018 = M \times 0.06 \times \sin 30^{\circ}$

$$M = \frac{0.018}{0.06 \times \frac{1}{2}}$$

$M = 0.06$ A–m^2

for $U_{min} \Rightarrow \theta = 0^{\circ}$

$U_{min} = -MB\cos 0^{\circ} = -MB$

for $U_{max} \Rightarrow \theta = 180^{\circ}$

$U_{max} = -MB(-1) = MB$

$W = \Delta U = U_{max} - U_{min}$

$W = MB - (-MB)$

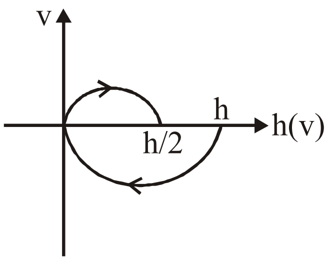
$= 2\,MB$

$= 2 \times 0.06 \times 0.6$

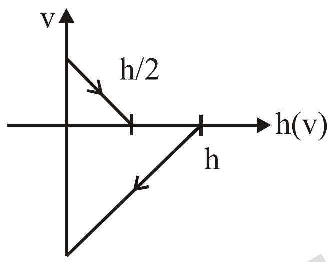
$= 0.072$ J

6. A Tennis ball is released from a height h and after freely falling on a wooden floor it rebounds and reaches height $\frac{h}{2}$. The velocity versus height of the ball during its motion may be represented graphically by : (graph are drawn schematically and on not to scale)

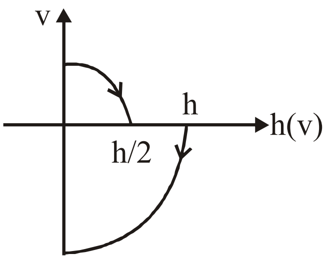
(A)



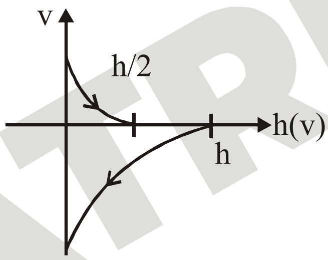
(B)



(C)



(D)



Ans (C)

Sol. (i) For uniformly accelerated/deaccelerated motion

$v^2 = u^2 \pm 2\ gh$

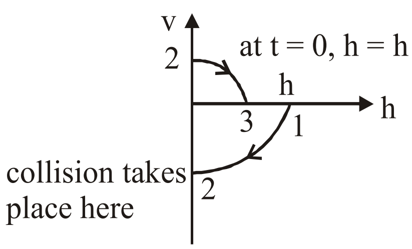
i.e. v – h graph will be a parabola (because equation is quadratic).

(ii) Initially velocity is downwards (–ve) and then after collision it reverses its direction with lesser magnitude. i.e. velocity is upwards (+ve). Graph (A) satisfies both these conditions.

Therefore, correct answer is (A)

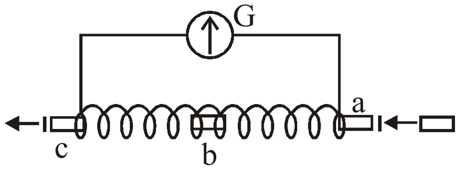
Note that time t = 0 corresponds to the point on the graph where h = h

Next time collision takes place at 3.

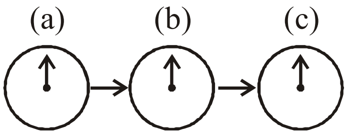


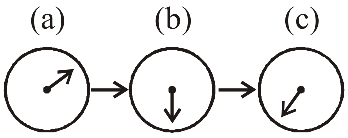
1→ 2 : V increases downwards
At 2 → velocity changes its direction
2 → 3 V decreases upwards

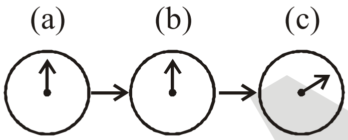
7. A small bar magnet is moved through a coil at constant speed from one end to the other. Which of the following series of observations will be seen on the galvanometer G attached across the coil ?

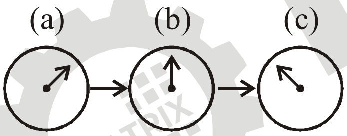


Three positions shown describe : (a) the magnet's entry (b) magnet is completely inside and (c) magnet's exit.

