1. Laws of Motion
Extra Questions

Q.1 State the Newton's third law of motion.

Ans.- 'Every action force has an equal and opposite reaction force which acts simultaneously.

Q. 2 State the three equations of motion and give the relationship explained by them.

Ans.- i) $V = u + at$: this is the relation between velocity and time.

ii) $S = ut + \frac{1}{2}at^2$: This is the relation between displacement and time.

iii) $v^2 = u^2 + 2as$: This is the relation between displacement and velocity.

Q. 3 What is 1 dyne?

Ans.- The force necessary to cause an acceleration of 1 cm/s^2 in an object of mass 1 gm is called 1 dyne.

1 dyne = 1 g × 1 cm/s^2.

Q. 4 Give scientific reasons :

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

Ans.- i) When a body is at rest there is no change in velocity.

ii) A body with constant velocity is said to be in uniform motion.

iii) Hence, the state of rest is an example of uniform motion.

Q. 5 Name the following.

a) S.I. unit of acceleration.

Ans. m/s^2.

b) C.G.S. unit of momentum.

Ans.- G cm/s.

Q. 6 What are vectors and scalars?

Ans.- Scalars are physical quantities having magnitude only whereas, vectors are physical quantities having both magnitude and direction.

Q. 7 When acceleration said to be positive?

Ans.- When the velocity of a body increases with a time, its acceleration is said to be positive acceleration.

Q. 8 Complete the sentences and explain them :

a) The minimum distance between the start and finish points of the motion of an object is called the _____ of the object.

Ans. The minimum distance between the start and finish points of the motion of an object is called the displacement of the object.

Q. 9 When an object falls freely to the ground its acceleration is uniform.

Ans.- When an object falls freely to the ground, its acceleration is uniform because while falling the velocity increases by equal amounts in equal interval of time.

Q. 10 What factors cause a change in velocity?

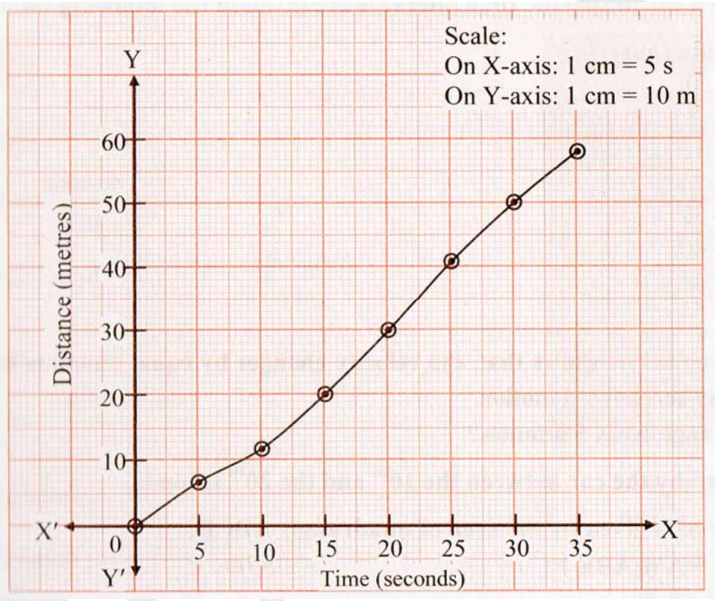
Ans.- Change in velocity is caused due to change in direction or magnitude of the velocity or both.

Q. 11 How positive and negative acceleration different in terms of velocity?

Ans.- In positive acceleration the acceleration is in the direction of the velocity while in negative acceleration, the direction of acceleration is opposite to the direction of the velocity.

Q. 12 Draw a graph of distance against time taking the time along the X – axis and distance along the Y – axis.

Ans.- Graph of distance verses time :



Q. 13 Distinguish between balanced and unbalanced force.

Ans.-

Balanced force	Unbalanced force
1) These forces do not change the state of rest or motion of a body.	1) These forces change the state of rest or motion of a body.
2) They do not produce any acceleration.	2) Acceleration can produced.
3) E.g. Book placed on table.	3) E.g. Boy kicking the football.

Q. 14 What is displacement per unit time called?

Ans.- Displacement per unit time is called velocity.

Q. 15 Give one example in which motion is visible.

Ans.- The motion of flying bird is visible.

Q. 16 What happens when a force is applied in the direction opposite to that of motion of a body?

Ans.- When a force is applied in the direction opposite to that of a body, the speed of body decreases.

