BSEH SAMPLE PAPER PHYSICS (2025-26)

Marking Scheme

Physics Class-XI

SECTION-A

1. (*c*) 663.8. **1**
2. (*d*) $[P^1 A^{1/2} T^{-1}]$. **1**
3. (*d*) both Newton's second and third law. **1**
4. (*d*) at first greater than mg, and later becomes equal to mg. **1**
5. (*c*) C. **1**
6. (*c*) least in (*b*). **1**
7. (*b*) energy. **1**
8. (*a*) $P_1 > P_2$. **1**
9. (*b*) $-2P_0V_0$. **1**
10. scaler. **1**
11. $\frac{1}{2}MR^2$. **1**
12. Decreases. **1**
13. uniform motion. **1**
14. zero. **1**
15. $dw = \tau\,(dQ)$. **1**
16. (*d*). **1**
17. (*c*). **1**
18. (*d*). 1

SECTION-B

19. $n_1 = 10,\quad W = [ML^2T^{-2}]$ **½**

$\therefore\quad a = 1,\quad b = 2\quad c = -2$

$$n_2 = n_1\left[\frac{M_1}{M_2}\right]^a\left[\frac{L_1}{L_2}\right]^b\left[\frac{T_1}{T_2}\right]^c$$ **½**

$$= 10\left[\frac{1\,\text{kg}}{1\text{g}}\right]^1\left[\frac{1\text{ m}}{1\text{ cm}}\right]^1\left[\frac{1\text{ s}}{1\text{ s}}\right]^{-2}$$

$$= 10\left[\frac{10^3 g}{\text{g}}\right]\left[\frac{10^2\,\text{cm}}{\text{cm}}\right]^2 \times 1$$

$= 10 \times 10^3 \times 10^4$ **1**

$= 10^8$ **1**

$\therefore\quad 10\text{ J} = 10^8$ ergs

OR

$$[P] = \left[\frac{A}{V^2}\right]$$ **½**

$$[ML^{-1}T^{-2}] \times [L^6] = [A]$$

$\therefore$ $$[A] = [ML^5T^{-2}]$$ ½

$$[b] = [V]$$ ½

$\therefore$ $$[b] = [L^3].$$ ½

20. When bullet is fired from gun, then gun recoils back with some velocity which is known as recoil velocity of gun. ½

According to law of conservation of liner momentum

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$ ½

$$0 = m_1v_1 + m_2v_2$$

$$v_2 = \frac{-m_1v_1}{m_2}$$ **1**

Before firing		After firing	
m_1	m_2	m_1	m_2
(B)	(G)	(B)	(G)
$u_1 = 0$	$u_2 = 0$	v_1	v_2

OR

$m = 3$ kg, $u = 2$ ms^{-1}, $v = 3.5$ ms^{-1}

$t = 25$ sec., $F = ?$

$$F = ma = \frac{m(v-u)}{t}$$ ½

$$= \frac{3(3.5-2)}{25}$$ ½

$$= 0.18\ N$$ ½

The direction is along the direction of motion. ½

21. **Positive work done**

$$W = \vec{F} \cdot \vec{S}$$

$$= FS\cos\theta$$

when $\theta < 90°$ then W is +ve. ½

For example when a body falls freely under the action of gravity, $\theta = 0$ and work done is positive.

½

Negative work done

when $\theta > 90°$ then W is –ve. ½

For example when body is thrown up against gravity then work done is negative. ½

Or

Work done is stopping the body = force × distance

= K.E of body, which is same for two bodies.

As retarding force applied is the same, therefore distance moved by both the bodies before coming to rest must be same. **2**

22. Moment of inertia (I) plays the same role in rotational motion as mass (m) plays in linear motion. **1**

Moment of Inertia: of a body about a given axis as the sum of the products of masses of all the particles and square of their respective perpendicular distances from the axis of rotation. **1**

23. **Law of orbits:–** Every planet revolves around the sun in an elliptical orbit. The sun is situated at one foci of the ellipse.