(A) 

(B) 

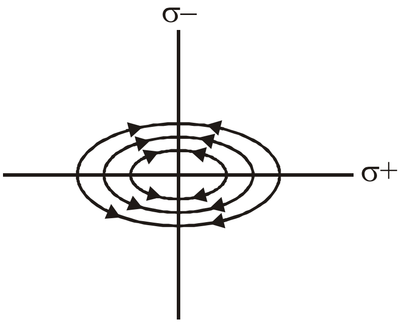
(C) 

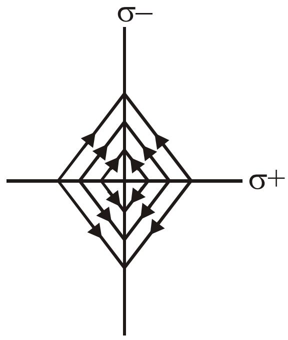
(D) 

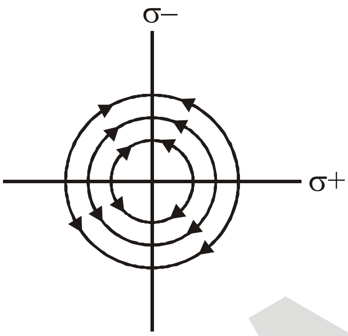
Ans (D)

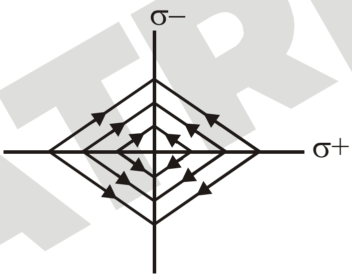
Sol. first ϕ increases $\rightarrow$ so current flow
then ϕ remaining constant $\rightarrow$ No current
then ϕ decreases $\rightarrow$ current flow

8. Two charged thin infinite plane sheets of uniform surface charge density σ + and σ–, where $|\sigma_+|>|\sigma_-|$, intersect at right angle. Which of the following best represents the electric field lines for this system:

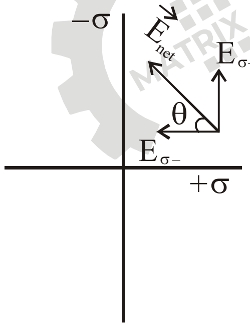
(A)


(B)


(C)


(D)


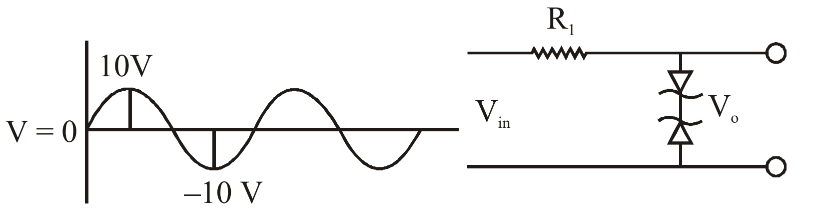
Ans (B)

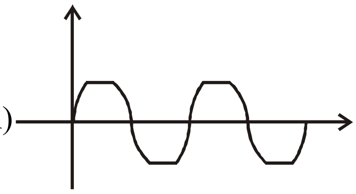
Sol.


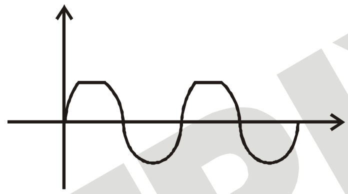
as $E_{\sigma+} > E_{\sigma-}$

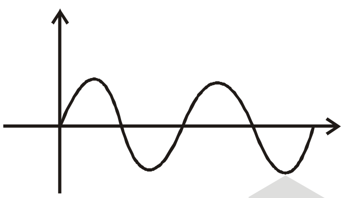
$\theta > 45°$

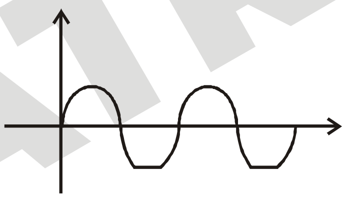
9. Take the breakdown voltage of the zener diode used in the given circuit as 6V. For the input voltage shown in figure below, the time variation of the output voltage is : (Graphs drawn are schematic and hot to scale)



(A) 

(B) 

