# MEASUREMENT OF TIME

*The interval between two instances or events is called time.* We measure time in terms of the **mean solar day**. A solar day is the time taken by the earth to complete one rotation about its own axis. The mean of 365 solar days in a year is called the mean solar day.

## Units of time

The S.I. unit of time is second. In short form, it is written by the letter **s**.

One second is defined as $\frac{1}{86400}$ part of a mean solar day. *i.e.*,

$$1\ \text{s} = \frac{1}{86400} \times \text{one mean solar day.}$$

If you look at the pendulum of a wall clock, the pendulum moves from one extreme to the other extreme in one second. Thus,

*One second is the time interval between two consecutive ticks that we hear from a pendulum wall clock.*

> ***Note*** **:** In MKS or metric system, F.P.S. system as well as in CGS system, the unit of time is second (symbol s).

The second is a smaller unit of time.

A bigger unit of time is **minute** (symbol min). **60 second make one minute,** *i.e.*

1 minute = 60 second or 1 min = 60 s

A still bigger unit of time is **hour** (symbol h). **60 minute make one hour** *i.e.*

1 hour = 60 minute or 1 h = 60 min

Thus, 1 h = 60 min = 60 × 60 s = 3600 s

Another bigger unit of time is **day**. 24 hour make one day. One day is the time taken by the earth to rotate once on its own axis. Thus

1 day = 24 hour

= 24 × 60 min = 1440 min

= 24 × 60 × 60 s = 86400 s

A **year** is another bigger unit of time. **365 days make one year**. One year is the time taken by the earth to complete one revolution around the sun, *i.e.*

1 year = 365 days

= 365 × 86400 s

= $3{\cdot}15 \times 10^7$ s

These units of time are summarized below:

1 min = 60 s

1 h = 60 min = 3600 s

1 day = 24 h = 86400 s

1 year = 365 days = $3{\cdot}15 \times 10^7$ s

## Devices for measuring time

We use (1) Pendulum clock and (2) A watch, to find the time in our daily life.

1. **A pendulum clock :** Fig. 2.12 shows a pendulum clock. In it, time is measured by making use of the time taken by its pendulum to complete one oscillation. The pendulum completes one to and fro oscillation in 2 s *i.e.* it moves from one extreme to the other extreme in 1 s and then returns from the other extreme to the first extreme in next 1 s. The circular dial has 12 markings divided in four quadrants. Each marking is further divided in five small divisions, so there are in all 60 small divisions. There are three needles joined to the axle of the gear wheels at the centre of the dial. These needles are named as second's arm, minute's arm and hour's arm. The second's arm moves by one small division in the time interval when the pendulum moves from one extreme to the other extreme (*i.e.* in 1 s). The minute's arm moves by a small division when the second's arm completes one round (*i.e.* in 60 s) and the hour's arm moves by 5 small divisions when the minute's arm completes one round (*i.e.*, 1 h).

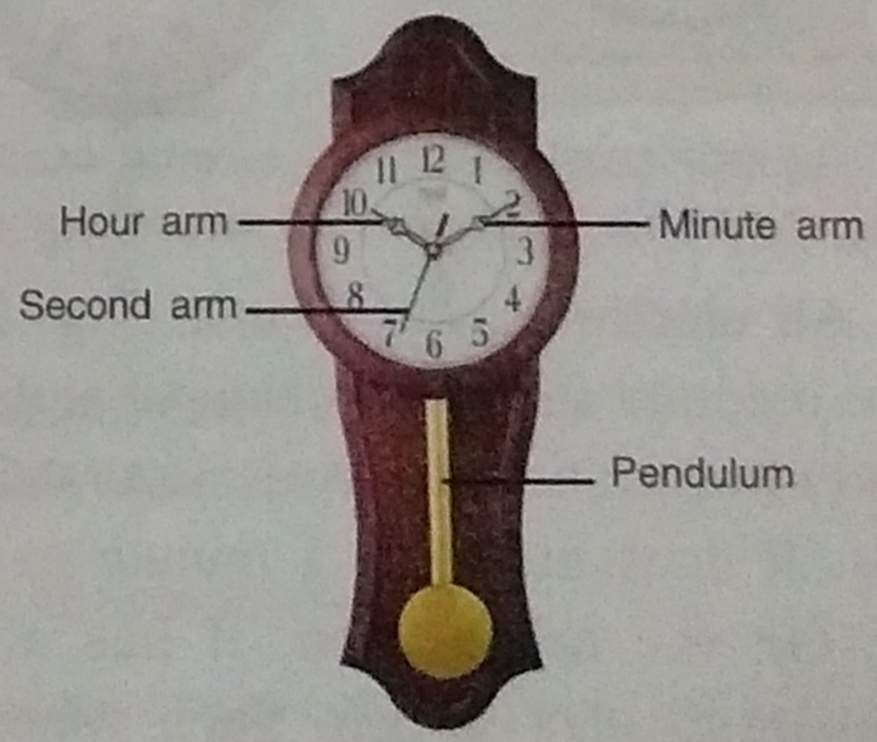


*Fig. 2.12 Pendulum clock*

2. **A watch :** Fig. 2.13 shows a watch. A watch makes use of the gear wheels. These wheels set up the speed of rotation of the second's, minute's and hour's arms. The second's arm is driven by a wound up spring. The dial of a watch is graduated similarly as that of the pendulum clock.

