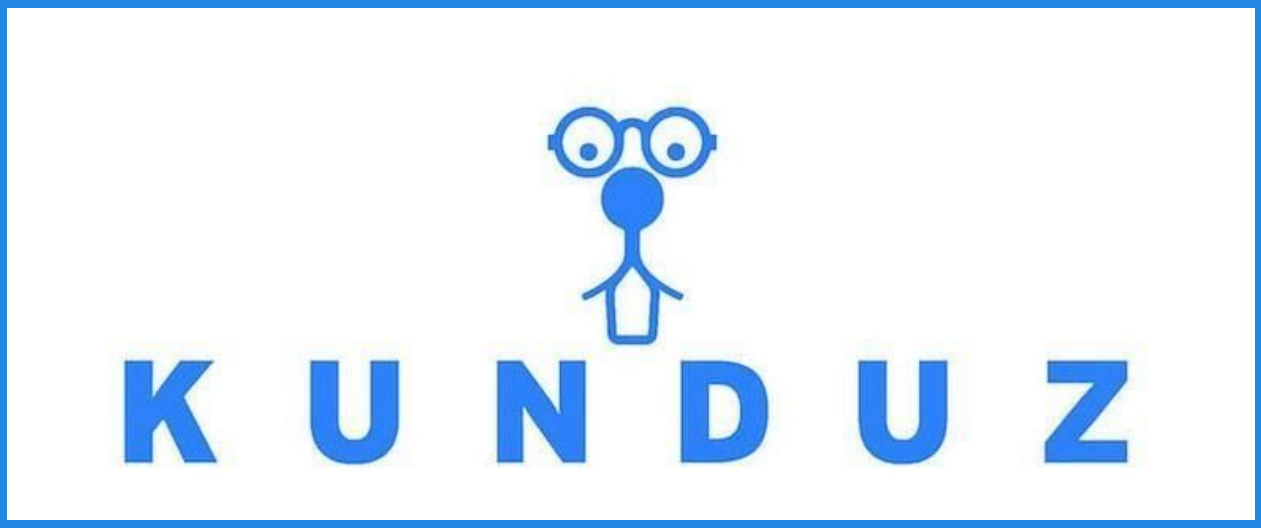
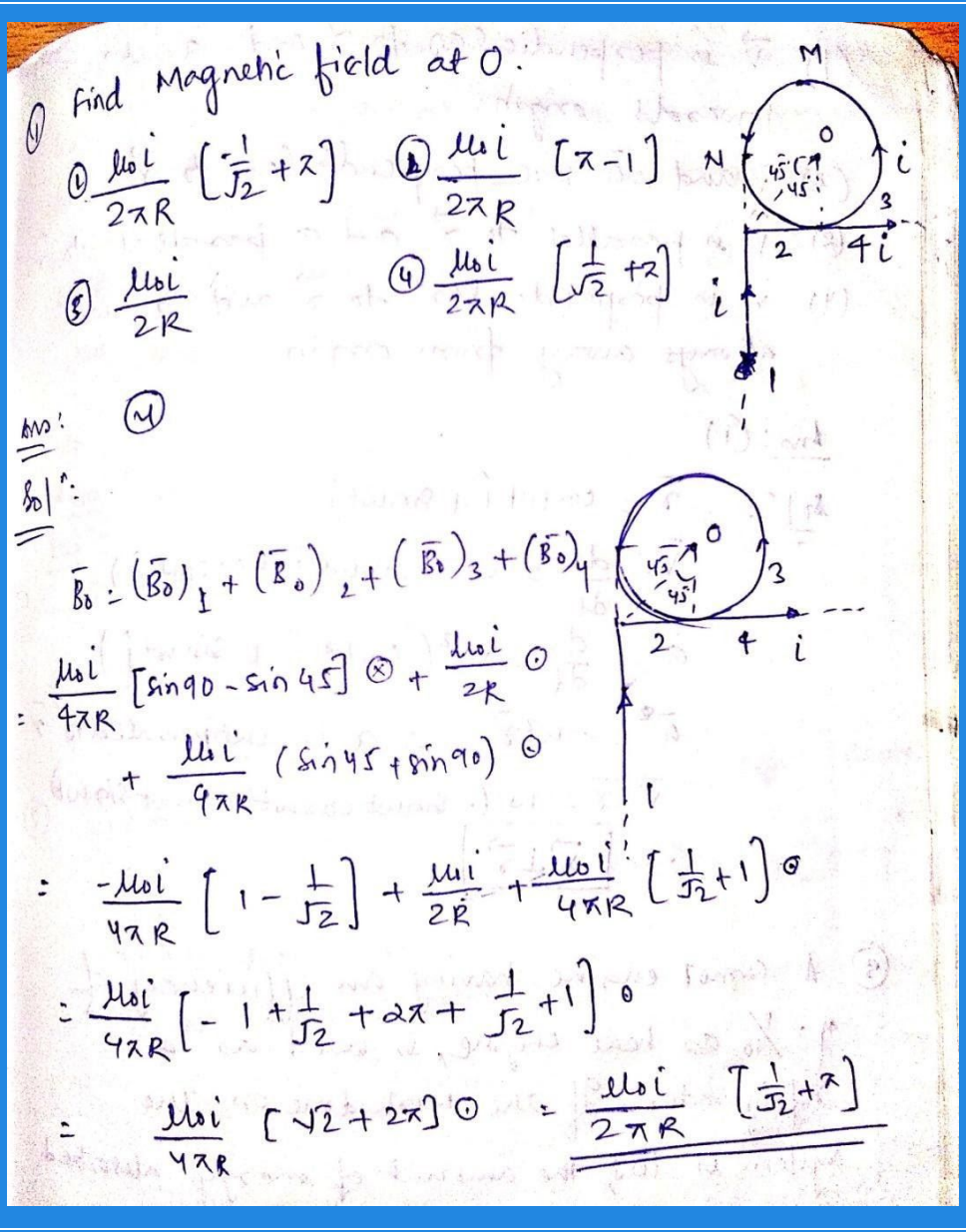


