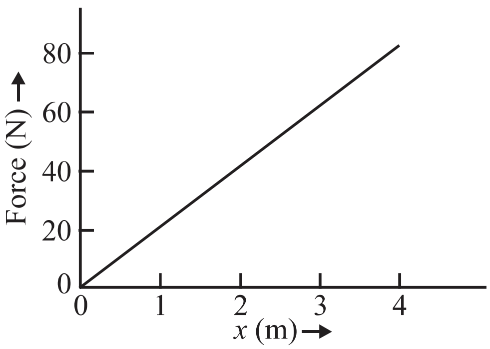
# NEET UG (2024)
## Physics
## Quiz-12

**SECTION - A**

**1.** A rifle man, who together with his rifle has a mass of 100 kg, stands on a smooth surface fires 10 shots horizontally Each bullet has a mass 10 gm and a muzzle velocity of 800 m/s What velocity does rifle man acquire at the end of 10 shots

(1) 0.8 m/s (2) 0.5 m/s
(3) 0.3 m/s (4) 1.2 m/s

**2.** Calculate work done in moving the object from $x = 2$ m to $x = 3$ m from the following graph:

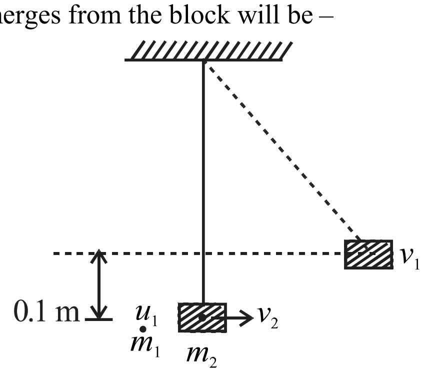



(1) 25 J (2) 30 J
(3) 50 J (4) 40 J

**3.** Two masses of 1 g and 4 g are moving with equal kinetic energy. The ratio of the magnitudes of their momenta is

(1) 4 : 1 (2) $\sqrt{2}:1$
(3) 1 : 2 (4) 1 : 16

**4.** A bullet of mass 0.01 kg travelling at a speed of 500 m/sec strikes a block of mass 2kg, which is suspended by a string of length 5m The centre of gravity of the block is found to rise a vertical distance of 0.1 m. The speed of the bullet after it emerges from the block will be –




(1) 1.4 m/s (2) 110 m/s
(3) 220 m/s (4) 14 m/s

**5.** An ideal spring with spring constant $k$ is hung from the ceiling and a block of mass $M$ is attached to its lower end. The mass is released with the spring initially unstretched. Then the maximum extension in the spring is

(1) $\frac{4Mg}{k}$ (2) $\frac{2Mg}{k}$
(3) $\frac{Mg}{k}$ (4) $\frac{Mg}{2k}$

**6.** A body of mass $m$ moving with $a$ velocity $v_1$ in the $X$-direction collides with another body of mass $M$ moving in $Y$-direction with a velocity $v_2$. They coalesce into one body during collision. The magnitude and direction of the momentum of the final body, will be-

(1) $\sqrt{(mv_1)+(Mv_2)}, \tan^{-1}\left(\frac{|Mv_2|}{mv_2}\right)$

(2) $\sqrt{(mv_1)+(Mv_2)}, \tan^{-1}\left(\frac{|Mv_1|}{mv_2}\right)$

(3) $\sqrt{(mv_1)^2+(Mv_2)^2}, \tan^{-1}\left(\frac{|Mv_2|}{mv_1}\right)$

(4) $\sqrt{(mv_1)^2+(Mv_2)^2}, \tan^{-1}\left(\frac{|Mv_1|}{mv_2}\right)$

**7.** Consider the following *two* statements:

(A) Linear momentum of a system of particles is zero
(B) Kinetic energy of a system of particles is zero-
Then

(1) $A$ does not imply $B$ and $B$ does not imply $A$
(2) $A$ imply $B$ but $B$ does not imply $A$
(3) $A$ does not imply $B$ but $B$ implies $A$
(4) $A$ implies $B$ and $B$ implies $A$.

**8.** A tennis ball from a height of 2m rebounds only 1.5 metre after hitting the ground. What fraction of energy is lost in the impact?

