# MOCK TEST 1 (PHY SOLUTIONS)

01. Either assume $[E]=[P^a A^b T^c]$
Solve using $[ML^2T^{-2}] =$
$= [MLT^{-1}]^a . [M^0L^2T^0]^b . [T]^c$
you get $a=1, b=1/2, c=-1$.
OR you can use –
$E = W = F.S$ ; $F = \frac{\Delta P}{T} = \frac{[P]}{[T]}$
& $[S]=[A^{1/2}]$ hence ans
$[P.T^{-1}.A^{1/2}]$ તે સાચું છે! ☺

02. Oscillations will not indicate SHM, this is not SHM as $U(x)$ is not $\propto$ to $x^2$ so it can be solved by dim. analysis. The term time is related to k here
$[K]=\frac{[U]}{[x]^3} = \frac{[ML^2T^{-2}]}{[L^3]} = [ML^{-1}T^{-2}]$
so T depends on mass, length (amplitude) & k let
$[T] = [M]^x . [L]^y [K]^z$
$[T] = [M^x][L^y][M^1 L^{-1} T^{-2}]^z$
$\therefore x+z=0, \; y-z=0, \; z=-\frac{1}{2}$
don't spend time in finding x & z, $y=z=-\frac{1}{2}$
so $y=-1/2$ hence $T \propto \frac{1}{\sqrt{a}}$

03. formula is $\Sigma \frac{\omega}{f} = 0$
where $\omega$ is dispersive power hence
$\frac{\omega_1}{f_1} + \frac{\omega_2}{f_2} = 0 = \frac{1}{f_1} + \frac{2}{f_2} = 0$
$\therefore f_2 = -2f_1$ & $\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{F}$
Hence 10cm & –20cm

BUT if you look and ans only one combination give
$\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{20}$ ell! ell! ell!

04. what else 0.511 MeV × 2
$= 0.8\times10^{-13}\times2 = 1.6\times10^{-13}$ J

05. trace is clockwise so +ve and Area of $\Delta = \frac{1}{2}PV$
$\Delta Q = \Delta U + \Delta W$ as cyclic $\Delta U = 0$
Hence $\Delta Q = \Delta W = \frac{1}{2}PV$.

06. We have $V_t = \frac{2(\rho-\sigma)r^2 g}{9\eta}$
for this problem
$V_t \equiv (\rho-\sigma)$ (All other terms are constant)
$V_{t_2} = \frac{\rho_2-\sigma}{\rho_1-\sigma} V_{t_1}$

07 Problem of simple rel^n & conversion of units –
strain $= \frac{\text{stress}}{Y} = \frac{F}{A.Y}$
$= \frac{40\times10^3}{(400\times10^{-6}).40\times10^9}$
$= \frac{1}{400} = 2.5\times10^{-3}$

08. Energy density equals
$\frac{1}{2}$ stress.strain $= \frac{1}{2}Y(\text{strain})^2$
$= \frac{1}{2}\times2\times10^{11}\times(10^{-3})^2 = 10^5 \, J/m^3$

09. $X_C = \frac{1}{\omega C} = \frac{1}{2\pi n.C} = 10$ (check)
now in case I, $Z=10$ as
$X_L = \omega L = 0$ (as $n=0$ for DC)
for $Z_2 = \sqrt{10^2+10^2} = 10\sqrt{2}$
actually no need to find value

10. $i_{rms} = \frac{V}{X_C}$ & $X_C = \frac{1}{2\pi n C}$ hence $i_{rms} = V.2\pi n.C$

$= 100.2.\pi.50.100\times10^{-6} = \pi = 3.14\,A$.

11. $e = \frac{d\phi}{dt} = \frac{d}{dt}(B.A.\cos\theta) = \frac{d}{dt}(0.2\sin(300t).5\times10^{-4}.\cos60^\circ)$

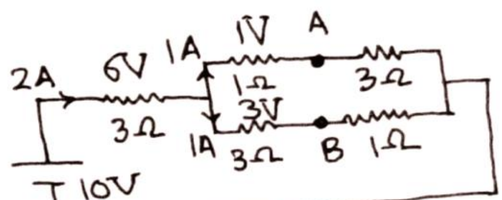
$= \frac{d}{dt}(5\times10^{-5}\sin300t) = 5\times300\times10^{-5}\cdot\cos300t$

$= 1.5\times10^{-2}\cos\frac{\pi}{3} = 7.5\times10^{-3}\,V$

12. (Nothing to do with cyclotron) $T = \frac{2\pi r}{v}$, $i = \frac{e}{T} = \frac{e.V}{2\pi r}$

$B = \frac{\mu_0 i}{2r}$; (magnetic field at centre of loop)

$= \frac{\mu_0.eV}{2r(2\pi r)}$ $\therefore B \propto \frac{V}{r^2}$




13. Total resistance $= 3+2=5$

Hence current $= \frac{10}{5} = 2A$

pot. drop upto A is $10-6-1 = 3 = V_A$

pot. drop upto B is $10-6-3 = 1 = V_B$ $\therefore V_A - V_B = 2V$

14. $V_d = \frac{I}{n.e.A}$ & $I = \frac{q}{t} = \frac{1200}{20\times60} = 1A$ $\therefore V_d = \frac{1}{6\times10^{22}\times10^{6}\times25\times10^{-6}\times1.6\times10^{-19}}$ (↑ $cm^3 \to m^3$)