Jan 8 2020 shift 2 Physics prepared by KUNDUZ tutors

https://kunduz.com/en/

Question no.	Questions and Answers
1	

2

② Position of particle as a function of time is given as $\bar{r} = \cos\omega t\,\hat{i} + \sin\omega t\,\hat{j}$. Choose correct statement about $\bar{r}$, $\bar{v}$ and $\bar{a}$ are velocity and acceleration of particle at time t.

(1) $\vec{v}$ is perpendicular to $\vec{r}$ and $\bar{a}$ is towards origin.

(2) $\vec{v}$ and $\bar{a}$ are perpendicular to $\vec{r}$.

(3) $\vec{v}$ is parallel to $\vec{r}$ and a parallel to $\vec{r}$.

(4) $\vec{v}$ is perpendicular to $\vec{r}$ and $\bar{a}$ is ~~always~~ away from origin.

Ans: (1)

Sol^n: $\bar{r} = \cos\omega t\,\hat{i} + \sin\omega t\,\hat{j}$

$\bar{v} = \frac{d\bar{r}}{dt} = \omega(-\sin\omega t\,\hat{i} + \cos\omega t\,\hat{j})$.

$\bar{a} = \frac{d\bar{v}}{dt} = -\omega^2(\cos\omega t\,\hat{i} + \sin\omega t\,\hat{j})$,

$\bar{a} = -\omega^2\bar{r}$ $\therefore$ $\bar{a}$ is antiparallel to $\bar{r}$

$\bar{v}\cdot\bar{r} = \omega(-\sin\omega t\cos\omega t + \cos\omega t\sin\omega t)$

$\therefore$ $\boxed{\vec{v} \perp \vec{r}}$

3

(3) A carnot engine, having an efficiency of $\eta = 1/10$ as heat engine, is used as a refrigerator. If the work done on the system is 10J, the amount of energy absorbed from the reservoir at lower temperature is

(1) 99J (2) 90J (3) 1J (4) 100J

Ans : 2

Sol^n: for carnot engine using as refrigerator

$$W = Q_2\left(\frac{T_1}{T_2} - 1\right)$$

$$\eta = \frac{1}{10} \qquad \eta = 1 - \frac{T_2}{T_1} \qquad \therefore \frac{T_2}{T_1} = \frac{9}{10}$$

So, $Q_2 = 90J$ (as $W = 10J$)

4

(4) Two uniformly charged solid spheres are such that E_1 is electric field at surface of 1st sphere due to itself. If $\frac{E_1}{E_2} = \frac{r_1}{r_2}$ then ratio of potential at the surface of spheres 1st & 2nd due to their self charge is :

(1) $\frac{r_1}{r_2}$ (2) $\left(\frac{r_1}{r_2}\right)^2$ (3) $\frac{r_2}{r_1}$ (4) $\left(\frac{r_2}{r_1}\right)^2$

Ans : (2)

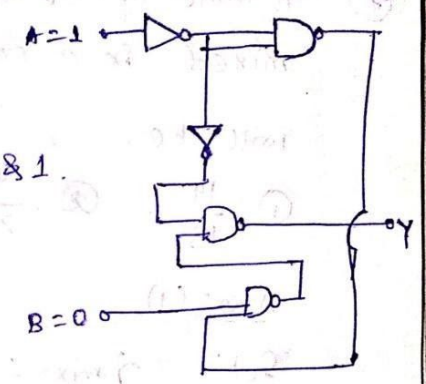
Sol : $\frac{E_1}{E_2} = \frac{r_1}{r_2}$

$$\frac{V_1}{V_2} = \frac{E_1 r_1}{E_2 r_2} = \frac{r_1}{r_2} \times \frac{r_1}{r_2} = \left(\frac{r_1}{r_2}\right)^2$$

5

(5) Output at terminal Y of given logic circuit.