(1) 1/2 (2) 1/4
(3) 1/8 (4) 1/16

**9.** Conservation of linear momentum is equivalent to

(1) Newton's second law of motion
(2) Newton's first law of motion
(3) Newton's third law of motion
(4) Conservation of angular momentum

**10.** **Statement-1:** Position of centre of mass is independent of the reference frame.

**Statement-1:** Centre of mass is same for all bodies.

(1) Statement-1 is true, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(3) Statement-1 is False, Statement-2 is True

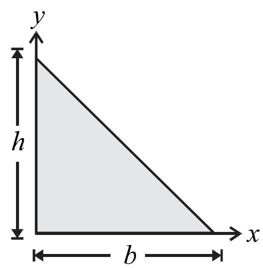
(4) Statement-1 is True, Statement-2 is False.

**11.** A 2 kg body and a 3kg body are moving along the $x$-axis. At a particular instant the 2 kg body has a velocity of 3 $ms^{-1}$. And the 3kg body has the velocity of 2 $ms^{-1.}$ The velocity of the centre of mass at that instant is

(1) 5 $ms^{-1}$ (2) 1 $ms^{-1}$

(3) Zero (4) None of these

**12.** The centre of mass of a triangle shown in figure has coordinates




(1) $x = \frac{h}{2}, y = \frac{b}{2}$

(2) $x = \frac{b}{2}, y = \frac{h}{2}$

(3) $x = \frac{b}{3}, y = \frac{h}{3}$

(4) $x = \frac{h}{3}, y = \frac{b}{3}$

**13.** A particle is projected at an angle of 60° to the horizontal with a kinetic energy $E$. The kinetic energy at the highest point

(1) $E$ (2) $E/4$

(3) $E/2$ (4) zero

**14.** A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It rolls down a smooth surface to the ground, then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m above the ground. The velocity attained by the ball is

(1) 10 $ms^{-1}$ (2) $10\sqrt{30}$ $ms^{-1}$

(3) 40 $ms^{-1}$ (4) 20 $ms^{-1}$

**15.** Two spheres of masses 2M and M are initially at rest at a distance $R$ apart. Doe to mutual force of attraction, they approach each other. When they are at separation $R/2$, the acceleration of the centre of mass of spheres would be

(1) 0 $m/s^2$ (2) g $m/s^2$

(3) 3 g $m/s^2$ (4) 12 g $m/s^2$

**16.** The centre of mass of body:

(1) Lies always at the geometrical centre

(2) Lies always inside the body

(3) Lies always outside the body

(4) May lie within or outside the body

**17.** A cricket bat is cut at the location of its centre of mass as shown in the fig. Then

(1) The two pieces will have the same mass

(2) The bottom piece will have larger mass

(3) The handle piece will have larger mass

(4) Mass of handle piece is double the mass of bottom piece

**18.** **Statement 1.** Two particles moving in the same direction do not lose all their energy in a completely inelastic collision.

**Statement 2.** Principle of conservation of momentum holds true for all kinds of collision.

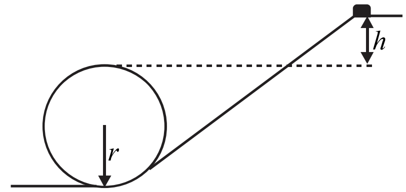
(1) Statement-1 is true, Statement - 2 is false

(2) Statement 1 is true, Statement 2 is true; - Statement 2 is the correct explanation of - Statement - 1

(3) Statement 1 is true, Statement - 2 is true; - Statement 2 is not the correct explanation of Statement - 1

(4) Statement-1 is false, Statement - 2 is true

**19.** Figure show a loop track of radius $r$. A box starts sliding from a platform at a distance $h$ above the top of the loop and goes around the loop without falling off the track. Find the minimum value of $h$ for a successful looping. Friction is negligible at all surfaces.




(1) $h = \frac{r}{4}$ (2) $h = \frac{3r}{2}$

(3) $h = \frac{r}{2}$ (4) $h = \frac{3r}{4}$

**20.** The potential energy function for the force between two atoms in a diatomic molecule is approximately given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$, where $a$ and $b$ are constant and $x$ is the distance between the atoms. Find the dissociation energy of the molecule which is given as $D = [U(x = \infty) - U_{\text{at equilibrium}}]$.

