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Physics - May 2025 - Paper 1A - TZ 1

1) B

2) Speed is area under curve $= \frac{1}{2} \times 6 \times h = \frac{1}{2} \times 8 \times 8 = 32 \rightarrow$ B

3) $F_{net} = ma = \underbrace{F\cos\theta}_{\text{vertical component of } F} - \underbrace{mg}_{\text{Weight}}$

$\Rightarrow a = \dfrac{F\cos\theta - mg}{m} \longrightarrow$ A

4) $F_1 = \rho V g = \rho . R^3 g.$

$F_2 = 2\rho \left(\frac{R}{2}\right)^3 g. = \frac{\rho R^3}{4} g.$

Pending

5) $\omega = 2\pi f$, $f = \dfrac{1}{24 \times 60 \times 60}$

$\omega = \dfrac{2\pi}{24 \times 60 \times 60} = 7.25 \times 10^{5} \longrightarrow$ C

6/ $\Delta p = 2$

$E = \dfrac{p^2}{2m} = \dfrac{2 \times 2}{2 \times 5} = 0.40\,J \longrightarrow$ A

7) $\Delta L = I \Delta\omega$

$= I(\omega_f - \omega_i)$ $\qquad \omega_f^2 = \omega_i^2 + 2\alpha . \theta$

$\theta = 2\pi \times 4 = 8\pi$

$\Delta L = 4I\sqrt{\pi\alpha} \leftarrow \begin{cases} \omega_f^2 = 0 + 2 . 8\pi\alpha = 16\pi \\ \omega_f = 4\sqrt{\pi\alpha} \end{cases}$

$\longrightarrow$ B

8) $I = mR^2 + mR^2$

$= 10(4)^2 \times 2 = 320\ kg m^2 \longrightarrow$ B

9) $u' = \dfrac{u - v}{1 - \frac{uv}{c^2}} = \dfrac{(0.5 + 0.5)c}{1 + \frac{0.5^2 c^2}{c^2}}$

$= \dfrac{1c}{1.25} = 0.8c \longrightarrow$ B

10) Ice $\qquad\qquad\qquad$ water

$ML \qquad\qquad\qquad mc\Delta T$

$$M = \frac{mc\Delta T}{L} \text{ or } \frac{mcT}{L} \longrightarrow A$$

11) D

12) C

13) C

14)

$$P - 2 + 2 + \frac{2}{2} = 2+2+1 = 5$$

$$Q - 2 + \frac{2}{\frac{2}{2}} = 2 + 2/3 = 2.66$$

$$R - 2 + \frac{2}{4} = 2 + \frac{4}{3} = 10/3 = 3.33$$

So $\quad$ QRP $\longrightarrow$ D

15) $$I = \frac{\Delta Q}{t} = \frac{5\times10^{-3} \times 0.6 \times 2.5\,t}{t} = 7.5\ mA \longrightarrow B$$

$$\left\{ \text{Total charge} = Q = \frac{C}{m^2} \times m^2 = \frac{Q}{m^2} \times d \times \frac{\text{velocity}}{t} \times t \right\}$$

16) $$R = \frac{\rho L}{A} = \rho\frac{1}{1} = \rho$$

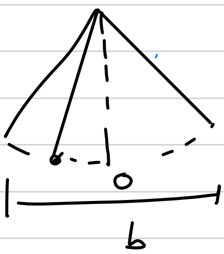
$$R' = \frac{4\rho}{1/4} = 16\rho = 16\times50 = 800\,\Omega \longrightarrow C$$

17) $T_1 = 2\pi\sqrt{\dfrac{m}{K}}$ $T_2 = 2\pi\sqrt{\dfrac{m}{2K}}$

$$\frac{T_2}{T_1} = \frac{2\pi\sqrt{\frac{m}{2K}}}{2\pi\sqrt{\frac{m}{K}}} = \frac{1}{\sqrt{2}} \rightarrow \text{(B)}$$

18) Amplitude = 5 nm

$$f = \frac{1}{T} = \frac{1}{4\times10^{-3}} = 250 \rightarrow \text{(B)}$$

19) 

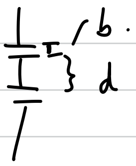
$$v = \omega\sqrt{x_0^2 - x^2}$$

$$v = \omega\sqrt{\frac{b^2}{4} - \frac{b^2}{16}} = \omega\sqrt{\frac{3b^2}{16}} = \frac{\sqrt{3}}{4}\omega b$$

$$= \frac{\sqrt{3}}{4} b\, 2\pi f = \frac{\sqrt{3}}{2} b\pi f \rightarrow \text{(D)}$$

20) $\sin 40 \cdot \dfrac{5}{3} = \sin\theta \cdot \dfrac{4}{3}$

$$\sin\theta = \frac{\sin 40 \times 5/3}{4/3} \Rightarrow \theta = 53.45^\circ \rightarrow \text{(C)}$$

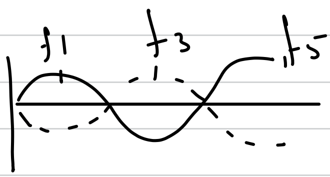
21) 

$\sin\theta = \dfrac{n\lambda}{d}$ (Interference)

$$\sin(0.05) = 5\frac{\lambda}{d} \Rightarrow \frac{\lambda}{d} = \frac{\sin(0.05)}{5} = 0.01$$

