JEE ADVANCED-2018 (PAPER-2)

PHYSICS

1. Ans. (ABD)

Sol.

$$m v \frac{dv}{dt} = \frac{dk}{}$$

$$v\, dv = \frac{\gamma}{m} t\, dt$$

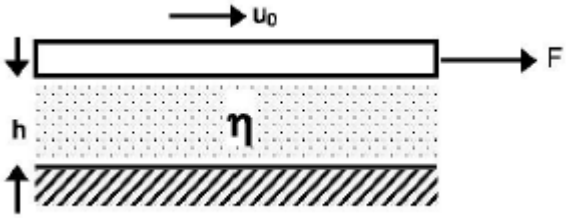
$$\frac{v^2}{2} = \frac{\gamma}{m}\frac{t^2}{2} \qquad \Rightarrow v \propto t$$

$$\frac{dv}{dt} = \text{constant} \qquad \Rightarrow F = \text{constnat}$$

$$\frac{dx}{dt} \propto t \qquad \Rightarrow x \propto t^2$$

2. Ans. (ACD)

Sol.



$$f = \eta A \frac{dv}{dy}$$

$$= \eta A \frac{u_0}{h}$$

3. Ans. (AB)

Sol.

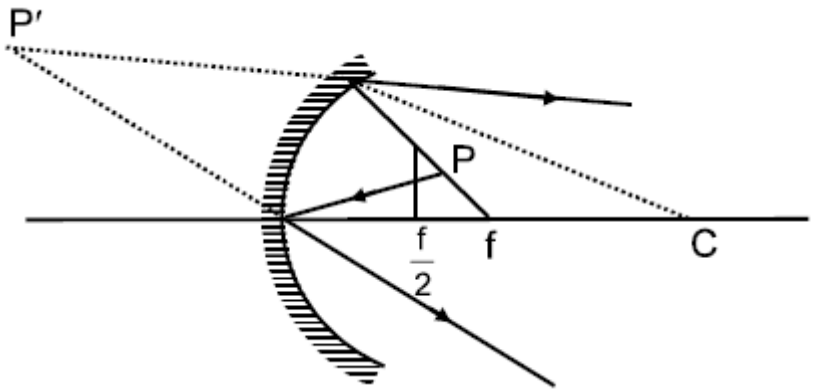
1

$$Q_{enc} = \lambda\sqrt{3}R$$

$$\phi = \frac{Q_{enc}}{\in_0} = \frac{\sqrt{3}\lambda R}{\in_0}$$

4. Ans. (B)

Sol.



The angle of the object is $45°$ the focus will not be defined for all points. For small angle the answer would be 'C' but for $45°$ best option is B

5. Ans. (AC)

Sol.

$$_{90}Th^{232} \rightarrow {}_{82}Pb^{212} + x_2He^4 + y_{-1}e^0$$

$$2x - y = 8$$

$$4x = 20$$

6. Ans. (AC)

Sol.

$$(2n+1)\frac{\lambda}{4} = 50.7\,\text{cm} + e$$

$$(2n+3)\frac{\lambda}{4} = 83.9\,\text{cm} + e$$

$$\text{using } n = 1 e = -0.9\,\text{cm}$$

$$\lambda = 66.4\ \text{cm}$$

$$\text{v} = f\lambda = 332\,\text{m/s}$$

7. Ans. 6.30

Sol.

$$v_0 = \frac{J}{m} = \frac{1}{0.4} = \frac{5}{2}\,\text{m/s}$$

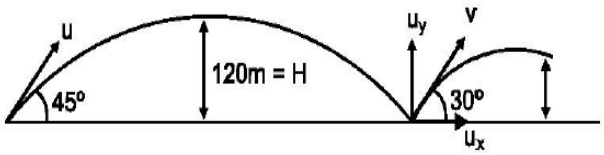
$$s = v_0 \int_0^{\tau} e^{-t/\tau}\,dt$$

$$= v_0 \tau \left(1 - e^{-1}\right)$$

$$= \left(\frac{5}{2}\right)(4)(0.63) = 6.30\,\text{m}$$

8. Ans. 30 m

Sol.