(1) 1
(2) 0
(3) Not determine
(4) Oscillating between 0 & 1.



Ans : (2)

Sol^n: $Y = \overline{\bar{A}B \cdot A}$

$= \overline{\bar{A}B} + \bar{A}$

$= AB + \bar{A}$

$= 0 + 0$

$= 0$

6

(5) Velocity of a wave in a wire V when tension in it is 2.06×10^4 N. find value of tension in wire when velocity of wave become $\frac{V}{2}$.

(1) 5.15×10^3 N
(2) 8.24×10^4 N
(3) 6×10^4 N
(4) 5.15×10^4 N.

Ans (1)

Sol: $V \propto \sqrt{T}$

$$\frac{V_1}{V_2} = \sqrt{\frac{T_1}{T_2}} \qquad \frac{V}{V/2} = \sqrt{\frac{2.06 \times 10^4}{T}}$$

$$T = \frac{2.06 \times 10^4}{4} = 0.515 \times 10^4 \text{ N}$$

7

(1) n mole of He and $2n$ mole of O_2 is mixed in a container. Then $\left(\frac{C_p}{C_V}\right)_{mix}$ will be.

① $\frac{19}{13}$ ② $\frac{40}{27}$ ③ $\frac{1}{3}$ ④ $\frac{1}{4}$

Ans: (1)

Sol^n: $\gamma_{mix} = \frac{n_1 C_{p1} + n_2 C_{p2}}{n_1 C_{v_1} + n_2 C_{v_2}}$

$= \frac{n\left(\frac{5}{2}R\right) + 2n\left(\frac{7}{2}R\right)}{n\left(\frac{3}{2}R\right) + 2n\left(\frac{5}{2}R\right)}$

$= \frac{5+14}{3+10} = \frac{19}{13}$

8

(8) A uniform solid sphere of radius R has a cavity of radius 1m cut from its centre of mass of the system lies at the periphery of the cavity then.

(1) $(R^2+R+1)(2-R)=1$ (2) $(R^2-R+1)(2-R)=1$

(3) $(R^2-R+1)(2-R)=1$ (4) $(R^2+R-1)(2-R)=1$

Ans: (1)

Sol^n: $M_1 = \frac{4}{3}\pi R^3\rho$

$M_2 = \frac{4}{3}\pi(1)^3(-\rho)$.

$$X_{com} = \frac{M_1X_1 + M_2X_2}{M_1+M_2}$$

$$\Rightarrow \frac{\left[\frac{4}{3}\pi R^3\rho\right]0 + \left[\frac{4}{3}\pi(1)^3(-\rho)\right][R-1]}{\frac{4}{3}\pi R^3\rho + \frac{4}{3}\pi 1^3(-\rho)} = -(2-R)$$

$$= \frac{(R-1)}{R^3-1} = 2-R$$

$(R^2+R+1)(2-R) = 1.$

9

(9) A solid sphere of mass $m = 500\,gm$ is rolling without slipping on a horizontal surface. Find Kinetic energy of sphere if velocity of centre of mass is 5 cm/sec.

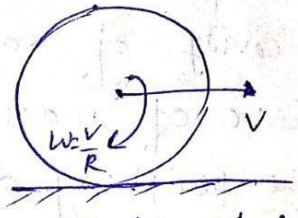
(1) $\frac{35}{2} \times 10^{-4} J$ (2) $\frac{35}{4} \times 10^{-4} J$

(3) $35 \times 10^{-4} J$ (4) $35 \times 10^{-3} J$.

Ans: (2)

Sol":

$KE_{sphere} = RE_{sphere} + TE_{sphere}$



$= \frac{1}{2} mv^2 \left(1 + \frac{K^2}{R^2}\right)$

K : Radius of Gyrat

$= \frac{1}{2} \times \frac{1}{2} \times \left(\frac{5}{100}\right)^2 \left(1 + \frac{2}{5}\right)$

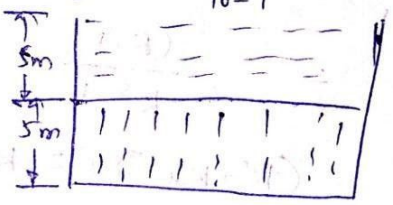
$= \frac{35}{4} \times 10^{-4} J.$

10

(10) Two solid columns of same height 5m and densities ρ and 2ρ are filled in a container of uniform cross sectional area. Then ratio of force exerted by the liquid on upper half of the wall to lower half of the wall is.