For diffraction. $\sin\theta = \dfrac{n\lambda}{b}$

$$\Rightarrow \sin 0.1 = 1\cdot\frac{\lambda}{b} \Rightarrow \frac{\lambda}{b} = 0.1 \rightarrow \text{(C)}$$

22) 

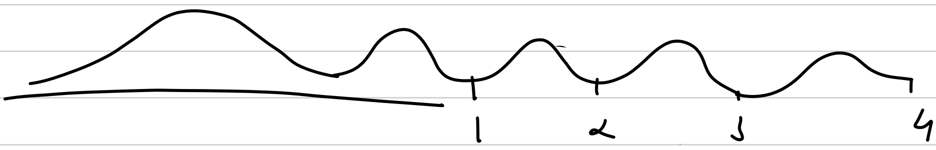
$f_5 \rightarrow L = \left(1\frac{1}{4}\right)\lambda$

$$L = \frac{5}{4}\lambda$$

$$\Rightarrow \lambda = \frac{4L}{5} \rightarrow \text{(C)}$$

23) $d = \dfrac{1}{400\,000} = 2.5 \times 10^{-6}\,m$

$\sin\theta = \dfrac{n\lambda}{d} \Rightarrow n = \dfrac{d\sin\theta}{\lambda} = \dfrac{2.5\times10^{-6}}{5.8\times10^{-7}} = 4.31$



so $4 + 4 + 1 = 9$ $\longrightarrow$ D

left right central bright

24) $\dfrac{g_p}{g_E} = \dfrac{\dfrac{G\,m_p}{(r_p)^2}}{\dfrac{G\,m_E}{(r_e)^2}} = \dfrac{m_p\,(r_e)^2}{(r_p)^2 \cdot m_E}$

$= \dfrac{m_p\,(d_e/2)^2}{\left(\frac{1}{3}\frac{d_e}{2}\right)^2 \; 18\,m_p} = \dfrac{1 \times 4 \times 9}{4 \times 18} = \dfrac{1}{2}$

$\Rightarrow \dfrac{g_p}{g_e} = \dfrac{1}{2} \Rightarrow g_p = \dfrac{g_e}{2}$ $\longrightarrow$ B

25) $V = -\dfrac{GM}{r}$ $\quad V \propto -\dfrac{1}{r}$ $\longrightarrow$ A

26) $\mu_0 \cdot \varepsilon_0 = \dfrac{1}{c^2}$ $\quad$ unit $\dfrac{1}{(m/s)^2} = s^2\,m^{-2}$ $\longrightarrow$ A

27) $E = \dfrac{V}{d} \Rightarrow$ slope of line $= \dfrac{(20-0)\,10^3}{5\times10^{-2}} = 4 \times 10^3 \times 10^2$
$= 4\times10^5\ NC^{-1}$ $\longrightarrow$ D

28) $F = BIL \Rightarrow B = \dfrac{F}{IL} = \dfrac{4\times10^{-3}}{5\times0.32} = 0.0025$
or $2.5\,mT$ $\longrightarrow$ A

29) $-ve$ travel counter clockwise. So $+ve$ travel clockwise

According to right hand screw rule, B will be into the page.

which is same direction as external field. so diameter will tend to increase $\longrightarrow$ (C)

30) (B)

31) $\varepsilon = Blv = Bl r\omega \Rightarrow 10 = Bl r\omega \Rightarrow Blr = \frac{10}{\omega}$

$\varepsilon' = Bl \frac{3}{4}\omega r \Rightarrow \varepsilon' = \frac{10}{\omega} \times \frac{3}{4}\omega = \frac{15}{2} = 7.5\ V$

$T = \frac{2\pi}{\omega}, \quad T' = \frac{2\pi}{\frac{3}{4}\omega} \Rightarrow T' = \frac{4T}{3} = \frac{4}{3} \times 0.8$ (0.8 from graph)

$= \frac{3.2}{3} = 1.066 \approx 1.1.$

$\longrightarrow$ (D)

32) (A)

33) (C) {density does not change}

34) $E = \phi + E_K \Rightarrow E_K = E - \phi \Rightarrow \frac{1}{2}mv^2 = E - \phi$

$\Rightarrow v = \sqrt{\frac{2(E-\phi)}{m}} \longrightarrow$ (A)

35) After scattering, energy decreases, so f decreases

$\Rightarrow f < f_0$ and $\lambda > \lambda_0$

$\Rightarrow \frac{\lambda}{\lambda_0} > 1$

$c = f\lambda$ is constant $\Rightarrow \frac{\lambda}{\lambda_0} \times \frac{f}{f_0} = 1 \longrightarrow$ (A)

36) $\rightarrow$ (A)

37) $\beta^- \rightarrow$ electron is released $\rightarrow N \rightarrow p + e$ released

$\alpha \rightarrow {}^4_2He$ is released.

for isotopes N changes P is same.

So one α decay and 2 beta decay will keep number of protons same $\rightarrow$ A

38) $\rightarrow$ D water

39) $\rightarrow$ 4N $\rightarrow$ Nc + N1 + back.
2 + 1 + 16 week $\rightarrow$ C

40) d (in parsec) $= \frac{1}{p} = \frac{1}{100^{-2}} = 100$ Parsec $\rightarrow$ D