

Class 6 Science – Chapter 7

Temperature and Its Measurement.

1. Introduction

We often describe objects as **hot** or **cold**.

For example:

- Water kept in the Sun may become hot.
- Water from an earthen pot may feel cooler.
- Ice feels very cold.
- Boiling water is very hot.

We can often sense hotness or coldness by touching an object. However, **our sense of touch cannot always tell us the temperature correctly.**

Therefore, we need a reliable method of measuring temperature.

The reliable measure of how hot or cold a body is called its **temperature**.

A device used to measure temperature is called a **thermometer**.

2. Can We Always Judge Hotness by Touch?

No.

Our sense of touch is **not a reliable method** for deciding whether something is hot or cold.

Activity: Feeling Hotness or Coldness

Take three containers:

- **A** – warm water
- **B** – tap water
- **C** – ice-cold water

Put:

- Right hand in warm water A
- Left hand in ice-cold water C

Keep them there for about **1–2 minutes**.

Then put both hands into container B.

Observation

The two hands may give different sensations:

- The right hand may feel that B is **cool**.
- The left hand may feel that B is **warm**.

But the water in B is the same for both hands.

Conclusion

We cannot always rely on our sense of touch to determine whether a body is hot or cold.

This shows the importance of measuring temperature scientifically.

3. What is Temperature?

Definition

Temperature is a reliable measure of the hotness or coldness of a body.

A hotter body has a **higher temperature** than a colder body.

For example:

If object A has a temperature of 50 °C and object B has a temperature of 20 °C, then A is hotter than B.

Important Point

Temperature tells us **how hot or cold a body is**.

4. What is a Thermometer?

Definition

A thermometer is an instrument used to measure temperature.

There are different types of thermometers used for different purposes.

The two important types discussed in this chapter are:

1. **Clinical thermometer**
 2. **Laboratory thermometer**
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5. Clinical Thermometer

A **clinical thermometer** is used to measure the temperature of the human body.

Modern clinical thermometers are generally **digital thermometers**.

They:

- Display temperature digitally
- Work using batteries
- Use heat sensors

- Can be used for measuring body temperature
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6. Digital Clinical Thermometer

Digital thermometers have largely replaced mercury thermometers.

Advantages of Digital Thermometers

- Easy to read
- Display the temperature clearly
- Do not contain toxic mercury
- Use electronic heat sensors

Earlier, mercury thermometers were commonly used. Mercury is highly toxic and can be difficult to dispose of safely if a thermometer breaks.

7. Contact and Non-Contact Thermometers

Contact Thermometer

A contact thermometer measures temperature when it is placed in contact with the body.

Non-Contact Thermometer

A non-contact thermometer can measure temperature **without touching the person's body**.

These thermometers are also called **infrared thermometers**.

Advantage

They reduce the risk of spreading disease because physical contact is not required.

8. Celsius Scale

Clinical thermometers generally use the:

Celsius Scale

The unit is:

Degree Celsius

Symbol:

°C

Example:

37 °C

9. How to Measure Body Temperature

A digital clinical thermometer can be used to measure body temperature.

Steps

1. Wash your hands.
 2. Clean the tip of the thermometer with soap and water.
 3. Reset the thermometer using its reset button.
 4. Place the thermometer under the tongue.
 5. Close the mouth.
 6. Wait until the thermometer beeps or flashes a light.
 7. Remove the thermometer.
 8. Read the temperature on the digital display.
 9. Record the reading.
 10. Clean the thermometer tip again.
 11. Dry it properly.
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10. Precautions While Using a Digital Clinical Thermometer

Remember these precautions:

- Read the thermometer's instruction manual before use.
 - Wash the tip before and after use.
 - Keep the digital portion, including the display, away from water.
 - Do not hold the thermometer by its tip.
 - Clean and dry the thermometer after use.
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11. Normal Human Body Temperature

The normal temperature of a healthy human body is generally taken as:

37.0 °C

It is also equal to:

98.6 °F

However, **every healthy person's temperature does not necessarily have to be exactly 37.0 °C.**

Normal temperature is an average obtained from measurements of many healthy people.

A healthy person may have a temperature slightly higher or lower than 37 °C.

12. Factors Affecting Body Temperature

Body temperature can be influenced by several factors, including:

- Age
- Time of day
- Activity level

Therefore, body temperature may vary during the day and from person to person.

