Dear student following is an Easy level [○ ● ○ ○ ○] test paper. Score of 18 Marks in 15 Minutes would be a satisfactory performance. Questions 1-9 (+3, –1). (All Questions have Single Options correct)

Q.1 A particle A suffers an oblique elastic collision with a particle B that is at rest initially. If their masses are the same, then, after the collision
(A) they will move in the opposite direction
(B) A continues move in the original direction while B remains at rest
(C) they will move in the mutually perpendicular direction
(D) None of these

Q.2 Choose the correct statement(s) from the following :
(A) The general form of Newton's second law of motion is $\mathbf{F}_{ext} = m\mathbf{a}$.
(B) A body can have energy and yet no momentum.
(C) The relative velocity of two bodies in a head-on collision remains unchanged in magnitude and direction.
(D) None of these

Q.3 The distance x moved by a body of mass 0.5 kg by a force varies with time t as
$$x = 3t^2 + 4t + 5$$
where x is expressed in metre and t in second. What is the work done by the force in the first 2 seconds ?
(A) 25 J (B) 50 J (C) 75 J (D) 100 J

Q.4 A body of mass m in dropped from a height h above the ground. The velocity v of the body when it has lost half its initial potential energy is given by
(A) $v = \sqrt{gh}$ (B) $v = \sqrt{2gh}$
(C) $v = \sqrt{\frac{gh}{2}}$ (D) $v = 2\sqrt{gh}$

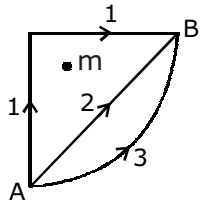
Q.5 A body of m is moving in a straight line at a constant line at constant speed v. Its kinetic energy is k and the magnitude of its momentum is p. Which of the following relations is/are correct ?
(A) $2k = pv$ (B) $p = \sqrt{mk}$
(C) $v = \sqrt{\frac{2k}{p}}$ (D) None of these

Q.6 A body of mass m is dropped from a certain height. It has a velocity v when it is at a height h above the ground. Which of the following will remain constant during the free fall ?
(A) $v^2 + 2gh$ (B) $v^2 - 2gh$
(C) $v + \sqrt{2gh}$ (D) $v - \sqrt{2gh}$

Q.7 Which of the following collisions is not perfectly inelastic ?
(A) a man boarding a moving bus
(B) a bullet fired into a wooden block and getting embedded in it.
(C) the capture of a neutron by a nucleus.
(D) a player kicking a football.

Q.8 A body of mass m_1 moving at a constant speed undergoes an elastic collision with a body of mass to m_2 initially at rest. The ratio of the kinetic energy of mass m_1 after the collision to that before the collision is
(A) $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2$ (B) $\left(\frac{m_1 + m_2}{m_1 - m_2}\right)^2$
(C) $\left(\frac{2m_1}{m_1 + m_2}\right)^2$ (D) $\left(\frac{2m_2}{m_1 + m_2}\right)^2$

Q.9 If W_1, W_2 and W_3 represent the work done in moving a particle from A to B along three different path 1, 2 and 3 (as sown in the figure) in the gravitational field of a point mass m, find the correct relation between W_1, W_2 and W_3



(A) $W_1 > W_3 > W_2$ (B) $W_1 = W_2 = W_3$
(C) $W_1 < W_3 < W_2$ (D) $W_1 < W_2 < W_3$

PHYSICS IIT JEE (JULY 5th WEEK CLASS TEST 1) (WORK, POWER, ENERGY & COLLISION) ANSWER KEY

Name : ..... **Roll No. :** .....

	A	B	C	D		A	B	C	D		A	B	C	D
1	○	○	○	○	4	○	○	○	○	7	○	○	○	○
2	○	○	○	○	5	○	○	○	○	8	○	○	○	○
3	○	○	○	○	6	○	○	○	○	9	○	○	○	○

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9
Ans.	C	B	C	A	A	C	D	A	B

SOLUTIONS

Sol.1 (C)

From the principle of conservation of momentum, we have total final momentum = total initial momentum.

Momentum conservation is possible in case (C). In case (C), the two masses should move in mutually perpendicular directions with velocity $v/\sqrt{2}$ each inclined at 45º with the original direction of motion of particle A.

Sol.2 (B)

The general form of Newton's second law is

$$\mathbf{F}_{ext} = \frac{d\mathbf{p}}{dt} = \frac{d}{dt}(mv) = m\frac{dv}{dt} + \mathbf{v}\frac{dm}{dt}$$

The form $\mathbf{F}_{ext} = m\mathbf{a}$ is valid only if $\frac{dm}{dt} = 0$, i.e. if mass does not change with time. Hence choice (A) is incorrect. (B) is correct. because a body at rest may have potential energy and yet no momentum. Choice (C) is incorrect because the relative velocity remains unchanged in magnitude and gets reserved in direction; $(v_2 - v_1) = =(u_2 - u_1)$.

Sol.3 (C)

$$\text{Velocity } (v) = \frac{dx}{dt} = \frac{d}{dt}(3t^2 + 4t + 5) = 6t + 4.$$

Acceleration is

$$a = \frac{dv}{dt} = \frac{d}{dt}(6t + 4) = 6ms^{-2}.$$

Therefore, applied force is

$F = ma = 0.5 \times 6 = 3N.$

Now t = 2s, the distance moved is

$x = 3 \times (2)^2 + 4 \times 2 + 5 = 25m$

$\therefore$ Work done $W = Fx = 3 \times 25 = 75J$

Sol.4 (A)

Initial PE = mgh. Now, gain in KE = loss in PE.

Thus $\frac{1}{2}mv^2 = \frac{1}{2}mgh$

or $v = \sqrt{gh}$

Sol.5 (A)

Now $p = mv$ or $p^2 = m^2v^2$

or $\frac{p^2}{2m} = \frac{1}{2}mv^2 = k$

or $p = \sqrt{2mk}$.

Also, $p = mv$ and $k = \frac{1}{2}mv^2$.

Dividing the two we get, $2k = pv$.

Sol.6 (C)

The total energy = KE + PE remains constant during the free fall, i.e.

$$mgh + \frac{1}{2}mv^2 = \text{constant}$$

or $gh + \frac{v^2}{2} = \text{constant}.$

Sol.7 (D)

The correct choice is (d), because in an inelastic collision, the colliding bodies stick to each other after the collision.

Sol.8 (A)

Let u_1 be the speed of mass m_1 before the collision. Here $u_2 = 0$. Therefore, the speed of masses m_1 and m_2 after the collision respectively are

$$v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)u_1 \text{ and } v_2 = \left(\frac{2m_1}{m_1 + m_2}\right)u_1$$

$\therefore$ KE of m_1 after collision $= \frac{1}{2}m_1v_1^2 =$

$\frac{1}{2}m_1\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2 u_1^2$. KE of m_1 before collision

$= \frac{1}{2}m_1u_1^2$. The ratio of the two is $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2$.

Sol.9 (B)

Gravitational force is conservative. The work done by a conservative force on a particle moving between two points does not depends on the path taken by the particle.