Law of areas:– The areal velocity of planet around the sun is constant. **1**

24. Any two differences **1 + 1**

Isothermal Process	Adiabatic Process
1. Temperature of system remains constant $dT = 0$	1. Heat of the system remains constant $dQ = 0$
2. Isothermal is slow process.	2. Adiabatic process is fast.

25. $$y = a \sin \omega t$$ ½

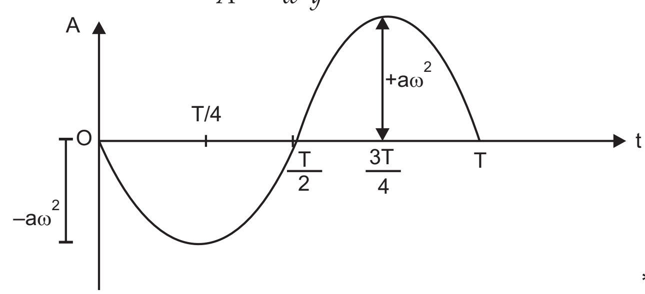
$$V = \frac{dy}{dt} = \frac{d}{dt}(a \sin \omega t)$$

$$= aw \cos \omega t$$

$$A = \frac{dV}{dt} = \frac{d}{dt}(aw \cos \omega t)$$ ½

$$= -w^2 a \sin \omega t$$

or $$A = -w^2 y$$ ½



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SECTION-C

26. Let the gas be heated at constant volume

dT be the rise in temperature.

$\therefore$ $$dQ = C_v dT$$

$$dV = 0$$

$\therefore$ $$PdV = dw = 0$$

Acc. to first law of thermodynamics

$$dQ = dU + dW$$

$$C_v dT = dU + 0$$

$\therefore$ $$dU = C_v dT$$ **1**

Now heat the gas at constant pressure.

$$dQ' = C_p dT$$

$$dW' = PdV$$

$$dQ' = dU' + dW'$$ **1**

$$C_p dT = C_v dT + PdV$$

[$\because$ $dU' = dU$ because dT is the same rise in temp.]

$$(Cp - Cv)\, dT = PdV$$
$$(Cp - Cv)\, dT = R\, dT$$
$$Cp - Cv = R$$

which is Mayer's formula.

OR

(*i*) Yes, this happens when the gas undergoes adiabatic compression.

As $\quad dQ = dU + dW$

As $\quad dQ = 0$ in adiabatic process

$\therefore \quad dU + dW = 0$

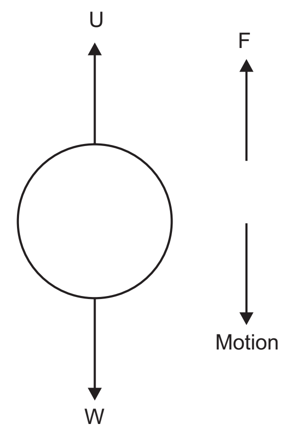
or $\quad dU = -dW$

In compression, work is done on the gas, so dW is negative.

Hence dU is +ve *i.e.*, internal energy of the gas increase. Hence, temperature of gas increases. **2**

(*ii*) Concept of internal energy is given by first law of thermodynamics and concept of temperature is given by zeroth law of thermodynamics. **½ + ½**

27. Let us consider a small spherical ball of radius r, density ρ is dropped in a liquid of density ρ' and coefficient of viscosity η.



viscous force, $\quad F = 6\pi\, \eta\, rv$

wt. of ball $\quad W = mg = \frac{4}{3}\pi r^3 \rho g$

wt. of the liquid displaced $\quad U = m^1 g = \frac{4}{3}\pi r^3 \rho' g$ **1**

At equilibrium

$$W = U + F \quad \textbf{1}$$

$$\frac{4}{3}\pi r^3 \rho g = \frac{4}{3}\pi r^3 \rho' g + 6\pi\eta r\, v$$

$$6\pi\, \eta r\, v = \frac{4}{3}\pi r^3 (\rho - \rho')g$$

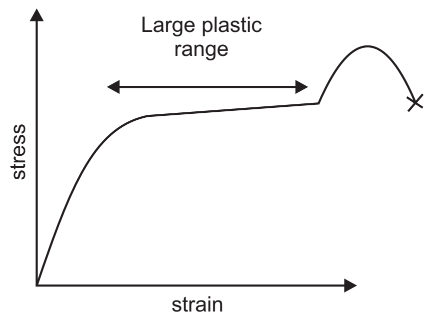
$$v = \frac{2r^2(\rho - \rho')g}{9\eta}. \quad \textbf{1}$$

