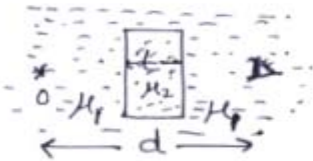


IITJEE-2009
TS7 Paper 2
Physics Solutions

Physics-Solutions Test Series – 7/Paper – II/ JEE – 2009

1. **Ans: (C)** at bottom B, $T - mg = \frac{mv_B^2}{r}$, $A \rightarrow B \Rightarrow mg \cdot l(1 - \cos 60) = \frac{1}{2}mv_B^2$
 $\Rightarrow T = 2mg = 4mg$ (min.)
 $\Rightarrow H_{\min} = 0.5$ (for 4m)
 $\Rightarrow A$ is correct.
2. $y = 4 \cos^2 \frac{t}{2} \sin 1000t$
 $= 2(1 + \cos t) \sin 1000t = 2 \sin 1000t + 2 \sin 1000t \cos t$
 $= 2 \sin 1000t + \sin 1001t + \sin 999t$
 $\Rightarrow n = 3$ **Ans: (B)**
3. given $\omega \frac{d\omega}{d\theta} \propto \omega$ def $\omega \frac{d\omega}{d\theta} = C\omega \Rightarrow \Delta\omega = C\Delta\theta \Rightarrow$ **Ans: (B)**
4. $P_1 V_1 + P_2 V_2 = P V_f \Rightarrow (P_0 + \frac{4\sigma}{r_1}) \frac{4\pi}{3} r_1^3 + (P_0 + \frac{4\sigma}{r_2}) \frac{4\pi}{3} r_2^3 = (P_0 + \frac{4\sigma}{r}) \frac{4\pi}{3} r^3$
 $\Rightarrow P_0 \left[\frac{4\pi}{3} r_1^3 + \frac{4\pi}{3} r_2^3 - \frac{4\pi}{3} r^3 \right] + \frac{4\sigma}{3} [4\pi r_1^3 + 4\pi r_2^3 - 4\pi r^3] = 0$
 $\Rightarrow P_0 V + \frac{4\sigma}{3} S = 0 \Rightarrow 3P_0 V + 4\sigma S = 0 \Rightarrow$ **Ans: (A)**
5. $n_1 = \frac{c}{2l_1}, n_2 = \frac{c}{2l_2}, n_3 = \frac{c}{2l_3}, l_1 + l_3 = 2l_2 \Rightarrow l_2 = \frac{2l_1 l_3}{l_1 + l_3} \Rightarrow$ **Ans: (A)**
6. $\frac{dQ}{dt} = m\sigma \frac{d\theta}{dt} \Rightarrow 1500 - 160 = 2 \times 4200 \cdot \frac{(75 - 20)}{\Delta t} \Rightarrow \Delta t = 550 \text{ sec}$ **Ans: (B)**

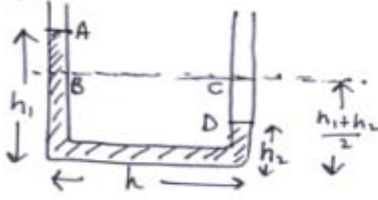
7.



$$\begin{aligned} \text{app. distance} &= \left(\frac{d-t}{\mu_1} + \frac{t}{\mu_2} \right) \cdot \mu_1 \\ &= d - t + \frac{\mu_1 t}{\mu_2} = d + t \left(\frac{\mu_1}{\mu_2} - 1 \right) \end{aligned}$$

8. \Rightarrow diameter of helical path = pitch. $\Rightarrow 2 \times \frac{mv \sin \theta}{qB} \Rightarrow$ **Ans: (D)**.
 $\Rightarrow \tan \theta = x \Rightarrow$ **Ans: (D)**

9.



levels are equal at B and C, \Rightarrow Equivalently
 we can assume column AB has shifted to CD
 $\Rightarrow \rho A \rho \left(\frac{h_1 - h_2}{2} \right)^2 = \text{loss in GPE}$ (AB = $\frac{h_1 - h_2}{2}$)
 $= \frac{1}{2} (h_1 + h_2 + h) A \rho U^2$ A: area of cross sec.

$$\Rightarrow V = \sqrt{\frac{\rho (h_1 - h_2)^2}{2(h_1 + h_2 + h)}} \Rightarrow \text{Ans: (C)}$$

10. **Ans: (D)** KVL is applicable instantaneously & peak values of p.d. across L, C & R do not occur at same time.

