

UNIQUE STUDY POINT

By Sumeet Sahu

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| Class: VI | Subject: Science | Session: 2025-26 |
| Chapter: 07 - Temperature and its Measurement | Time: 1½ Hours | Max. Marks: 40 |

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

1. The temperature of ice-cold water is closest to:
(a) $-10\text{ }^{\circ}\text{C}$
(b) $0\text{ }^{\circ}\text{C}$
(c) $10\text{ }^{\circ}\text{C}$
(d) $20\text{ }^{\circ}\text{C}$
2. Which scale of temperature is used in most scientific work?
(a) Celsius scale
(b) Fahrenheit scale
(c) Kelvin scale
(d) Reaumur scale
3. A laboratory thermometer with 50 divisions between $0\text{ }^{\circ}\text{C}$ and $100\text{ }^{\circ}\text{C}$ can measure temperature with accuracy of:
(a) $0.5\text{ }^{\circ}\text{C}$
(b) $1\text{ }^{\circ}\text{C}$
(c) $2\text{ }^{\circ}\text{C}$
(d) $5\text{ }^{\circ}\text{C}$
4. When measuring body temperature in the armpit, the temperature reading will be:
(a) Same as oral temperature
(b) About $0.5\text{ }^{\circ}\text{C}$ to $1\text{ }^{\circ}\text{C}$ higher than actual
(c) About $0.5\text{ }^{\circ}\text{C}$ to $1\text{ }^{\circ}\text{C}$ lower than actual
(d) About $2\text{ }^{\circ}\text{C}$ lower than actual
5. The absolute zero temperature is approximately:
(a) $0\text{ }^{\circ}\text{C}$

- (b) $-100\text{ }^{\circ}\text{C}$
- (c) $-273.15\text{ }^{\circ}\text{C}$
- (d) $-373.15\text{ }^{\circ}\text{C}$

6. Who developed the Celsius temperature scale?

- (a) Anders Celsius
- (b) Daniel Fahrenheit
- (c) Lord Kelvin
- (d) Anna Mani

7. In digital thermometers, temperature is determined with the help of:

- (a) Mercury expansion
- (b) Alcohol expansion
- (c) Heat sensors
- (d) Light sensors

8. The temperature of melting ice remains constant at:

- (a) $-5\text{ }^{\circ}\text{C}$
- (b) $0\text{ }^{\circ}\text{C}$
- (c) $5\text{ }^{\circ}\text{C}$
- (d) $10\text{ }^{\circ}\text{C}$

9. Before fever thermometers were developed in India, fever was detected by measuring:

- (a) Blood pressure
- (b) Pulse rate
- (c) Breathing rate
- (d) Skin color

10. The correct symbol for the temperature unit kelvin is:

- (a) $^{\circ}\text{K}$
- (b) K
- (c) k
- (d) $^{\circ}\text{k}$

SECTION B - Short Answer Questions (2 marks each)

11. State two reasons why mercury thermometers are considered hazardous.

12. While reading a laboratory thermometer, why should the eye be directly in line with the level of the liquid column?

13. Write two differences between the Celsius scale and the Kelvin scale of temperature.

14. A student measured the temperature of boiling water and recorded it as $98\text{ }^{\circ}\text{C}$ instead of $100\text{ }^{\circ}\text{C}$. Give two possible reasons for this error.

SECTION C - Short Answer Questions (3 marks each)

15. Anna Mani is known as the 'Weather Woman of India'. Write about her contributions to science and mention how her work helped India in the field of weather measurement and renewable energy.

16. A thermometer shows the following reading: Between $20\text{ }^{\circ}\text{C}$ and $30\text{ }^{\circ}\text{C}$, there are 5 divisions. (a) What is the value of each small division? (b) If the liquid column is at the 3rd division mark after $20\text{ }^{\circ}\text{C}$, what is the

temperature reading?

17. Explain why the temperature reading must be taken while the laboratory thermometer is still immersed in the liquid. What happens if we take out the thermometer before reading?

SECTION D - Long Answer Question (5 marks)

18. Describe an experiment to measure and compare the temperatures of boiling water and melting ice using a laboratory thermometer. Include the materials required, procedure, precautions, and expected observations. Also explain what we learn about temperature during phase changes from this experiment.