(1) $\frac{b^2}{4a}$ (2) $\frac{b^2}{2a}$

(3) $\frac{2a}{b^2}$ (4) $\frac{4a}{b^2}$

**21.** A uniform chain is held on a frictionless table with one third of its length hanging over the edge. If the chain has a length $l$ and mass $m$, how much work is required to pull the hanging part back on the table?

(1) $\frac{Mgl}{9}$ (2) $\frac{Mgl}{18}$

(3) $\frac{2Mgl}{9}$ (4) $\frac{4Mgl}{9}$

**22.** A uniform metal disc of radius R is taken and out of it a disc of diameter $\frac{R}{2}$ is cut off from the end. The centre of mass of the remaining part will be

(1) $\frac{R}{10}$ from the centre

(2) $\frac{R}{15}$ from the centre

(3) $\frac{R}{5}$ from the centre

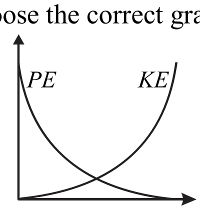
(4) $\frac{R}{20}$ from the centre

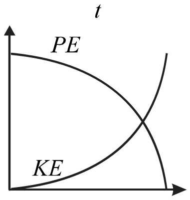
**23.** A ball is released from the top of a tower. The ratio of work done by force of gravity in first, second and third second of the motion of ball is:

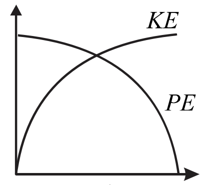
(1) 1:2:3 (2) 1:4:16

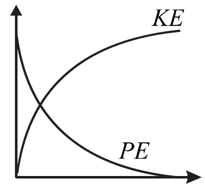
(3) 1:3:5 (4) 1:9:25

**24.** A particle falls from rest under gravity. Its potential energy with respect to ground ($PE$) and its kinetic energy ($KE$) are plotted against time ($t$). Choose the correct graph:

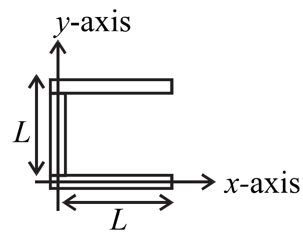
(1)



(2)



(3)



(4)



**25.** Locate the centre of mass of arrangement shown in figure. The three rods are identical in mass and length.




(1) $\left(\frac{L}{2}, \frac{L}{2}\right)$ (2) $\left(\frac{L}{3}, 0\right)$

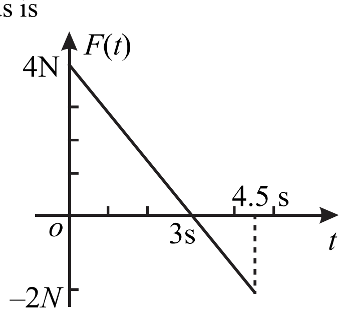
(3) $\left(\frac{L}{3}, \frac{L}{2}\right)$ (4) $\left(0, \frac{L}{3}\right)$

**26.** A particle of mass 0.01 kg travels along a space curve with velocity given by $\left(4\hat{i} + 16\hat{k}\right)$ m/s. After some time, its velocity becomes $\left(8\hat{i} + 20\hat{j}\right)$ m/s due to the action of a conservative force. The work done on the particle during this interval of time is:

(1) 0.32J (2) 6.9J

(3) 9.6J (4) 0.96J

**27.** A block of mass 2 kg is free to move along the $x$-axis. It is at rest and from $t = 0$ onwards it is subjected to a time-dependent force $F$(t) in the $x$-direction. The force $F$(t) varies with $t$ as shown in the figure. The kinetic energy of the block after 4.5 seconds is




(1) 4.50 J (2) 7.50 J

(3) 5.06 J (4) 14.06 J

**28.** A small block of mass $m$ is kept on a rough inclined surface of inclination $\theta$ fixed in a elevator. The elevator goes up with a uniform velocity $v$ and the block does not slide on the wedge. The work done by the force of friction on the block in time $t$ will be:

(1) Zero (2) $mgvt\cos^2\theta$

(3) $mgvt\sin^2\theta$ (4) $mgvt\sin 2\theta$

**29.** A 1.5 kg block is initially at rest on a horizontal frictionless surface when a horizontal force in the positive direction of $x$-axis is applied to the block. The force is given by $\vec{F} = (4 - x^2)\hat{i}$ where $x$ is in metre and the initial position of the block is $x = 0$. The maximum kinetic energy of the block between $x = 0$ and $x = 2.0$ m is

(1) 2.33 J (2) 8.67 J

(3) 5.33 J (4) 6.67 J

**30.** A circular disc of radius 20 cm is cut from right edge of a larger circular disc of radius 50 cm. The shift of centre of mass is

(1) 5.7 cm (2) –5.7 cm

(3) 3.2 cm (4) –3.2 cm

**31.** An elevator platform is going up at a speed 20 m/sec and during its upward motion a small ball of 50 gm mass falling in downward direction strikes the platform at a speed 5 $ms^{-1}$. Find the speed with which the ball rebounds.

