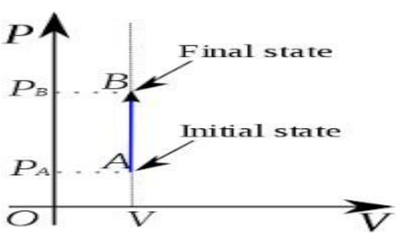
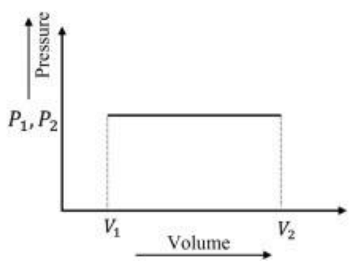
GRADE: XII	ANNUAL EXAMINATION 2023-24 PHYSICS-MS	Marks: 70 Time: 3h

Q.N0.	SECTION A	MARKS
1	[d]45	1
2	[b] momentum	1
3	[a]may have a unit	1
4		
5	[a]light body	1
6	[a]-40^0	1
7	(c)11 km/s	1
8	[c] 90^0	1
9	[b]4	1
10	(d)T^4	1
11	(a)is zero	1
12	c)40 N	1
13	[c]both will reach simultaneously	1
14	d) radiation	1
15	[c]λ/2	1
16	a) Along the direction of wave propagation	1
17 18	[a] [a]	1 1
	SECTION B	
18	T= mg = 30 (10) = 300 N T-mg = ma (climbing up) a=T-mg/m a=300-25(10)/25 a=2 m/s2	2
19	 	2
20	$0 = u^2 - 2gs$ $\Rightarrow 0 = (u \sin\theta)^2 - 2gs$ $\Rightarrow 2gs = (u \sin\theta)^2$ $\Rightarrow s = \frac{(u\sin\theta)^2}{2g}$ $, H = \frac{u^2 \sin^2\theta}{2g}$	2

21

V=√gr

V=√10*6400

V=8000 m/s

22 (Marks: 2)

Diagram or consideration

$F \propto -x$

$F = -kx \quad ...(1)$

$W_s = \int_0^{x_m} F\,dx \quad ...(2)$

$W_s = -\int_0^{x_m} kx\,dx \quad ...(3)$

$W_s = -k\left[\frac{x^2}{2}\right]_0^{x_m}$

$W_s = -\frac{1}{2}kx_m^2$

$W_E = \frac{1}{2}kx_m^2 \quad ...(4)$

This work done is stored as the elastic potential energy 'U' of the spring.

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

OR

Statement

Diagram or consideration

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

Multiplying both the sides by 1/2m, we get

$\frac{1}{2}mv^2 - \frac{1}{2}mu^2 = mas$

By Newton's second law, ma = F

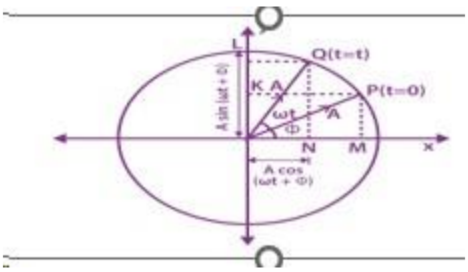
Therefore $\quad \frac{1}{2}mv^2 - \frac{1}{2}mu^2 =$ F x s = W

Kf – Ki = W

23 (Marks: 2)

Damped oscillation	Undamped oscillation
The oscillations die down over time due to the presence of damping.	The amplitude of oscillations remains unaffected over time.
Damped oscillations eventually decay to a halt over time.	Energy remains conserved and the oscillations do not die out.
The amplitude is not constant.	The amplitude remains constant.
All practical oscillations are damped to some degree.	Undamped oscillations don't exist practically.

24



X=acoswt

25 P=

P=hdg

$M^1L^{-1}T^{-2} = M^1L^{-1}T^{-2}$

26 F=6 πr ɧ v

Proof: When the body acquires terminal velocity,

FT+FV=W

Putting values,

FT=4/3πr3ρgFV=6πηrvW=4/3πr3ρog

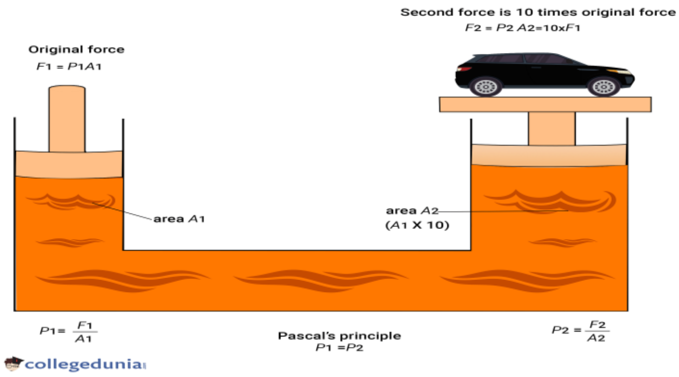
We get,

4/3πr3ρg+6πηrv=43πr3ρog

6πηrv=43πr3(ρo−ρ)g

v=2r2(ρo−ρ)g/9η

27 pressure change at any point in a confined incompressible fluid is transmitted throughout the fluid such that the same change occurs everywhere.