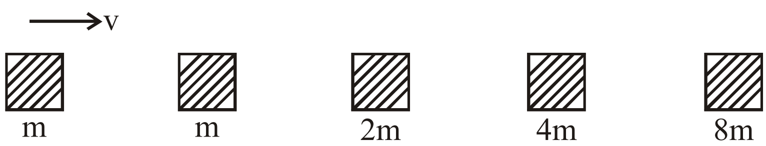
(C) 

(D) 

Ans (A)

Sol. Part of theory

10. Four blocks of masses m, 2m, 4m and 8m are arranged in a line on a frictionless floor. Another block of mass m, moving with speed v along the same line (see figure) collides with mass m in perfectly inelastic manner. All the subsequent collisions are also perfectly inelastic. By the time the last block of mass 8m starts moving the total energy loss is p% of the original energy. Value of 'p' is close to :



(A) 87 (B) 37 (C) 77 (D) 94

Ans (D)

Sol. 

Ist colliscon

$KE_i = \frac{1}{2}mv^2$

$KE_f = \frac{1}{2}(16\,m)\left(\frac{v}{16}\right)^2$

$= \frac{1}{32}mv^2$

$mv = 16mv \Rightarrow V^1 = \frac{V}{16}$

$\% \text{ loss} = \frac{\frac{1}{2}mv^2 - \frac{1}{32}mv^2}{\left(\frac{1}{2}mv^2\right)} \times 100$

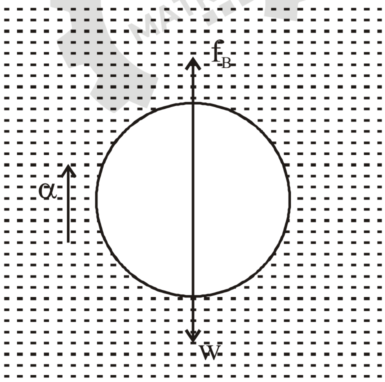
$= \left(\frac{15}{16}\times 100\right)\% = 93.75\%$

11. A air bubble of radius 1 cm in water has an upward acceleration 9.8 cm s^{-2}. The density of water is 1 gm cm^{-3} and water offers negligible drag force on the bubble. The mass of the bubble is (g = 980 cm/s^2).

(A) 1.52 gm (B) 4.51 gm (C) 3.15 gm (D) 4.15 gm

Ans (D)

Sol.



$f_B = \rho_w Vg$

$W = mg$

for 2^{nd} Law $\Rightarrow f_B - w = ma$

$\Rightarrow \rho_w Vg - mg = ma \qquad \Rightarrow a = \left(\frac{\rho_w V}{m} - 1\right)g$

$$\Rightarrow a = \left(\frac{1000 \times \frac{4}{3} \times \pi \times 10^{-6}}{m}\right)9.8$$

$\Rightarrow \frac{0.098}{9.8} = \frac{4}{3}\frac{\pi}{m} \times 10^{-3} - 1 \qquad \Rightarrow \frac{4\pi}{3m} \times 10^{-3} = 1.01$

$\Rightarrow m = \frac{4\pi}{3 \times 1.01} \times 10^{-3}$

$m = 4.147$ gm

12. Dimensional formula for thermal conductivity is (here K denotes the temperature) :

(A) $MLT^{-3}K^{-1}$ (B) $MLT^{-2}K$ (C) $MLT^{-3}K$ (D) $MLT^{-2}K^{-2}$

Ans (A)

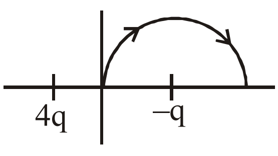
Sol. As $\left(\frac{dk}{dt}\right) = KA\left(\frac{dT}{dx}\right)$

$\Rightarrow K = \left(\frac{dk}{dt}\right)\frac{1}{A}\left(\frac{dx}{dT}\right)$

$[K] = \left(\frac{M^1L^2T^{-3}}{L^2}\right)\frac{L}{K}$

$[K] = M^1 L^1 T^{-3} K^{-1}$

13. A two point charges 4q and –q are fixed on the x–axis at $x = -\frac{d}{2}$ and $x = \frac{d}{2}$, respectively. If a third point charge 'q' is taken from the origin to x = d along the semicircle as shown in the figure, the energy of the charge will :



(A) increase by $\frac{3q^2}{4\pi\epsilon_0 d}$ (B) decrease by $\frac{4q^2}{3\pi\epsilon_0 d}$