OR

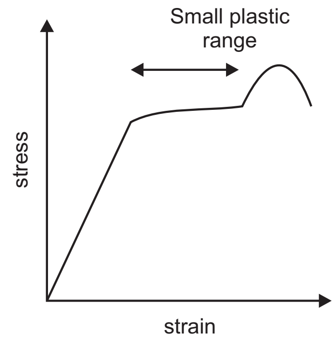
Ductile— The breaking point is widely separated from the point of elastic limit on the stress-strain graph. These materials show large plastic region.

Brittle— These are the materials which show very small plastic range beyond elastic limit.

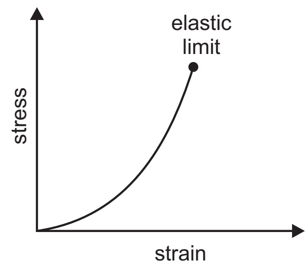
Elastomers— With in elastic limit, stress is not proportional to strain. **1 + 1 + 1**



(Ductile)



(Brittle)



28. No. of $DOF = 3$ **½**

Av. energy per molecule per $DOF = \frac{1}{2}\ \mathrm{K_B T}$ **½**

Av. energy per molecule with $3\ DOF = \frac{3}{2}\ K_B T$

Total energy of 1g mole of gas $= \frac{3}{2}\ K_B T \times N$ **½**

$$U = \frac{3}{2} RT \qquad [\because \quad K_B \times N = R]$$

$$C_v = \frac{dU}{dT} = \frac{d}{dT}\left(\frac{3}{2}RT\right)$$ **½**

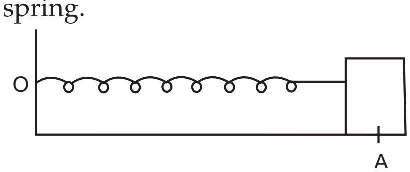
$$C_v = \frac{3}{2}R$$

$$C_p - C_v = R$$

$$C_p = \frac{3}{2}R + R = \frac{5}{2}R$$

$$\gamma = \frac{C_p}{C_v} = \frac{5}{3} = 1.67.$$ **1**

29. The potential energy of a spring is the energy associated with the state of compression or expansion of an elastic spring. **1**



When the spring is compressed or elongated it tends to recover its original length. So Restoring force $\propto$ extension or compression.

$$-F \propto x$$

$$F = -kx \qquad \mathbf{1}$$

where k is spring constant.

Small amount of work done is displacing by distance dx is

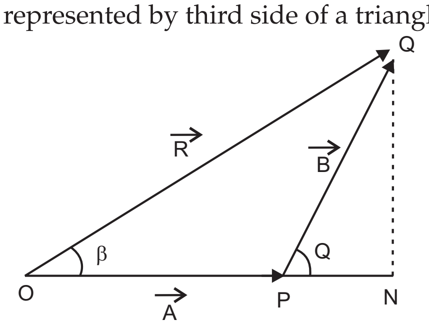
$$dW = -Fdx = kxdx$$

$$W = \int dw = \int_0^x kx\,dx = k\left[\frac{x^2}{2}\right]_0^x$$

$$W = \frac{1}{2}kx^2 \qquad \mathbf{1}$$

This work done is stored in the form of potential energy of spring.