(1) $\frac{1}{4}$ (2) $\frac{1}{2}$

(3) $\frac{1}{3}$ (4) $\frac{2}{3}$



Ans: (1)

Sol:

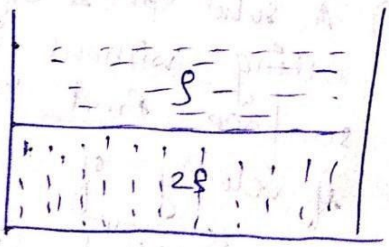
$P_1 = 0$

$F_1 = \left(\frac{P_1+P_2}{2}\right) A$

$P_2 = \rho g 5$

$F_2 = \left(\frac{P_3+P_2}{2}\right) A$

$P_3 = \rho g 5 + 2\rho g 5$



$$\frac{F_1}{F_2} = \frac{1}{4}$$

11

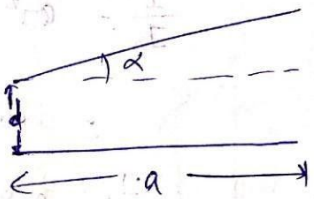
(11) Two square plates of side 'a' are arranged as shown in figure. The minimum seperation between plates is 'd' and one of the plate is inclined at small angle 'α' with plane parallel to another plate. The capacitance of capacitor is (given α is very small).

① $\frac{\epsilon_0 a^2}{d}\left(1-\frac{\alpha a}{2d}\right)$

② $\frac{\epsilon_0 a^2}{d}\left(1-\frac{\alpha a}{d}\right)$

③ $\frac{\epsilon_0 a^2}{d}\left(1+\frac{\alpha a}{2d}\right)$

④ $\frac{\epsilon_0 a^2}{d}\left(1-\frac{\alpha a}{4d}\right)$



Sol:

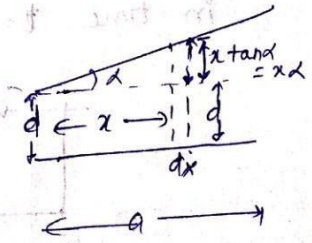
$$dc = \frac{\epsilon_0 a\, dx}{d+\alpha x}$$

$$C = \epsilon_0 a \int \frac{dx}{d+\alpha x}$$

$$C = \frac{\epsilon_0 a}{\alpha}\left[\ln(d+\alpha x)\right]_0^a$$

$$= \frac{\epsilon_0 a}{\alpha}\ln\left(1+\frac{\alpha a}{d}\right)$$

$$\approx \frac{\epsilon_0 a^2}{d}\left(1-\frac{\alpha a}{2d}\right)$$



12

(12) In YDSE path difference at a point on screen is $\frac{\lambda}{8}$. Find ratio of intensity at this point with maximum intensity.

(1) 0.853 (2) 0.533

(3) 0.234 (4) 0.123

Ans: (1)

Sol: $I = I_0 \cos^2\left(\frac{\Delta\phi}{2}\right)$

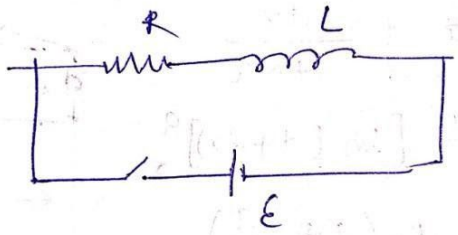
$$\frac{I}{I_0} = \cos^2\left(\frac{\frac{2\pi}{\lambda} \times \Delta x}{2}\right)$$

$$= \cos^2\left(\frac{\pi}{8}\right)$$

$$\frac{I}{I_0} = 0.853$$

13

(13) In the given circuit switch is closed at $t=0$, The charge flown in time $t=T_c$ (where T_c is time constant)



① $\frac{\varepsilon L}{R^2 e}$ ② $\frac{\varepsilon L}{R^2}$ ③ $\frac{\varepsilon L\left(1-\frac{1}{e}\right)}{R}$ ④ $\frac{\varepsilon L}{R}$

Ans: (1)

Sol: $q = \int_0^{T_c} i\,dt$

$$= \frac{\varepsilon}{R}\left[t - \frac{e^{-t/T_c}}{\frac{-1}{T_c}}\right] = \frac{\varepsilon}{R}\left(T_c + T_c e^{-1} - T_c\right)$$

$$= \frac{\varepsilon}{R} \times \frac{1}{e} \times \frac{L}{R} = \frac{\varepsilon L}{R^2 e}$$

14

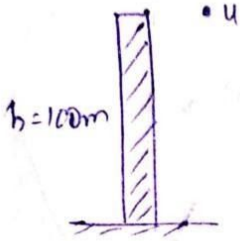
(14) A particle is dropped from height $h = 100m$, from surface of a planet. If in last $\frac{1}{2}$ sec of its journey it covers 19m, then value of acceleration due to gravity that planet is :