SECTION E - Case Study Based Questions (4 marks each)

19. Case Study 1:

During a science practical class, students were measuring the temperature of water in a beaker being heated. Four students recorded the following observations:

Student A: Held the thermometer tilted and read 68 °C

Student B: Held the thermometer vertically, bulb touching the bottom, read 82 °C

Student C: Held the thermometer vertically, bulb not touching bottom/sides, read 75 °C

Student D: Took the thermometer out of water before reading, recorded 70 °C

Based on the above case study, answer the following questions:

- Which student followed the correct procedure for measuring temperature? (1 mark)
- What mistake did Student B make and how would it affect the reading? (1 mark)
- Why did Student D get a lower reading than the actual temperature? (1 mark)
- What is the correct temperature of water in the beaker? Justify your answer. (1 mark)

20. Case Study 2:

A weather station in Shillong recorded the following maximum and minimum temperatures over a week:

Day 1: Max 22 °C, Min 12 °C

Day 2: Max 24 °C, Min 14 °C

Day 3: Max 20 °C, Min 10 °C

Day 4: Max 23 °C, Min 13 °C

Day 5: Max 25 °C, Min 15 °C

Based on the above case study, answer the following questions:

- Which day had the highest maximum temperature and which day had the lowest minimum temperature? (1 mark)
- Calculate the average maximum temperature for the five days. (1 mark)
- On which day was the temperature range (difference between max and min) the greatest? (1 mark)
- Why does air temperature vary from day to day even in the same location? (1 mark)

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SECTION A - Answers to MCQs**1. (b) 0 °C**

The temperature of ice-cold water is closest to 0 °C. At 0 °C, ice melts and becomes water, so ice-cold water is typically near this temperature.

2. (c) Kelvin scale

The Kelvin scale is used in most scientific work. It is the SI unit of temperature and is preferred in scientific calculations because it starts from absolute zero.

3. (c) 2 °C

With 50 divisions between 0 °C and 100 °C, each division = $100\text{ °C} \div 50 = 2\text{ °C}$. Therefore, this thermometer can measure temperature with an accuracy of 2 °C.

4. (c) About 0.5 °C to 1 °C lower than actual

When body temperature is measured in the armpit, the reading is typically about 0.5 °C to 1 °C lower than the actual body temperature measured orally.

5. (c) -273.15 °C

Absolute zero, the lowest possible temperature, is approximately -273.15 °C (or 0 kelvin). At this temperature, molecular motion theoretically stops.

6. (a) Anders Celsius

The Celsius temperature scale was developed by Swedish astronomer Anders Celsius in 1742. The scale is named in his honor.

7. (c) Heat sensors

In digital thermometers, temperature is determined with the help of heat sensors (thermistors). These electronic sensors detect temperature changes and display the reading digitally.

8. (b) 0 °C

The temperature of melting ice remains constant at 0 °C. During the phase change from solid to liquid, the temperature stays constant until all the ice melts.

9. (b) Pulse rate

Before fever thermometers were developed in India, fever was detected by measuring pulse rate. Fever affects the pulse rate of a person, though this method alone is not completely reliable.

10. (b) K

The correct symbol for the temperature unit kelvin is K (capital K without the degree symbol). It is written as 300 K, not 300 °K.

SECTION B - Answers to Short Answer Questions**11. Why mercury thermometers are hazardous:**

Two reasons why mercury thermometers are considered hazardous:

1. **Toxicity:** Mercury is an extremely toxic substance that can cause serious health problems if inhaled, ingested, or absorbed through the skin. If a mercury thermometer breaks, the mercury can vaporize and pose health risks.

2. **Disposal difficulties:** Mercury is difficult to dispose of safely and properly. If not disposed of correctly, it can contaminate the environment, water sources, and harm wildlife. The cleanup of mercury spills also requires special procedures.

12. Eye position while reading thermometer:

Answer: While reading a laboratory thermometer, the eye should be directly in line with the level of the liquid column to avoid parallax error.

Explanation: If we read the thermometer from above or below the level of the liquid column, our viewing angle creates a parallax error, which means we see the liquid level at a different position than it actually is. This leads to incorrect temperature reading. By keeping our eye directly in line with the liquid level, we ensure an accurate reading.

13. Differences between Celsius and Kelvin scales:

Two differences between Celsius and Kelvin scales:

1. **Starting point:** The Celsius scale starts from 0 °C (freezing point of water), while the Kelvin scale starts from 0 K (absolute zero, which is -273.15 °C).