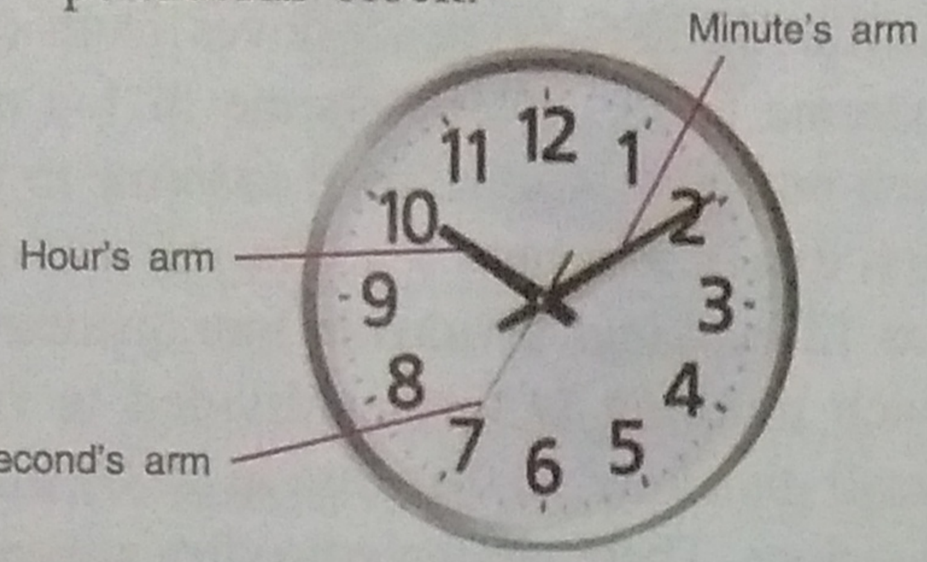


*Fig. 2.13 Watch*

### Measuring devices for a short time interval

The short time interval of an event is measured with the help of a stop clock or a stop watch. Fig. 2.14 shows a stop clock and a stop watch. They have arrangements 'to start', 'to stop' and 'to reset at zero'.

(a) STOP CLOCK (b) STOP WATCH

*Fig. 2.14 Short time interval measuring devices*

An electronic stop watch (Fig. 2.15) is more accurate than a mechanical stop watch. It can measure time intervals accurately up to 0·01s. It does not have a minute or second arm. On the other hand, it has a digital (number) display screen. Such watches are used for measuring the timings of athletic activities such as time taken by atheletes to complete a 100 m race.


*Fig. 2.15 An electronic stop watch*

## MEASUREMENT OF TEMPERATURE

If we touch an object, it appears hot to us if heat passes from the object to our hand while it appears cold if heat passes from our hand to the object. Thus, hotness or coldness of an object depends on the direction of flow of heat. Heat always flows from the high temperature to the low temperature. Thus

> Temperature is the measure of degree of hotness or coldness of an object.

### Units of temperature

The S.I. unit of temperature is **kelvin** (symbol **K**).

Apart from kelvin, the other *two* most commonly used units are :

1. **Degree celsius or degree centigrade (symbol °C) :** It was given by the scientist Andrews Celsius, and
2. **Degree fahrenheit (symbol °F) :** It is named after the scientist Gabriel Daniel Fahrenheit.

These units and their symbols are given below :

| Unit of temperature | Symbol |
|---|---|
| 1. kelvin | K |
| 2. Degree celsius or degree centigrade | °C |
| 3. Degree fahrenheit | °F |

*Note :* (1) The unit kelvin is never written as degree kelvin (or K is not written as °K).

(2) The ice point (*i.e.* freezing point of water), the steam point (*i.e.* the boiling point of water) and the number of degrees in between the ice point and boiling point on the three scales are as follows :

| Scale of temperature | Ice point | Steam point | Number of degrees in between the ice point and steam point |
|---|---|---|---|
| 1. Kelvin | 273 K | 373 K | 100 |
| 2. Celsius | 0°C | 100°C | 100 |
| 3. Fahrenheit | 32°F | 212°F | 180 |

3. One degree on Celsius scale is equal to one degree on Kelvin scale.
4. One degree on Celsius scale is equal to $\frac{9}{5}$ (or 1·8) degree on Fahrenheit scale.
5. There are 100 divisions between the ice point and steam point in the Celsius scale, so it is also called the centigrade scale.