30. It states that if two vectors are represented by the two sides of a triangle taken in the same order then resultant is represented by third side of a triangle taken in opposite order. **1**



In ΔOQN,

$$(OQ)^2 = (ON)^2 + (QN)^2$$

$$= (OP + PN)^2 + (QN)^2 \qquad ...(1) \quad \mathbf{1}$$

In ΔPNQ

$$\sin\theta = \frac{QN}{PQ} \Rightarrow QN = B\sin\theta$$

$$\cos\theta = \frac{PN}{PQ} \Rightarrow PN = B\cos\theta$$

Put in (1)

$$R^2 = (A + B\cos\theta)^2 + (B\sin\theta)^2$$

$$= A^2 + B^2\cos^2\theta + 2AB\cos\theta + B^2\sin^2\theta \; ... .$$

$$R = \sqrt{A^2 + B^2 + 2\,AB\cos\theta}. \qquad \mathbf{1}$$

SECTION-D

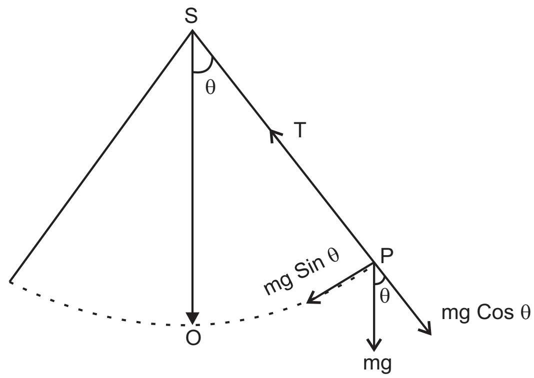
31. A simple pendulum consists of a massless string of length l whose one end is connected to a spherical body of mas m known as bob and other end is connected to rigid support.

When the bob is displaced to position P, through a small angle θ from vertical.

Various forces acting on bob are:

(*i*) Weight mg to bob vertically downward.

(*ii*) Tension T along PS. **1**



Resolve mg into two components as shown in fig.

$$T = \text{mg} \cos \theta \qquad \text{...(1)}$$

mg sin θ will provide restoring torque.

$$\tau = -(\text{mg} \sin \theta)l = -\text{mg}\, l \sin \theta \qquad \mathbf{1}$$

$$\tau \cong \text{mg}\, l\, \theta \qquad [\because\ \theta \text{ is very small}]$$

or $$\tau^* \propto \theta$$

$$\tau = -k\,\theta$$

where $$k = \text{spring factor} = \text{mg}\, l$$

$$\text{Inertia factor} = \text{ml}^2$$

$$T = 2\pi\sqrt{\frac{\text{Inertia factor}}{\text{Spring factor}}}$$

$$= 2\pi\sqrt{\frac{\text{ml}^2}{\text{mgl}}}$$

$$T = 2\pi\sqrt{\frac{l}{g}}\,. \qquad \mathbf{2}$$

OR

(*i*) Newton gave an empirical relation to calculate velocity of sound in gas.

$$v = \sqrt{\frac{B}{\rho}} \quad \begin{array}{l}\text{B- bulk modulus of gas}\\ \rho\text{- density of gas}\end{array} \qquad \mathbf{1}$$

Newton assumed that the change in pressure and volume of gas when sound wave propagated through it, are isothermal.

∴ $$PV = \text{constant}$$

Differentiating it **1**

$$PdV + VdP = 0$$

$$P = \frac{-dP}{dV / V} = B$$

∴ $$v = \sqrt{\frac{P}{\rho}}$$

$$P = h\rho g = 0.76 \times 13.6 \times 10^3 \times 9.8 \quad \text{of Hg – Column}$$