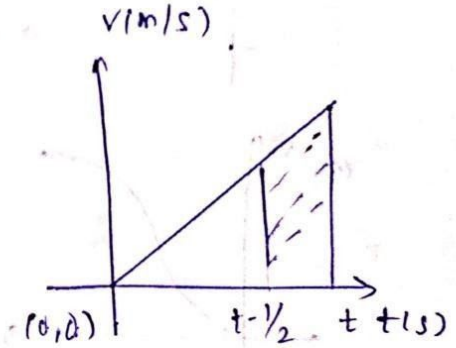
(1) $8\ m/s^2$ (2) $\frac{1}{8} m/s^2$

(3) $\frac{1}{4} m/s^2$ (4) $2 m/s^2$

Ans : (1)

Sol :



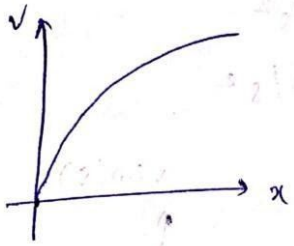


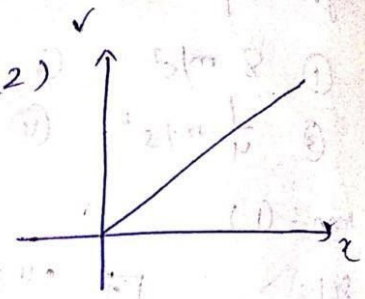
Area of shaded trapezium,

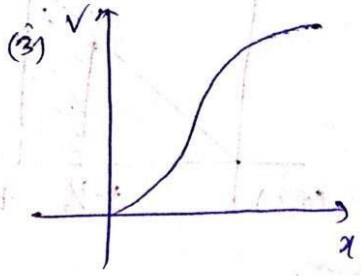
$$g\left(t - \frac{1}{2} + t\right) \times \frac{1}{2} = 19$$

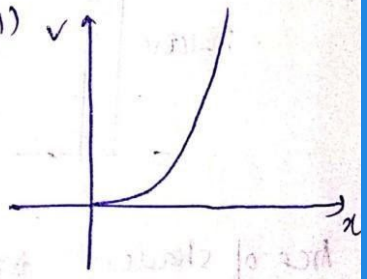
15

(15) A charge particle of mass m and charge q is released from rest in uniform electric field. Its graph between velocity (v) and distance travelled (x) will be :

(1) 

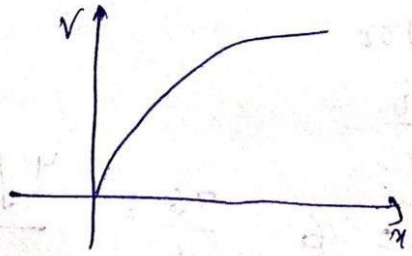
(2) 

(3) 

(4) 

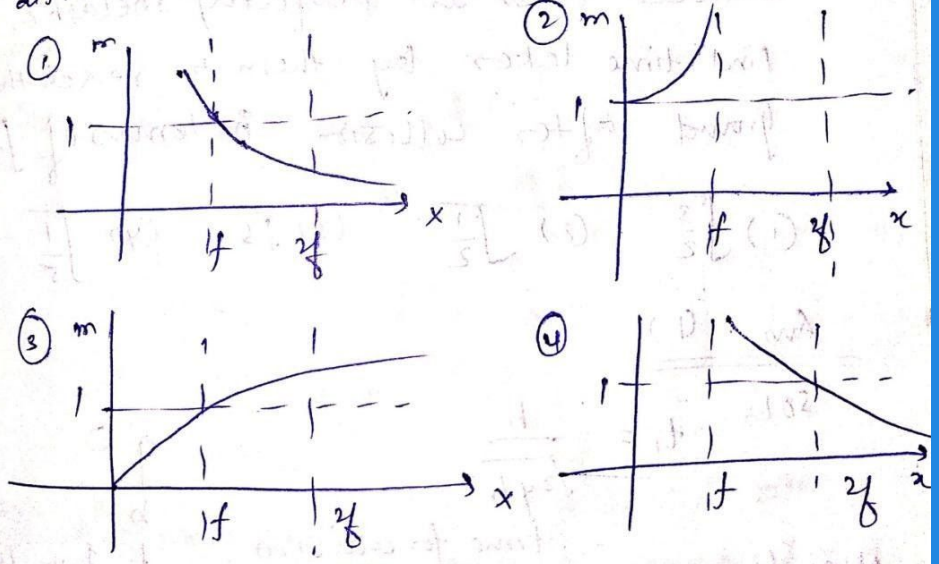
Ans : (1)

Sol^n : $v^2 = \frac{2qE}{m} x.$

$\therefore$ 

16

(16) An object is moving away from concave mirror of focal length f starting from focus. The distance of an object from pole of mirror is x. The correct graph of magnitude of magnification (m) verses distance x is:



Ans: (4)

Sol^n: At focus, magnification is ∞.

17

(17) In full scale deflection current in galvanometer of 100Ω resistance is 1m. Resistance required in series to convert it into voltmeter of range 10V.

