FIRST YEAR HIGHER SECONDARY EXAM - 2025

HSE-I

PHYSICS

FY-324

I) Answer Any 5 (1-7)

1) b) Temperature

2) c) Object has constant velocity

3) mass of body

4) hydrostatic paradox

5) True

6) Water

7) $KE = \frac{3}{2} k_B T$

II) Answer Any 5 (8-14)

$u = 126 \text{ km h}^{-1}$

$= 126 \times \frac{5}{18} = 35 \text{ m/s}$

$v = 0$

$s = 200 \text{ m}$

$a = \frac{v^2 - u^2}{2s} = \frac{0 - 35^2}{2 \times 200}$

$= -3.0625 \text{ m/s}^2$

Retardation $= 3.0625 \text{ m/s}^2$

9) a) True

b) True

10) Elastic collision

KE conserved

Linear momentum (P) conserved

Inelastic collision

KE not conserved

Linear momentum conserved

11) a) angular velocity

b) vector

12) a) Escape speed - minimum speed of projection so that a body escape from gravitational pull of a planet/earth.

b) Escape speed of gas on the surface of moon is less than the rms speed of gas.

$V_e < V_{rms}$

13) 1. Isothermal - temp constant

2. Adiabatic - No heat transfer

3. Isochoric - Constant volume

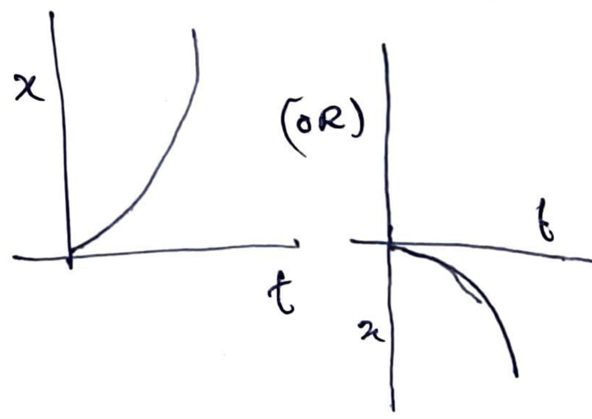
4. Isobaric - Constant pressure

14) The total energy of a molecule is equally distributed in all possible energy modes, with each mode having average energy equal to $\frac{1}{2} k_B T$.

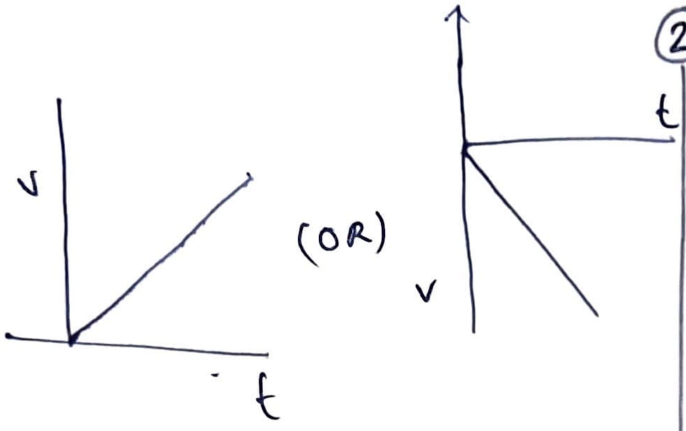
$E = N \times \frac{1}{2} k_B T$

III Answer any 6 (15-21)

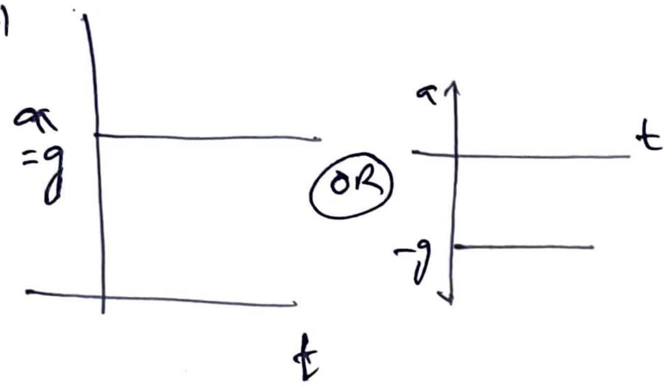
15) a)



b)