13. Body Temperature Range

According to the chapter:

Human body temperature does not normally go below **35 °C** or above **42 °C**.

For measuring the temperature of small children or older people, a digital thermometer may also be placed in the **armpit**.

The temperature measured in the armpit is generally about **0.5 °C to 1 °C lower** than the actual body temperature.

14. Temperature Scales

There are three important temperature scales discussed in the chapter:

1. **Celsius scale**
2. **Fahrenheit scale**
3. **Kelvin scale**

Scale	Unit	Symbol
Celsius	degree Celsius	°C
Fahrenheit	degree Fahrenheit	°F
Kelvin	kelvin	K

The **SI unit of temperature is kelvin (K)**.

15. Fahrenheit Scale

The Fahrenheit scale uses:

Degree Fahrenheit

Symbol:

°F

The normal human body temperature:

37.0 °C = 98.6 °F

The Fahrenheit scale is not commonly used in most scientific studies today.

16. Kelvin Scale

The Kelvin scale is used extensively in scientific work.

Its unit is:

kelvin

Symbol:

K

The SI unit of temperature is **kelvin**.

Important Rule

The degree sign is **not** written with kelvin.

Correct:

300 K

Incorrect:

300 °K

17. Celsius to Kelvin Conversion

Temperature can be converted from Celsius to Kelvin using:

Formula

Temperature in Kelvin = Temperature in Celsius + 273.15

Example

Suppose temperature = 27 °C.

Then:

K = 27 + 273.15

K = 300.15 K

18. Writing Temperature Correctly

When writing temperature:

Correct

25 °C

98.6 °F

300 K

There should be a **space between the number and the unit**.

The symbols are:

- °C
- °F
- K

The names of the scales begin with capital letters:

- Celsius
- Fahrenheit
- Kelvin

The unit **kelvin** begins with a lowercase letter when written in words.

19. Clinical Thermometer vs Laboratory Thermometer

Clinical Thermometer	Laboratory Thermometer
Used to measure body temperature	Used for experiments and other purposes
Designed for human body temperature	Has a wider temperature range
Usually digital in modern use	Commonly has a liquid column
Used in medical situations	Used in school and scientific laboratories

20. Can a Clinical Thermometer Measure Boiling Water?

No.

A clinical thermometer is designed for measuring human body temperature.

The temperatures of:

- Ice
- Boiling water

are outside the normal range of a clinical thermometer.

Therefore, a clinical thermometer should not be used for these measurements.

21. Laboratory Thermometer

A **laboratory thermometer** is used for measuring the temperature of substances during experiments and for other purposes.

A typical laboratory thermometer consists of:

- A long, narrow glass tube
- A bulb at one end
- A liquid inside the bulb
- A narrow liquid column
- A Celsius scale

The liquid column rises or falls when temperature changes.

The temperature is read from the mark corresponding to the top of the liquid column.

22. Liquid Used in Laboratory Thermometers

The liquid in a laboratory thermometer is generally:

- Alcohol, often coloured red
- Or mercury

The coloured alcohol makes the liquid column easier to see.

23. Temperature Range of a Laboratory Thermometer

The temperature range means the difference between:

- Lowest temperature the thermometer can measure
- Highest temperature the thermometer can measure

For the laboratory thermometer shown in the chapter:

Range = $-10\text{ }^{\circ}\text{C}$ to $110\text{ }^{\circ}\text{C}$

Different laboratory thermometers may have different ranges. Therefore, always check the thermometer before using it.

24. Precautions While Using a Laboratory Thermometer

Remember:

- Handle the thermometer carefully.

- Do not allow it to hit a hard object.
 - It may break if handled roughly.
 - Do not hold it by the bulb.
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25. Smallest Measurement of a Thermometer

The smallest value that a thermometer can measure is determined by looking at its smallest division.

Method

1. Select two consecutive large markings.
2. Find the temperature difference between them.
3. Count the number of smaller divisions between them.
4. Divide the temperature difference by the number of divisions.

Formula

Value of one small division = Temperature difference ÷ Number of divisions

26. Example of Smallest Division

Suppose:

Temperature difference between two large marks = **10 °C**

Number of small divisions = **10**

Then:

One small division = $10 \div 10$

= 1 °C

Therefore, the smallest value the thermometer can measure is:

1 °C

27. Correct Way to Use a Laboratory Thermometer

When measuring the temperature of water:

Rule 1

The bulb should be immersed in the water.