3

$$K_2 = \frac{1}{2} m u^2 \qquad \frac{U_y}{U_x} = \tan 30° = \frac{1}{\sqrt{3}}$$

$$H = \frac{u^2 \sin^2 45°}{2g} \qquad \sqrt{3} u_y = u_x .$$

$$= \frac{u^2}{4g} = 120\,\text{m} \qquad K_f = \frac{1}{2} m u^2 = \frac{1}{2} m \left(u_x^2 + u_y^2 \right)$$

$$K_f = \frac{1}{2} K_i$$

$$\Rightarrow \quad \frac{1}{2} m \left(u_x^2 + u_y^2 \right) = \frac{1}{2} \times \frac{1}{2} m u^2$$

$$\Rightarrow \quad u_x^2 + u_y^2 = \frac{u^2}{2}$$

$$\Rightarrow \quad 3u_y^2 + u_y^2 = \frac{u^2}{2}$$

$$\Rightarrow \quad u_y^2 = \frac{u^2}{8}$$

$$h = \frac{u_y^2}{2g} = \frac{u^2}{16g} = \frac{1}{4}\left(\frac{u^2}{4g} \right) = \frac{H}{4} = \frac{120}{4} = 30\,\text{m}$$

9. Ans. 2.00

Sol.

$$E = qE_0 \sin \omega t = m \frac{dv}{dt}$$

$$\int_0^v dv = \frac{qE_0}{m} \int_0^{\pi/\omega} \sin \omega t \, dt$$

$$v = \frac{qE_0}{\omega m} \left(-\cos \omega t \right)_0^{\pi/\omega}$$

$$= -\frac{qE_0}{m\omega} \left((-\cos \pi) - (-\cos 0) \right)$$

$$= \frac{2qE_0}{m\omega} = 2\,\text{m/s}$$

10. Ans. 5.56 or 5.55

Sol.

$N = 50$

$A = 2 \times 10^{-4}\,\text{m}^2 C = 10^{-4}, R = 50\Omega, B = 0.02T, \theta = 0.2\text{rad}$

$NiAB = C\theta$

$$i_g = \frac{C\theta}{NAB} = \frac{10^{-4} \times 0.2}{50 \times 2 \times 10^{-4} \times 0.02}$$

$= 0.1A$

$i_g \times G = (i - i_g) S$

$0.1 \times 50 = (1 - 0.1) \times S$

$5 = 0.9 \times S$

$$S = \frac{50}{9}\Omega$$

11. Ans. 3

Sol.

$$\Delta\ell = \frac{F\ell}{Ay} = \frac{1.2 \times 10 \times 1}{\pi\left(\frac{5 \times 10^{-4}}{2}\right) \times 2 \times 10^{11}}$$

Solving this we get

$\Delta\ell = 0.3\text{mm}$

Since least count of vernier calipers is $0.1\,\text{mm}$. So, third marking of vernier scale will coincide with main scale.

12. **Ans. 900 J**

Sol.

$$TV^{\gamma-1} = T_f (8V)^{\gamma-1}$$

$$\Rightarrow T_f = \frac{T}{(8)^{\frac{5}{3}-1}} = \frac{T}{4}$$

$$\Delta U = nC_v \Delta T = \frac{f}{2} nR\Delta T = \frac{f}{2} 1.R.\left(\frac{-3T}{4}\right)$$

$$= -\frac{3}{2} \times 8 \times \frac{3}{4} \times 100$$

$$= -900\ J$$

decrease in internal energy is $900\ J$.