$\rho = 1.293$ k/m^3 for air

so we get $v = 280$ ms^{-1} **1**

(*ii*) $h = 300$ m, $g = 9.8$ ms^{-2}, $v = 340$ ms^{-1}

If t_1 = time taken to strike the surface of water

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

$$300 = 0 + \frac{1}{2} \times 9.8\ t_1^2$$

$$t_1 = \sqrt{\frac{300}{4.9}} = 7.82 \text{ s}$$ **1**

Time taken by sound to reach the top of tower

$$t_2 = \frac{h}{v} = \frac{300}{340} = 0.88 \text{ sec.}$$ **½**

Total time after which splash of sound is heared

$= t_1 + t_2$

$= 7.82 + 0.88$

$= 8.70$ sec. **½**

32. Let R = radius of curvature of liquid meniscus

P = atmospheric pressure

S = Surface tension of liquid

r = radius of capillary tube

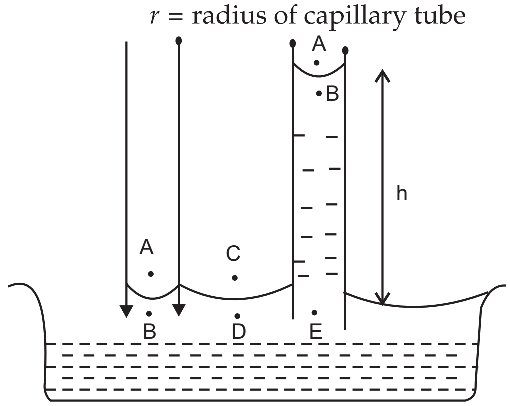


Fig. 1

The pressure of point A $= P$

The pressure of point B $= P - \frac{2S}{R}$

Pressure at point C and D is also P.

In order to attain equilibrium, the liquid level rise in the capillary tube upto height h.

Now, pressure at E = Pressure at B + Pressure due to height, h

$$= \left(P - \frac{2S}{R}\right) + h\rho g$$ **2**

As there is equilibrium,

Pressure at E = Pressure at D

$$P - \frac{2S}{R} + h\rho g = P$$

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

or $$h = \frac{2S}{R\rho g}$$

In Fig. (2)

$$\text{Cos}\,\theta = \frac{GH}{OG} = \frac{r}{R}$$

or $$R = \frac{r}{\cos\theta}$$

So, we get $$h = \frac{2S\cos\theta}{r\rho g}$$

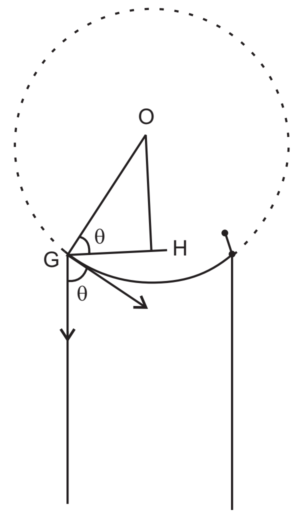


Fig. 2

OR

Newton's law of cooling states that the rate of loss of heat of a body is directly proportional to the difference in temperature of the body and the surroundings, provided he difference in temperature not more than 40°C. **1**

Let a body of mass m, specific heat s at the temperature T. Let T_0 is the temperature of surroundings. $T > T_0$