Rule 2

The bulb should **not touch the bottom or sides of the beaker**.

Rule 3

The thermometer should be held **vertically**.

Rule 4

Do not tilt the thermometer.

Rule 5

Read the temperature while the thermometer is still immersed.

Rule 6

The eye should be directly in line with the level of the liquid column.

28. Measuring Warm Water Temperature

Procedure

1. Take warm water in a beaker.
2. Dip the thermometer into the water.
3. Make sure the bulb is immersed.
4. Do not allow the bulb to touch the bottom or sides.
5. Keep the thermometer vertical.
6. Observe the liquid column.
7. Wait until the column stops rising.
8. Read the temperature.
9. Take the reading while the thermometer is still in the water.

If the thermometer is removed from the water, the liquid level begins to change. Therefore, the reading should be taken while it is immersed.

29. Why Should We Not Touch the Bulb?

The bulb contains the temperature-sensitive liquid.

Holding the thermometer by the bulb can affect the reading and may also damage the thermometer.

Therefore:

Handle the thermometer carefully and do not hold it by the bulb.

30. Temperature of Boiling Water and Melting Ice

When the temperature of boiling water is measured carefully, different students may get slightly different readings.

The chapter's example gives readings such as:

- 97.8 °C
- 98.0 °C
- 97.9 °C
- 98.0 °C
- 98.1 °C

Small differences may occur because the correct method of reading the thermometer may not have been followed by everyone.

Important Observation

The temperature of water remains constant while it is **boiling**.

Similarly, the temperature of ice remains constant while it is **melting**.

31. Air Temperature

Air temperature is important for understanding weather.

You may have seen thermometers:

- In schools
- In laboratories
- In hospitals
- In doctor's clinics
- In other places

A room thermometer gives an approximate idea of the **room temperature**.

Weather reports commonly provide:

- Maximum air temperature
- Minimum air temperature

for a particular day.

32. Maximum and Minimum Temperature

The maximum and minimum temperatures do not usually remain the same every day.

Weather depends on several factors.

Generally:

- Temperature rises as summer approaches.

- Temperature falls during winter.

Air temperature is monitored at weather stations around the world.

The collected information helps in preparing **weather forecasts**.

33. Anna Mani – Weather Woman of India

Anna Mani (1918–2001) was an Indian scientist.

She is also known as the:

"Weather Woman of India"

She:

- Designed and built many weather-measuring instruments.
 - Helped reduce India's dependence on other countries for such instruments.
 - Studied the possibilities of wind energy.
 - Studied solar energy in India.
 - Contributed to India's development in renewable energy.
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34. Temperature and Fever

Before thermometers were developed, people tried to detect fever in other ways.

The chapter mentions that fever can affect a person's **pulse rate**.

However, pulse rate can also change for reasons other than fever.

Therefore:

Pulse rate alone is not a reliable indicator of fever.

A thermometer provides a much more reliable measurement of temperature.

35. Important Temperature Values

Quantity	Temperature
Normal average human body temperature	37.0 °C
Normal average human body temperature	98.6 °F
Typical laboratory thermometer range in chapter –10 °C to 110 °C	
Approximate absolute zero	–273.15 °C
Absolute zero	0 K

36. Absolute Zero

According to scientific understanding, there is a limit to how low temperature can become.

This lowest theoretical temperature is called:

Absolute Zero

Its value is approximately:

-273.15 °C

or

0 K

The chapter notes that there is no known limit to the highest possible temperature, while there is a lower limit close to absolute zero.

37. Comparison of Temperature Scales

Feature	Celsius	Fahrenheit	Kelvin
Unit	degree Celsius	degree Fahrenheit	kelvin
Symbol	°C	°F	K
Normal body temperature	37.0 °C	98.6 °F	About 310.15 K
SI unit?	No	No	Yes

38. Important Formulas

Celsius to Kelvin

$$K = ^\circ C + 273.15$$

Example

20 °C:

$$20 + 273.15 = 293.15 \text{ K}$$

Therefore:

$$20 ^\circ C = 293.15 \text{ K}$$

39. Important Definitions

Temperature

A reliable measure of the hotness or coldness of a body.

Thermometer

An instrument used to measure temperature.

Clinical Thermometer

A thermometer used to measure human body temperature.

Laboratory Thermometer

A thermometer used for measuring temperatures during experiments and for other purposes.

