Excel Coaching Classes

Date: 10-Jul-2026
Time: 60min

Laws of motion

Marks: 20

Q.1(A) **Choose the correct alternative.** **(2)**

i **_____ force acting on an object brings it in motion.**

- (A) Large
- (B) Balanced
- (C) Unbalanced
- (D) Tangential

Ans: ["C"]

Explanation:

An *unbalanced force* is a net force that results in a change in motion of an object. This means that the object will either start moving, stop moving, or change direction. A balanced force, on the other hand, results in no change in motion.

Since the question states that a force brings an object into motion, it implies that the force is unbalanced. An unbalanced force causes an object to accelerate, which is a change in its velocity (speed and/or direction).

Therefore, the correct answer is *Unbalanced*.

ii **If the position of an object is changing with respect to its surroundings, then it is said to be _____.**

- (A) in uniform motion
- (B) in circular motion
- (C) in motion
- (D) stationary

Ans: ["C"]

Explanation: The position of an object is changing with respect to its surroundings means the object is moving. It could be moving in a straight line, a circle, or any other path. Regardless of the specific type of motion, the object is ***in motion***.

Q.1(B) **Answer the following.** **(3)**

i State True or False:

Earth moves around the Sun with uniform velocity.

Ans: ["B"]

Explanation:

Earth moves around the Sun with uniform speed.

ii **Define:**

Uniform motion

The motion in which the object covers equal distances in equal intervals of time is called uniform motion.

iii Name the following:

The force equal to and opposite to action force

Reaction

Q.2(A) Give scientific reasons. (Attempt any 1) (2)

i Give Scientific Reason.

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

i. Momentum is the product of mass of body and its velocity.

ii. Mass of a cricket ball is more than the mass of a tennis ball. Therefore, if both balls move with the same velocity, the momentum of cricket ball is more than the momentum of a tennis ball.

iii. As a result, more force is required to stop a cricket ball.

Hence, it is easier to stop a tennis ball than a cricket ball moving with the same velocity.

ii Give Scientific Reason.

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

Action and reaction forces act on different objects. They do not act on the same object and hence cannot cancel each other's effect.

Q.2(B) Answer the following. (Attempt any 1) (2)

i **State the following law with examples:**

Newton's third law of motion

Statement: Every action force has an equal and opposite reaction force which acts simultaneously.

Examples:

i. A book kept on a table remains stationary.

ii. An air filled balloon held in hand when released, moves forward.

ii(a) Name the following:

A quantitative measure of inertia of a body

Mass

(b) **Give example of the following:**

Change in direction of motion without a change in speed of a body.

When a body moves along a circular path, covering equal distances in equal intervals of time, its direction of motion changes continuously but there is no change in its speed.

iii **The mass of a cannon is 500 kg and it recoils with a speed of 0.25 m/s. What is the momentum of the cannon?**

Given: Mass of the cannon (m) = 500 kg,

recoil speed (v) = 0.25 m/s

To find: Momentum (p)

Formula: $p = mv$

Calculation: From formula,

$p = 500 \times 0.25 =$ **125 kg m/s**

Q.3 Answer the following. (Attempt any 2) **(6)**

i(a) Distinguish between:

Speed and velocity

	Speed	Velocity
i.	Speed is the distance travelled by a body in unit time.	Velocity is the distance travelled by the body in a given direction in unit time.
ii.	Speed is a scalar quantity.	Velocity is a vector quantity.
iii.	Speed = $\frac{\text{distance}}{\text{time}}$	Velocity = $\frac{\text{displacement}}{\text{time}}$
iv.	It is always positive or zero but never negative.	It may be positive, zero or negative.

(b) **In the table given below, the distances covered by Rahul for different time intervals are mentioned. Study the table and determine the type of motion.**

Time in the clock(pm)	Distance covered by Rahul in km
5:00	0
5:30	15
6:00	30
6:30	45
7:00	60

The type of motion followed by Rahul is uniform linear motion.

ii **Explain the principle of conservation of momentum.**

i. According to principle of conservation of momentum, the total momentum before collision of both the bodies is equal to the total momentum after collision.

ii. Consider two bodies A and B.

Let mass of A = m_1, initial velocity of A = u_1, final velocity of A = v_1 and force acting on A due to B = F_1.

Let mass of B = m_2, initial velocity of B = u_2, final velocity of B = v_2 and force acting on B due to A = F_2.

iii. When A and B collide, a force F_1 due to body B acts on A and the body A accelerates.

iv. According to Newton's third law, body A also exerts an equal and opposite force on body B.

v. Since these forces are opposite in direction,

$F_2 = -F_1$

$\therefore \quad m_2a_2 = -m_1a_1$

$\therefore \quad \frac{m_2(v_2 - u_2)}{t} = \frac{-m_1(v_1 - u_1)}{t}$

$\therefore \quad m_2(v_2 - u_2) = -m_1(v_1 - u_1)$

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

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

$\therefore$ Final momentum = Initial momentum.