(1) 35 $ms^{-1}$ (2) 30 $ms^{-1}$

(3) 25 $ms^{-1}$ (4) 45 $ms^{-1}$

**32.** A body falling vertically downwards under gravity breaks in two parts of unequal masses. The centre of mass of the two parts taken together shifts horizontally towards:

(1) heavier piece

(2) lighter piece

(3) does not shift horizontally

(4) depends on the vertical velocity at the time of breaking

**33.** A ball is dropped from a height of 10 m. It is embedded 1 m in sand and stops. In this process:

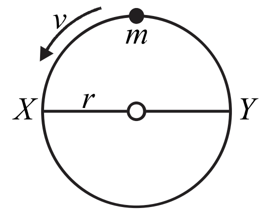
(1) Only momentum is conserved

(2) Only kinetic energy is conserved

(3) Both momentum and kinetic energy. Are conserved

(4) Neither momentum nor kinetic energy is conserved

**34.** A body of mass $m$ moves in a horizontal circle of radius $r$ at constant speed $v$. Which pair of values correctly gives:




(i) the work done by the centripetal force,

(ii) the change in linear momentum of the body, when it moves from $X$ to $Y$ (where $XY$ is a diameter)?

(1) $2mv^2$ $2\ mv$

(2) $\pi\ mv^2$ $2\ mv$

(3) 0 0

(4) 0 $2\ mv$

**35.** In a system of particles, internal forces can change:

(1) The linear momentum but not the kinetic energy

(2) The kinetic energy but not the linear momentum

(3) Linear momentum as well as kinetic energy

(4) Neither the linear momentum nor the kinetic energy

## SECTION-B

**36.** A man pushes a wall and fails to displace it. He does

(1) Negative work

(2) Positive but not maximum work

(3) No work at all

(4) Maximum work

**37.** Two particle which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are $v$ and 2 $v$ at any instant, then the speed of centre of mass off the system will be:-

(1) $v$ (2) $2v$

(3) zero (4) 1.5 $v$

**38.** A rubber ball is dropped from a height of 5 m on a planet where the acceleration due to gravity is not known. On bouncing it rises to 1.8 m. The ball loses its velocity on bouncing by a factor of:

(1) $\frac{16}{25}$ (2) $\frac{2}{5}$

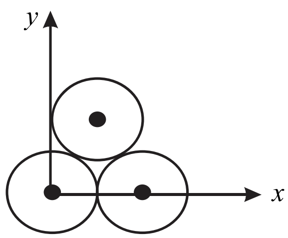
(3) $\frac{3}{5}$ (4) $\frac{9}{2}$

**39.** A shell explodes into three fragments of equal masses. Two fragments fly off at right angles to each other with speed of 9 $ms^{-1}$ and 12 $ms^{-1}$. What is the speed of the third fragment?

(1) 9 $ms^{-1}$ (2) 12 $ms^{-1}$

(3) 15 $ms^{-1}$ (4) 18 $ms^{-1}$

**40.** Three identical spheres each of radius $R$ are placed touching each other on a horizontal table as shown in the figure. The coordinates of center of mass are:




(1) $(R, R)$ (2) $(0, 0)$

(3) $\left(\frac{R}{2}, \frac{R}{2}\right)$ (4) $\left(R, \frac{R}{\sqrt{3}}\right)$

**41.** A metal ball does not rebound when struck on a wall, whereas a rubber ball of same mass when thrown with the same velocity on the wall rebounds. From this it is inferred that-

(1) Change in momentum is same in both

(2) Change in momentum in rubber in more

(3) Change in momentum of metal ball is more

(4) Initial momentum of metal ball is more than that of rubber ball

**42.** A collision is said to be perfectly inelastic when:

(1) Coefficient of restitution = 0

(2) Coefficient of restitution = 1

(3) Coefficient of restitution = $\infty$

(4) Coefficient of restitution = < 1

**43.** Two small spheres of equal mass, and heading towards each other with equal speeds, undergo a head-on collision (no external force acts on system of two spheres). Then which of the following statement is correct?

