WORKSHEET 1

CHAPTER 2 – MOTION IN ONE DIMENSION

A. Tick (✓) the correct option.

1. Which one of the following is a vector quantity?
   a. Speed b. Displacement c. Distance d. Position
2. Which one of the following is a unit of speed?
   a. $m\ s^{-1}$ b. km c. $m\ s^{-2}$ d. m-s
3. An object is moving in a circular path of radius *r*. The displacement after half a circle would be
   a. $2\pi r$. b. $2r$. c. $4\pi r$. d. zero.
4. A car from rest accelerates uniformly to achieve a speed of 20 km/h in 30 minutes. The distance travelled by the car in this time interval will be
   a. 300 km. b. 60 km. c. 5 km. d. 15 km.
5. The velocity–time graph of a body in motion is a straight line inclined to the time axis. The correct statement is
   a. Acceleration is uniform. b. Velocity is uniform.
   c. Both acceleration and velocity are uniform. d. none of these.

B. Fill in the blanks.

1. An ________________ is used to measure the distance travelled by an automobile.
2. Speed is a ________________ quantity but velocity is a ________________ quantity.
3. If an object is moving with uniform ________________, then the acceleration is zero.
4. ________________ can be positive or zero.
5. Motion of a freely falling body is an example of ________________ motion.

C. State whether the following statements are true or false.

1. The velocity of a body is defined as the distance travelled by it per unit time.
2. When the velocity of a body decreases with time, its acceleration is negative.
3. The SI unit of acceleration is metre per second.
4. The geometrical relationship between the distance travelled by a body and the time taken is called the distance–time graph.
5. The sun is at absolute rest.

D. Match the following.

1.	Energy	$m\ s^{-2}$
2.	Momentum	$5\ m\ s^{-1}$
3.	18 km/h is equal to	36 km/h
4.	$10\ m\ s^{-1}$ is equal to	vector
5.	Retardation	scalar

Name: .... Teacher's signature: ....

Class: ....IX.................. Date: ....

E. Answer the following questions.

Very short answer questions

1. When is the magnitude of displacement equal to the distance?
2. What does the slope of velocity–time graph represent?

Short answer questions

1. A train moving with a velocity of 20 m/s is brought to rest by applying brakes in 5 s. Calculate its retardation.
2. What is the numerical ratio of average velocity to average speed of an object when it is moving along a straight path?

Long answer questions

1. Derive the equation: $s = ut + \frac{1}{2}at^2$ using a speed–time graph.
2. What is velocity–time graph? Write briefly about any three types of it.

ANSWERS

WORKSHEET 1

A. Tick (✓) the correct option.

1. b 2. a 3. b 4. c 5. a

B. Fill in the blanks.

1. odometer
2. scalar, vector
3. velocity
4. Speed
5. Uniformly accelerated

C. State whether the following statements are true or false.

1. F 2. T 3. F 4. T 5. F

D. Match the following.

1. Energy	scalar
2. Momentum	vector
3. 18 km/h is equal to	5 m s^{-1}
4. 10 m s^{-1} is equal to	36 km/h
5. Retardation	m s^{-2}

E. Answer the following questions.

Very short answer questions

1. When the motion is in a fixed direction.
2. Acceleration.

Short answer questions

1. Given:

   Initial velocity of train (u) = 20 m/s

   Final velocity of train (v) = 0 m/s

   Time = 5 s

   Now acceleration = $\frac{v-u}{t}$

   $$= \frac{0\text{ m/s} - 20\text{ m/s}}{5\text{ s}} = -4\text{ m s}^{-2}\text{ (retardation)}$$

2. When an object is moving along a straight path in a given direction, then the magnitude of average velocity is equal to its average speed. So, the numerical ratio of average velocity to average speed of the given object is equal to 1.

Long answer questions

1. To derive $S = ut + \frac{1}{2}at^2$ by graphical method

Suppose a body is moving under uniform acceleration. It travels a distance S in time t. The distance travelled by the body is given by the area under the velocity–time graph AB which is equal to the area of trapezium OABC (Fig). Thus,

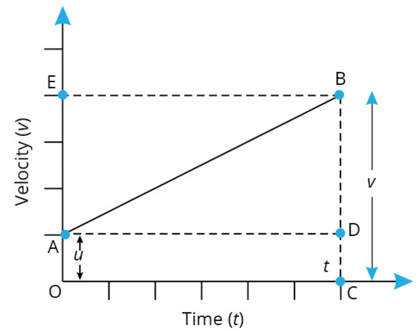
Distance travelled,

$$S = \left[\text{Area of trapezium OABC}\right.$$

$$S = \left[\text{Area of } \Delta\text{ABD} + \text{Area of rectangle OADC}\right.$$

$$S = \left(\frac{1}{2} \times \text{base} \times \text{height}\right) + (\text{length} \times \text{breadth})$$

$$S = \left(\frac{1}{2} \times \text{AD} \times \text{BD}\right) + (\text{OC} \times \text{OA}) \quad \ldots (1)$$



Velocity–time graph to derive the equation of motion

From the figure,

$$\text{AD} = \text{OC} = t$$
$$\text{BD} = (\text{BC} - \text{DC})$$
$$= (v - u)$$
$$= (u + at - u)$$
$$= at \quad [\text{Since } v = u + at]$$
$$\text{OA} = u$$

Substituting these values in equation (1), we get

$$S = \left(\frac{1}{2} \times t \times at\right) + (t \times u)$$

$$S = \left(\frac{1}{2}at^2\right) + (ut)$$

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

This is the second equation of motion.

2. The geometrical relationship between the velocity of a body and the time is called the velocity–time graph.

The velocity–time graph for a body can be drawn by plotting the velocity of the body on the y-axis and the time on the x-axis.

Since acceleration is the ratio of the change of velocity and the time taken, for this change, therefore the slope of the velocity–time graph gives the acceleration of the body, i.e. acceleration of the body at a point of time can be calculated from the velocity– time graph.

For a straight-line motion, different types of velocity–time graphs are possible depending upon the nature of motion. These are as follows:

a. Velocity–time graph for a body in motion with uniform (constant) velocity.
   - The velocity–time graph for a body moving with uniform (constant) velocity is a straight line parallel to the time axis (x-axis)
   - The slope of the straight line is zero. Therefore, the slope of a velocity–time graph is also zero.
   - The slope of the velocity–time graph gives the acceleration of the body. Therefore, the acceleration of a body moving with constant (uniform) velocity is zero.

b. Velocity–time graph for a body in motion with uniform retardation. Velocity–time graph for a body whose velocity decreases uniformly with time is a straight line sloping downwards. The slope of the straight line is negative.

c. Velocity–time graph for a body when its velocity. increases non-uniformly with time The velocity–time graph in this case is a curve moving upwards. The slope of the curve is positive and increases with time. The acceleration of the body increases with time, i.e. body is under non-uniform acceleration.