(C) increase by $\frac{2q^2}{3\pi\epsilon_0 d}$ (D) decrease by $\frac{q^2}{4\pi\epsilon_0 d}$

Ans (B)

Sol. At O

$$V_0 = \frac{K(4q)}{\left(\frac{d}{2}\right)} + \frac{K(-q)}{\left(\frac{d}{2}\right)}$$

$$V_0 = \frac{8Kq}{d} - \frac{2Kq}{d} = \frac{6Kq}{d}$$

$$V_p = \frac{K(4q)}{\left(\frac{3d}{2}\right)} + \frac{K(-q)}{\left(\frac{d}{2}\right)}$$

$$V_p = \frac{8Kq}{3d} - \frac{2Kq}{d} = \frac{2}{3}\frac{Kq}{d}$$

$$\Delta V = \text{Change in potential} = V_p - V_o = \left(\frac{2}{3} - 6\right)\frac{Kq}{d} = -\frac{16}{3}\frac{Kq}{d}$$

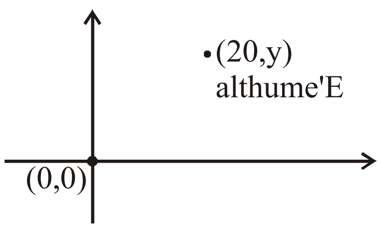
$$\text{Change in potentcal energy } \Delta V = -\frac{16}{3}\frac{Kqq}{d} \quad \frac{-16Kqq}{3d} = \frac{-4q^2}{3\pi \in_0 d}$$

14. Starting from the origin at time t = 0, with initial velocity $5\hat{j}ms^{-1}$, a particle moves in the x – y plane with a constant acceleration of $(10\hat{i} + 4\hat{j})ms^{-2}$. At time t, its coordinates are (20 m, y_0 m). The values of t and y_0 are, respectively :

(A) 2 s and 18 m (B) 4 s and 52 m (C) 5 s and 25 m (D) 2 s and 24 m

Ans (A)

Sol.



$\vec{u} = 5m/sec\,\hat{j}$ $\vec{a} = 10\hat{i} + 4\hat{j}$

X direction

$$x = 0 + \frac{1}{2} \times 10 \times t^2$$

$20 = \frac{1}{2} \times 10\, t^2$

$t = 2$ sec

y direction

$y = 5\times 2 + \frac{1}{2} \times 4(2)^2$ ....(Put t = 2 sec.)

$y = 18$

15. A beam of plane polarised light of large cross–sectional area and uniform intensity of 3.3 Wm^{-2} falls normally on a polariser (cross sectional area $3 \times 10^{-4}\ m^2$) which rotates about its axis with an angular speed of 31.4 rad/s. The energy of light passing through the polariser per revolution, is close to :

(A) 5.0×10^{-4} J (B) 1.5×10^{-4} J (C) 1.0×10^{-4} J (D) 1.0×10^{-5} J

Ans (A)

Sol. Avg energy = $I_0 A \times (< \cos^2\theta >)$

[for one cycle] $\rightarrow < \cos^2\theta > = \frac{1}{2}$

$= 3.3 \times 3 \times 10^{-4} \times \frac{1}{2}$

$= \frac{9.9}{2} \times 10^{-4} = 4.95 \times 10^{-4}$

16. Match the $C_p \backslash C_V$ ratio for ideal gases with different type of molecules :

Molecule Type	C_P/C_V
(A) Monatomic	(I) 7/5
(B) Diatomic rigid molecules	(II) 9/7
(C) Diatomic non–rigid molecules	(III) 4/3
(D) Triatomic rigid molecules	(IV) 5/3

(1) (A)–(IV), (B)–(II), (C)–(I), (D)–(III)

(2) (A)–(II), (B)–(III), (C)–(I), (D)–(IV)

(3) (A)–(IV), (B)–(I), (C)–(II), (D)–(III)

(4) (A)–(III), (B)–(IV), (C)–(II), (D)–(I)

Ans (C)

