

# CBSE Class 11 Physics Sample Paper Solution Set 2

**Q. No** **Marks**

Ans1. (i)  $[ML^2T^{-2}]$  1/2  
(ii) Dimensionless 1/2

Ans2. Reaction is the force applied by the block on the Earth. 1

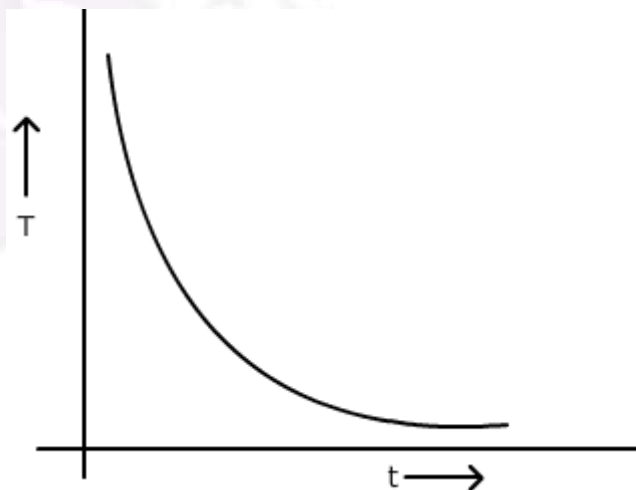
Ans3. Two advantages of 'I' shape of iron beams are  
(i) minimizes sagging 1/2  
(ii) minimizes buckling 1/2

Ans4. Wire B. 1

Ans5. Natural Convection: Trade winds/Land and sea breeze 1/2

Forced Convection: Human circulatory system. 1/2

Ans6.



Ans7. Because of a very small coefficient of linear expansion. 1

1

Ans8. The frequency of free oscillations of a vibrating system. 1

Ans9. Absolute error is the magnitude of difference between the value of individual measurement and the true value of the quantity. 1

$$\begin{aligned}\Delta t &= t_2 - t_1 \\ &= (50 \pm 0.5) - (20 \pm 0.5) \\ &= 30^\circ\text{C} \pm 1^\circ\text{C}\end{aligned}$$

1/2  
1/2

Ans10. (i) Velocity is negative as the slope of x-t graph is negative. 1

(ii) Acceleration is negative. The increasing slope indicates speeding up, hence the sign of acceleration and velocity are same. 1

Ans11.  $T = \frac{2u \sin \theta}{g}$  1/2

$$\Rightarrow u \sin \theta = \frac{gT}{2}$$

Max. Height  $H = \frac{u^2 \sin^2 \theta}{2g}$  1/2

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

$$= \frac{\left(\frac{gT}{2}\right)^2}{2g}$$
 1/2

$$= \frac{gT^2}{8}$$

1/2

Ans12. (i) Because no reaction from any surface underneath is available which can make the horse move forward. 1

(ii) Due to inertia of motion, the upper part of the body continues to move along the tangent to the circular path of the bus. 1

Ans13. Concurrent forces are the forces whose lines of action intersect at a common point. 1

Conditions:

1.  $\sum \vec{F} = 0$

1/2

2.  $\sum \vec{\tau} = 0$

1/2

Ans14. Because the gravitational force between the satellite and the earth provides the necessary centripetal force required to keep it in its orbit. 1

No, because New Delhi is not on the equatorial plane. 1

Ans15. (a) All have same average K.E. as  $K_{av}$  depends only on temperature. 1

(b) C, B and A as  $v_{rms} \propto \frac{1}{\sqrt{m}}$  1

OR

(i)  $P = \frac{1}{3} \frac{mn}{V} v_{rms}^2$  1/2

$\frac{P_i}{P_f} = \frac{1}{2}$  1/2

(ii)  $P = \frac{2}{3} E$  1/2

$\Rightarrow E = \frac{3}{2} P = 3 \times 10^5 \text{ J/m}^3$  1/2

Ans16. (i)  $\frac{Q_1}{Q_2} = \frac{T_1}{T_2}$  1/2

$\Rightarrow T_2 = 320 \text{ K}$  1/2

(ii)  $\eta = 1 - \frac{T_2}{T_1}$  1/2

$\Rightarrow \eta = 0.2$  1/2

Ans17. Motion in which the restoring force is always proportional to the displacement from the mean position and is directed against it. 1

When angular displacement  $\theta$  is very small. 1

Ans18. Fraction =  $\frac{KE}{TE} = \frac{\frac{1}{2} m \omega^2 (A^2 - y^2)}{\frac{1}{2} m \omega^2 A^2}$  1