(1) Their final velocities must be zero

(2) Their final velocities may be zero.

(3) Each must have a final velocity equal to the other's initial velocity.

(4) Their velocities must be reduced in magnitude

**44.** A body of mass 6 kg is under a force which causes displacement in it given by $S = \frac{t^2}{4}$ metres where $t$ is time. The work done by the force in 2 seconds is

(1) 12 J (2) 9 J

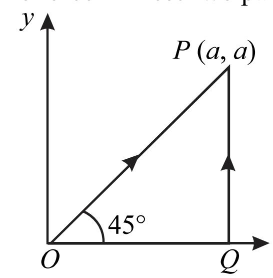
(3) 6 J (4) 3 J

**45.** Power of a water pump is 2 kW. If $g$ = 10 m/sec², the amount of water it can raise in one minute to a height of 10 m is

(1) 2000 litre (2) 1000 litre

(3) 100 litre (4) 1200 litre

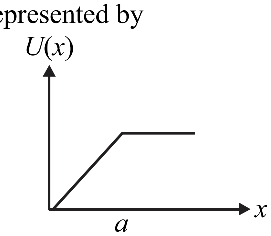
**46.** A particle is moved from (0, 0) to $(a, a)$ under a force $F = (3\hat{i} + 4\hat{j})$ from two paths. Path 1 is $OP$ and Path 2 is $OQP$. Let $W_1$ and $W_2$ be the work done by this force in these two paths. Then

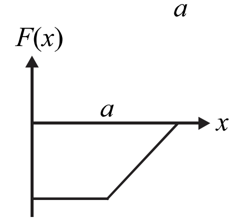


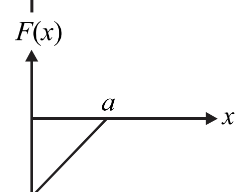

(1) $W_1 = W_2$ (2) $W_1 = 2W_2$

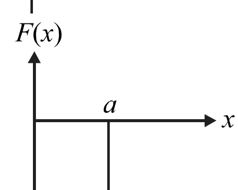
(3) $W_2 = 2W_1$ (4) $W_2 = 4W_1$

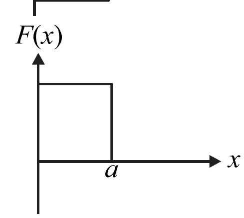
**47.** The potential energy of a system is represented in the first figure, The Force acting on the systems will be represented by




(1) 


(2) 


(3) 


(4) 

**48.** At time $t = 0\ s$ particle starts moving along the $x$-axis. If its kinetic energy increases uniformly with time, $t$ the net force acting on it must be proportional to

(1) $\sqrt{t}$ (2) constant

(3) $t$ (4) $\dfrac{1}{\sqrt{t}}$

**49.** A stationary particle explodes into two particles of masses $m_1$ and $m_2$ which move in opposite directions with velocities $v_1$ and $v_2$. The ratio of their kinetic energies $E_1/E_2$ is

(1) $m_1v_2 / m_2v_1$ (2) $m_2 / m_1$

(3) $m_1 / m_2$ (4) 1

**50.** The potential energy of a particle of mass 1 kg free to move along the $x$-axis is given by $U(x) = \left(3x^2 - 4x + 6\right)$ J. Force acting on the particle at $x = 0$ is

1) $2\hat{i}\ N$ (2) $-4\hat{i}\ N$

(3) $5\hat{i}\ N$ (4) $4\hat{i}\ N$

# Solution

**1.** **(1)**

$m_1 = 10$ gm

$m_2 = 100$ kg

$v_1 = 800\ \text{ms}^{-1}$

$p_1 = 10\ p_+$

$m_1\ v_1 + m_2\ v_2 = 0$

$$v_2 = \frac{-m_1 v_1}{m_2} = -\frac{10\times10^{-3}\times800}{100}$$

$v_2 = -\ 0.08\ \text{ms}^{-1}$

After 10 shots

$|v_2| = 0.8\ \text{ms}^{-1}$

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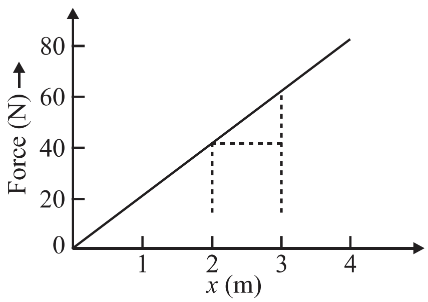
**2.** **(3)**

