Time & Temperature

Time
There are two types of clocks.

- Analog clock

It has a minute hand, hour hand and also a second hand.

- Digital clock

The digits on the left side show the hours from 1 to 12 and the right side digits show the minutes from 00 to 59.

Units of Time
Here are some units for measuring time.

Seconds	
Minute (min)	1 min = 60 s
Hour (h)	1 h = 60 min
Day (d)	1 day = 24 h

Week	1 week = 7 days
Month	1 month = 28, 29, 30 or 31 days
Year	1 year = 12 months
	= 365 or 366 days (leap year)

Time Using AM and PM
A day is divided into 2 periods of 12 hours each.

1. **AM (Ante Meridian: Before Midday)**
   It is the time between midnight and noon. Rahul took his breakfast at 8:00 a.m.
2. **PM (Post Meridian: After Midday)**
   It is the time between noon and midnight.
   Rahul came from work at 6:00 p.m.
   The railways, airlines and bus timetables generally use the 24-hour clock. Instead of starting again at 1: 00 p.m. after 12 noon, the clock continues as 1300 hours, 1400 hours and so on.
   8:45 a.m. is 0845 hours. 4:45 p.m. is 1645 hours.

Hours, Minutes and Seconds

Most of the clocks have three hands. The long thin hand which moves very fast measures seconds.
A **second** is a very short period of time, say, time taken to smile, to sneeze, etc. It is a smaller unit of time than a minute. When the seconds hand completes its full circle it means 1 minute has passed. So, 1 minute has 60 seconds.

$$1 \text{ min} = 60 \text{ sec}$$

Tips: 12 o'clock, noon time is written as 12 noon and 12 o'clock, midnight is written as 12 midnight. It is wrong to write 12 a.m. or 12 p.m.

Conversion of Units of Time

1. **Conversion of Minutes to Seconds**
   We know that,

   $$1 \text{ min} = 60 \text{ sec}$$

   Look at the following examples:
   1 min = 1 × 60 s = 60 s; 3 min = 3 × 60 s = 180 s ; 10 min = 10 × 60 s = 600 s;
   2 min 10 s = 2 min + 10 s = 2 × 60 s + 10 s = 120 s + 10 s = 130 s

2. **Conversion of Seconds to Minutes**
   We know that,

   $$1 \text{ sec} = \frac{1}{60} \text{ min}$$

   Look at the following examples:
   180 s = (180 ÷ 60) min = 3 min; 1200 s = (1200 ÷ 60) min = 20 min;
   107 s = 60 s + 47 s = 1 min 47 s

Or 107 s = (107 ÷ 60) min = 1 min 47s

```
        1 ← Minutes
6 0 ) 1 0 7
   −   6 0
        4 7 ← Seconds
```

3. **Conversion of Hours to Minutes**
   We know that,

   $$1 \text{ h} = 60 \text{ min}$$

   Look at the following examples:
   3 h = 3 × 60 min = 180 min
   1 h 45 min   = 1 h + 45 min
                     = 1 × 60 min + 45 min
                     = 60 min + 45 min = 105 min

4. **Conversion of Minutes to Hour**
   We know that,

   $$1 \text{ min} = \frac{1}{60} \text{ h}$$

   Look at the following examples:
   360 min = (360 ÷ 60) h = 6 h
   230 min = (230 ÷ 60) h = 3 h 50 min
   230 min = 180 min + 50 min
         = (180 ÷ 60) h + 50 min = 3 h + 50 min = 3 h 50 min

```
          3
6 0 ) 2 3 0
    − 1 8 0
        5 0
```

5. **Conversion of Seconds to Hours, Minutes and Seconds**
   Look at the following examples:
   2105 s = (2105 ÷ 60) min
   = 35 min + 5 s = 35 minutes 5 seconds

```
       3 5
6 0)2 1 0 5
 − 1 8 0 ↓
      3 0 5
    −3 0 0
          5
```

5430 s = (5430 ÷ 60) min
        = 90 min + 30 s
        = 60 min + 30 min + 30 s
        = 1 h 30 min 30 seconds

```
        9 0
6 0)5 4 3 0
 − 5 4 0 ↓
        3 0

      1
6 0)9 0
 − 6 0
    3 0
```

Tips:

- 60 seconds = 1 minute
- 1 second = 1 / 60 minute
- 60 minutes = 1 hour
- 1 minute = 1 / 60 hour

Operations on Measures of Time

1. Addition
Example 1: Add 12 hours 27 minutes and 3 hours 58 minutes

We write the time in hours and minutes in separate columns. Add as you do for ordinary numbers.

$$
\begin{array}{r}
\overset{(1)}{}\;\;1\;2\;\text{hours}\quad2\;7\;\text{minutes}\\
+\qquad\;3\;\text{hours}\quad5\;8\;\text{minutes}\\
\hline
1\;6\;\text{hours}\quad2\;5\;\text{minutes}\\
\end{array}
$$

Thus, 12 hours 27 minutes + 3 hours 58 minutes = **16 hours 25 minutes**.

Think:
27 min + 58 min = 85 min
= 60 min + 25 min
= 1 h + 25 min

Example 2: Add 1 hour 20 minutes 36 seconds and 2 hours 45 minutes 55 seconds.

$$
\begin{array}{r}
\overset{(1)}{}\;1\;\text{hour}\quad\overset{(1)}{2}\;0\;\text{minutes}\;3\;6\;\text{seconds}\\
+\;\;2\;\text{hours}\;4\;5\;\text{minutes}\;5\;5\;\text{seconds}\\
\hline
4\;\text{hours}\quad6\;\text{minutes}\;3\;1\;\text{seconds}\\
\end{array}
$$

Thus, 1 hour 20 minutes 36 seconds + 2 hours 45 minute 55 seconds
= **4 hours 6 minutes 31 seconds.**

Think:
36 s + 55 s = 91s
= 60 s + 31 s
= 1 min 31 s
20 min + 45 min + 1 min = 66 min
= 60 min + 6 min
= 1 h + 6 min
1 h + 2 h + 1 h = 4 h

2. Subtraction
Example 3: Subtract 12 minutes 25 seconds from 35 minutes 12 seconds.

Think:
You cannot subtract 25 s from 12 s, so borrow 1 min from 35 min.
1 min = 60 s; 60 s + 12 s = 72 s;
72 s – 25 s = 47 s.

Example 4: Doon Express took 26 hours 37 minutes 10 seconds in travelling from Dehradun to Lucknow. Due to a techincal fault the train had a total stoppage of 8 hours 49 minutes 55 seconds at different stations. For how much time was the train moving?

To find out the time the train was moving, we need to subtract the stoppage time from the total travelling time.

Thus, the train was moving for
17 hours 47 minutes 15 seconds.

Think:
Borrow 1 min.
60 s + 10 s = 70 s
70 s – 55 s = 15 s
Borrow 1 h.
60 min + 36 min = 96 min
96 min – 49 min = 47 min
25 h – 8 h = 17 h

Example 5: Subtract: 2 hours 40 minutes 50 seconds from 4 hours 25 minutes 31 seconds.

Thus, 4 hours 25 minutes 31 seconds – 2 hours 40 minutes 50 seconds
= 1 hour 44 minutes 41 seconds.