① 0.99 KΩ ② 9.9 KΩ

③ 9.8 KΩ ④ 10 KΩ

Ans: (2)

Sol: $V_g = i_g R_g = 0.1V$

$V = 10V$

$R = R_g \left(\frac{V}{V_g} - 1 \right) = 100 \times 99 = 9.9\ K\Omega$

18

(18) There are two identical particles A & B. One is projected vertically upward with speed $\sqrt{2gh}$ from ground and other is dropped from height h along the same vertical line. Collision between them is perfectly inelastic. Find time taken by them to reach the ground after collision in terms of $\sqrt{\frac{h}{g}}$

(1) $\sqrt{\frac{3}{2}}$ (2) $\sqrt{\frac{1}{2}}$ (3) $\sqrt{3}$ (4) $\sqrt{\frac{1}{5}}$

Ans : (1)

Sol. $t_1 = \frac{h}{\sqrt{2gh}}$

... time for collision.

After t_1,

$V_A = 0 - gt_1 = -\sqrt{\frac{gh}{2}}$

$V_B = \sqrt{2gh} - gt_1 = \sqrt{gh}\left[\sqrt{2} - \frac{1}{\sqrt{2}}\right]$

At the time of collision $\bar{P}_i = \bar{P}_f$

$m\bar{V}_A + m\bar{V}_B = 2m\bar{V}_f$

$-\sqrt{\frac{gh}{2}} + \sqrt{gh}\left(\sqrt{2} - \frac{1}{\sqrt{2}}\right) = 2V_f$

$\boxed{V_f = 0}$

and height from ground $= h - \frac{1}{2}gt_1^2 = h - \frac{h}{4} = \frac{3}{4}$

So time. $\sqrt{\frac{2\left(\frac{3h}{4}\right)}{g}} = \sqrt{\frac{3h}{\quad}}$

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19

(19) Length of a simple pendulum is 25.0 cm and time of 40 collision is 50 sec. If resolution of stop watch is 1sec. then accuracy of g is (n%)

(1) 2.4 (2) 3.4 (3) 4.4 (4) 5.4

Ans: (3)

Sol. $\frac{\Delta T}{T} = \frac{1}{2}\left(\frac{\Delta g}{g} + \frac{\Delta L}{L}\right)$

$\frac{\Delta g}{g} = \frac{2\Delta T}{T} + \frac{\Delta L}{L}$

$= 2\left(\frac{1}{50}\right) + \frac{0.1}{25.0}$

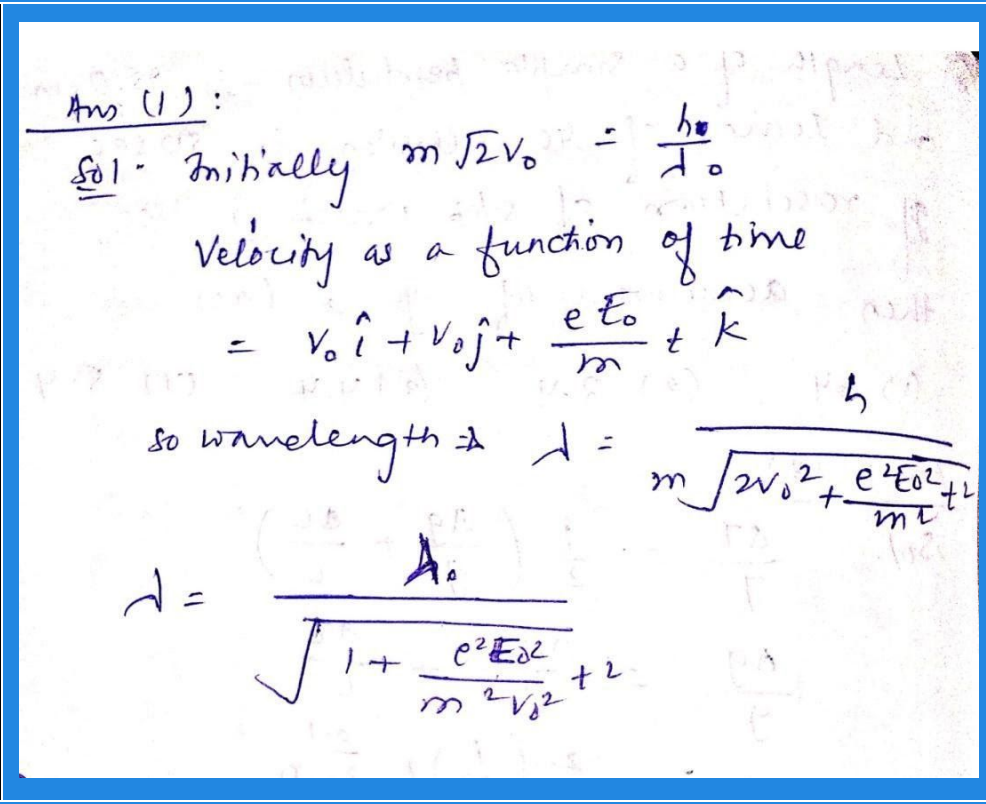
$= 4.4\%$

20

(20) An electron is moving initially with velocity $V_0\hat{i} + V_0\hat{j}$ in uniform electric field $\vec{E} = -E_0\hat{k}$. If initial wavelength of electron is λ_0 and mass of electron is m. Find wavelength of electron as a function of time.