Work done = Area under the curve




$$W = 40\times1 + \frac{1}{2}\times1\times20$$

$$\boxed{W = 50J}$$

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**3.** **(3)**

$p = \sqrt{2km}$

$$\frac{p_1}{p_2} = \sqrt{\frac{m_1}{m_2}}$$

$p_1 : p_2 = 1 : 2$

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**4.** **(3)**

Using conservation of momentum

$P_1 = p_{2+}$

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_1$

$0.01 \times 500 = 0.01\ v_1 + 2v_2$

$v_1 + 200v_2 = 500$ …(i)

$\frac{1}{2} m_2v^2 = m_2$ gh

$v_2 = \sqrt{10\times0.1\times2}$

$= 1.4\ \text{ms}^{-1}$

$v_1 = 500 - 200 \times 1.4$

$$\boxed{v_1 = 220\,\text{ms}^{-1}}$$

**NCERT 11th Page No. 83**

**5.** **(2)**

$\frac{1}{2}$ K $x^2$ = mg $x$

$$x = \frac{2Mg}{k}$$

**NCERT 11th Page No. 80**

**6.** **(3)**

Resultant momentum

$$p = \sqrt{(mv_1)^2 + (Mv_2)^2}$$

$$\tan\theta = \frac{Mv_2}{mv_1} \Rightarrow \theta = \tan^{-1}\left(\frac{Mv_2}{Mv_1}\right)$$

**NCERT 11th Page No. 83**

**7.** **(3)**

Theory based

**NCERT 11th Page No. 83**

**8.** **(2)**

Fraction energy lost

$$= \frac{\Delta U}{U} = \frac{Mgh_1 - Mgh_2}{Mgh_1} = \frac{2-1.5}{2}$$

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

**NCERT 11th Page No. 84**

**9.** **(3)**

Theory based

**NCERT 11th Page No. 57**

**10.** **(4)**

Position of Centre of mass does not depends upon reference frame

**NCERT 11th Page No. 95**

**11.** **(4)**

$$\vec{V}_{cm} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1 + m_2} = \frac{2\times3+3\times2}{3+2}$$

$$\vec{V}_{cm} = 2.4\hat{i}\ \ \text{ms}^{-1}$$

**NCERT 11th Page No. 99**

**12.** **(3)**

Assume the there particles placed at corners

$$\vec{r}_{cm} = \frac{m\times0 + m\times b\hat{i} + m\times h\hat{j}}{m+m+m}$$

$$= \frac{b}{3}\hat{i} + \frac{h}{3}\hat{j}$$

$$x = \frac{b}{3},\ \ y = \frac{h}{3}$$

**NCERT 11th Page No. 96**

**13.** **(2)**

$E = \frac{1}{2}mv^2$

At highest point,

$E' = \frac{1}{2}m(v\cos 60)^2 = \frac{1}{2}mv^2 \times \frac{1}{4}$

$E' = \frac{E}{4}$

**NCERT 11th Page No. 76**

**14.** **(3)**

Conservation of energy

$mg(h_i - h_f) = \frac{1}{2}mv^2$

$10 \times 80 \times 2 = v^2$

$v = 40 \text{ ms}^{-1}$

**NCERT 11th Page No. 78**

**15.** **(1)**

$\therefore \vec{F}_1 == -\vec{F}_2 \Rightarrow 2Ma_1 = -Ma_2$

$\vec{a}_{cm} = \frac{2Ma_1 - Ma_2}{2M + M}$

$\vec{a}_{cm} = 0$

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**16.** **(4)**

Theory based.