$= 1 - \frac{1}{4} = \frac{3}{4}$  1

Ans19.  $x(t) = \int v dt = \int (-12t + 12) dt$  1/2

$= -12 \frac{t^2}{2} + 12t + c$

$= -6t^2 + 12t + c$  1/2

Since, at  $t = 0$ ,  $x(0) = 5$ , therefore,  $c = 5$

1/2

Therefore,  $x(t) = -6t^2 + 12t + 5$  m

1/2

Also,  $a = \frac{dv}{dt}$

1/2

$$= -12 \text{ m/s}^2$$

1/2

Ans20.  $\vec{F}_1 = 2\hat{j}$  N

$$\vec{F}_2 = 2 \cos 60^\circ \hat{i} - 2 \sin 60^\circ \hat{j}$$

1/2

$$= \hat{i} - \sqrt{3}\hat{j}$$

1/2

$$\vec{F}_3 = -1 \sin 60^\circ \hat{i} + 1 \cos 60^\circ \hat{j}$$

1/2

$$= -\frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}$$

1/2

$$\vec{F}_1 + \vec{F}_2 - \vec{F}_3 = 2\hat{j} + (\hat{i} - \sqrt{3}\hat{j}) - \left(-\frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}\right)$$

1/2

$$= \left(1 + \frac{\sqrt{3}}{2}\right)\hat{i} + \left(\frac{3}{2} - \sqrt{3}\right)\hat{j}$$

1/2

Ans21. (i) Conservative: spring force, gravitational force

1

Non-conservative: Human push, viscous drag

1

(ii)  $F = -\frac{dU}{dr}$

1

Ans22. Definition: Ratio of relative speed of separation to relative speed of approach.

1

No, not for each body separately. Total energy and total momentum of the whole isolated system will be conserved.

1

Because collision between fast neutron and near stationary deuterons in heavy water results in maximum exchange of kinetic energy as their masses are comparable.

1

Ans23. (a)  $\vec{F} = 7\hat{i} + 3\hat{j} - 5\hat{k}$ ,  $\vec{r} = \hat{i} - \hat{j} + \hat{k}$

$$\vec{\tau} = \vec{r} \times \vec{F}$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 1 \\ 7 & 3 & -5 \end{vmatrix}$$

1/2

$$= (5 - 3)\hat{i} + (5 + 7)\hat{j} + (3 + 7)\hat{k}$$

1

$$\vec{\tau} = 2\hat{i} + 12\hat{j} + 10\hat{k}$$

1/2

(b) Curl the fingers of right hand along the direction of rotation, the out stretched thumb points along the direction of angular velocity.

1

Ans24. If we define perpendicular axes X, Y, and Z (which meet at origin O) so that the body lies in the XY plane, and the Z axis is perpendicular to the plane of the body and

- $I_x$  be the moment of inertia of the body about the X axis;
- $I_y$  be the moment of inertia of the body about the Y axis; and
- $I_z$  be the moment of inertia of the body about the Z axis.

The perpendicular axis theorem states that

$$I_z = I_x + I_y$$

1

$$I = MR^2$$

1/2

$$= 2 \times (.50)^2 = 0.5 \text{ kg m}^2$$

1/2

$$I' = MR^2 + MR^2$$

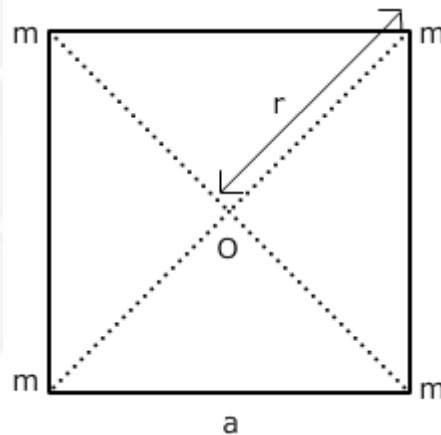
1/2

$$= 2MR^2 = 2 \times 0.5$$

$$= 1 \text{ kg m}^2$$

1/2

Ans25.



$$U(r) = -\frac{Gm_1m_2}{r_{12}}$$

$$\text{Therefore, total } U = -4 \frac{Gm^2}{a} - 2 \frac{Gm^2}{a\sqrt{2}}$$

1

$$= -\frac{2Gm^2}{a} \left( 2 + \frac{1}{\sqrt{2}} \right)$$

1/2

$$= -5.41 \frac{Gm^2}{a}$$

1/2

$$\text{Potential } V(r) = -\frac{Gm_1}{r_1}$$

1/2

$$\text{Total } V = -4 \frac{Gm}{\left(\frac{a\sqrt{2}}{2}\right)} = -4\sqrt{2} \frac{Gm}{a}$$

1/2

Ans26. Main features of kinetic theory of an ideal gas are about

- (i) Molecules
- (ii) Motion
- (iii) Collisions
- (iv) Forces
- (v) Time
- (vi) Path

1/2 × 6

Ans27. The first law of thermodynamics is an expression of the conservation of energy. It states:

The increase in the internal energy of a system is equal to the amount of energy added by heating the system, minus the amount lost as a result of the work done by the system on its surroundings.