Q. 17 State the direction of velocity of a particle performing uniform circular motion.

Ans.-

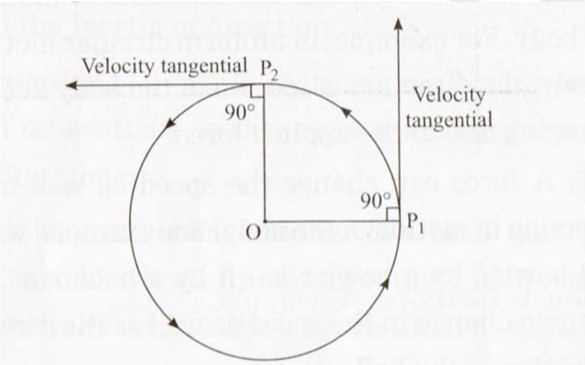


Fig 1.7 : (for reference) : Velocity of a particle in uniform circular motion

The direction of velocity of a particle performing uniform circular motion is along the tangent to the circle at the position of the particle, in the sense of motion of the particle.

Q. 18 what is inertia of rest?

Ans.- The inherent property of a body by virtue of which it cannot change its position of rest is called the inertia of rest.

Q. 19 Give the example in which force is not visible.

Ans.- The force exerted by a table on a book, kept on it is not visible.

Q. 20 What is meant by a unit force?

Ans.- A force which causes a unit mass to move with a unit acceleration is called a unit force.

Q. 21 Difference between speed and velocity.

Ans.-

Speed	Velocity
1) Speed is the distance covered per unit time.	1) Velocity is the displacement per unit time.
2) It does not have direction.	2) It has direction.

Q. 22 Match the following.

Column A	Column B
1) Displacement	1) m/s
2) Velocity	2) m
3) Acceleration	3) kg. m/s
4) Momentum	4) m/s^2

Ans.-

Column A	Column B
1) Displacement	1) m
2) Velocity	2) m/s
3) Acceleration	3) m/s^2
4) Momentum	4) kg. m/s

Q. 23 Find the odd one and give the reasons.

i) Speed, distance, mass, velocity.

Ans. Velocity - It is a vector quantity, other are scalar quantities.

Q. 24 Find odd one out and give reasons.

i) Momentum, Acceleration, Force, time.

Ans. Time - It is a scalar quantity, others are vector quantities.

Q. 25 State true or false. If statement is false, correct it and rewrite it.

i) 1 dyne = 1 g × 1 cm/s^2

Ans.- True.

ii) 1 newton = 1 kg × 1 cm/s^2

Ans.- True.

iii) Momentum is a scalar quantity.

Ans.- False. Momentum is a vector quantity.

Q. 26 Define – Zero acceleration.

Ans.- If the velocity of the object does not change with time, it has zero acceleration.

Q. 27 Distinguish between velocity and acceleration.

Ans.-

Velocity	Acceleration
1) The displacement that occurs in unit time is called velocity.	1) The rate of change of velocity is called acceleration.
2) S. I. unit is m/s.	2) SI unit is m/s^2.
3) Velocity = $\frac{\text{displacement}}{\text{time}}$	3) Acceleration = $\frac{\text{change in velocity}}{\text{time}}$

Q. 28 In which of the following examples can you sense motion? How will you explain presence and absence of motion?

i) The flight of a bird.

ii) A stationary train

iii) Leaves flying through air.

iv) A stone lying on a hill.

Ans.- Amongst the given examples, motions that can be sensed by a stationary observer are the flight of a bird and leaves flying through air. A body is said to be in motion, if it changes its position with respect to its surroundings. Body at rest (i.e., it does not change its position with respect to its surroundings indicates absence of motion.

Q.29 Fill in the blanks –

1. When two objects collide, the total momentum before collision is____ the total momentum after collision.

Ans – Greater than

2. Retardation means ___acceleration.

Ans – Negative.

3. Force = Rate of____.

Ans- Momentum.

4. Newton's ____law of motion is called the law of inertia.

Ans – First.

5. In SI system, the unit of force is ____ .

Ans – Newton.

6. The first kinematic equation states the relation between ____ and time.

Ans- Velocity.

7. ____ is the length of the actual path travelled by an object in motion while going from one point to another.

Ans – Distance.

8. The distance travelled in a particular direction by an object in unit time is called its____ .

Ans – Velocity.