$P_2=f_2/a_2$

$P_1=p_2$

$F_1/a_1*a_2=f_2$

$F_2=f_1/a_1*a_2$

$Mg=mg*a_2/a_1$

$M=ma_2$

28 Elastic collisions occur when both the momentum and kinetic energy are conserved, similar to how billiard balls bounce off each other and move at the same speeds as before. Inelastic collisions happen when only the momentum is conserved but not the kinetic energy.

m1u1 + m2u2 = m1v1 + m2v2

∴ m(u1-v1) = m(v2-u2) ⇢ (Equation A)

Kinetic energy formula for elastic collisions is:

1/2(m1u12) + 1/2(m2u22) = 1/2(m1v12) + 1/2(m2v22)

∴ m1(u12-v12) = m2(v22-u22)

∴ m1(u1+v1)(u1-v1) = m2(v2+u2)(v2-u2) ⇢ (Equation B)

Divide Equation B to Equation A,

u1 + v1 = v2 + u2

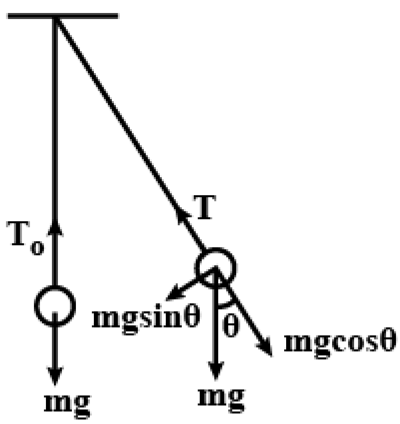
∴ u1 – u2 = -(v1 – v2)

29 ***$Y = FL_0 / A\Delta L$***

$Y=mgl/(\pi r^2 l)$
$M=14.1*10^{-2}$ kg

30 $$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

$f=\pi/5$
(b)Max.Speed=Aw
V=1 m/s
(c)$a=Aw^2$
$a=10\ m/s^2$

31


$T - mg\cos\theta = mv^2L$

The torque tends to bring the mass to its equilibrium position,

$\tau = mgL \times \sin\theta = mg\sin\theta \times L = I \times \alpha$

For small angles of oscillations $\sin\theta \approx \theta$,

Therefore, $I\alpha = -mgL\theta$

$\alpha = -(mgL\theta)/I$

$-\omega_0^2\ \theta = -(mgL\theta)/I$

$\omega_0^2 = (mgL)/I$

$\omega_0 = \sqrt{(mgL/I)}$

Using $I = ML^2$, [where I denote the moment of inertia of bob]

we get, $\omega_0 = \sqrt{(g/L)}$

Therefore, the time period of a simple pendulum is given by, T = 2π/ω_0 = 2π × √(L/g)

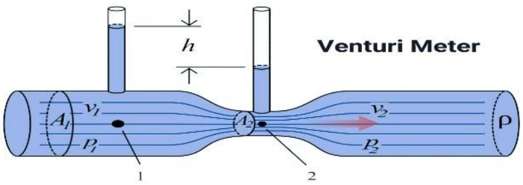
(b)length

(c) T = 2π × √(L/g)

L=1.01 m

32 Streamline flow is a fluid's smooth flow with a velocity less than a critical velocity. Turbulent flow is uneven, unstable and exceeds the fluid's critical velocity.

$$(P_1 - P_2)dv = \frac{1}{2}\rho dv(v_2^2 - v_1^2) + \frac{1}{2}\rho dvg(y_2 - y_1)$$
$$\Rightarrow (P_1 - P_2) = \frac{1}{2}\rho(v_2^2 - v_1^2) + \frac{1}{2}\rho g(y_2 - y_1)$$
$$\Rightarrow P_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2$$



From the equation of continuity,

$A_1 v_1 — = A_2 v_2$

From Bernoulli's theorem,

$$P_1 + \frac{1}{2}v_1^2 = P_2 + \frac{1}{2}v_2^2$$

$$\text{or, } P_1 - P_2 = \frac{1}{2}(v_2^2 - v_1^2)$$

$$\Rightarrow (P_1 - P_2) = \frac{1}{2}\left(\frac{A_1^2 v_1^2}{A_2^2} - v_1^2\right)$$

$$\Rightarrow (P_1 - P_2) = \frac{1}{2}v_1^2\left(\frac{A_1^2 - A_2^2}{A_2^2}\right)$$

$$\text{or } v_1 = A_2\left[\frac{2(P_1 - P_2)}{(A_1^2 - A_2^2)}\right]^{1/2} \text{ ....(11.17)}$$

But, $A_1 v_1 = \Delta V$

where $\Delta V \rightarrow$ Volume that flows through a cross-section per second.

$$\therefore \Delta V = A_2 A_1\left[\frac{2(P_1 - P_2)}{(A_1^2 - A_2^2)}\right]^{1/2} \text{ ....(11.18)}$$

$$\Delta V = A_1 A_2\left[\frac{2gh}{A_1^2 - A_2^2}\right]^{1/2} \text{ ....(11.19)}$$

33 Acceleration of the particle , performing S.H.M is given by $\alpha=-\omega^2 y$

where ω is the angular velocity, and y is the displacement of particle.

now, workdone by particle = $\vec{F}.\vec{dy}$

as we know, acceleration and displacement are in opposite directions in case of S.H.M

so, $W=-m\omega^2 y dy$

where m is the mass of the particle.

$W=-m\omega^2\int y dy$

$W=-12m\omega^2 y^2$

so, potential energy = -W

$=12m\omega^2 y^2$

we know, $\omega=2\pi\eta$

so, $P.E=2\pi^2\eta^2 m y^2$ ......(1)

velocity of particle , $v=\omega A\cos\omega t$

or, $v=\omega\sqrt{A^2-y^2}$

so, kinetic energy of particle, $K.E=12mv^2$

hence, $K.E=12m\omega^2(A^2-y^2)$

but $\omega=2\pi\eta$

so, $K.E=2\pi^2\eta^2 m(A^2-y^2)$ ....(2)

so, total mechanical energy = K.E + P.E

$=2\pi^2\eta^2 mA^2$

34 i [d]
ii[a]
iii[d]
iv[c]

35 i[d]
ii[b]
iii[d]
iv[c]