(c)



(16) a) Rate of change in linear momentum is directly proportional to applied force and takes place in the direction of force

$F \propto \frac{\Delta p}{\Delta t}$

b) $F \propto \frac{\Delta p}{\Delta t}$

$F = k\frac{\Delta p}{\Delta t}$

$= k\frac{\Delta (mv)}{\Delta t}$

$= k\,m\frac{\Delta v}{\Delta t}$

$= kma$ $\quad k = 1$

$F = ma$

17) a) $KE_{rot} = \frac{1}{2} I \omega^2$

b) $m = 20\,kg$

$\omega = 100\,rad/s$

$R = 0.25\,m$

$I = \frac{MR^2}{2} = \frac{20 \times 0.25^2}{2}$

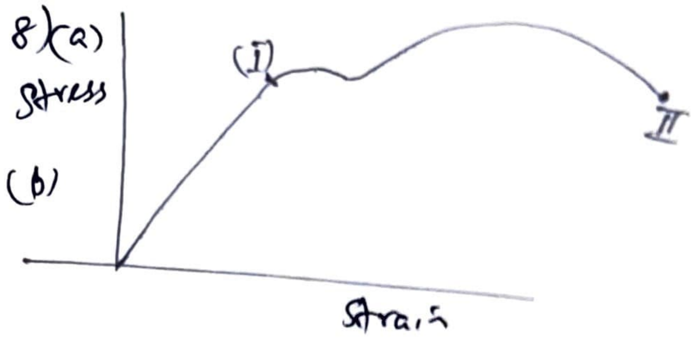
$= 0.625\,kgm^2$

$KE_{rot} = \frac{1}{2} I \omega^2$

$= \frac{1}{2} \times 0.625 \times 100^2$

$= 3125\,J$

18) (a)



(b)

B) i

19) a) gauge pressure (OR) hydraulic pressure

b) $P = P_0 + h\rho g$

$= 1.01325 \times 10^5 + 10 \times 10^3 \times 9.8$

$= (1.01325 + 0.98) \times 10^5$

$= 1.99325 \times 10^5\,Pa$

(OR)

$P = P_0 + h\rho g$

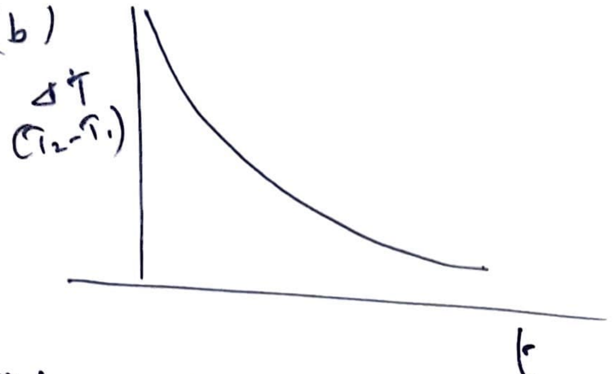
$\approx 10^5 + 10 \times 10^3 \times 10$

$= 2 \times 10^5\,Pa$

20) Rate of cooling (heat loss) of a body is directly proportional to the temperature difference b/w the body and surrounding

$-\frac{dQ}{dt} \propto (T_2 - T_1)$

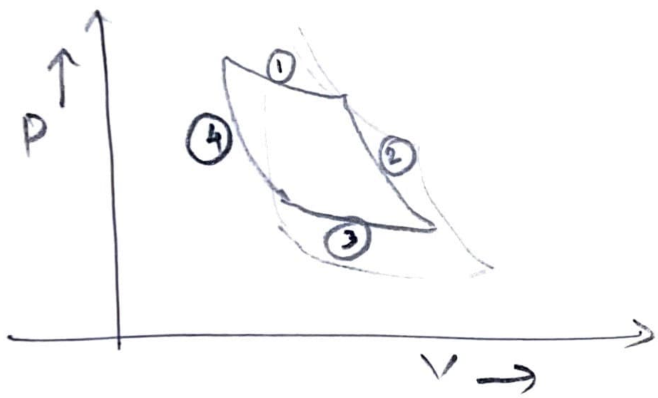
(20) (b)