$= 4.2\times10^{-6}\,m/s$ $\left(\frac{1}{9.6\times25\times10^{3}}\right)$

15. c.m. is at $(\frac{2}{3},\frac{2}{3})$ hence $\frac{2}{3}(i+j)$

16. $F = m_A.(g-a) = 0.5\times8 = 4N$

17. Using $mgh = \frac{1}{2}m.(\sqrt{5gR})^2 \Rightarrow h = \frac{5R}{2}$ hence $5 = \frac{5R}{2}$ so $R \leq 2$

18. KE = PE if $x = \frac{A}{\sqrt2}$ as in SHM, $a = \omega^2 x$ given $a_0 = \omega^2 A$

Hence $a = \frac{\omega^2.A}{\sqrt2} = \frac{a_0}{\sqrt2}$

19. To keep $f_r$ fixed we must have $\sqrt{LC}$ = const. as $C \to 4C$ so $L \to \frac{L}{4}$

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20. $\frac{a_A}{a_B} = \frac{g\sin\theta}{g\sin\theta - \mu g\cos\theta} = \frac{1}{2}$

∴ $2\sin\theta = \sin\theta - 2\mu\cos\theta$

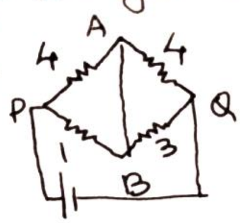
$\sin\theta = 2\mu\cos\theta$ but $\sin\theta = \cos\theta$ hence $\mu = 0.5$

21. $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ now heat produced is 4 times due to 2A means 8A. hence $I_{rms} = \frac{8}{\sqrt{2}} = 4\sqrt{2} = 5.6A$

22. $P_{Av} = \frac{V_0 . I_0}{2} . \cos\phi = \frac{200 . 2}{2} . \cos\frac{\pi}{3} = 100W$

23. Using $\frac{1}{4\pi\epsilon} \cdot \frac{e^2}{r^2} = mv^2/r$ & $mvr = \frac{nh}{2\pi}$ we get $r \propto n^2$ (4).

24. As resistance of PAQ = 8 & of PBQ = 4 the current will be in ratio 1 : 2 if is assumed as 1A & 2A then $V_A = V - 4$ & $V_B = V - 2$ hence $V_B > V_A$ so current flow from B to A. OR you can solve by voltage law.




25. By basic def. $E = i(R + r) = 40$ & $30 = i.R$

Hence $\frac{40}{30} = \frac{R+r}{R} = 1 + \frac{r}{R}$ ∴ $\frac{4}{3} - 1 = \frac{1}{3} = \frac{r}{9}$ ∴ $r = 3\Omega$

26. initial resistance $5\Omega$; now rad is 1/3 so area is 1/9 hence new resistance of a wire is $45\Omega$ ($R = \rho\frac{L}{A}$) but there are 6 such in ∥ hence $\frac{6}{45} = \frac{1}{R_e}$ ∴ $R_e = \frac{45}{6} = 7.5\Omega$

27. $L = \mu_0 . \mu_r . N^2 A/l$ hence $L \propto N^2$ & $L \propto \mu_r$ hence c & d (3).

28. both correct but reson is NOT reason.

29. Recall $\lambda = \frac{h}{\sqrt{2mqV}}$ now α is having mass 4 times of p & charge 2 times hence factor 8 will be

30. This problem is common & need small imagination

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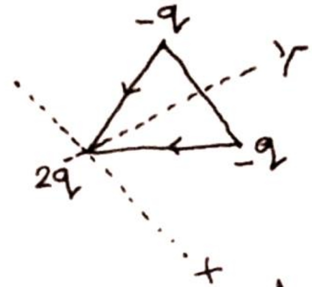
fig is as 


consider x axis as shown & Y. now we can see two dipoles dipole moment is vector from -ve to +ve & magnitude is $q \cdot l$

Hence components along x will cancell each other & along Y will add as $2 \cdot (q \cdot l \cdot \cos 30) = 2 \cdot q \cdot l \cdot \frac{\sqrt{3}}{2} = \sqrt{3} ql$

32. $U = \frac{1}{2}\frac{q^2}{C} = \frac{1}{2}\frac{q^2 d}{\epsilon A}$ all other remain same $d \to 4d$

hence $U \to 4U$.

31. In an experiment of meter bridge to find unknown resistance we interchange resistances to balence non uniformity.

33. Initial energy $= \frac{1}{2} CV^2$

Loss of energy $= \frac{1}{2}\left(\frac{1}{C}+\frac{1}{C}\right)^{-1} \cdot V = \frac{1}{4} CV^2$

$\therefore$ % loss = 50%

34. to find $\eta$ all above is correct but to find $V_t$ (3) is correct.