9. ____cause a change in the state of an object at rest or in uniform motion.

Ans – Unbalanced forces.

10. In CGS system, the unit of ~~force is~~ .

Ans – dyne.

Q.30 Match the pairs –

1.

(A)	(B)
1) Acceleration	- Body at rest
2) Velocity	- metre
3) Displacement	- Metre/second^2
4) Speed of object is zero	- Deceleration
5) Negative Acceleration	- Metre/second

Ans.-

(A)	(B)
1) Acceleration	- Metre /second^2
2) Velocity	- Metre/second
3) Displacement	- Metre
4) Speed of object is zero	- Body at rest
5) Negative Acceleration	- Deceleration

2.

(A)	` (B)
1) Negative Acceleration of body is	- Final velocity zero
2) Distance	- Body at rest

3) When body comes to nest Position at the end of the motion - Always positive

4) Balanced force law of - Newton's first motion

5) Inertia - Retardation

Ans.- (A) (B)

1) Negative Acceleration - Retardation

2) Distance - Always positive

3) When body comes to nest position at the end of the motion motion - Final velocity of body is zero

4) Balanced force - Body at rest

5) Inertia - Newton's first law of motion

3. (A) (B)

1) Uniform circular motion - Newton's third law of motion

2) Action force and reaction force - Electrons revolve around the nucleus

3) Uniform velocity - F = ma

4) Rate of change of momentum - Acceleration is zero

5) Equation of force - Newton's second

Ans- (A) (B)

1) Uniform circular motion - Electrons revolve around the nucleus

2) Action force and reaction force - Newton's third law of motion

3) Uniform velocity - Acceleration is zero

4) Rate of change of momentum - Newton's second law of motion

5) Equation of force - F = ma

Q.31 Multiple choice questions-

1. The force necessary that causes acceleration of 1 cm/s^2 in an object of mass 1gm is called .
   a) 1 kilodyne
   b) 1newton
   c) 1 kilo
   d) 1 dyne

   Ans- 1 dyne

2. Which of the following law of motion are used in launching rocket?
   a) First
   b) Second
   c) Third
   d) equation

   Ans- third

3. The forces of action and reaction have the same and opposite _____.
   a) Direction, unit
   b) Unit, direction
   c) Momentum, direction

d) Inertia, momentum

Ans- unit, direction

4. Momentum =

a) $\frac{\text{velocity}}{\text{Mass}}$

b) Velocity × mass

c) speed × time

d) $\frac{\text{acceleration}}{\text{time}}$

Ans- velocity × mass

5. The displacement that occurs in unit time is _____ .

a) Velocity

b) Displacement

c) Distance

d) Acceleration

Ans- velocity

6. _____ is the relation between displacement and time.

a) $v = u+at$

b) $v^2 = u^2 + 2as$

c) $v = u + 2as$

d) $s = ut + \frac{1}{2} at^2$

Ans- $s = ut + \frac{1}{2} at^2$

Q. 32 An object continues to remain at rest or in a state of uniform motion along a straight line unless an ____ acts on it.

a) Internal unbalanced force

b) Internal balanced force

c) External unbalanced force

d) External balanced force

Ans.- External unbalanced force

Q. 33 Sharayu is running an a circular track. she returning to her original position. what is her average speed and velocity?

Solution –

Total distance travelled = 600 m,

Total displacement = 0, as she returns to her original position.

Total time taken = 25s.

Average speed = ?

Average velocity= ?

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

$$= \frac{600}{25} = 24 m/s.$$

$$\text{Average velocity} = \frac{\text{Total displacement}}{\text{Total time taken}}$$

$$= \frac{0}{25}$$

$$= 0\, m/s.$$

Sharayu run at an average speed of 24 m/s and her velocity 0 m/s .

Q. 34 A car is travelling at a speed of 90 km/hr. The brakes are applied so as to produce a uniform acceleration of -0.5 m/s^2. Find how far the car goes before. it is brught to rest.

Ans.- Initial velocity (u) of car = 90 km/hr

$$= \frac{90 \times 1000}{60 \times 60}$$

$= 25\ m/s$. u = $25\ m/s$.

Find the distance covered by car,

According to third kinematic equation,

$V^2 - u^2 = 2as.$

$o - u^2 = 2as.$

$-(25)^2 = 2\ (-0.5)\ (s)$

$-625 = -1 \times 5$

$S = \frac{-625}{-1}$ s = 625m.

