EXERCISE

Select the correct answer from the following choices.

1) A car takes 1 hour to travel 100 km along a main road and then 1/2 hour to travel 20 km along a side road.

What is the average speed of the car for the whole journey?

a. 60 km h^{-1} b. 70 km h^{-1}

c. 80 km h^{-1} d. 100 km h^{-1}

2) How is the motion of a body affected by balanced and unbalanced forces acting on it?

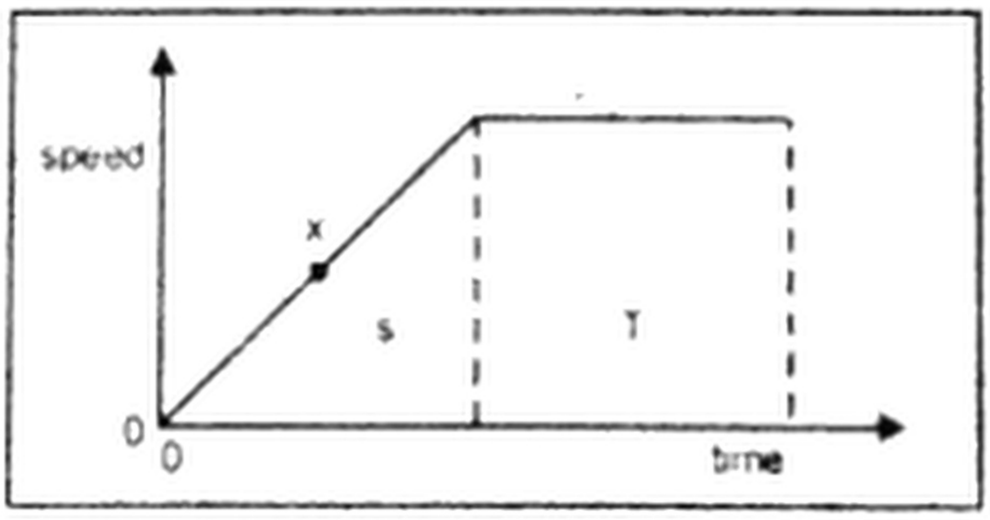
	Balanced forces	**Unbalanced forces**
a.	Velocity constant	Velocity constant
b.	Velocity changes	Velocity constant
c.	Velocity constant	Velocity changes
d.	Velocity changes	Velocity changes

3. When a block of wood of mass 2 kg is pushed along a horizontal flat surface of a bench, the force of friction is 4N. When the block is pushed along the bench with a force of 10 N, it moves with a constant.

a. Speed of 3 ms^{-1} b. Speed of 5 ms-1

c. acceleration of 3 ms^{-2} d. Acceleration of 5 ms^{-2}

4. The graph illustrates the motion of an object.



Which features of the graph represent. The distance travelled by the object while moving at a constant speed?

a. Area S

b. Area S + area T

c. Area T

d. The gradient at point X

5. A body is travelling with a constant acceleration of 10 ms^{-2}. If S_1 is the distance traveled in 1st second and S_2 is the distance traveled in 2nd second, which of the following shows a correct relation between S_1 and S_2.

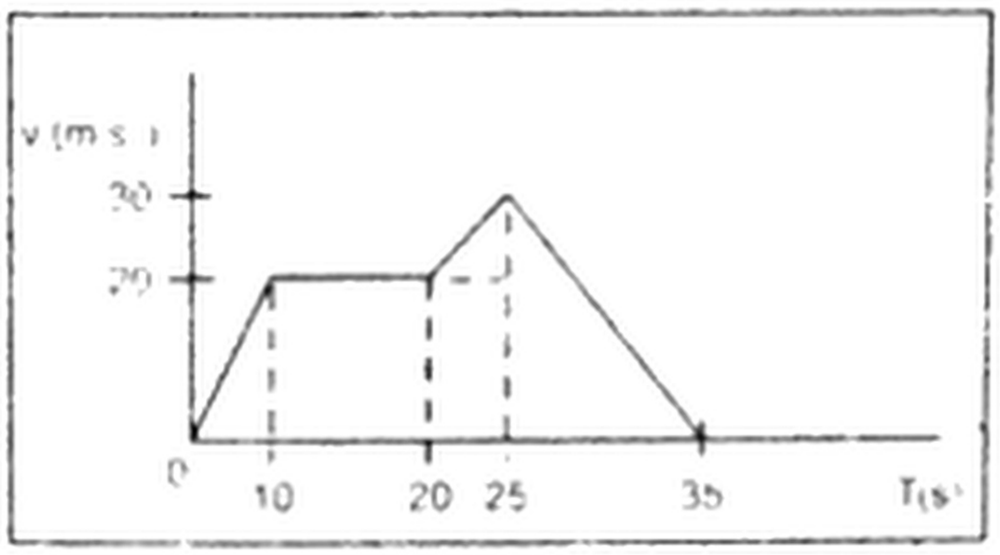
a. $S_1 = S_2$

b. $S_1 = 3S_2$

c. $S_2 = 3S_1$

d. none

6. The journey of a car is shown in the velocity – time graph. How much distance it traveled?



a. 1250 m b. 2500 m c. 3120 m d. none

7. Two balls travelling in opposite direction slightly of different masses elastically and bounce back. Which of the following correctly show that relative speed of approach is equal to relative speed of separation?

a. $U_1 + U_2 = V_1 + V_2$ b. $U_1 - U_2 = V_1 - V_2$

c. $U_1 + V_1 = V_2 + U_2$ d. $V_1 - U_1 = U_2 - V_2$

8. A projectile is thrown so that it travels a maximum range of 1000m. How high will it rise?

a. 500 m b. 250 m c. 400 m d. none

9. What does not change when force is applied on a body?

a. mass b. Velocity c. Position d. acceleration

Answers:

1.	(b)	**2.**	(c)	**3.**	(b)	**4.**	(d)	**5.**	(d)
6.	(d)	**7.**	(d)	**8.**	(b)	**9.**	(a)	-	-

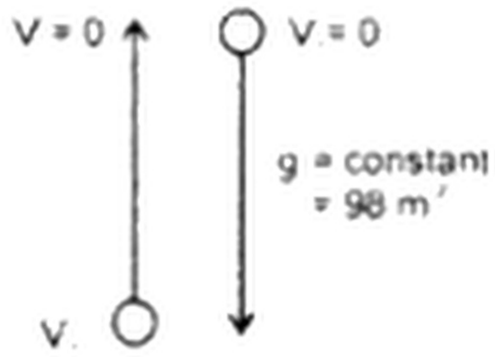
Write the short answers of the following:

Q.1 Can the velocity of a body reverse the direction, when acceleration is constant? If you think so, give an example?

Answer

Yes, it can be possible i.e. when a body is thrown vertically upward, its velocity goes on decreasing due to gravity and become zero at the maximum height.

After that it reverses its direction, its velocity goes on Increasing, but throughout the motion acceleration due to gravity is constant.



Q.2 A man standing on the top of a tower throws a ball straight up with initial velocity V_i at the same time throws a second ball straight downward with the same speed. Which ball will hit the ground with higher speed?

Answer.

Both the balls hit the ground with same speed, because the ball which is thrown vertically up with velocity V, will have same velocity V, when it reaches back of the top of the tower. So, the two balls have same downward velocity. Hence, they hit the ground with same final velocity.

Q.3 Motion with constant velocity is a special case of motion with constant acceleration. Is this statement true? Discuss.

Answer

The statement is not true because if a body is moving with constant velocity then according to Newton's first law there will be no acceleration i.e. a = 0, but if a body is moving with constant acceleration then it means equal change in velocity occur in equal interval of time. So, motion with constant velocity is not a special case of motion with constant acceleration.

Q.4 Define and explain impulse and show that how it is related to linear momentum?

Answer

Definition: When a large force acts on a body for short interval of time then the product of average force and the time over which force acts is called impulse and the force is called impulsive force.

Explanation

In many situations in which momentum of a body suddenly changed such as collision of fast-moving vehicles and striking a ball with a bat. In these cases, force act for very short interval of time and hence are not constant. Also, these forces varying over wide limits and instantaneously not measurable. It is convenient to measure a physical quantity known as impulse.

$$F_{av} = \frac{\Delta P}{\Delta t}$$

$$\Delta P = F_{av} \times \Delta t \qquad \text{.....(1)}$$

In equation (1) change in momentum is equal to the time over which force acts. Thus, change in momentum is called impulse represented by J.

$$J = F_{av} \times \Delta t \qquad \text{.....(2)}$$

From Equation (2) it is clear that gradual change in momentum requires small force and long interval of time, and sudden change in momentum requires large force and short interval of time.

The principal is used in the design of automobile safety devices such as air bags and helmet etc. These devices extend the time of collision and decrease the net force, so little change of injury will be there.

Q.5 What is head on collision? Explain with an example.

Answer

If there are only two objects involved in the collision, then the momentum change of the individual objects are equal in magnitude and opposite in direction. Certain collisions are referred to as elastic collisions.

Q.6 For any specific velocity of projection, the range of a projectile cannot exceed from a value equal to four times of the corresponding height.

Answer

According to the given condition.

Let $R = 4H$

$$\Rightarrow \quad \frac{v_i^2 \sin 2q}{g} = 4\frac{v_i^2 \sin^2 q}{2g}$$

$$\Rightarrow \quad 2\cos\theta\sin\theta = 2\sin^2\theta$$

$$\Rightarrow \quad \cos\theta = \sin\theta$$

$$\Rightarrow \quad \frac{\sin q}{\cos q} = 1$$

$$\Rightarrow \quad \tan\theta = 1$$

$$\Rightarrow \quad \theta = \tan^{-1}(-1)$$

$$\Rightarrow \quad \theta = 45^\circ$$

Since range of projectile is maximum for $\theta = 45^\circ$ therefore, range cannot exceed from a value equal to our times of the maximum corresponding height.

Q.7 What is the angel of projection for which the maximum height reached and corresponding range are equal?

Answer

Since $R = \frac{v_i^2}{g}\sin 2\theta$ .....(1)

& $H = \frac{v_i^2 \sin^2 q}{2g}$ .....(2)

According to the given condition

$R = H$

$\Rightarrow \frac{v_i^2}{g}\sin^2\theta = \frac{v_i^2 \sin^2 q}{2g}$

$\Rightarrow 2\cos\theta\sin\theta = \sin^2 q$

$\Rightarrow 2\cos\theta = \frac{\sin q}{2}$

$\Rightarrow 4 = \frac{\sin q}{\cos q}$

$\Rightarrow \tan\theta = 4$

$\Rightarrow \theta = \tan^{-1}(4)$

$\Rightarrow \boxed{\theta = 76^\circ}$

Q.8 An airplane while horizontally drops a bomb when reaches exactly above the target but missed it. Explain?

Answer

The airplane while horizontally drops a bomb when reaches exactly above the target, the target is missed because the bomb follows the parabolic path. Also, the bomb has the horizontal motion at the point of drop due to which it moves ahead.

Since acceleration is equal to slope of the graph i.e.

$$\text{Slope} = a = \tan\theta$$

$a = \tan(60^\circ)$ $\therefore \theta = 60^\circ$

$\boxed{a = \sqrt{3}\,m/s^2}$