2. **Symbol notation:** The Celsius scale uses the degree symbol (°C), while the Kelvin scale does not use the degree symbol and is written simply as K. For example: 25 °C but 298 K.

14. Possible reasons for error in measuring boiling water temperature:

Two possible reasons for getting 98 °C instead of 100 °C:

1. **Altitude effect:** The boiling point of water varies with atmospheric pressure. At higher altitudes (like in hill stations such as Shillong), the atmospheric pressure is lower, and water boils at a temperature lower than 100 °C. This is why Phiban and her classmates in Shillong recorded temperatures around 97-98 °C.

2. **Measurement error:** The student may have read the thermometer incorrectly, or the thermometer bulb may have been touching the bottom or sides of the container instead of being immersed properly in the boiling water, leading to an inaccurate reading.

SECTION C - Answers to Short Answer Questions

15. Anna Mani - The Weather Woman of India:

Anna Mani (1918-2001) was an Indian scientist who made significant contributions to meteorology and atmospheric physics. She is known as the 'Weather Woman of India'.

Her Major Contributions:

1. **Weather Instruments:** Anna Mani invented and built a large number of weather measurement instruments. She designed and manufactured more than 100 different types of weather instruments. This was a major achievement that reduced India's reliance on other nations for importing such instruments.

2. **Renewable Energy:** She was a pioneer in exploring the possibilities of using wind and solar energy in India. She conducted extensive research on solar radiation and its practical applications. Her work laid the

foundation for India's renewable energy programs.

3. **Impact:** Her work helped India become self-reliant in weather instrumentation and established the country as one of the global leaders in renewable energy research. She established a network of weather stations across India that continue to provide valuable meteorological data.

16. Calculating thermometer divisions and reading:

Given: Between 20 °C and 30 °C, there are 5 divisions

(a) Value of each small division:

Temperature difference = 30 °C - 20 °C = 10 °C

Number of divisions = 5

Value of each division = 10 °C ÷ 5 = 2 °C

Therefore, each small division represents 2 °C.

(b) Temperature reading at 3rd division after 20 °C:

Starting temperature = 20 °C

3 divisions beyond 20 °C = 3 × 2 °C = 6 °C

Temperature reading = 20 °C + 6 °C = 26 °C

Therefore, the temperature reading is 26 °C.

17. Why reading must be taken while thermometer is immersed:

Explanation: The temperature reading must be taken while the laboratory thermometer is still immersed in the liquid because the liquid inside the thermometer (mercury or alcohol) responds to the temperature of its surroundings. As long as the thermometer is in the liquid being measured, the liquid column maintains the same temperature and gives an accurate reading.

What happens if we take out the thermometer before reading:

1. As soon as we take the thermometer out of the liquid, the liquid column inside the thermometer starts to come in contact with the cooler air around it.
2. The liquid (mercury or alcohol) begins to cool down immediately and starts contracting, causing the liquid column to fall.
3. This falling of the liquid column happens very quickly, so we will get a reading that is lower than the actual temperature of the liquid we were measuring.

Conclusion: Therefore, to get an accurate measurement, we must read the temperature while the thermometer is still immersed in the liquid being measured.

SECTION D - Answer to Long Answer Question

18. Experiment to measure temperatures of boiling water and melting ice:

Aim: To measure and compare the temperatures of boiling water and melting ice using a laboratory thermometer and to observe temperature behavior during phase changes.

Materials Required:

- Two beakers
- Laboratory thermometer
- Crushed ice

- Water
- Burner/hot plate
- Stand and clamp
- Stopwatch or clock

Procedure:

Part A - Measuring temperature of melting ice:

1. Take crushed ice in a beaker and set up the laboratory thermometer using a stand and clamp so that the bulb is immersed in the ice but not touching the bottom or sides.
2. Observe the thermometer reading as the ice starts to melt.
3. Note the temperature at regular intervals (every 2 minutes) and observe whether it changes while ice is melting.
4. Record the observations in a table.

Part B - Measuring temperature of boiling water:

1. Take water in another beaker and heat it using a burner.
2. Set up the laboratory thermometer so that its bulb is immersed in water but not touching the bottom or sides.
3. As the water starts boiling, note the temperature reading while the thermometer is still in the boiling water.
4. Continue observing for a few minutes and note if the temperature changes while water is boiling.
5. Record the observations in a table.