The car travels a distance of 625m. before it comes to rest.

Q.35 A body of mass 100 kg moves with avelocity of $20 m/s$. Find the momentum.

Ans.- 501^n – Mass (m) = 100 kg.

Velocity (v) = $20\ m/s$

Momentum = mass × velocity

= 100 × 20

= $2000\ m/s$.

Momentum of body = $2000\ m/s$

Q. 36 An object starts from rest and moves with uniform acceleration of $4\ m/s^2$ How much time will be required to cover a distance of 128 m?

Ans-

Initial velocity (u) = 0 m/s .

Acceleration (a) = 4 m/s^2

Distance (s) = 128 m.

Time (t) = ?

$$S = ut + \frac{1}{2}at^2$$

By putting the values we get,

$$128 = o \times t + \frac{1}{2} \times 4 \times t^2$$

$$128 = 2t^2$$

$$\frac{128}{2} = t^2$$

$$64 = t^2$$

$$t = 8 \text{ s.}$$

The object takes 8s to cover distance of 128 m.

Q. 37 Give examples of uniform circular motion

Ans- a) Motion of earth around the sun

b) Motion of the moon around the earth

Q.38 We can easily walk on a concrete road, than on sand.

Ans- The reaction force exerted by concrete road is more than sand, as sand is not rigid body. Hence we can easily walk on a concrete road, than on sand.

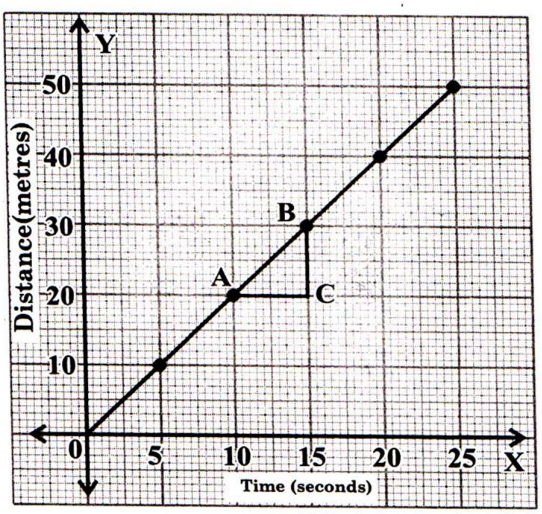
Q. 39 observe the following graphs for the motion of an object and answer the questions-

a) What do graph (1) and graph (2) represent?

b) Which graph represents uniform motion and non-uniform motion?

c) AC is drawn parallel to x-axis and BC is drawn parallel to Y-axis what does $\frac{BC}{AC}$ represent?

(1)



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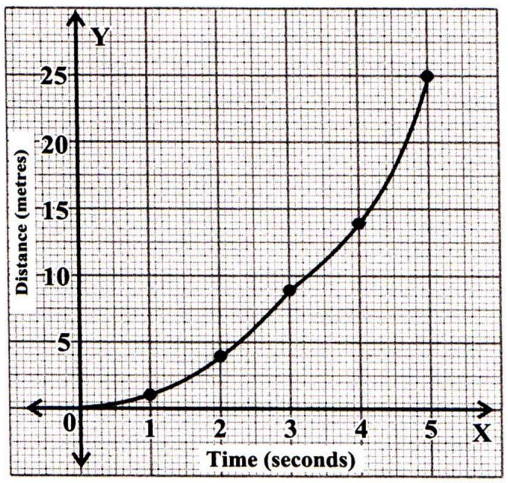

Ans.-

1) The graphs represent the distance travelled by an object with respect to time.

ii) Graph (1) represents uniform motion.

There is linear relationship between distance and time. Since the graph is straight line.

Graph (2) represents non – uniform motion, since there is no linear relationship between distance and time.

3) $\frac{QR}{PR}$ represents the speed of the object as it moves from position A to position B.

4) The following graph represent the velocity of an object with respect to time. Observe the graphs and answer the following-

a) Which graphs of the following represent an object with constant velocity, uniform and non – uniform acceleration?
Ans- We can see that line is parallel to x- axis in graph 1, so it has constant velocity

b) What does the area of rectangle PQSR represent in figure 1?
Ans- Area of rectangle PQRS represents the distance travelled. by the object in 2 secs, 2^{nd} and 4^{th} second.

c) What do heights PR and RS represent in figure 1&2?
Ans- PR and RS represent the velocities of the object after 2 secs and 4 secs in figure 1, after 10 secs and 20 secs in figure2.

d) Is the values for the areas same between two intervals of time in figure (2)?
Ans- The values of areas between any two intervals of time will always be different.