Celsius Scale

A temperature scale whose unit is degree Celsius ($^{\circ}\text{C}$).

Fahrenheit Scale

A temperature scale whose unit is degree Fahrenheit ($^{\circ}\text{F}$).

Kelvin Scale

A temperature scale whose unit is kelvin (K).

Air Temperature

The temperature of the surrounding air, which is an important weather parameter.

Temperature Range

The interval between the lowest and highest temperatures that a thermometer can measure.

Smallest Division

The smallest temperature difference that can be read using a particular thermometer.

40. Clinical Thermometer vs Laboratory Thermometer

Point	Clinical Thermometer	Laboratory Thermometer
Main use	Body temperature	Laboratory experiments
Temperature range	Suitable for body temperatures	Wider range
Modern type	Usually digital	Often liquid-column type
Used for boiling water?	No	Yes, if within range
Used for measuring ice?	No	Yes, if within range
Typical use	Medical	Scientific experiments

41. Important Rules for Reading a Thermometer

Remember the following:

Rule 1

Read the thermometer at eye level.

Rule 2

Keep a laboratory thermometer vertical.

Rule 3

Do not allow the bulb to touch the container.

Rule 4

Read the laboratory thermometer while it is immersed.

Rule 5

Check the thermometer's range before use.

Rule 6

Determine the smallest division before taking accurate readings.

42. Common Mistakes to Avoid

- ✗ Using your hand to accurately judge temperature.
 - ✗ Using a clinical thermometer for boiling water.
 - ✗ Allowing a laboratory thermometer's bulb to touch the beaker.
 - ✗ Tilting the thermometer while measuring.
 - ✗ Taking the reading after removing the thermometer from the water.
 - ✗ Holding the laboratory thermometer by its bulb.
 - ✗ Writing °K instead of K.
 - ✗ Forgetting the space between the number and temperature unit.
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43. Chapter Activities – Key Learning

Activity 7.1 – Hot or Cold?

Learning: Touch cannot always accurately judge temperature.

Activity 7.2 – Measuring Body Temperature

Learning: A digital clinical thermometer can be used to measure body temperature.

Activity 7.3 – Finding Thermometer Range

Learning: Every thermometer has a particular temperature range.

Activity 7.4 – Finding Smallest Division

Learning: The smallest division tells us the smallest temperature value that can be read.

Activity 7.5 – Measuring Warm Water

Learning: Correct positioning of the thermometer is necessary for accurate measurement.

Activity 7.6 – Comparing Temperatures

Learning: Accurate measurement requires correct reading technique.

Activity 7.7 – Air Temperature

Learning: Air temperature changes from day to day and is important for weather forecasting.

44. Chapter Summary

The main points of the chapter are:

1. Our sense of touch cannot always correctly determine hotness or coldness.
 2. **Temperature** is a reliable measure of hotness or coldness.
 3. A **thermometer** measures temperature.
 4. A **clinical thermometer** measures human body temperature.
 5. A **laboratory thermometer** is used for experiments and other purposes.
 6. The Celsius scale uses **°C**.
 7. The Fahrenheit scale uses **°F**.
 8. The Kelvin scale uses **K**.
 9. The **SI unit of temperature is kelvin**.
 10. Normal average human body temperature is taken as **37.0 °C**.
 11. **37.0 °C = 98.6 °F**.
 12. A typical laboratory thermometer may have a range of **–10 °C to 110 °C**.
 13. The thermometer must be used correctly for accurate measurement.
 14. Air temperature is an important weather parameter.
 15. Weather stations measure air temperature and other parameters to help prepare weather forecasts.
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45. Important Questions and Answers

Q1. What is temperature?

Answer: Temperature is a reliable measure of the hotness or coldness of a body.

Q2. Why can we not always depend on our sense of touch?

Answer: Our sense of touch may give different sensations for the same object depending on what our hands were exposed to previously. Therefore, touch is not a reliable way to determine temperature.

Q3. What is a thermometer?

Answer: A thermometer is an instrument used to measure temperature.

Q4. What is a clinical thermometer?

Answer: A clinical thermometer is used to measure the temperature of the human body.

Q5. What is a laboratory thermometer?

Answer: A laboratory thermometer is used to measure the temperature of substances during experiments and for other purposes.

Q6. What is the SI unit of temperature?

Answer: The SI unit of temperature is **kelvin (K)**.