Think:
Borrow 1 min = 60 s from 25 min
You now have 91 s.
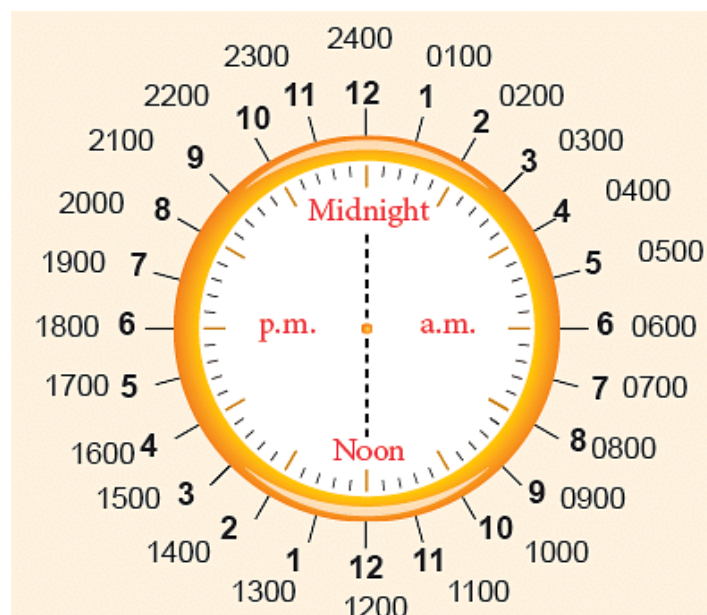91 s – 50 s = 41 s 24 minutes remain in minutes.
Borrow 1 h = 60 minutes from 4 h.
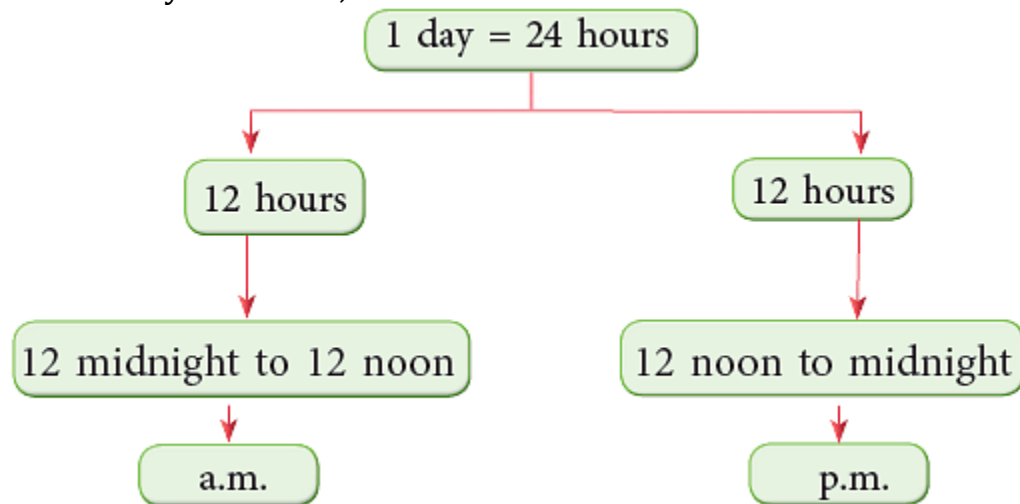You now have 84 minutes.
84 minutes – 40 minutes = 44 minutes

24-Hour Time Notation
You have already studied the 24-hour clock in Class IV. The 24-hour time notation is represented by a '24-hour clock'.

You already know that,

1 day = 24 hours

12 hours — 12 hours

12 midnight to 12 noon — 12 noon to midnight

a.m. — p.m.

Thus, 2:35 a.m. = 0235 hours; 10:30 a.m. = 1030 hours
5:25 p.m. = 1725 hours; 9:15 p.m. = 2115 hours.
Also, we have,

- 12 midnight in 24-hour clock is written as 00:00 or 0000 hours (start of the day).
- 12 noon is written as 12:00.
- 12 midnight (end of the day) is written as 24:00 or 2400 hours.

Elapsed Time
Using the 24-hour time notation and our knowledge of addition and subtraction of time, we can easily find the elapsed time, i.e., the time between two given times or the starting time when the finishing time and duration of activity is given or the finishing time when starting time and duration of activity is given.

Example 6: How long is it from?
(a) 1652 hours to 2143 hours
(b) 2:35 a.m. to 5:30 p.m.
(a) The elapsed time is 2143 hours – 1652 hours.

$$
\begin{array}{r}
\overset{\text{(20)}}{2\,\overset{1}{1}} \text{ hours} \quad \overset{\text{(103)}}{\cancel{4\,3}} \text{ minutes} \\
-\quad 1\,6 \text{ hours} \quad 5\,2 \text{ minutes} \\
\hline
4 \text{ hours} \quad 5\,1 \text{ minutes}
\end{array}
$$
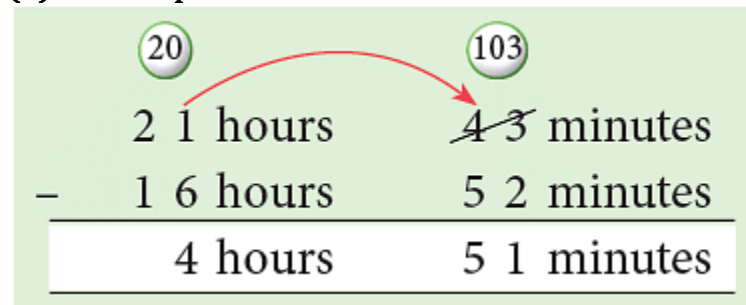
Thus, the elapsed time is **4 hours 51 minutes.**