(c) (i) Law is applicable for small temperature difference (or) (ii)

21) a) 1) Isothermal expansion
2) Adiabatic "
3) Isothermal compression
4) Adiabatic "

b)



III) Any 3 (22-25)

22) a) Statement (OR)
dimension of LHS = dimension of RHS

b) $T \propto l^a m^b g^c$

$T = k l^a m^b g^c$ —— (1)

$[T] = [M^0 L^0 T^1]$ —— (2)

$[k l^a m^b g^c] = L^a M^b (LT^{-2})^c$
$= [L^{a+c} M^b T^{-2c}]$ —— (3)

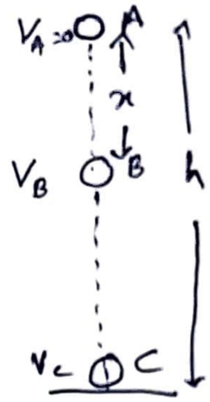
(2) and (3) ⇒ $b = 0$
$-2c = 1 \Rightarrow c = -\frac{1}{2}$

$a + c = 0$
$a + -\frac{1}{2} = 0$
$a = \frac{1}{2}$

∴ (1) $T = k l^{1/2} m^0 g^{-1/2}$

$T = k\sqrt{l/g}$

(23) (a)



A

$V_A = 0$
$KE_A = \frac{1}{2} m V_A^2 = 0$
$PE_A = mgh$
$TE_A = 0 + mgh$
$= mgh$

B

$V_B = \sqrt{2gx}$ =
$KE_B = \frac{1}{2} m V_B^2 = \frac{1}{2} m \times 2gx = mgx$
$PE_B = mg(h-x)$
$TE_B = mgx + mg(h-x) = mgh$

C

$V_C = \sqrt{2gh}$
$KE_C = \frac{1}{2} m V_C^2 = \frac{1}{2} m \times 2gh = mgh$
$PE_C = 0$
$TE_C = mgh + 0 = mgh$

i.e., $TE_A = TE_B = TE_C$

(b) False

(24) $x = A\cos(\omega t + \phi)$

$v = \frac{dx}{dt} = \frac{d(A\cos(\omega t + \phi))}{dt}$

$= A \cdot -\sin(\omega t + \phi) \times \omega$

$v = -\omega A \sin(\omega t + \phi)$

$$a = \frac{dv}{dt}$$
$$= \frac{d}{dt}\left(-\omega A \sin(\omega t+\phi)\right)$$
$$= -\omega A \times \cos(\omega t+\phi) \times \omega$$
$$= -\omega^2 A \cos(\omega t+\phi)$$
$$a = -\omega^2 x$$

(25) $y = 3.0 \sin(36t + 0.018x + \pi/4)$

a) Travelling

b) general equation;

$y = A \sin(\omega t + kx + \phi)$

$V = \frac{\omega}{k} = \frac{36}{0.018} = 2000\ cm/s = 20\ m/s$

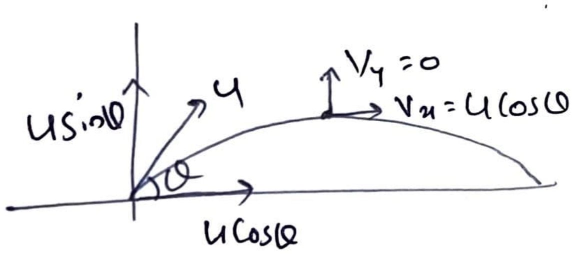
c) $\omega = 2\pi\nu$

$\nu = \frac{\omega}{2\pi} = \frac{36}{2 \times 3.14} = 5.73\ Hz$

d) $\phi = \pi/4$

V Any 3 (26-29)