1/2

Derivation: 1. Expression for  $dU_1$  at constant volume

1/2

2. Expression for  $dU_2$  at constant pressure

1/2

3.  $PdV = n R dT$

1/2

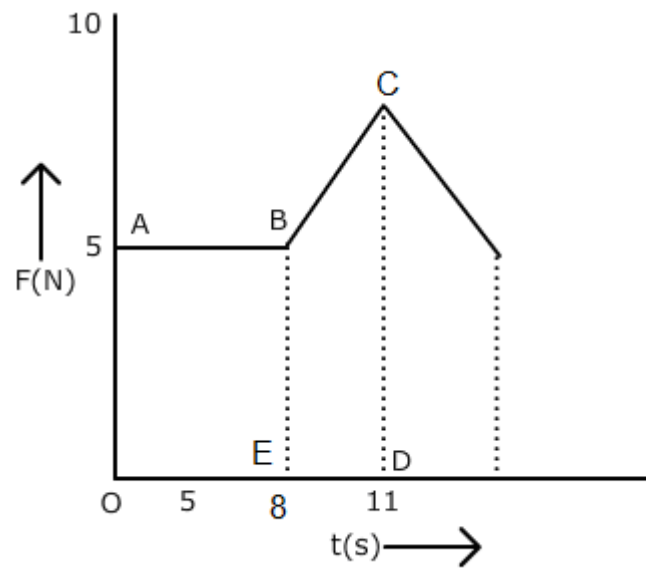
4.  $dU_1 = dU_2$  with reason

1/2

5.  $C_p - C_v = R$

1/2

Ans28. (a)



Impulse = Area under  $F(t)$  graph

$$\begin{aligned} &= \text{area OABE} + \text{area BCDE} \\ &= 5 \times 8 + \frac{1}{2} \times 3 \times (10 + 5) \\ &= 40 + \frac{45}{2} \\ &= 62.5 \text{ kg m/s} \end{aligned}$$

$$\Delta p = m(v - u) = \text{Impulse}$$

$$\text{Therefore, } 7(v - 0) = 62.5$$

$$v = \frac{62.5}{7} \approx 9 \text{ m/s}$$

$\frac{1}{2}$

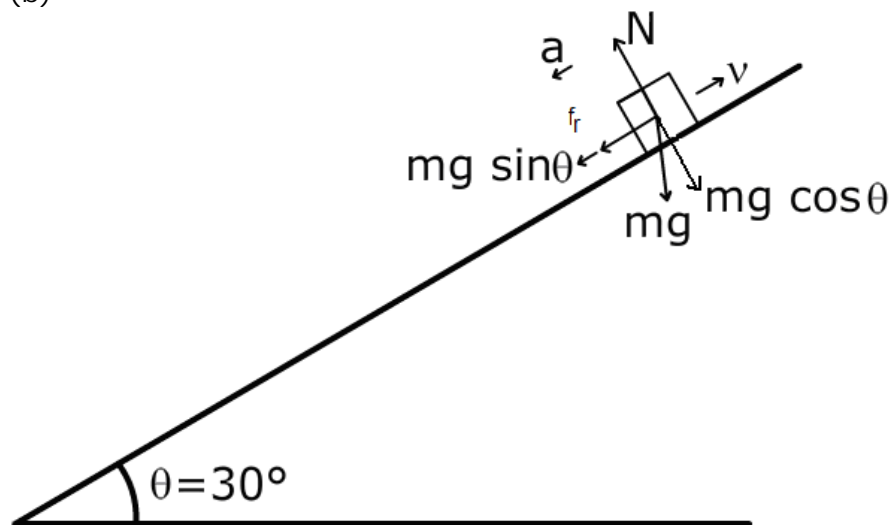
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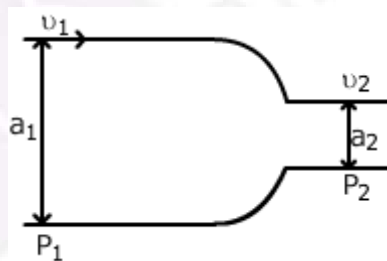
$\frac{1}{2}$