(b) To find the elapsed time between 2:35 a.m and 5:30 p.m., first convert the time to 24-hour time.
Elapsed time =

```
   (16)              (90)
   1̶7̶ hours          3̶0̶ minutes
 −    2 hours          3 5 minutes
   _____
      1 4 hours          5 5 minutes
```

2 : 35 a.m. = 0235 hours
5 : 30 p.m. = 1730 hours
Thus, the elapsed time is **14 hours 55 minutes.**

Example 7: Using a 24-hour clock, find the time.
(a) 3 hours 10 minutes after 2030 hours
(b) 8 hours 15 minutes before 2:35 p.m.

(a) Add 3 hours 10 minutes to 2030 hours to find the required time.
20 hours 30 minutes + 3 hours 10 minutes
              = **23 hours 40 minutes (11:40 p.m.).**

(b) 2:35 p.m. = 1435 hours = 14 hours 35 minutes
∴ Required time = 14 hours 35 minutes – 8 hours 15 minutes
              = 6 hours 20 minutes
Thus, the required time = 6 hours 20 minutes = **0620 hours (6:20 a.m.).**

Calendar
1. Years, Months and Weeks
By studying the calendar, we know that
7 days = 1 week, 12 months = 1 year
About 52 weeks = 1 year, 4 weeks = 1 month

Tips: 1 month = 1 / 12 year

2. Conversion of Years to Months and Months to Years
1 year = 12 months

5 years = (5 × 12) months = 60 months
3 years 7 months = 3 years + 7 months

$$= (3 \times 12) \text{ months} + 7 \text{ months}$$
$$= 36 \text{ months} + 7 \text{ months} = 43 \text{ months}$$
48 months = (48 ÷ 12) years = 4 years
25 months = 24 months + 1 month = 2 years 1 month

```
            2 ←—Year
      _____
 1 2) 2 5
   −  2 4
      _____
        1 ←—Month
```

Example 8: A child is asked to complete two assignments in 4 weeks. He completed the first assignment in 2 weeks 3 days. How much time is left for him to complete the second assignment?
Remaining Time

```
        ( 3 )  Borrow 1 week  ( 7 )
      4 weeks          0 days
   −  2 weeks          3 days
   _____
      1  week          4 days
```

Thus, the child has **1 week 4 days** left to complete the second assignment.

Think:
0 < 3
Thus, borrow 1 week = 7 days.
7 days – 3 days = 4 days

Example 9: Ananya was 10 years 6 months old when her sister Tanya was born. Her sister is now 27 years 8 months old. How old is Ananya now?
Ananya's present age = 27 years 8 months + 10 years 6 months

```
        ( 1 )
      2 7 years       8 months
   +  1 0 years       6 months
   _____
      3 8 years       2 months
```

Thus, Ananya is presently **38 years 2 months** old.

Think:
8 months + 6 months
= 14 months
= 12 months + 2 months
= 1 year + 2 months

Temperature
Temperature is the measure to describe how hot or cold something is.

We can find out how hot a soup is or how cool a drink is by **measuring its temperature**.

Measuring Temperature
The instrument used for measuring temperature is a **thermometer.** It is a thin tube with a coloured liquid called mercury in it.
Look at the following illustrations:

A thermometer shows the temperature of the soup. It shows how warm the soup is.
The thermometer at the right shows a temperature of 60 degrees.
When the liquid gets hotter, the red liquid expands, so it moves up the thin tube.

Now, the thermometer is put into a cold drink. The temperature shown is 5°.
When the liquid gets cooler, the red liquid contracts, occupies less space, so moves back down the tube.

Unit of Temperature
Temperature in the metric system is measured in **degree Celsius (°C)**.