(1) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2E_0^2}{m^2V_0^2}t^2}}$ (2) $\frac{\lambda_0}{\sqrt{2 + \frac{e^2E_0^2}{m^2V_0^2}t^2}}$

(3) $\frac{\lambda_0 m V_0}{eE_0 t}$ (4) $\frac{2\lambda_0 m V_0}{eE_0 t}$



Ans (1):

Sol. Initially $m\sqrt{2}v_0 = \frac{h}{\lambda_0}$

Velocity as a function of time

$$= v_0\hat{i} + v_0\hat{j} + \frac{eE_0}{m}t\,\hat{k}$$

so wavelength $\lambda = \dfrac{h}{m\sqrt{2v_0^2 + \frac{e^2E_0^2}{m^2}t^2}}$

$$\lambda = \frac{\lambda_0}{\sqrt{1 + \frac{e^2E_0^2}{m^2v_0^2}t^2}}$$

21

(21) An asteroid of mass m ($m << m_E$) is approaching with a velocity 12 Km/s when it is at distance of 10R from centre of earth (where R is radius of Earth). When it reaches at the surface of Earth. Its velocity is (Nearest Integer) in km/s.

Ans: 16

Sol": $KE_i + PE_i = KE_f + PE_f$

$$\frac{1}{2}mu_0^2 + \left(-\frac{GMm}{10R}\right) = \frac{1}{2}mv^2 + \left(-\frac{GMm}{R}\right)$$

$$v^2 = u_0^2 + \frac{2GM}{R}\left(1 - \frac{1}{10}\right)$$

$$v = \sqrt{u_0^2 + \frac{9}{5}\frac{GM}{R}}$$

$$= \sqrt{144 + \frac{9}{5} \times \frac{11.2^2}{2}} = \sqrt{144 + 0.9 \times 11.2^2}$$

$$= \sqrt{256.896} \approx 16$$

22

In H-spectrum wavelength of 1st line Ba series is $\lambda = 6561\text{Å}$. Find out wavele of 2nd line of same series in nm.

Ans: 486

Sol^n:

$$\frac{1}{\lambda} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

$$\frac{1}{\lambda_1} = R(1)^2\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5R}{36}$$

$$\frac{1}{\lambda_2} = R(1)^2\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = \frac{3R}{16}$$

$$\frac{\lambda_2}{\lambda_1} = \frac{20}{27}$$

$$\lambda_2 = \frac{20}{27} \times 6561 = 4860\text{Å}$$

23

(23) There are 3 containers C_1, C_2 and C_3 filled with same material at different constant temperature. When we mix them for different volume then we get some final temperature as shown in the below table.

C_1	C_2	C_3	$t(^\circ C)$
1l	2l	0	60
0	1l	2l	30
2l	0	1l	60
1l	1l	1l	0

Ans: $50^\circ C$

Sol:

$$1\theta_1 + 2\theta_2 = (1+2)60$$

$$\theta_1 + \theta_2 = 180 \quad \text{——— (1)}$$

$$0\times\theta_1 + 1\times\theta_2 + 2\times\theta_3 = (1+2)30$$

$$\theta_2 + 2\theta_3 = 90 \quad \text{——— (2)}$$

$$2\times\theta_1 + 0\times\theta_2 + 1\times\theta_3 = (2+1)30$$

$$2\theta_1 + \theta_3 = 180 \quad \text{——— (3)}$$

And, $\theta_1 + \theta_2 + \theta_3 = (1+1+1)\theta$

from (1)+(2)+(3),

$$3\theta_1 + 3\theta_2 + 3\theta_3 = 450$$

$$\theta_1 + \theta_2 + \theta_3 = 150$$

from 4th Eqn $150 = 3\theta$

$$\theta = 50^\circ C$$

24

(24) Two batteries (connected in series) of same emf 10V of internal resistance 20Ω and 5Ω are connected to a load resistance of 30Ω. Now an unknown resistance x is connected in parallel to the load resistance. Find value of x so that potential drop of battery having internal resistance 20Ω becomes zero.