Sol. $\gamma = \frac{f+2}{f}$

for montomic

$f = 3, \quad \gamma = 5/3$

for Diatomic rigid

$f = 5, \quad \gamma = 7/5$

for Diatomic non rigid - $f = 7, \quad \gamma = 9/7$

for Triatomic rigid $f = 6$ $\gamma = \frac{8}{6} = \frac{4}{3}$

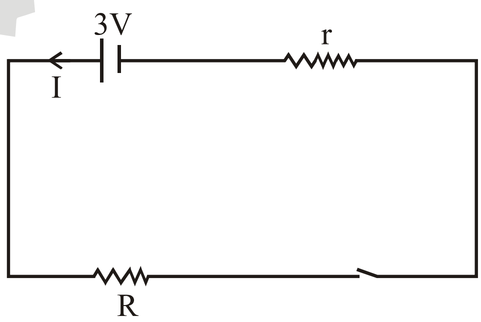
$A \rightarrow IV$
$B \rightarrow I$
$C \rightarrow II$
$D \rightarrow III$

17. A battery of 3.0 V is connected to a resistor dissipating 0.5 W of power. If the terminal voltage of the battery is 2.5 V, the power dissipated within the internal resistance is :

(A) 0.50 W (B) 0.125 W (C) 0.10 W (D) 0.072 W

Ans (C)

Sol.



Given $V_R = 2.5V$ also $\frac{V_R}{V_r} = \frac{IR}{Ir} \Rightarrow \frac{R}{r} = \frac{2.5}{0.5} = 5 \quad \Rightarrow R = 5r$

$\Rightarrow V_r = 0.5V$

Rate Heat Loss across R, $(P_R) = I^2R = 0.5$

Power loss arcoss r = $Pr = I^2r$

$\Rightarrow \frac{P_R}{P_r} = \frac{R}{r} = 5 \quad \Rightarrow P_r = \frac{P_R}{5} = 0.1$ watt

18. On the x–axis and at a distance x from the origin, the gravitational field due to a mass distribution is given by $\frac{Ax}{(x^2+a^2)^{3/2}}$ in the x–direction. The magnitude of gravitational potential on the x–axis at a distance x, taking its value to be zero at infinity, is :

(A) $A(x^2+a^2)^{3/2}$ (B) $\frac{A}{(x^2+a^2)^{3/2}}$ (C) $A(x^2+a^2)^{1/2}$ (D) $\frac{A}{(x^2+a^2)^{1/2}}$

Ans (D)

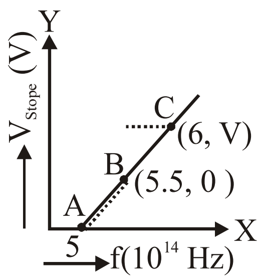
Sol. $E=\frac{Ax}{(a^2+x^2)^{\frac{3}{2}}}=-\frac{dv}{dx}$

$\Rightarrow \int_0^v dv=-\int_\infty^x A\frac{x}{(a^2+x^2)^{\frac{3}{2}}}dx$

$\Rightarrow V=\left[\frac{A}{\sqrt{a^2+x^2}}\right]_\infty^x=\left[\frac{A}{\sqrt{a^2+x^2}}-0\right]$

$V=\frac{A}{\sqrt{a^2+x^2}}$

19. Given figure shows few data points in a photo electric effect experiment for a certain metal. The minimum energy for ejection of electron from its surface is : (Plancks constant h = 6.62 × 10^{-34} J.s)



(A) 1.93 eV (B) 2.27 eV (C) 2.59 eV (D) 2.10 eV

Ans (B)

Sol. $eV_S=hv-\phi$

$V_S=\left(\frac{h}{e}\right)\nu-\phi$

when $f = 5.5 \times 10^{14}$ Hz, $V_S = 0$

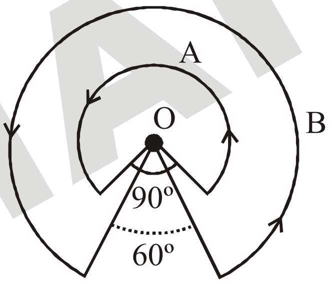
so $\phi = \frac{h}{e} \times \nu$

$\phi = \frac{6.62 \times 10^{-34}}{1.6 \times 10^{-19}} \times 5.5 \times 10^{14}$

$\phi = \frac{6.62 \times 5.5}{1.6 \times 10}$

$\phi = \frac{3.641}{1.6} = 2.27\,\text{eV}$

20. A wire A, bent in the shape of an arc of a circle, carrying a current of 2 A and having radius 2 cm and another wire B, also bent in the shape of arc of a circle, carryinga current of 3 A and having radius of 4 cm, are placed as shown in the figure. The ratio of the magnetic fields due to the wires A and B at the common centre O is :