**Look at the Celsius scale thermometer alongside:**
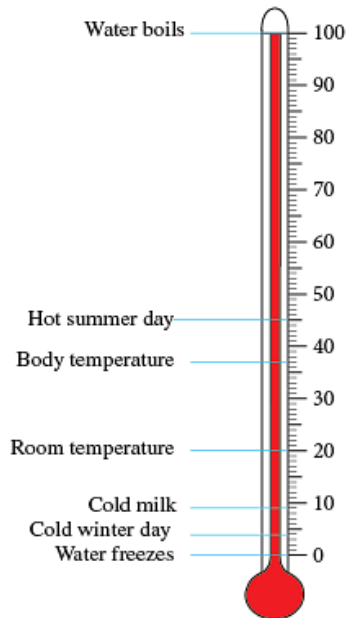
°C Thermometer
Between 0°C and 100°C, this thermometer is marked off in intervals of ten degrees, labelled 10, 20, 30 and so on to 100. The smaller markings show intervals of one degree.

You can get an idea of some other temperatures by looking at the thermometer at the right.

Count from 30 to determine that **normal body temperature is 37°C.**

We call the point at which **water freezes: 0°C** (zero degrees Celsius). We call the point at which **water boils: 100°C.**

Types of Thermometer
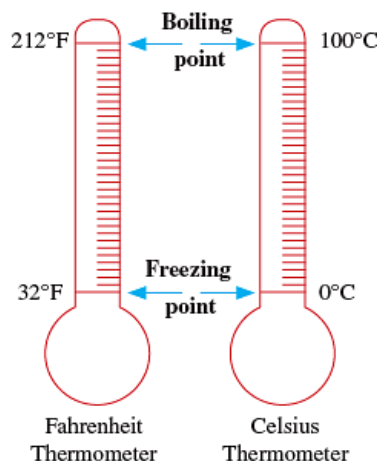
Two standard units of temperature are the **Fahrenheit degree (F)** and the **Celsius degree (C)** (sometimes called centigrade.)
In India, we use the centigrade or the celsius scale. Celsius thermometer was designed by the Swedish astronomer
Celsius Anders (1701-44) and so the word celsius.
In short it is called 'cel'.
Water freezes at 0°C (also written as 0° cel) and boils at 100°C (also written as 100° cel).
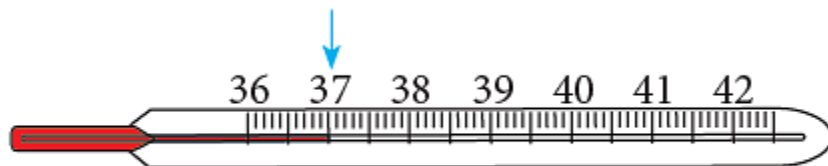In Fahrenheit unit, water freezes at 32°F and boils at 212°F.
The normal temperature of the human body is 37°C or 98.4°F.

How many degrees is it from the freezing point to the boiling point on the Celsius thermometer and on the Fahrenheit thermometer?
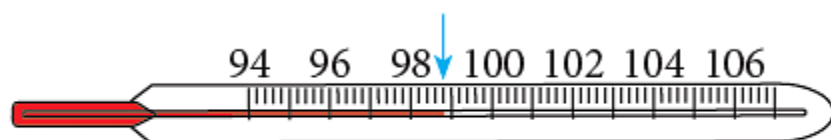
A Clinical Thermometer with Fahrenheit Scale

A Clinical Thermometer with Celsius Scale

The thermometer used by a doctor to measure the temperature of a human body is called a **clinical thermometer.**
Nowadays, thermometers with celsius scale are also used by doctors.
Before using a clinical thermometer, it should always be adjusted by giving jerks so as to bring the level of mercury in the tube much below the degree marked 98° which is approximately the body temperature in normal conditions.

Conversion from One Unit to Another
1. To Change from Fahrenheit to Celsius

| Temperature in °F | Subtract 32 and multiply the result by $\dfrac{5}{9}$. | Temperature in °C |

Example 10: Convert 122°F to °C.
Step 1: Subtract 32. 122 – 32 = 90
Step 2: Multiply the difference by 5 / 9

$$\overset{10}{\cancel{90}} \times \dfrac{5}{\underset{1}{\cancel{9}}} = 50$$

∴ 122°F = 50°C

2. Conversion from Celsius to Fahrenheit.

Multiply by $\dfrac{9}{5}$ and add 32

Temperature in °C → Temperature in °F

Example 11: Convert 80°C to °F.
Step 1: Multiply by 9 / 5

$$\overset{16}{\cancel{80}} \times \dfrac{9}{\underset{1}{\cancel{5}}} = 144$$

Step 2: Add 32. 144 + 32 = 176
∴ 80°C = 176°F.