(b)



$$\begin{aligned} ma &= f_r + mg \sin\theta && 1/2 \\ ma &= \mu mg \cos\theta + mg \sin\theta && 1/2 \\ a &= (\mu \cos\theta + \sin\theta)g = (0.1 \cos 30^\circ + \sin 30^\circ)10 && 1/2 \\ &= \frac{\sqrt{3}}{2} + 5 = 5.87 \text{ m/s}^2 && 1/2 \end{aligned}$$

Ans29. Laminar flow occurs when a fluid flows in parallel layers, with no disruption between the layers.



$$\begin{aligned} P_1 + \frac{1}{2} \rho v_1^2 &= P_2 + \frac{1}{2} \rho v_2^2 \text{ and } a_1 v_1 = a_2 v_2 && 2 \\ \text{Therefore, } P_2 &= P_1 + \frac{1}{2} \rho (v_1^2 - v_2^2) && 1/2 \\ &= P_1 + \frac{1}{2} \rho \left[ v_1^2 - \left( \frac{a_1}{a_2} \right)^2 v_1^2 \right] && 1/2 \\ &= P_1 + \frac{1}{2} \rho v_1^2 \left[ 1 - \left( \frac{a_1}{a_2} \right)^2 \right] \end{aligned}$$



$$\begin{aligned}
&= 4 \times 10^4 + \frac{1}{2} \times 10^3 \times 4 \left[ 1 - \frac{4 \times 10^{-4}}{1 \times 10^{-4}} \right] && 1 \\
&= 4 \times 10^4 - 0.6 \times 10^4 && 1/2 \\
&= 3.4 \times 10^4 P_a && 1/2
\end{aligned}$$

OR

Definition: The contact angle is the angle at which a liquid/vapor interface meets the solid surface. The contact angle is specific for any given system and is determined by the interactions across the three interfaces.

2

For acute angle of contact.

$$n \cdot \frac{4}{3} \pi r^3 = \frac{4}{3} \pi R^3 \Rightarrow r = \frac{R}{n^{\frac{1}{3}}} \quad 1/2$$

$$= \frac{4 \times 10^{-3}}{\frac{1}{(1000)^{\frac{1}{3}}}} = 4 \times 10^{-4} \text{ m} \quad 1/2$$

$$\Delta A = n \cdot 4\pi r^2 - 4\pi R^2 \quad 1/2$$

$$= 4\pi \frac{R^2}{n^{\frac{2}{3}}} \cdot n - 4\pi R^2 = 4\pi R^2 \left( \frac{1}{n^{\frac{1}{3}}} - 1 \right) \quad 1/2$$

$$= 4 \times 3.14 \times 16 \times 10^{-16} (10 - 1) = 9 \times 64 \times 3.14 \times 10^{-6} \text{ m}^2$$

Therefore,  $\Delta E = \sigma \Delta A$  1/2

$$= 0.07 \times 9 \times 64 \times 3.14 \times 10^{-6} \approx 1.23 \times 10^{-2} \text{ J} \quad 1/2$$

Ans30. (i) -z direction 1

$$(ii) f = \frac{\omega}{2\pi} \quad 1/2$$

$$= \frac{500}{2\pi} = \frac{250}{\pi} \text{ Hz} \quad 1/2$$

$$(iii) \lambda = \frac{2\pi}{R} \quad 1/2$$

$$= \frac{2\pi}{0.025} = 80\pi \text{ m} \quad 1/2$$

$$(iv) v = \frac{\omega}{R} \quad 1/2$$

$$= \frac{500}{0.025} = 2 \times 10^4 \text{ m/s} \quad 1/2$$

$$\begin{aligned} \text{(v) } v_{p\max} &= \omega A && 1/2 \\ &= 0.25 \times 10^{-3} \times 500 = 0.125 \text{ cm/s} && 1/2 \end{aligned}$$

OR

(a) Definition: The Doppler effect is the change in frequency and wavelength of a wave for an observer moving relative to the source of the waves. 1

(i) For the listener standing outside the circle, the whistle moves towards him as well as away from him. Therefore, the frequency will appear to increase as well as decrease. 2

(ii) For the listener at the centre, the distance between him and the whistle remains constant. So, there will be no change in frequency. 1

(b) Beat frequency = 5 Hz 1  
application = tuning of musical instruments. 1

