PHYSICS CLASS-7

CHAPTER- 2: MOTION

SUMMARY

- An object is said to be at rest, if it does not change its position with respect to the stationary surroundings, with the passage of time.
- An object is said to be at motion, if it changes its position with respect to the stationary surroundings, with the passage of time.
- The rest and motion are two relative terms. An object can be in motion with respect to an object and at rest with respect to another object at the same time.
- A point or a fixed position with respect to which the motion of a body is studied is called the reference point or the origin.
- To describe the motion of an object, three things are needed to be kept in mind: (i) the distance of the body from a reference point, which is origin of the motion of the body, (ii) the direction of motion of the motion, (iii) the time of motion.
- Motion is mainly classified into FOUR types: (i) Translatory motion, (ii) Rotatory motion, (iii) Oscillatory motion and (iv) Vibratory motion.
- A translatory motion is a motion in which all the parts of a body move through the same distance in the same interval of time.
- The translatory motion is further divided into two types: (i) Rectilinear motion, (ii) Curvilinear motion.
- Rectilinear motion is the motion of an object in straight line. Example: a car moving on a straight road, motion of carom men on carom board, etc.
- Curvilinear motion is the motion of an object along a curved path. Example: a stone thrown into the air and at an angle with the ground, a javelin thrown in the air, etc.
- A motion is said to be rotatory if an object moves in a circular path around a fixed axis without changing its position. Example: motion of a potter's wheel, motion of an electric fan, etc.
- Rotatory motion is different from curvilinear motion.
- Oscillatory motion is the back and forth motion which takes place about a mean position. Example: motion of a swing, motion of a simple pendulum, etc.
- Vibratory motion is a motion in which a part of a body undergoes oscillatory motion and remaining body stays at rest. Example: motion of the strings of a guitar, violin, etc.
- A motion is said to be periodic if it repeats itself after fixed interval of time. Example: motion of the moon around the earth, beating of our heart, motion of the needle of a sewing machine.

- A periodic motion need not be oscillatory, but an oscillatory motion is always periodic.
- An ideal simple pendulum is a heavy point mass suspended by a weightless, inextensible and a perfectly flexible string from a rigid support. A small heavy brass sphere called bob, is suspended by a long fine thread from a rigid support.
- A motion is said to be non-periodic when it repeats itself at non-regular intervals of time. Example: motion of a finger while typing on a keyboard, motion of a car on driving on a busy road, etc.
- Combination motion are the types of motion which are combination of any two types of the main four types of motion. Example: motion of a ball on the ground has both rectilinear as well as rotatory, an electric drill has both translatory and rotatory, etc.
- Random (or Brownian) motion is a chaotic, haphazard movement of atoms and molecules. Random motion is a quality of liquid and especially gas molecules as described in kinetic theory.
- If an object covers equal distances in equal interval of time, it is said to be in uniform motion. Example: hour hand of a clock, motion of a fan, a ship steaming on a straight course at steady speed.
- If a body is involved in rectilinear motion and the motion is uniform, then the speed of the body is constant.
- If an object covers unequal distances in equal intervals of time, it is said to be in non-uniform motion. Example: a horse racing in a race, a bouncing ball, a train coming to the terminal point, etc.
- If a body involved in rectilinear motion, and if the motion is non-uniform, then the speed of the body is not constant.
- Most of the motions taking place around us are non-uniform motions.
- Distance is the actual path followed by a body between the points between which it moves.
- Speed is the ratio of the distance travelled by a body to the time taken to do so.
- Speed = $\frac{Distance}{Time}$ or, S = $\frac{D}{T}$
- S.I. unit of speed is metre per second (m/s). The other unit is kilometre per hour(km/h).
- 1 km/h = $\frac{5}{18}$ m/s
- Average speed = $\frac{Total\ distance}{Total\ time}$
- If a car travels at a speed S_1 km/h on a trip and at a speed S_2 km/h on a return trip, then the average speed for the entire trip is

$$\text{Average speed} = \frac{2\,S_1\,S_2}{(S_1 + S_2)}$$

- Weight is the measure of the force of gravity on a body.
- Weight can also be described as the force with which a body is attracted towards the Earth or another celestial body.
- Weight is equal to the product of the object's mass and the acceleration.

  Weight = mass * acceleration due to gravity

  Therefore, $W = mg$
- The weight of a body changes according to the gravitational pull it is experiencing. Since acceleration due to gravity varies from place to place, therefore weight is not same at all places. In contrary, mass of any substance remains constant irrespective of its position.
- A given body will have the same mass on the earth and on the moon, but its weight on the moon will be only 16% of the weight as measured on the earth.
- Weight is measured in two systems: (i) Absolute and (ii) Gravitational.
- In S.I. and gravitational system, weight is measured in kilogram force (kgf) and in C.G.S. system, it is measured in gram force (gf).
- One-kilogram force is the force with which the earth attracts a mass of 1 kg.
- In S.I. and absolute system, weight is Newton (N) and in CGS unit is dyne (dyn).
- Weight is measured with the help of a spring balance or digital balance.

