FIRST YEAR HIGHER SECONDARY MODEL EXAM - FEB - 2025
PHYSICS

Section A (Any 5)

1) 5 ② $S = -\frac{u^2}{2a}$

③ V_0 ④ Elastomers

⑤ Mass ⑥ Radiation

7) Absolute temperature (T)

Section B (Any 5)

⑧ $u = 29.4$ m/s

a) Downward

b) $v = 0$, $a = 9.8$ m/s^2

9) a) No, $(\vec{A}+\vec{B}) \neq (\vec{A}-\vec{B})$

(But $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$ when $\theta = 90^\circ$)

b) (i) $\vec{A} + \hat{0} = \hat{0}$

(ii) $\vec{A} + -\vec{A} = \hat{0}$

(iii) $k \times \hat{0} = \hat{0}$

(10) a) True

Force and displacement are ⊥r to each other

b)

Conservative	Non-Conservative
Electrostatic	Frictional
Magnetic	Viscous

11) a) product of mass of the body and square of distance (radius of gyration)

$I = MK^2$

b) i) Mass of the body

ii) axis of rotation

iii) orientation of axis

iv) Size and shape of body (Any 2)

12) Statement (OR) $\frac{dA}{dt}$ = Constant

(OR)

Areal velocity = Constant

b) P (v is maximum at p)

⑬ a) Statement

OR

$\Delta Q = \Delta U + \Delta W$

b) Adiabatic

14) a) $V_{rms} \propto \sqrt{T}$ (V_{rms} increases)

b) $\overline{v^2} = \frac{3K_BT}{m}$ | $m = \frac{M}{N_A}$

$= \frac{3K_BT}{M/N_A}$ | $K_B N_A = R$

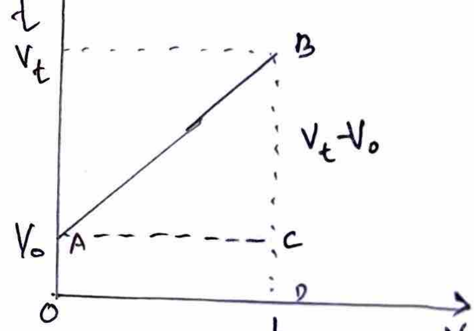
$= \frac{3RT}{M}$

$V_{rms} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3 \times 8.314 \times 100}{32}}$

$= 8.83$ m/s

Section C (Any 6)

15) a)



b) Displacement = Area OABD

S = Area OACD + Area ABC

$= V_0 \times t + \frac{1}{2} \times t \times (V_t - V_0)$

$= V_0t + \frac{1}{2} t \times at$

$\boxed{S = V_0t + \frac{1}{2}at^2}$

16) a) statement or $F \propto \frac{dP}{dt}$

b) $\frac{\Delta P}{\Delta t} = F$

$\Delta P = F \times \Delta t$

= Area under F-t graph

$= \left(\frac{1}{2} \times 5 \times 5\right) + 5 \times (10-5)$

$= 12.5 + 25$

$= 37.5$ kgm/s

17) a) Statement. (OR)

If $\tau = 0$, L = Constant

b) $\vec{L} = \vec{r} \times \vec{P}$

$\frac{d\vec{L}}{dt} = \vec{r} \times \frac{d\vec{P}}{dt} + \frac{d\vec{r}}{dt} \times \vec{P}$

$= \vec{r} \times \vec{F} + \vec{v} \times m\vec{v}$

$= \vec{r} \times \vec{F} + 0$

$= \vec{\tau}$

18) a) Within the proportional limit stress $\propto$ strain

b) (i) False

(ii) True

19) a) thin needle, $P = \frac{F}{A}$, $P \propto \frac{1}{A}$

b) Same pressure

pressure at a depth depends on depth from the surface only

$P = h\rho g$

20) a) As the temp: of the water increases from $0°C$, its volume first decreases upto $4°C$ and then increases. Water has minimum volume and maximum density at $4°C$.

b) $L_v = 22.6 \times 10^5$ J/kg

$m = 0.5 \times 10^{-3}$ kg

$Q = mL_v$

$= 0.5 \times 10^{-3} \times 22.6 \times 10^5$

$= 11.3 \times 10^2$

$= 1130$ J

21) $dW = PdV$

$W = \int_{V_1}^{V_2} PdV$

For isothermal process, $PV = \mu RT = K$

or, $P_1V_1 = P_2V_2$

$W = \int_{V_1}^{V_2} \frac{\mu RT}{V} dV$

$= \mu RT \int_{V_1}^{V_2} \frac{1}{V} dV$

$= \mu RT \left[\log_e (V)\right]_{V_1}^{V_2}$

$= \mu RT \log_e \left(\frac{V_2}{V_1}\right)$

Section D (Any 3)

22) a) Statement

(OR)

$[LHS] = [RHS]$

b) Angle

c) $KE \propto m^a v^b$.