26)



a) $u_x = u\cos\theta$
$u_y = u\sin\theta$

b) $V_y = 0$, $u_y = u\sin\theta$
$a = -g$, $S_y = H = y$

Taking vertical components

$V_y^2 = u_y^2 + 2a_y \times y$

$0 = (u\sin\theta)^2 + 2 \times -g H$

$2gH = u^2 \sin^2\theta$

$$H = \frac{u^2 \sin^2\theta}{2g}$$

(c) $u = 28\ m/s$
$\theta = 30°$

$H = \frac{u^2 \sin^2\theta}{2g}$

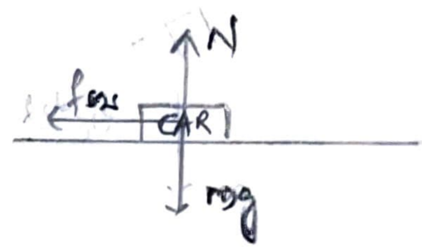
$= \frac{28^2 \times \sin^2 30}{2 \times 9.8}$

$= \frac{784 \times 0.5^2}{2 \times 9.8}$

$= 10\ m$

27)

a)



b) For the car moving without skidding

$F_c \leq f_{ms}$

For maximum speed without skidding

$F_c = f_{ms}$

$\frac{mv^2}{r} = \mu N$

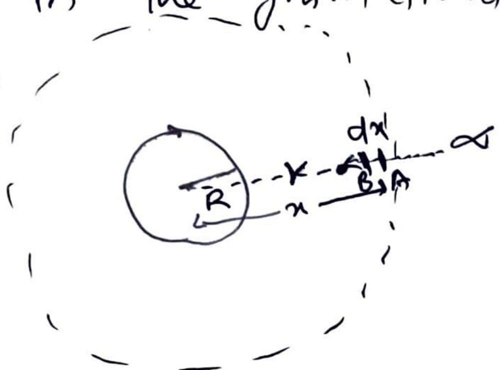
$\frac{mv^2}{r} = \mu mg$

$v^2 = \mu r g$

$$V = \sqrt{\mu r g}$$

24) c) Increase the friction between tyre and road
(OR)
Increase the roughness of road
(OR)
Use tyre with good condition

28) It is the amount of work to move any body from infinity to a point in the gravitational field.



$F = \frac{GMm}{x^2}$ at A

Work done for small displacement dx

$dW = \vec{F} \cdot \vec{dx}$

$= F\,dx \cos\theta$ $\theta = 0$

$= \frac{GMm}{x^2} dx$ $\cos\theta = 1$

Total work done,

$W = \int_{\infty}^{R} \frac{GMm}{x^2} dx$

$= GMm \int_{\infty}^{R} x^{-2} dx$

$= GMm \left(\frac{x^{-2+1}}{-2+1}\right)_{\infty}^{R}$

$= -GMm \left(\frac{1}{x}\right)_{\infty}^{R}$

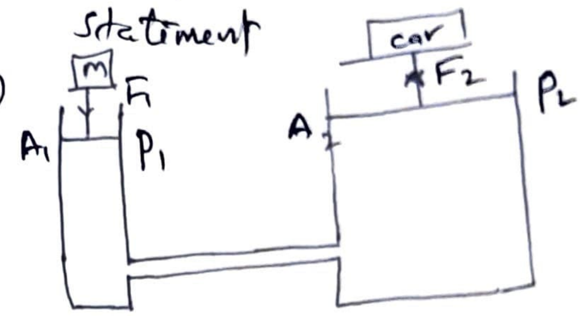
$= -GMm \left(\frac{1}{R} - \frac{1}{\infty}\right)$

$W = -\frac{GMm}{R} = PE$

(c) Grav: pot: energy is -ve. The force is attractive only.
(OR)
The system is a bound system.

(29) (a) Pascal's law.
Statement

b)



Pascal's law

$P_1 = P_2$

$\frac{F_1}{A_1} = \frac{F_2}{A_2}$

$$F_2 = \frac{A_2}{A_1} F_1$$

mechanical advantage $= \frac{A_2}{A_1}$

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