35. expression for escape velocity $= \sqrt{\frac{2GM}{R}}$

36. $V_{p(max)} = Y_0 \cdot \frac{2\pi}{\lambda} \cdot \vartheta$ we need $Y_0 \cdot \frac{2\pi}{\lambda} \cdot \vartheta = 2\vartheta$

Hence $\lambda = \pi Y_0$.

37. look at truth table

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| B | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| output | 0 | 1 | 1 | 1 | 0 | 1 | 1 |

indicate OR

38. imp. point is when compression is maximum the velocities of both blocks will be same & spring force is internal on both blocks hence

$m_1 v_1 + m_2 v_2 = (m_1 + m_2) V \quad \therefore V = \frac{25}{7} = 3.57$ m/s

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now to find compression use energy conservation –

$$\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 + \frac{1}{2}k.0 = \frac{1}{2}m_1v^2 + \frac{1}{2}m_2v^2 + \frac{1}{2}kx$$

substituting $122.5 = 44.6 + \frac{1}{2}(1120)x^2$

solving $x = 0.37$ m.

39. $\frac{2}{3}ML^2$

40. Using law of conservation of angular momentum $\frac{v_1}{v_2} = \frac{r_2}{r_1}$

as $mv_1r_1 = mv_2r_2$.

41. Recall $\mu = \tan i_p$ (Brewster's angle) $\therefore \mu = 1.414 = \sqrt{2}$

& $\mu = \frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin(A/2)} \Rightarrow \sqrt{2} = \frac{\sin(30^\circ + \frac{\delta m}{2})}{\sin 30^\circ}$ (as $A = 60^\circ$)

$\Rightarrow \sin\left(30^\circ + \frac{\delta m}{2}\right) = \frac{1}{\sqrt{2}} = \sin 45^\circ \therefore 30 + \frac{\delta m}{2} = 45^\circ \therefore \delta_m = 30^\circ$

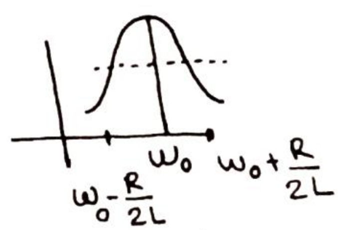
42. $e = \frac{v_2 - v_1}{u_1} = \frac{v_2 - v_1}{v_2 + v_1}$ use dividendo-componendo & $\frac{v_1}{v_2} = \frac{1-e}{1+e}$

43. by changing distance the freq. remain same hence stopping pot. remain same.

44. $V = \sqrt{40^2 + (40-10)^2} = 50V$, $I_{rms} = \frac{I_{max}}{\sqrt{2}} = 10A$

$Z = \frac{V_{RMS}}{I_{RMS}} = 5\Omega$

45. $\omega_0 = \frac{1}{\sqrt{LC}} = 50$ rad/s




$50 \pm \frac{40}{2.5} = 54 \& 46.$

46. $V = \frac{1}{\sqrt{2}}$; $I = \frac{1}{\sqrt{2}}$, $\phi = \frac{\pi}{3}$ hence $P_{AV} = \frac{1/\sqrt{2} \cdot 1/\sqrt{2}}{2} . \cos 60^\circ = \frac{1}{8}W$

47. no exp. needed $|PE| = |-2KE| = |-2TE|$ $\therefore TE = -3.4$,

$KE = 3.4$ ; $PE = -6.8$

48.

48. $(N_0)_A = (N_0)_B$ & at time t, $\frac{N_A}{N_B} = \left(\frac{1}{e}\right)^2$

$\frac{N_A}{(N_0)_A} = e^{-\lambda_A . t}$ and $\frac{N_B}{(N_0)_B} = e^{-\lambda_B t}$ taking ratio

$\frac{N_A}{N_B} = e^{-(\lambda_A - \lambda_B)t} = e^{-4\lambda t} = \left(\frac{1}{e}\right)^{4\lambda t} = \left(\frac{1}{e}\right)^2$ hence

$4\lambda t = 2 \Rightarrow t = \frac{1}{2\lambda}$

49. If one angle is $\theta^\circ$ then other is $90^\circ - \theta^\circ$

$T_1 = \frac{2u\sin\theta}{g}$, $T_2 = \frac{2u\cos\theta}{g}$ (as $\sin 90 - \theta = \cos\theta$)

Don't hate maths

$T_1 . T_2 = \frac{4u^2 \sin\theta . \cos\theta}{g . g} = \frac{2R}{g}$ as $R = \frac{2u^2 \sin\theta\cos\theta}{g}$

50. If V is volume of small drop then of big is 2V,

if $r$ is radius of small & R of big then $r = \left(\frac{1}{2}\right)^{1/3} . R$

$\frac{U_1}{U_2} = \frac{2 . r^2}{R^2} = 2\left[\left(\frac{1}{2}\right)^{1/3}\right]^2 = 2 . 2^{-2/3} = 2^{1/3}$

દેવીઓ ઔર સજ્જનો

Use screening method – After 35 when you get 10 problems DONT spend time in reading other (if time permits you can go through the questions before your last number) સબ વર્ક અચ્છા કરો – ફેંગો બિચારે મત લાવ – કઠની પ્રાબ્લેમ k પીછે મત લગો!