$KE = k m^a v^b$ — ①

$[KE] = [M^1 L^2 T^{-2}]$

$[k m^a v^b] = M^a (L^1 T^{-1})^b$

$= [M^a L^b T^{-b}]$ — ②

① and ② $\Rightarrow$ $a = 1$, $b = 2$

$\therefore$ ① $\Rightarrow$ $KE = k m^1 v^2$

$= kmv^2$

23) Statement

(OR)

$W = \Delta KE$

proof

$v^2 - u^2 = 2as$

$\frac{1}{2}mv^2 - \frac{1}{2}mu^2 = \frac{1}{2}m \times 2as$

$= mas$

$KE_f - KE_i = mas$
$= FS$
$= W$

$\Delta KE = W$

b) i) Increase
ii) Increases

24) a) oscillation of simple pendulum
oscillation of loaded spring

b) $x = A\cos\omega t$

$V = \frac{dx}{dt} = -\omega A \sin\omega t$

$KE = \frac{1}{2}mV^2$

$= \frac{1}{2}m \times \omega^2 A^2 \sin^2\omega t$

$\boxed{KE = \frac{1}{2}kA^2\sin^2\omega t}$

OR

$KE = \frac{1}{2}kA^2(1-\cos^2\omega t)$ $\quad \sin^2\omega t = 1-\cos^2\omega t$

$= \frac{1}{2}k(A^2 - A^2\cos^2\omega t)$

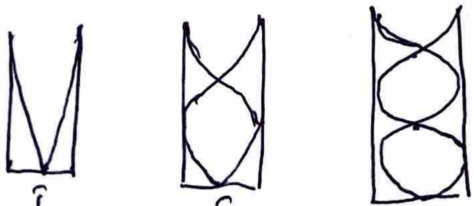
$= \frac{1}{2}k(A^2 - x^2)$

$PE = \frac{1}{2}kx^2$

$\boxed{PE = \frac{1}{2}kA^2\cos^2\omega t}$

25) a) Elasticity of the medium
density of the medium

b)



I $\quad$ II $\quad$ III

mode 1 $\quad l = \frac{\lambda}{4}$; $\lambda = 4l$

$\nu_1 = \frac{V}{\lambda} = \frac{V}{4l} = \nu_0$

mode 2 $\quad l = \frac{3\lambda}{4}$; $\lambda = \frac{4l}{3}$

$\nu_2 = \frac{V}{\lambda} = \frac{V}{(4l/3)} = \frac{3V}{4l} = 3\nu_0$

mode 3 $\quad l = \frac{5\lambda}{4}$; $\lambda = \frac{4l}{5}$

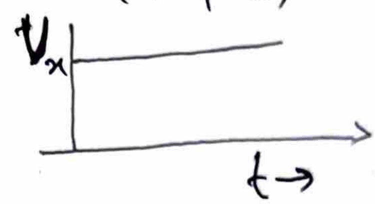
$\nu_3 = \frac{V}{\lambda} = \frac{V}{(4l/5)} = \frac{5V}{4l} = 5\nu_0$

$\nu_1 : \nu_2 : \nu_3 = \nu_0 : 3\nu_0 : 5\nu_0$

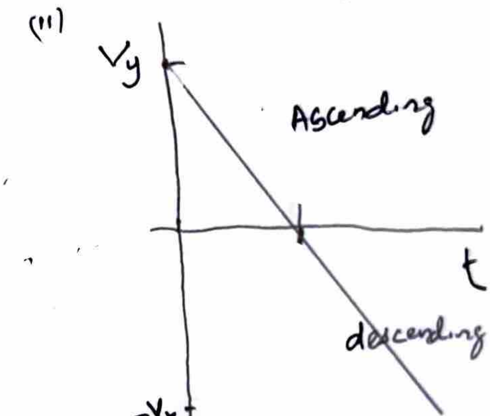
$= 1 : 3 : 5$

Section E (Any 3)

26) a) (i)



(ii)



b) $S = ut + \frac{1}{2}at^2$

$y = u_y t + \frac{1}{2}a_y t^2$ $\quad$ | $y = 0$, $u_y = u\sin\theta$, $a_y = -g$