WORKSHEET

A. State whether the statement is true or false.

1. A car moving on a road is in a state of rest.
2. The motion of a ceiling fan is a rotatory motion.
3. The unit of speed is newton.
4. The motion of earth around the Sun is non-periodic motion.
5. Displacement is a scalar quantity.
6. Velocity is the distance travelled by a moving body per unit time.
7. A motion which repeats itself after a fixed interval of time is called periodic motion.
8. A runner, running along a circular track at a constant speed has a uniform velocity.

B. Choose the correct option:

1. A bicycle moving on a straight road is an example of a
   a) Vibratory motion,
   b) Periodic motion,
   c) Rectilinear motion,
   d) None of these

2. The kind of motion a pendulum is
   a) Random motion,
   b) Oscillatory motion,
   c) Rectilinear motion,
   d) Vibratory motion

3. A person driving a car is in a state of rest with respect to the
   a) Car engine,
   b) Person on the ground,
   c) Trees, lamp posts, etc. on the road,
   d) Person on the ground

4. A school bag kept on a desk is an example of a
   a) Body in motion,
   b) Body at rest,
   c) Body at rest and in motion,
   d) None of these

5. The quantity which tells the distance of a body travels in a certain time is called
   a) Speed
   b) Displacement
   c) Acceleration
   d) Velocity

6. An example of curvilinear motion is:
   a) The motion of a pendulum,
   b) A potter's wheel,
   c) Throwing of a javelin,
   d) A coconut falling from a tree

7. Motion is of
   a) Three types,
   b) Four types,
   c) Two types
   d) Five types

8. Translatory motion is of
   a) Three types,
   b) Four types,
   c) One type,
   d) Two types

C. Fill in the blanks:

1. A car moving on a road is in a state of _____.
2. Motion of the earth around the Sun is an example of _____ motion.
3. A spinning top has _____ motion.
4. The strings of a guitar have _____ motion.
5. The actual path covered by an object is called _____.
6. When a body completes one revolution, the displacement of the body is _____.
7. The rate of change of motion in a specific direction is called _____.
8. Motion of an electric drill is a combination of _____ motions.

D. Match the following:

Column A	Column B
1. A book on the table	(a) Newton
2. Speed	(b) State of rest
3. Distance	(c) m/s
4. Weight	(d) motion
5. Moving car	(e) Simple Pendulum
6. Vibratory	(f) A basketball thrown into the basket
7. Curvilinear	(g) Tabla
8. Oscillatory	(h) metre

E. Choose the odd one out:

1. Strings of guitar, drum, table, violin, javelin thrown in the air.
2. Rotatory motion, curvilinear motion, translatory motion, rectilinear motion.

F. Give one-word answer:

1. A state in which a body does not change its position with respect to its surroundings.
2. A state in which a body changes its position with respect to the surroundings.
3. A motion in which all the parts of a body move along a straight line.
4. A motion in which an object moves to and fro about a fixed point.
5. A motion in which all the parts of a body move through the same distance in same interval of time.
6. The amount of matter contained in a body.
7. A motion which repeats itself after regular intervals of time.
8. The measure of force of gravity on a body.

G. Define:

1. Distance
2. Motion
3. Speed
4. Velocity
5. Uniform motion
6. Non-uniform motion
7. Mass
8. Weight

H. Short Answer Type Questions:

1. A drilling machine shows a combination of motions. Explain.
2. Displacement can be zero but distance cannot be zero. Explain.
3. Give reason: 'revolution of Earth around the Sun is a periodic motion.'
4. What is uniform motion? Explain with the help of an example.
5. What is translatory motion? Give an example.
6. What is the difference between oscillatory motion and vibratory motion?

I. Long Answered Type Questions:

1. Why rest and motion are relative terms?
2. Difference between uniform motion and non-uniform motion with the help of an example.
3. What are the factors need to keep in mind while describing motion?
4. Identify the types of motion in the following:
   i) A car moving in a straight road,
   ii) Motion of the string of guitar,
   iii) A basketball thrown towards a basket,
   iv) Motion of a simple pendulum,
   v) Spinning top,
   vi) Swing.
5. Distinguish between mass and weight.
6. Define the term motion. How many different types of motion are there? Give an example of each.
7. An oscillatory motion is always periodic, but a periodic motion is not always oscillatory. Explain with an example.
8. A car moves with a speed of 40 km/h for 15 minutes and then with a speed of 60 km/h for the next 15 minutes. Find the total distance covered.
9. A girl leaves school at 3:00 pm and starts walking towards her home. Her house is 12 km away from the school. She reaches home at 3:30 pm. What is her average speed?
