

CHAPTER - 3 [MEASUREMENT OF TIME AND MOTION]

3. What is the shape of distance-time graph for a body moving with uniform motion.

A straight line inclined to the time axis.

8. Convert 54 km/h into m/s.

calculation:

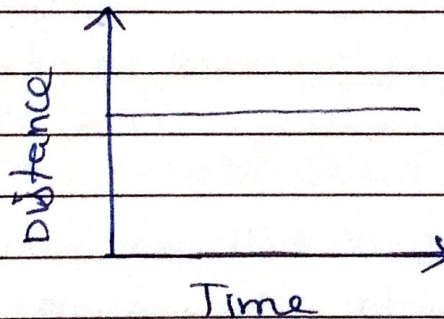
$$\frac{54 \times 5}{18} = 15 \text{ m s}^{-1}$$

9. What do you mean by zero speed?

Zero speed means the object is completely stationary (at rest).

11. With the help of distance-time graph show that the object is stationary.

A horizontal straight line parallel to the time axis.



SHORT ANSWER TYPE:

Answer only)

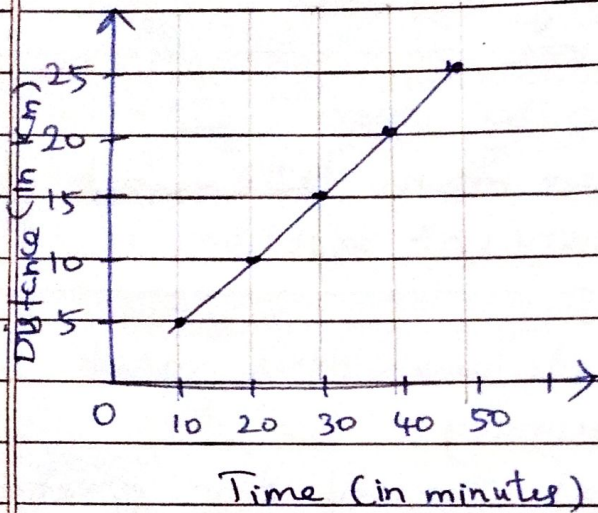
1. Mean position: The central, stable position where the bob of the pendulum rests when it is not moving or experiencing any external force.

Oscillation: One complete back and forth movement of the pendulum bob, starting from its mean position, moving to one extreme,

and returning back to the mean position.

Time period: The total time taken by the pendulum bob to complete one full oscillation

2. Since equal distances are covered in equal intervals of time, this represents uniform motion.



3.

Quartz watches are used nowadays to measure time accurately.

Explanation: These watches contain an electronic oscillator by a tiny quartz crystal. When an electronic current passes through the quartz crystal, it vibrates at a highly precise and consistent frequency [32,768 times per second]. An electronic circuit counts these vibrations and uses them to generate precise regular pulses to drive the watch hands or digital display.

5. calculation:

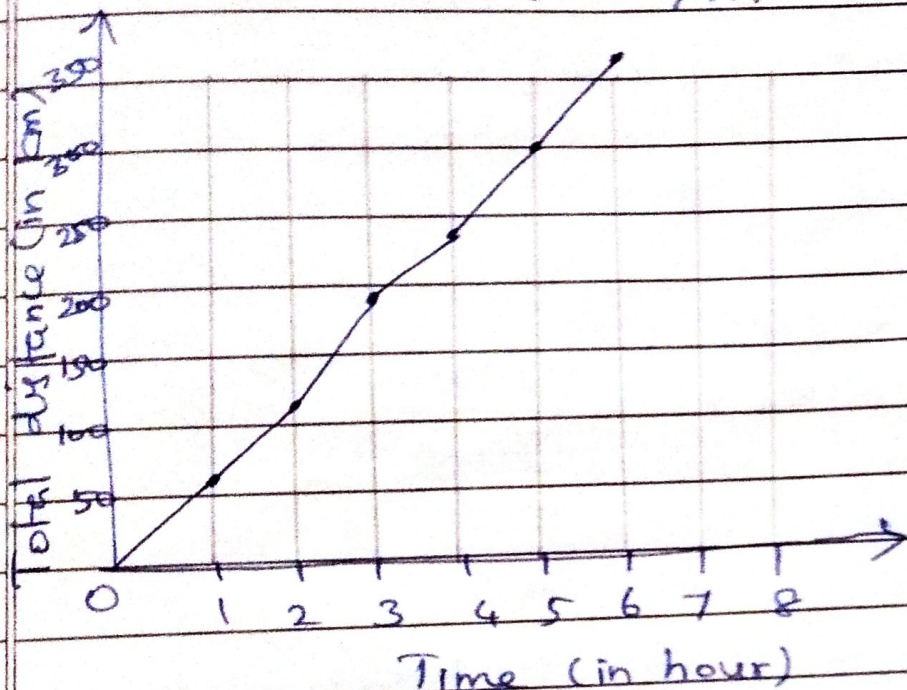
$$\begin{aligned} \text{Total distance} &= 60 + 55 + 70 + 50 + 65 + 60 \\ &= 360 \text{ km.} \end{aligned}$$

$$\text{Total time} = 1+1+1+1+1+1$$

$$= 6 \text{ hours}$$

$$\text{Average speed} = \frac{360}{6}$$

$$= 60 \text{ km/h.}$$



- i) It cannot measure time at night or when the sky is heavily overcast because it requires direct sunlight to cast a shadow.
- ii) Its accuracy is affected by seasonal changes because the sun's path across the sky changes throughout the year.
- iii) It cannot be carried around ~~portably~~ as a personal timepiece.