Q.40 Define Scalars-
Ans.- Physical quantities that are described by their magnitude alone are called scalars.

Q. 41 Write a note on-
i) Principle of conservation of momentum

ii) Give two examples of principle of conservation of linear momentum.

Ans. i) The principle of conservation of momentum, is-The total momentum before collision of both the bodies is equal to total momentum, after collision.

Let us consider two objects P and Q. Now, mass of P = m_1, initial velocity of P=u_1, Final velocity of P =v_1, force acting on P due to Q = F_1. Now, mass of Q = m_2, initial velocity of Q = u_2, final velocity of Q = v_2, and force acting on Q due to P = F_2.

When P and Q collide, a force F_1 due to body Q acts on object P and object P accelerates. Newton's third law of motion states object P exerts an equal and opposite force on object P . $F_2 = -F_1$, Because forces have opposite directions.

Now $m_2a_2 = -m_1a_1$

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

$m_2(v_2-u_2) = -m_1(v_1-u_1)$

$m_2 v_2 - m_2u_2 = - m_1 v_1 + m_1u_1$

Hence final momentum = Initial momentum.

The Total momentum in a collision is always conserved.

ii) Examples – 1) When a person jumps from a boat, the boat get pushed away.

2) A hammer rebounds after hitting a nail into wall.

Q. 42 Differentiate between speed and velocity.

Ans.-

Speed	velocity
1) Speed is a scalar quantity. 2) Speed is the distance travelled by an object in unit time. 3) Speed = $\frac{distance}{time}$ 4) Speed is always positive or zero. It can be never negative.	1) Velocity is a rector quantity 2) Velocity is the distance travelled by an object in a given direction in a unit time. 3) Velocity = $\frac{\text{displacement}}{\text{time}}$ 4) Velocity may be positive, zero or also negative.

Q. 43 A car starts moving from rest and gets velocity of 90 km/hr after 5 mins. If the engine exerts a force of 540 N, then find out the mass of the bus.

Ans- Initial velocity of the car (u) = 0

Final velocity (v) = $90 km/hr$

$= \frac{90 \times 1000}{60 \times 60}$

$= 25\ m/s.$

Force (F) = 540 N

Time (t) = 5×60s = 300s.

We know that, F = m.a

F = $\frac{m(v-u)}{t}$ (a = $\frac{v-u}{t}$)

We get, 540 = $\frac{m(25-0)}{300}$

25 m = 540×300

$$m = \frac{540 \times 300}{25}$$

m = 6480

Mass of the car is 6480 kg.

Q. 44 What are the types of inertia ?

Ans.- Types of inertia are –

1) Inertia of rest
2) Inertia of motion
3) Inertia of direction.

Q. 45 Obtain the relation between newton and the dyne.

Ans- Force = mass ×acceleration

1 newton = 1kg ×1 $m/s2$

= 1039 × 102 $cm/s2$

= 105 $9cm/s2$

1dyne = 19 × 1$cm/s2$ = 1$g\ cm/s2$

1 newton (N) = 105 dynes.

Q. 46 An object of mass 20kg moves . with a velocity of 10 m/s Find its momentum.

Ans.- Given m = 20 kg, v = 10m/s , P= ?

Formula P = m × v

P = 20 ×10

= 200 kg m/s

The momentum of the body = 200 kg m/s .

Q. 47 Explain the different ways for changing the velocity.

Ans – Velocity is related to speed and direction, so using these terms velocity can be changed

i) Changing speed and keeping direction constant.

ii) Changing direction and keeping speed constant.

iii) Changing both speed and direction of motion.

Q. 48 Differentiate – Uniform motion and non-uniform motion.

Ans.-

Uniform motion	Non-uniform motion
1) A body is said to have uniform motion when it covers equal distances in very small equal intervals of time. 2) In this case, the speed of the body is constant.	1) A body is said to have non uniform motion when it covers unequal distances in equal intervals of time. 2) In this case, the speed of the body is not constant.

Q. 49 What is uniform speed?

Ans – When an object covers equal distance in equal intervals of time its motion, the object has uniform speed.

Q. 50 What is zero acceleration?

Ans – If the velocity of a body or an object does not change with time, it has zero acceleration.