## Device used to measure the temperature of an object

Temperature is measured with a thermometer.

**Description of a thermometer :** Fig. 2.16 shows a laboratory thermometer. It consists of a glass capillary tube with a bulb at one end. The bulb is filled with mercury. The long part of capillary is called the stem. The stem has markings from –10°C to 110°C.

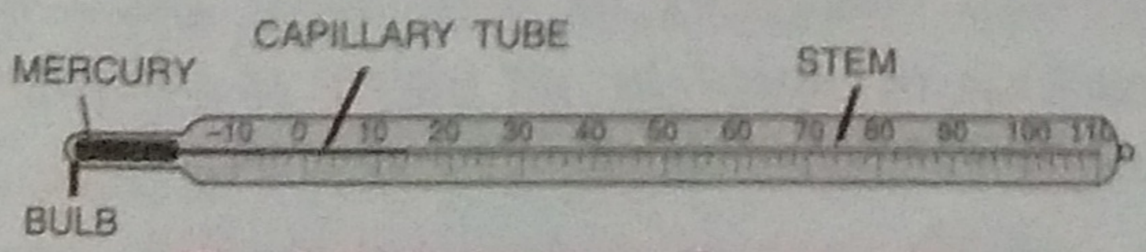


*Fig. 2.16 Laboratory thermometer*

The zero mark is at the level of mercury in the capillary when its bulb is placed in melting ice, while 100 mark is at the level of mercury in the capillary when its bulb is placed in the boiling water. The space between the 0 mark and 100 mark is divided into 100 equal divisions. Each division is called a degree.

## Measuring the temperature of an object using a laboratory thermometer

To measure the temperature of an object with the help of a laboratory thermometer, the bulb of the thermometer is kept in contact with the object. The mercury rises in the capillary. Wait for some time. When the mercury does not rise further and gets stabilised, look at the mark up to which the mercury has risen, keeping your eye in the horizontal line of the level of mercury. Fig. 2.17 shows how to measure the temperature of water. In Fig. 2.17, the temperature of water is 30°C.

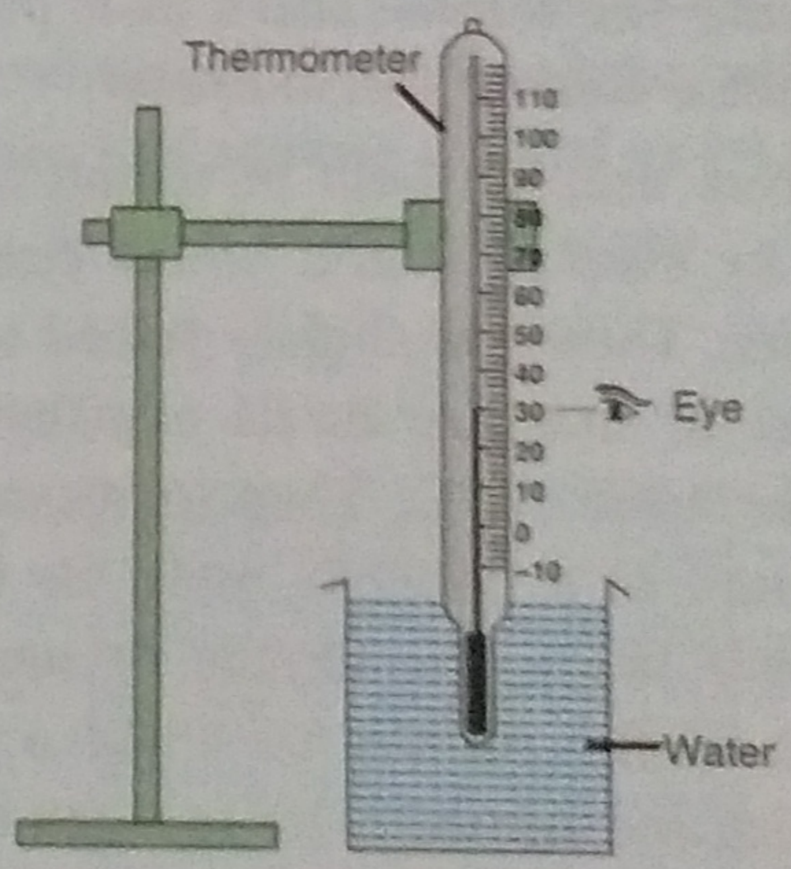


*Fig. 2.17 Measuring the temperature of water*

# Class - 6
## Work Sheet

Q.1 What is time?
Q.2 What is a solar day?
Q.3 What is the S.I unit of time?
Q.4 Write two bigger units of time and how are they related to the S.I unit?
Q.5 1 day = _____ S.
Q.6 Name some devices for measuring time.
Q.7 What is temperature?
Q.8 What is the S.I unit of temperature?
Q.9 Name two most commonly used units of temperature other than Kelvin.
Q.10 Name the instrument used to measure the temperature of an object.