Galileo Galilei discovered that a pendulum takes exactly the same amount of time to complete one full swing (oscillation) regardless of how wide it swings. This phenomenon is known as isochronism. This reliable, periodic timekeeping principle directly inspired the invention of the

pendulum clock, which significantly enhanced time measurement precision.

9. Given:

$$\text{Distance (D)} = 270 \text{ km}$$

$$\text{Time (T)} = 4\frac{1}{2} \text{ hours or}$$

$$= 4.5 \text{ hours}$$

$$\text{Speed} = ?$$

Solution:

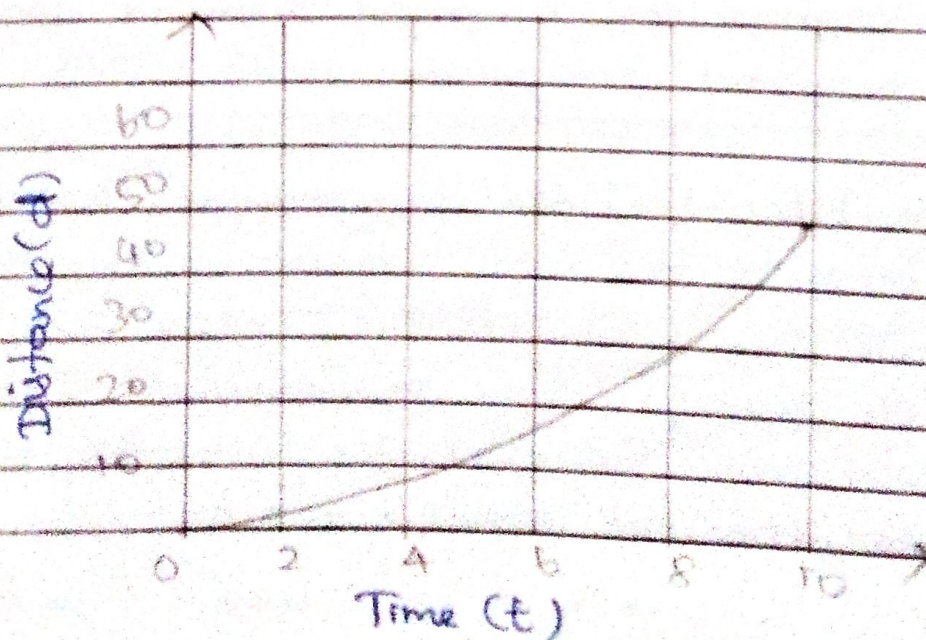
$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{270}{4.5}$$

$$= 60 \text{ km/h.}$$

10. In non-uniform motion, an object covers unequal distances in equal intervals of time.

Consequently, its distance-time graph is a curved line, indicating that the speed changes continuously.



LONG ANSWER TYPE

1. Sundial: A device that tells the time of day by the apparent position of the sun in the sky. It consists of a flat plate (the dial) and a gnomon, which casts a shadow onto the dial marked with hour lines. As the sun moves, the shadow moves, indicating the time. [Works only during daytime when it is sunny]

Water clock: A timekeeper that measures time by the regulated flow of water into or out of a vessel. The changing water level against marked lines indicates elapsed time.

Sand clock: Consists of two glass bulbs connected vertically by a narrow neck that allows a regulated trickle of sand from the upper bulb to the lower one. The time taken for all sand to pass through is a fixed duration. [Example: one hour].

3. When plotting data on a graph, choosing a proper scale is necessary so that the entire data fits well and is easy to read.

Example:

Suppose you want to plot a maximum distance of 50 km on a graph paper that has 10 cm of available space.

Method:

1) Divide the maximum value by the available length: $\frac{50 \text{ km}}{10 \text{ cm}} = 5 \text{ km/cm}$

ii) Therefore, a suitable scale on the axis, would be : $1 \text{ cm} = 5 \text{ km}$. This allows the entire dataset to utilize the graph space clearly.

4. Some objects exhibit two or more types of motion at the exact same time.

i) A rolling bowling ball or bicycle wheel. It undergoes rotational motion about its own axis while simultaneously undergoing linear (translational) motion as it moves forward along the ground.

ii) The Earth: It undergoes rotational motion around its own axis [causing day and night] while at the same time performing revolutionary [circular/periodic] motion around the sun.

5. To answer the questions accurately, let's first calculate the time elapsed, distance covered and speed for each interval.

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

	Time interval	Δt (minutes)	Δt (hours)	Δd (km)	speed (km/h)
(i)	10:05 - 10:25 am	20 min	$\frac{20}{60} = \frac{1}{3} \text{ h}$	5-0 = 5	$\frac{5}{1/3} = 15$
ii)	10:25 - 10:40 am	15 min	$\frac{15}{60} = \frac{1}{4} \text{ h}$	12-5 = 7	$\frac{7}{1/4} = 28$

$$\frac{95}{60} \text{ hours} = \frac{19}{12} \text{ hours}$$

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

$$= \frac{42}{(19/12)}$$

$$= \frac{42 \times 12}{19}$$

$$= \frac{504}{19}$$

$$= 26.53 \text{ km/h.}$$

d) The speed between 11:25 am and 11:40 am

$$\text{distance : } 42 \text{ km} - 38 \text{ km} = 4 \text{ km}$$

$$\text{time : } 15 \text{ minutes} = 0.25 \text{ hours (or)}$$

$$\Rightarrow \frac{1}{4} \text{ hours}$$

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{4}{(\frac{1}{4})}$$

$$= 4 \times 4$$

$$= 16 \text{ km/h}$$

e) This happened between the distance marks of 26 km and 28 km.