11. **Ans: (D)** $\vec{F} = q(\vec{v} \times \vec{B})$ does not depend on mass $\vec{F}_1 = \vec{F}_2$.

12. **Ans: (C)**.

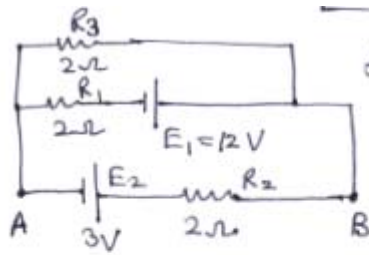
13. **Ans: (B)**. force acts on charge particle along tangent to lines of force, but velocity vector \leftarrow acc. vector may be in diff direction.

14. no of e's/m³ = no of atoms/m³ = $\frac{\rho}{M} \times \text{Avogadro's no.} = \frac{5 \times 10^3 \times 10^7 \times 10^{23}}{60} \times 10^6$
Ans: (D) = $5 \times 10^{28} / \text{m}^3$

15. $I = neAV_d$

$\Rightarrow 16 = 5 \times 10^{28} \times 1.6 \times 10^{-19} \times 10^{-6} V_d \Rightarrow V_d = 2 \times 10^{-3} \text{ m/s} \Rightarrow$ **Ans: (A)**

16. Current density $J = \sigma E \Rightarrow E = \rho J = 1.72 \times 10^{-8} \times \frac{16}{10^{-6}} \text{ V/m}$
 $\Rightarrow E = 0.2752 \text{ V/m} \Rightarrow$ **Ans: (C)**

17. $S \rightarrow 1$.

$$\text{Let } V_A - V_B = x \Rightarrow \frac{x}{R_3} + \frac{x+12}{R_1} + \frac{x+3}{R_2} = 0$$

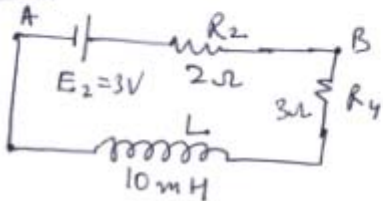
$$\Rightarrow x = -5 \text{ Volts.}$$

$$H_1 = \left(\frac{x+12}{R_1}\right)^2 \cdot R_1 = 24.5 \text{ J}$$

Ans: (B)

 $S \rightarrow 2$.

18.



$$i_{\text{steady state}} = \frac{3}{2+3} = 0.6 \text{ A} \quad \text{Ans: (A)}$$

$$19. \quad i = \frac{i}{2} (1 - e^{-Rt/L}) ; R = R_2 + R_4 \Rightarrow e^{-Rt/L} = \frac{1}{2}$$

$$\Rightarrow t = \frac{L}{R} \ln 2 = \frac{10 \times 10^{-3}}{5} \ln 2 = 1.386 \text{ mSec}$$

$$U = \frac{1}{2} L i^2 = \frac{1}{2} \times 10 \times 10^{-3} \times (0.3)^2 = 4.5 \times 10^{-4} \text{ joules} \Rightarrow \text{Ans: (B)}$$

20. (A) \rightarrow 3, (B) \rightarrow 1, (C) \rightarrow 2, (D) \rightarrow 4.21. (A) \rightarrow 4, (B) \rightarrow 3, (C) \rightarrow 2, (D) \rightarrow 1.22. (A) \rightarrow 3, (B) \rightarrow 2, (C) \rightarrow 1, (D) \rightarrow 4.