Hence, total momentum in a collision is always conserved.

iii(a) Name the following:

Direction along which coin kept on rotating disc would be thrown off if the disc is rotated fast enough

Tangential

(b) Name the following:

Product of mass and acceleration

Force

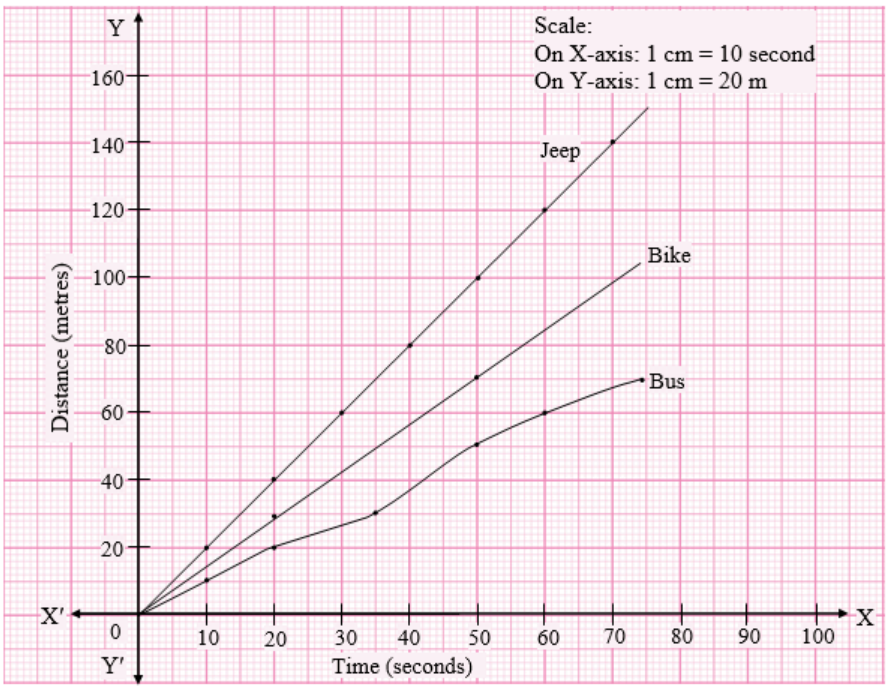
(c) Name the following:

The first scientist to measure speed as distance/time

Galileo

Q.4 **Answer the following. (Attempt any 1)** **(5)**

i Given below are distance-time graphs for a bike, a jeep and a bus starting from the same spot at same time along straight road. Answer the following questions, studying the graph.



(a) **Assuming all the vehicles maintain the type of motion they are undergoing, for which vehicle we cannot find the distance covered after 150 seconds?**

Bus.

(b) **What will be the nature of speed-time graph for the jeep?**

Speed time graph for the jeep will be a straight line parallel to time axis.

(c) **What is the value of acceleration of the bike?**

Zero.

(d) **Assuming all the vehicles maintain the type of motion they are undergoing, what will be the distance between the bike and jeep at 120 seconds?**

Speed of jeep = Slope of graph = 2 m/s

∴ Distance covered by jeep after 120 seconds = 2 × 120 = 240 m

Speed of bike = Slope of graph = $\frac{7}{5}$ m/s

∴ Distance covered by bike after 120 seconds = $\frac{7}{5}$ × 120 = 168 m

∴ Distance between the bike and jeep = 240 – 168 = 72 m

(e) **Which vehicle has maximum average speed?**

Jeep.

ii(a) **A train starts moving from rest and attains a velocity of 90 km/hr after 2 minutes. If the force exerted by engine is 750 N, then calculate the mass of the train.**

Given: Initial velocity (u) = 0,

final velocity (v) = 90 km/hr = $90 \times \frac{1000}{60 \times 60} = 90 \times \frac{5}{18} = 25 m/s$

time (t) = 2 minutes = 2 × 60 = 120 s, force (F) = 750 N

To find: mass (m)

Formulae: i. a = $\frac{v - u}{t}$ ii. F = ma

Calculation: From formula (i),

a = $\frac{25 - 0}{120} = \frac{25}{120} = \frac{5}{24}$ m/s^2

From formula (ii),

m = $\frac{F}{a} = \frac{750}{5/24}$ = **3600 kg**

(b) **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?**

Given: Distance covered in first three seconds (d_1) = 18 m,

distance covered in next three seconds (d_2) = 22 m,

distance covered in last three seconds (d_3) = 14 m

total time (t) = 3 + 3 + 3 = 9 s

To find: Average speed

Formula: Average speed = $\frac{Total\ distance\ covered}{Total\ time}$

Calculation: From formula,

Average speed = $\frac{18 + 22 + 14}{9} = \frac{54}{9}$

= **6 m/s**

(c) **When an object is at rest in the beginning of its motion, what is its initial velocity?**

When an object is at rest in the beginning of its motion, its initial velocity is zero.