$0 = u\sin\theta \times t + \frac{1}{2} \times -gt^2$

$\frac{1}{2}gt^2 = u\sin\theta \times t$

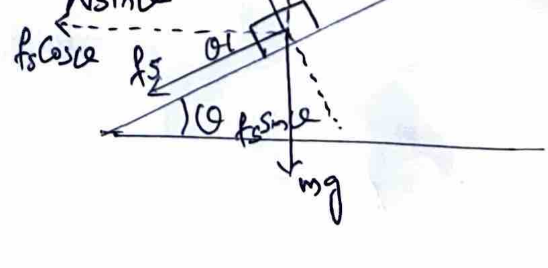
$gt = 2u\sin\theta$

$\boxed{t = \frac{2u\sin\theta}{g}}$

c) At the highest position $V_x = u\cos\theta$
$V_y = 0$

$\therefore KE = \frac{1}{2}mV_x^2 = \frac{1}{2}mu^2\cos^2\theta$

27) a)



27 b) $\frac{mv^2}{R} = N\sin\theta + f_s\cos\theta$ —— ①

$f_s\sin\theta + mg = N\cos\theta$

$mg = N\cos\theta - f_s\sin\theta$ —— ②

$\frac{①}{②} \Rightarrow \frac{v^2}{Rg} = \frac{N\sin\theta + f_s\cos\theta}{N\cos\theta - f_s\sin\theta}$

÷ Nr and Dr of RHS by $N\cos\theta$

$$\frac{v^2}{Rg} = \frac{\tan\theta + \frac{f_s}{N}}{1 - \frac{f_s}{N}\tan\theta}$$

For max permissible speed $f_s = f_{ms}$

and $\frac{f_{ms}}{N} = \mu_s$

$$\therefore \frac{v^2}{Rg} = \frac{\tan\theta + \mu_s}{1 - \mu_s\tan\theta}$$

$$v = \sqrt{Rg\left(\frac{\mu_s + \tan\theta}{1-\mu_s\tan\theta}\right)}$$

ⓒ Max permissible speed on level road

$V_m = \sqrt{\mu R g}$

$= \sqrt{0.2 \times 4 \times 9.8} = 2.8\,m/s$

Speed of vehicle

$V = 80\,km/h = \frac{80 \times 5}{18} = 22.2\,m/s$

Since $V > V_m$, car will skid

28) a) pole

(Hint: $g = \frac{GM}{R^2}$

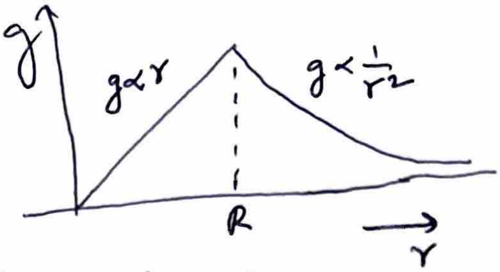
$R_{pole} < R_{eq}$.

$g_{pole} > g_{eq}$)

b) Derivation

$g_h = g\left(1 - \frac{2h}{R}\right)$

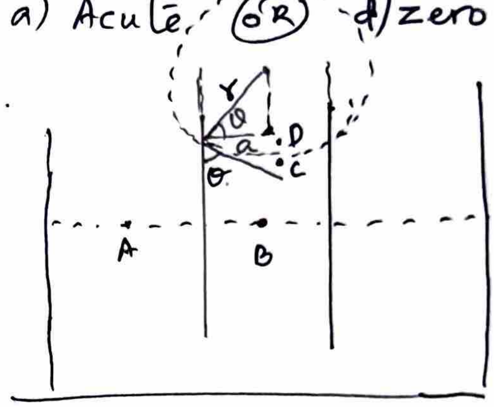
ⓒ a)



29) a) It is the angle between the tangent at the point of contact and the solid inside the liquid

b) a) Acute, OR d) zero

c)



$P_A = P_B = P_D = P_a$, atmospheric pressure

$P_D - P_C = \frac{2S}{r}$ (excess pressure) —— ①

$P_B = P_C + h\rho g$

$P_B - P_C = h\rho g$ —— ②

① and ② $\Rightarrow$ $h\rho g = \frac{2S}{r}$ | $\because P_D = P_B$

$h = \frac{2S}{r\rho g}$

from figure, $\cos\theta = \frac{a}{r}$

$\frac{1}{r} = \frac{\cos\theta}{a}$

$\therefore h = \frac{2S}{\rho g}\left(\frac{\cos\theta}{a}\right)$

$$\boxed{h = \frac{2S\cos\theta}{a\rho g}}$$

$\cos\theta$ is +ve for $\theta = 0$ and for $\theta < 90$

29 ⓑ Hint

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