$$\text{Rate of loss of heat} = -\frac{dQ}{dt}$$

$$\frac{-dQ}{dt} \propto (T - T_0)$$

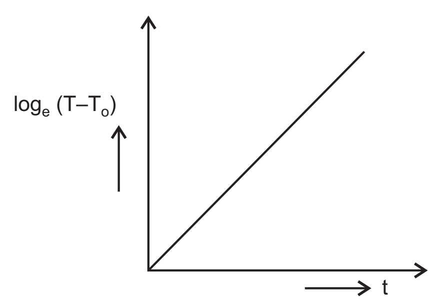
$$\frac{-dQ}{dt} = k\,(T - T_0)$$

$$\frac{-d}{dt}(msT) = k\,(T - T_0) \qquad [\because\ Q = msT]$$

$$\frac{-dT}{dt} = \frac{k}{ms}(T - T_0)$$

$$\frac{-dT}{dt} = K\,(T - T_0)$$

$$\frac{-dT}{(T - T_0)} = Kdt$$

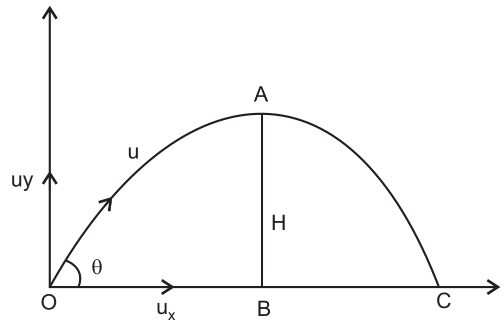


on Integrating both sides

$$\log_e (T - T_0) = -Kt + C$$

This equation is similar to a straight line; $y = mx + C$ **3**

33.
$$u_x = u\cos\theta$$
$$u_y = u\sin\theta$$
$$a_x = 0$$
$$a_y = -g$$



(*a*) Path of Projectile

(1) Motion along *x*-axis

$$x = u_x t + \frac{1}{2} a_x t^2$$

$$x = u \cos\theta \, t + \frac{1}{2} (0) t^2$$

$$x = (u \cos\theta)\, t$$

$$t = \frac{x}{u\cos\theta} \qquad (1)$$

(2) Motion along *y*-axis

$$y = u_y t + \frac{1}{2} a_y t^2$$

$$= (u \sin\theta)t + \frac{1}{2}(-g)t^2$$

$$= u \sin\theta \cdot \frac{x}{u\cos\theta} - \frac{g}{2} \frac{x^2}{u^2 \cos^2\theta}$$

$$y = x \tan\theta - \frac{1}{2} \frac{gx^2}{u^2 \cos^2\theta}$$

This is the equation of parabola. Hence path of projectile is parabolic. **2**

(*b*) **Time of flight**

Time of flight, T = time of ascent + time of descent

$T = t + t$

or $t = \frac{T}{2}$

use $v_y = u_y + a_y t$

At highest point, $v_y = 0$

∴ $0 = u \sin\theta + (-g)\frac{T}{2}$

or $\boxed{T = \frac{2u\sin\theta}{g}}$ **2**

Maximum height attained $y = H$, $t = \frac{T}{2}$

$$y = u_y t + \frac{1}{2} a_y t^2$$

$$H = u \sin\theta \left(\frac{u \sin\theta}{g}\right) + \frac{1}{2}(-g)\frac{u^2 \sin^2\theta}{g^2}$$

$$= \frac{u^2 \sin^2\theta}{g} - \frac{1}{2}\frac{u^2 \sin^2\theta}{g}$$

$$H = \frac{u^2 \sin^2\theta}{2g}$$ **1**

OR

(*i*) Muzzle speed of bullet $v_B = 150 \text{ ms}^{-1}$
$= 540 \text{ km h}^{-1}$
speed of police van, $v_p = 30 \text{ km h}^{-1}$
speed of thief car, $v_T = 192 \text{ kmh}^{-1}$ **1**
since the bullet is sharing the velocity of the police man.
So effective velocity $V_B = v_B + v_P$
$= 540 + 30 = 570 \text{ kmh}^{-1}$ **1**
The speed of bullet w.r.t. the thief's car moving in the same direction
$$V_{BT} = V_B - V_T = 570 - 192 = 378 \text{ kmh}^{-1}$$ **1**

(*ii*) we know $a = \frac{dv}{dt}$

$$dv = a\, dt$$ **1**

Integrating on both sides

$$\int_u^v dv = a\int_0^t dt$$

$$[v]_u^v = a[t]_0^t$$

$$[v - u] = a[t - 0]$$

$$v = u + at$$ **1**

SECTION-E (CASE STUDY)

34. (*i*) (*c*) (*ii*) (*B*) **1 × 4 = 4**
(*iii*) rolling (*iv*) $\mu = \tan\theta$.

Or

By using lubricants, we can reduce friction.

35. (*i*) (*B*) (*ii*) (*B*) **1 × 4 = 4**
(*iii*) (A) (*iv*) w = mg

$$\therefore \quad m = \frac{w}{g} = \frac{49}{9.8}$$

$$= 5 \text{ kg}$$

Or

Decreases.

❑❑❑