Q7. What is normal human body temperature?

Answer: The normal average temperature of a healthy human body is taken as **37.0 °C or 98.6 °F**.

Q8. Why may a healthy person's temperature differ from 37 °C?

Answer: Normal body temperature is an average value. Individual temperature can vary due to factors such as age, time of day and activity level.

Q9. Why is a clinical thermometer not used for measuring boiling water?

Answer: The temperature of boiling water is outside the temperature range for which a clinical thermometer is designed.

Q10. Why should the bulb of a laboratory thermometer not touch the beaker?

Answer: The bulb should not touch the sides or bottom because the thermometer needs to measure the temperature of the substance being tested correctly.

Q11. Why should a laboratory thermometer be held vertically?

Answer: It should be held vertically so that the liquid column can be read correctly.

Q12. Why should the temperature be read while the thermometer is immersed?

Answer: After removing the thermometer, the liquid column begins to change level. Therefore, the temperature should be read while it is still immersed.

Q13. What is the formula for converting Celsius to Kelvin?

Answer:

Temperature in Kelvin = Temperature in Celsius + 273.15

Q14. What is the range of the laboratory thermometer shown in the chapter?

Answer: Its range is -10°C to 110°C .

Q15. What is the smallest division of the example laboratory thermometer?

Answer: The smallest division is 1°C .

46. MCQs for Practice

1. Which instrument measures temperature?

- A. Ruler
- B. Thermometer
- C. Balance
- D. Measuring tape

Answer: B. Thermometer

2. Which thermometer is used to measure body temperature?

- A. Laboratory thermometer
- B. Clinical thermometer
- C. Room thermometer
- D. Weather thermometer

Answer: B. Clinical thermometer

3. The SI unit of temperature is:

- A. °C
- B. °F
- C. K
- D. J

Answer: C. K

4. Normal average human body temperature is:

- A. 27 °C
- B. 32 °C
- C. 37 °C
- D. 42 °C

Answer: C. 37 °C

5. 37 °C is equal to:

- A. 98.6 °F
- B. 88.6 °F
- C. 78.6 °F
- D. 108.6 °F

Answer: A. 98.6 °F

6. Which is a non-contact thermometer?

- A. Infrared thermometer
- B. Mercury thermometer
- C. Laboratory thermometer
- D. Liquid thermometer

Answer: A. Infrared thermometer

7. A typical laboratory thermometer shown in the chapter has a range of:

- A. 0 °C to 100 °C
- B. -10 °C to 110 °C
- C. 35 °C to 42 °C
- D. 20 °C to 50 °C

Answer: B. -10 °C to 110 °C

8. Which scale uses the symbol °F?

- A. Celsius
- B. Kelvin
- C. Fahrenheit
- D. SI

Answer: C. Fahrenheit

9. Which symbol is correct for kelvin?

- A. °K
- B. K°
- C. K
- D. °k

Answer: C. K

10. Which scientist is known as the "Weather Woman of India"?

- A. Anna Mani
- B. Marie Curie
- C. Janaki Ammal
- D. Kalpana Chawla

Answer: A. Anna Mani

47. Numerical Questions

Q1. Convert 25 °C into Kelvin.

Formula:

$$K = ^\circ C + 273.15$$

Therefore:

$$K = 25 + 273.15$$

Answer: 298.15 K

Q2. Convert 0 °C into Kelvin.

$$K = 0 + 273.15$$

Answer: 273.15 K

Q3. A thermometer has 50 divisions between 0 °C and 100 °C. What is the value of each division?

Temperature difference:

$$100 - 0 = 100\text{ °C}$$

Number of divisions = 50

Therefore:

$$\text{Value of one division} = 100 \div 50$$

Answer: 2 °C

48. Exam Revision Sheet ★

Learn These First

Temperature → measure of hotness/coldness

Thermometer → measures temperature

Clinical thermometer → body temperature

Laboratory thermometer → experiments

Celsius → °C

Fahrenheit → °F

Kelvin → K

SI unit → kelvin

Normal average body temperature → 37 °C

37 °C → 98.6 °F

Laboratory thermometer example range → -10 °C to 110 °C

Celsius → Kelvin → +273.15

Touch → not always reliable

Bulb → should not touch beaker

Thermometer → held vertically

Reading → eye at liquid-column level

Laboratory thermometer → read while immersed

Absolute zero → approximately -273.15 °C = 0 K