13. **Ans. 24.00**

Sol.

$$\text{Number of electrons emitted } N = \frac{200W}{6.25eV}$$

$$\text{rate of change of linear momentum of electrons} = F = N\sqrt{2mk}$$

$$F = \frac{200}{1.6 \times 6.25 \times 10^{-9}} \times \sqrt{29 \times 10^{-31} \times 1.6 \times 10^{-19}} \times 500$$

$$= 24.00$$

14. **Ans. 3**

Sol.

$$13.6Z^2\left(1 - \frac{1}{4}\right) = 74.8eV + 13.6z^2\left(\frac{1}{4} - \frac{1}{9}\right)$$

$$\Rightarrow 13.6 \times Z^2\left(\frac{11}{18}\right) = 74.8$$

$$\Rightarrow Z^2 = 9 \Rightarrow Z = 3$$

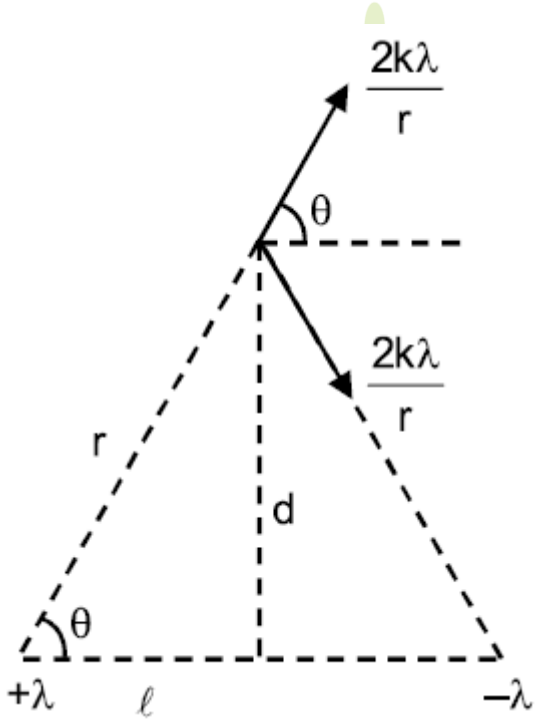
15. Ans. (B)

Sol. (1) in case of point charge $E = \frac{KQ}{d^2}$

(2) In case of dipole $E = \frac{Kp}{d^3}$

(3) For an infinite long line charge $E = \frac{2K\lambda}{d}$

(4)



$$E = \frac{K\lambda}{r}\cos\theta = \frac{k\lambda}{\sqrt{d^2+\ell^2}} = \frac{4k\lambda\ell}{\left(d^2+\ell^2\right)} \simeq \frac{2k\lambda\ell}{d^2}$$

(5) $E = \frac{\sigma}{2\varepsilon_0}$

16. Ans. (B)

Sol. (P) $v_0 = \sqrt{\frac{GM}{R}}$

$$\frac{V_1}{V_2} = \sqrt{\frac{R_2}{R_1}} = \frac{2}{1}$$

(Q) $L = mvR$

$$\frac{L_1}{L_2} = \frac{m_1}{m_2} = \frac{v_1}{v_2} = \frac{R_1}{R_2} = \frac{2}{1} \times \frac{2}{1} \times \frac{1}{4} = 1$$

(R) $KE = \frac{GMm}{R}$

$$\frac{K_1}{K_2} = \frac{m_1}{m_2} \times \frac{R_1}{R_2} = \frac{2}{1} \times \frac{4}{1} = 8$$

(S) $\frac{T_1}{T_2} = \left(\frac{Rl1}{R_2}\right)^{3/2} = \frac{1}{8}$

17. Ans. 3(C)

Sol. (P) Process -1 is adiabatic $(Q = 0)$

(Q) Process -2 is isobaric

$\Delta w = 6P_0V_0,$

(R) Process -3 is isochoric

$AW = 0$

(S) Process -4 is isothermal ($T = constant$)

18. **Ans. (A)**

Sol. (P) $\vec{V} = constant\ \vec{a} = 0\ P \rightarrow 1,2,3,4,5$

(Q) $\vec{a} = -\omega^2 \vec{r}$ *path of the particle is elliptical* $Q \rightarrow 2,5$

(R) $\vec{a} = -\omega^2 \vec{r}$ *path of the particle is circular* $R \rightarrow 2,3,4,5$

$|\vec{V}| = constant$

(S) $\vec{a} = constant\ S \rightarrow 5$