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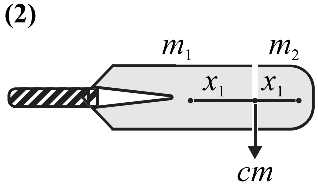
**17.** **(2)**




$m_1x_1 = m_2x_2$

$m_2 = m_1\frac{x_1}{x_2}$

$\therefore x_1 > x_2$

$\Rightarrow m_2 > m_1$

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**18.** **(2)**

Inelastic collision

$v = \frac{m_1v_1 + m_2v_2}{m_1 + m_2} \neq 0$

Thus K. E $\neq$ 0. After collision

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**19.** **(3)**

Minimum velocity for complete revolution, $v = \sqrt{5gr}$

$\frac{1}{2}mv^2 = mg(h + 2r)$

$5gr = 2hg + 4rg$

$h = \frac{r}{2}$

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**20.** **(1)**

$U(x) = \frac{a}{x^{12}} = \frac{b}{x^6}$

$\frac{dU}{dx} = 0 \Rightarrow x = \left(\frac{2a}{b}\right)^{1/6}$

$D = U(x = \infty) - U_{at}$

$D = 0\left[\frac{a}{\left(\frac{2a}{b}\right)^2} - \frac{b}{\left(\frac{2a}{b}\right)}\right]$

$D = \frac{b^2}{4a}$

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**21.** **(2)**

Work done, $W = \frac{mgl}{2n^2}$

$n = 3$

$W = \frac{mgl}{18}$

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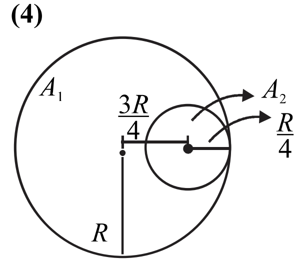
**22.** **(4)**




$X_{cm} = \frac{M_1x_1 \div M_2x_2}{M_1 - M_2} = \frac{A_1x_1 - A_2x_2}{A_1 - A_2}$

$= \frac{\pi R^2 x(0) - \pi\left(\frac{R}{4}\right)^2 \times \frac{3R}{4}}{\pi R^2 - \pi\left(\frac{R}{u}\right)^2}$

$\Rightarrow X_{cm} = \frac{-R}{20}$

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**23.** **(3)**

$S_1 : S_2 : S_3 = \frac{g}{2}(2\times1-1) : \frac{g}{2}(2\times2-1) :$

$\frac{g}{2}(2\times3-1)$

$W_1 : W_2 : W_3 := mgs_1 : mgs_2 mgs_3$

$=1:3:5$

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**24.** **(2)**

$P.E = mg\left(h - \frac{1}{2}gt^2\right)$

$KE = \frac{1}{2}mv^2 = \frac{1}{2}g^2t^2$

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**25.** **(3)**

$X_{com} = \frac{\frac{L}{2}M + \frac{L}{2}m}{M+M+M}$

$X_{com} = \frac{L}{3}$

$Y_{com} = \frac{\frac{L}{2}M + Lm}{M+M+M}$

$= \frac{L}{2}$

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**26.** **(4)**

$W = k_f - k_i$

$= \frac{1}{2}\times M\left[v_f^2 - v_i^2\right]$

$= \frac{1}{2}\times 0.01[272-464]$

$W = 0.96$ J

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**27.** **(3)**

Area covered in $F - t$ graph = change in Momentum

$= \frac{1}{2}[4\times3 - 2\times1.5]$

$= \frac{1}{2}\times 9 = 4.5$

$K.E = \frac{p^2}{2m} = 5.06\,\text{J}$

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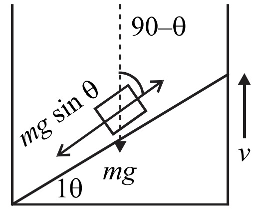
**28.** **(3)**




$W = Fd\cos(90-\theta)$

$= mg\sin\theta vt\sin\theta$

$W = mgvt\sin^2\theta$

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**29.** **(3)**

$dW = F.\,dx$

$W = \int_0^2 (4-x^2)dx = \left|4x \frac{-x^3}{3}\right|_0^2$

$W = 5.33$ J

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**30.** **(2)**

$\text{Shift} = \frac{r^2}{R+r}$

$= \frac{20\times20}{50+20} = \frac{400}{70}$

Shift = 5.7 cm

com shifts towards left of origin

⇒ Shift = – 5.7 cm

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**31.** **(4)**

Velocity of approach

$v_a = (20+5) = 25\ \text{ms}^{-1}$

velocity of separation

$v_s = v - 20$

$e = \frac{v-20}{25} = 1$

$V = 45\ \text{ms}^{-1}$

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**32.** **(3)**

There is no motion horizontally.

