

2. Clarify the differences

A. Distance and displacement

Answer:

Distance	Displacement
(i) Distance is the length of the actual path travelled by an object. (ii) It is a scalar quantity. (iii) It is either equal to or greater than displacement. (iv) Distance travelled is always positive.	(i) Displacement is the minimum distance between the starting and finishing points. (ii) It is a vector quantity. (iii) It is either equal to or less than distance. (iv) Displacement may be positive or negative or zero.

B. Uniform and non-uniform motion.

Answer:

Uniform motion	Non-uniform motion
(i) If an object covers equal distances in equal intervals of time it is said to be in uniform motion. (ii) Distance – time graph for uniform motion is a straight line. (iii) In uniform motion, acceleration is zero.	(i) If an object moves unequal distances in equal intervals of time, its motion is said to be non-uniform. (ii) Distance – time graph for non-uniform motion is not a straight line. (iii) In non-uniform motion acceleration is non-zero.

5. Give scientific reasons.

a. When an object falls freely to the ground, its acceleration is uniform.

Answer:

- When the body falls freely to the ground, there are equal changes in velocity of the body in equal intervals of time.
- Thus the acceleration of the body is constant, and it possesses uniform acceleration.

b. Even though the magnitudes of action force and reaction force are equal and their directions are opposite, their effects do not get cancelled.

Answer:

- Action and reaction forces act on different bodies.
- They don't act on the same body, hence they cannot cancel each other's effect.
- Hence, even though the magnitudes of action force and reaction force are equal, they do not cancel each other.

c. It is easier to stop a tennis ball as compared to a cricket ball, when both are traveling with the same velocity.

Answer:

- Momentum of an object depends on its mass as well as its velocity.
- Cricket ball is heavier than a tennis ball. Although they are thrown with the same velocity, cricket ball has more momentum than a tennis ball.
- The force required to stop a cricket ball is more than a tennis ball.
- Hence it is easier to stop a tennis ball than a cricket ball moving with same velocity.

d. The velocity of an object at rest is considered to be uniform.

Answer:

- When a body is at rest there is no change in velocity.
- A body with constant velocity is said to be in uniform motion.
- Hence, the state of rest is an example of uniform motion.

7. Solve the following examples.

a) An object moves 18 m in the first 3 s, 22 m in the next 3 s and 14 m in the last 3 s. What is its average speed? (Ans: 6 m/s)

Answer:

Given:

Total distance (d) = 18 + 22 + 14 = 54 m

Total time taken (t) = 3 + 3 + 3 = 9 sec

To find:

Average speed = ?

Formula :

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

Solution :

$$\begin{aligned}\text{Average speed} &= \frac{\text{Total distance covered}}{\text{Total time taken}} \\ &= \frac{54}{9} \\ &= 6 \text{ m/s}\end{aligned}$$

The object moves with an average speed of 6 m/s.

b) An object of mass 16 kg is moving with an acceleration of 3 m/s^2 . Calculate the applied force. If the same force is applied on an object of mass 24 kg, how much will be the acceleration? (Ans: 48 N, 2 m/s^2)

Answer:

Given :

Mass of 1st body (m_1) = 16 kg

Acceleration of 1st body (a_1) = 3 m/s^2

Mass of 2nd body (m_2) = 24 kg

To find :

Force on 1st body (F_1) = ?

Acceleration of 2nd body (a_2) = ?

Formula :

$$F = m \times a$$

Solution :

$$F_1 = m_1 \times a_1$$

$$F_1 = 16 \times 3$$

$$F_1 = 48 \text{ N}$$

$$F_2 = m_2 \times a_2$$

$$a_2 = \frac{F_2}{m_2}$$

$$a_2 = \frac{48}{24}$$

$$a_2 = 2 \text{ m/s}^2$$

The force acting on the 1 body is 48 N and the acceleration of the 2nd body is 2 m/s^2

c) A bullet having a mass of 10 g and moving with a speed of 1.5 m/s, penetrates a thick wooden plank of mass 90 g. The plank was initially at rest. The bullet gets embedded in the plank and both move together. Determine their velocity. (Ans: 0.15 m/s)

Answer:

Given :

$$\text{Mass of bullet } (m_1) = 10\text{g} = \frac{10}{1000} \text{ kg}$$

$$\text{Mass of plank } (m_2) = 90\text{g} = \frac{90}{1000} \text{ kg}$$

$$\text{Initial velocity of bullet } (u_1) = 1.5 \text{ m/s}$$

$$\text{Initial velocity of plank } (u_2) = 0 \text{ m/s}$$

To find : Common velocity

$$\text{Formula: } m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$\text{Solution: } v_1 = v_2 = v$$

$$\therefore m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$\left(\frac{10}{1000} \times 1.5\right) + \left(\frac{90}{1000} \times 0\right) = \left(\frac{10}{1000} \times v\right) + \left(\frac{90}{1000} \times v\right)$$

$$\frac{15}{1000} + 0 = v \left(\frac{10}{1000} + \frac{90}{1000}\right)$$

$$\frac{15}{1000} = v \left(\frac{100}{1000}\right)$$

$$15 = v \times 100$$

$$v = \frac{15}{100}$$

$$v = 0.15 \text{ m/s}$$

d) A person swims 100 m in the first 40 s, 80 m in the next 40 s and 45 m in the last 20 s. What is the average speed? (Ans: 2.25 m/s²)

Answer:

Given:

$$\text{Total distance } (d) = 100 + 80 + 45 = 225 \text{ m}$$

$$\text{Total time taken } (t) = 40 + 40 + 20 = 100 \text{ sec}$$

To find:

Average speed =?

Formula :

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

Solution :

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{225}{100}$$

$$= 2.25 \text{ m/s}$$

The person swims with an average speed of 2.25 m/s.