(A) 6 : 5 (B) 6 : 4 (C) 4 : 6 (D) 2 : 5

Ans (A)

Sol. $B_{center} = \frac{\mu_0 I}{u\pi R}\theta$

When $\theta_1 = 360 - 90 = 270^o$ When $\theta_2 = 300^o$

$I_1 = 2A$ $I_2 = 3A$

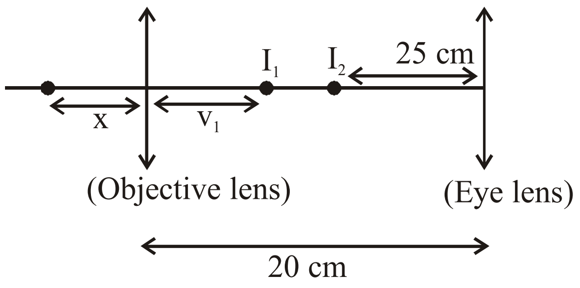
$R_1 = 2cm$ $R_2 = 4cm$

$\frac{B_1}{B_2} = \frac{I_1}{I_2}\frac{\theta_1}{\theta_2}\frac{R_2}{R_1} = \frac{6}{5}$

21. In a compound microscope, the magnified virtual image is formed at a distance of 25 cm from the eye–piece. The focal length of its objective lens is 1 cm. If the magnification is 100 and the tube length of the microscope is 20 cm, then the focal length of the eye–piece lens (in cm) is _______.

Given 4

Sol.



for objective lens

$\frac{1}{v_1} - \frac{1}{-x} = \frac{1}{1}$ $\quad = v_1 = \frac{x}{x-1}$

magnification $|m_1| = \left|\frac{v_1}{u_1}\right| = \frac{1}{x-1}$

for eye lens

$u = -(20 - v_1) = -\left[20 - \frac{x}{x-1}\right]$

$v_2 = -25$

angular magnification $|m_2| = \left|\frac{D}{u_2}\right| = \frac{25}{|u_2|}$

Total magnifiaction = $m_1 m_2 = 100$

$$\Rightarrow \left(\frac{1}{x-1}\right)\left[\frac{25}{20 - \left(\frac{x}{x-1}\right)}\right] = 100$$

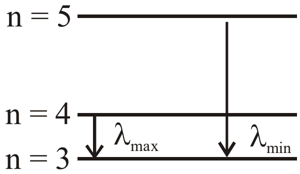
$x = \frac{81}{76}$

$u_2 = \frac{-19}{5}$ now by lens formula $\frac{1}{-25} - \frac{1}{\left(\frac{-19}{5}\right)} = \frac{1}{fe} \Rightarrow fe = 4.98\text{cm}$

22. In the line spectra of hydrogen atom, difference between the largest and the shortest wavelengths of the Lyman series is 304Å. the corresponding difference for the Paschan series in Å is : ______.

Ans 10553 Å

Sol.



For Lyman series

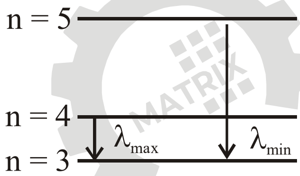
$$\frac{1}{\lambda_{min}} = R\left(1-\frac{1}{\infty}\right) = R \qquad \Rightarrow \lambda_{min} = \frac{1}{R}$$

$$\Rightarrow \lambda_{max} = R\left(1-\frac{1}{R}\right) = \frac{3R}{4} \qquad \Rightarrow \lambda_{max} = \frac{4}{3R}$$

$$\lambda_{max} - \lambda_{min} = \frac{4}{3R} - \frac{1}{R} = \frac{1}{3R} = 304 A^o$$

$$\Rightarrow \frac{1}{R} = (304\times 3)\, A^o \quad ....(i)$$

Also her paschem



$$\frac{1}{\lambda_{max}} = R\left(\frac{1}{9}-\frac{1}{16}\right) = \frac{7R}{16\times 9}$$