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**33.** **(4)**

Theory based.

**NCERT 11th Page No. 84**

**34.** **(4)**

$a_c \perp$ displacement

$\Delta P = mv - (-mv)$

$= 2\,mv$

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**35.** **(2)**

Theory based.

**NCERT 11th Page No. 100**

**36.** **(3)**

Work = $Fs\cos\theta$

$\because \quad s = o$

$W = o$

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**37.** **(3)**

$\vec{F}_{ext} = 0$

$\Rightarrow \vec{a}_{com} = 0$

$\vec{v}_{com}$ = Constant

Initially $u_1 = u_2 = 0$

$\Rightarrow \vec{v}_{com} = 0$

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**38.** **(2)**

$h_1 = 5\text{m}, h_2 = 1.8\text{ m}$

Fraction loss in velocity $= \dfrac{\sqrt{2gh_1} - \sqrt{2gh_2}}{\sqrt{2gh_1}}$

$= \dfrac{\sqrt{10} - \sqrt{3.6}}{\sqrt{10}} = \dfrac{2}{5}$

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**39.** **(3)**

$p_i = p_f$

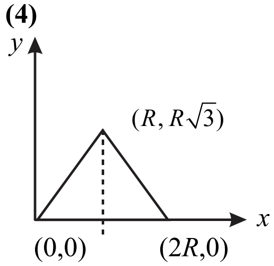
$0 = \dfrac{M}{3} \times 9\hat{i} + \dfrac{M}{3} \times 12\hat{j} + \dfrac{M}{3}\vec{v}$

$\vec{v} = -9\hat{i} - 12\hat{j}$

$|\vec{v}| = \sqrt{(-9)^2 + (-12)^2} = 15 \text{ ms}^{-1}$

**NCERT 11th Page No. 85**

**40.** **(4)**




$X_{cm} = \dfrac{m \times 0 + m \times 2R + m \times R}{3m} = R$

$Y_{cm} = \dfrac{m \times 0 + m \times R\sqrt{3}}{3m} = \dfrac{R}{\sqrt{3}}$

**41.** **(2)**

For metal ball $\Delta P = mv - 0 = mv$

For rubber ball $\Delta P = mv - (-mv) = 2mv$

**NCERT 11th Page No. 84**

**42.** **(1)**

Theory based.

**NCERT 11th Page No. 84**

**43.** **(2)**

$e = \dfrac{v_2 - v_1}{u_2 - u_1}$

Final velocity depends upon value of coefficient of restitution

**NCERT 11th Page No. 84**

**44.** **(4)**

$S = \dfrac{t^2}{4} \Rightarrow v = \dfrac{t}{2}$

$W = k_f - k_i = \dfrac{1}{2}\text{m}\left(\dfrac{t}{2}\right)^2$

$W(t = 2s) = \dfrac{1}{2} \times 6 \times \dfrac{4}{4}$

= 3 J

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**45.** **(4)**

$p = \dfrac{w}{t} = \dfrac{mgh}{t}$

$m = \dfrac{2 \times 10^3 \times 60}{10 \times 10} = 1200 \text{ kg}$

$\rho = 1$ kg/L

Volume = 1200 litre

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**46.** **(1)**

$W_1 = W_2$

$\because$ work done does not depend upon path when force is conservative in nature

**NCERT 11th Page No. 81**

**47.** **(3)**

$F = -\dfrac{dU}{dx}$

(i) $U(x) = x \Rightarrow F = -$ constant

(ii) $U(x) = \text{constant} \Rightarrow F = 0$

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**48.** **(4)**

$KE = \dfrac{1}{2}mv^2 \propto t$

$v \propto \sqrt{t}, \; a \propto \dfrac{1}{\sqrt{t}}$

$F \propto \dfrac{1}{\sqrt{t}}$

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**49.** **(2)**

$$E = \frac{p^2}{2m}$$

$$\frac{E_1}{E_2} = \frac{m_2}{m_1}$$

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**50.** **(4)**

$U(x) = 3x^2 - 4x + 6$

$$F = \frac{-du(\times)}{dx} = -(6x - 4)$$

At $x = 0$

$F = 4iN$

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