Ans: 30

Sol: $V_1 = \varepsilon_1 - i \cdot r_1$

$0 = 10 - i \times 20$

$i = 0.5\,A$

$V_2 = \varepsilon_2 - i r_2$

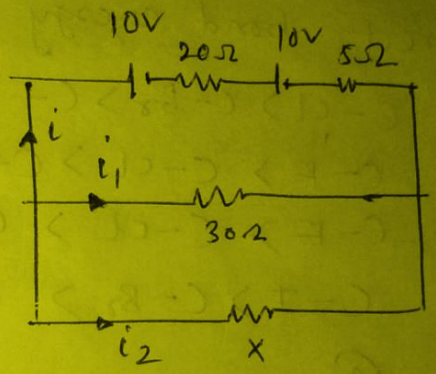
$= 10 - 0.5 \times 5$

$V_2 = 7.5\,V$

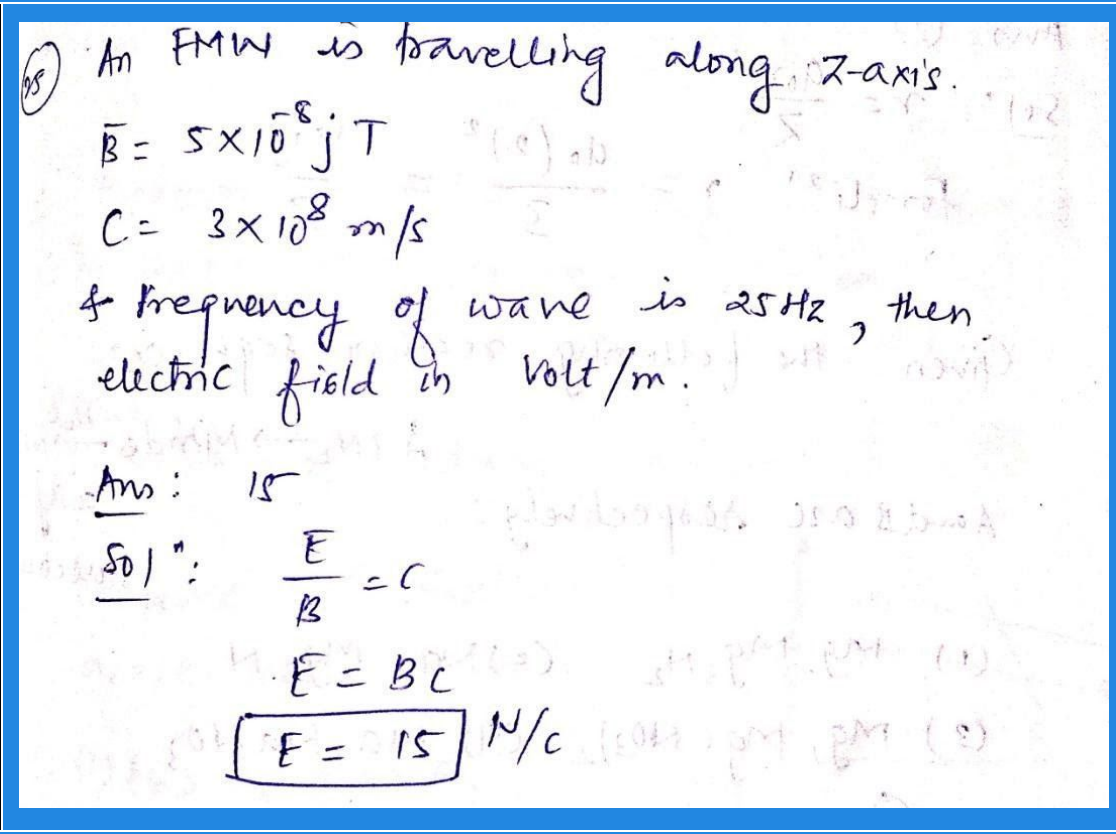
$0.5 = \frac{7.5}{30} + \frac{7.5}{x}$

$\frac{7.5}{x} = 0.25$

$x = \frac{7.5}{0.25} = 30$



25



(25) An EMW is travelling along Z-axis.

$\bar{B} = 5 \times 10^{-8}\, j\ T$

$C = 3 \times 10^{8}\ m/s$

& frequency of wave is 25 Hz, then electric field in volt/m.

Ans: 15

Sol": $\frac{E}{B} = C$

$E = BC$

$\boxed{E = 15}\ N/C$

Enrolling yourself for coaching classes has long been considered the first step towards cracking the jee. however, this trend is starting to slip. Recent studies show that, for the students who cleared the JEE Main/Advance, the number of students who had joined a coaching class is lower than the number of students who managed the feat with self-study

Preparation for JEE Main/Advance requires a lot of hard work and determination. Be ready to even go through many sleepless nights, missed birthdays and extracurriculars to finish the vast JEE syllabus. But simply completing the syllabus is not enough! If you want to have an edge over your counterparts you need to step up your game. This

means practicing a variety of problems and revising diligently while following a meticulous study plan that recognizes your strengths and takes care of all your weaknesses. To get your doubts solved or questions checked there is no better place than Kunduz.

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