Precautions:

1. The thermometer bulb should not touch the bottom or sides of the beaker.
2. The thermometer should be held vertically.
3. Reading should be taken while the thermometer is immersed in the substance.
4. Eye should be at the same level as the liquid column in the thermometer.
5. Handle the thermometer carefully as it is fragile.
6. Be careful while working with the burner and hot water.

Expected Observations:

For melting ice:

- The temperature will be around 0 °C
- The temperature remains constant at 0 °C while ice is melting
- Only after all ice melts, the temperature of water starts to rise

For boiling water:

- The temperature rises as water is heated
- When water starts boiling, temperature reaches around 100 °C (at sea level; may be lower at higher altitudes)
- The temperature remains constant at 100 °C while water continues to boil

What we learn from this experiment:

1. **Temperature during phase changes:** During phase changes (solid to liquid or liquid to gas), the temperature of a substance remains constant even though heat is being supplied. This is because the heat energy is used to break the bonds between molecules rather than increasing the temperature.
2. **Fixed melting and boiling points:** Pure substances have fixed melting and boiling points under standard conditions (0 °C for ice melting and 100 °C for water boiling at sea level).

3. **Effect of pressure:** Boiling point can vary with atmospheric pressure - at higher altitudes where pressure is lower, water boils at lower temperatures.

4. **Reliability of thermometers:** Unlike our sense of touch, a thermometer provides objective and accurate measurements of temperature that don't vary based on previous conditions or individual perception.

SECTION E - Answers to Case Study Based Questions

19. Case Study 1 - Answers:

(a) Student who followed correct procedure:

Student C followed the correct procedure for measuring temperature. Student C held the thermometer vertically with the bulb immersed in water without touching the bottom or sides of the beaker. (1 mark)

(b) Student B's mistake and its effect:

Student B's mistake was that the thermometer bulb was touching the bottom of the beaker. The bottom of the beaker is in direct contact with the heat source and is much hotter than the water itself. Therefore, Student B got a higher reading (82 °C) than the actual water temperature because the thermometer was measuring the temperature of the hot beaker bottom rather than the water. (1 mark)

(c) Why Student D got lower reading:

Student D took the thermometer out of water before reading the temperature. As soon as the thermometer was removed from hot water, the liquid column (mercury or alcohol) inside started cooling down due to contact with cooler air and began to fall, resulting in a lower reading (70 °C) than the actual water temperature. (1 mark)

(d) Correct temperature and justification:

The correct temperature of water in the beaker is 75 °C, as measured by Student C. This is the correct reading because Student C followed all the correct procedures: held the thermometer vertically, kept the bulb immersed without touching bottom or sides, and read the temperature while the thermometer was still in the water. Students A, B, and D all made procedural errors that led to incorrect readings. (1 mark)

20. Case Study 2 - Answers:

(a) Highest maximum and lowest minimum temperatures:

Day 5 had the highest maximum temperature at 25 °C.

Day 3 had the lowest minimum temperature at 10 °C. (1 mark)

(b) Average maximum temperature:

Sum of maximum temperatures = 22 + 24 + 20 + 23 + 25 = 114 °C

Number of days = 5

Average maximum temperature = $114 \div 5 = 22.8$ °C

Therefore, the average maximum temperature for the five days is 22.8 °C. (1 mark)

(c) Day with greatest temperature range:

Temperature range (difference between max and min):

Day 1: $22 - 12 = 10$ °C

Day 2: $24 - 14 = 10$ °C

Day 3: $20 - 10 = 10$ °C

Day 4: $23 - 13 = 10$ °C

Day 5: $25 - 15 = 10$ °C

Interestingly, the temperature range was the same (10 °C) on all five days. So all days had equal temperature range. (1 mark)

(d) Why air temperature varies from day to day:

Air temperature varies from day to day in the same location because weather depends on several factors such as: cloud cover, wind patterns, humidity levels, presence or absence of rainfall, and seasonal changes. These factors continuously change, causing daily variations in temperature. For example, cloudy days are cooler than sunny days, and windy days may feel colder. Additionally, air masses from different regions (hot or cold) can move into an area, causing temperature changes. (1 mark)

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