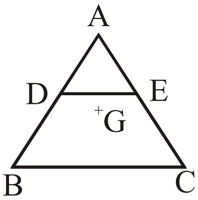
$$\frac{1}{\lambda_{min}} = R\left(\frac{1}{9}-\frac{1}{\infty}\right) = \frac{R}{9}$$

$$(\lambda_{max} - \lambda_{min}) = \frac{16\times 9}{7R} - \frac{9}{R} = \frac{81}{7R}$$

$$\text{so } \lambda_{max} - \lambda_{min} = \left(\frac{81}{7}\times 304\times 3\right) \qquad ....(\text{from eqn (i)})$$

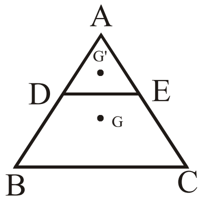
$= 10553\ A^o$

23. ABC is a plane lamina of the shape of an equilateral triangle. D, E are mid points of AB, AC and G is the centroid of the lamina. Moment of inertia of the lamina about an axis passing through G and perpendicular to the plane ABC is I_0. If part ADE is removed, the moment of inertia of the remaining part about the same axis is $\frac{NI_0}{16}$ where N is an integer. Value of N is ______.



Ans 11

Sol.



Let side of trangle = a, mas = m then $I_G = \frac{ma^2}{12} = I_0$
(G = Centroid)

Let moment of inertia of trangular plate ADE about G' is I_1 & mass of plate ADE = $\frac{m}{4}$

so $I_1 = \frac{\left(\frac{m}{4}\right)\left(\frac{a}{2}\right)^2}{12} = \frac{ma^2}{192}$

Now

Distance between G & G' = $\frac{11}{16}I_0$

Moment of inertia of ADE about G = $\frac{ma^2}{192} + \left(\frac{m}{4}\right)\left(\frac{a}{2\sqrt{3}}\right)^2$

$= \frac{5}{192}ma^2$

So moment of inertia of remaning mass = $\frac{ma^2}{12} - \frac{5ma^2}{192} = \frac{11}{12\times16}ma^2$

$= \frac{11}{16}I_0$ $\Rightarrow N = 11$

24. A closed vessel contains 0.1 mole of a monatomic ideal gas at 200 K. If 0.05 mole of the same gas at 400 K is added to it, the gas in the vessel will be close to _______.

Ans 266.67 K

Sol. $U_i = U_f$

$$\frac{f}{2}n_1RT_1 + \frac{f}{2}n_2RT_2 = \frac{f}{2}(n_1 + n_2)RT_f$$

$n_1T_1 + n_2T_2 = (n_1+n_2)T_f$

$\Rightarrow 0.1 \times 200 + 0.05 \times 400 = (0.1 + 0.05)\ T_f$

also $T_f = 266.67$

25. A circular disc of mass M and radius R is rotating about its axis with angular speed ω_1. If another stationary disc having radius $\frac{R}{2}$ and same mass M is dropped co–axially on to the rotating disc. Gradually both discs attain constant angular speed ω_2. The energy lost in the process is p% of the initial energy. Value of p is _________.

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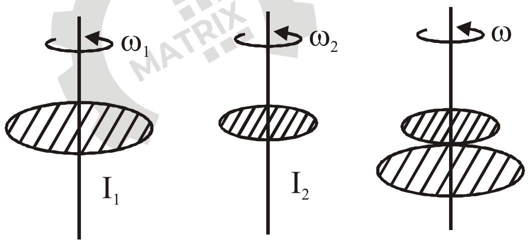
Ans 20%

Sol.



Angluar momentum conservation

$I_1\omega_1 + I_2\omega_2 = (I_1 + I_2) \times \omega f$

$$\frac{MR^2}{2}\times\omega + 0 = \left(\frac{MR^2}{2} + \frac{M}{2}\left(\frac{R}{2}\right)^2\right)\omega f$$

$$\omega_f = \frac{4}{5}\omega$$

Final K.E.

$$K_f = \frac{1}{2}\left(\frac{MR^2}{2} + \frac{MR^2}{8}\right)\frac{16}{25}\omega^2$$

$$K_f = \frac{MR^2\omega^2}{5}$$

$$K_i = \frac{1}{2}\left(\frac{MR^2}{2}\right)\omega^2 = \frac{MR^2\omega^2}{4}$$

Percentage loss in kinetic energy

$$\%loss = \frac{\frac{MR^2\omega^2}{4} - \frac{MR^2\omega^2}{5}}{\frac{MR^2\omega^2}{4}} \times 100 = 20\%$$