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7. Temperature and Its Measurement

Word Meanings

S.No.	Word (शब्द)	Meaning (हिंदी अर्थ)
1.	Temperature	तापमान – किसी वस्तु के गर्म या ठंडे होने की माप।
2.	Thermometer	थर्मामीटर / तापमापी – तापमान मापने के लिए उपयोग किया जाने वाला उपकरण।
3.	Clinical Thermometer	चिकित्सीय थर्मामीटर – मानव शरीर का तापमान मापने के लिए उपयोग किया जाने वाला थर्मामीटर।
4.	Laboratory Thermometer	प्रयोगशाला थर्मामीटर – प्रयोगशाला में प्रयोगों के दौरान तापमान मापने के लिए उपयोग किया जाने वाला उपकरण।
5.	Digital Thermometer	डिजिटल थर्मामीटर – स्क्रीन पर संख्याओं के माध्यम से तापमान प्रदर्शित करने वाला आधुनिक थर्मामीटर।
6.	Mercury	पारा – थर्मामीटर में उपयोग किया जाने वाला एक जहरीला तरल धातु।

7.	Celsius Scale	सेल्सियस पैमाना – वह तापमान पैमाना जिसमें पानी 0 °C पर जमता है और 100 °C पर उबलता है।
8.	Fahrenheit Scale	फारेनहाइट पैमाना – वह तापमान पैमाना जिसमें पानी 32 °F पर जमता है और 212 °F पर उबलता है।
9.	Kelvin Scale	केल्विन पैमाना – तापमान का एसआई (SI) मात्रक, जो परम शून्य से शुरू होता है।
10.	Infrared Thermometer	इन्फ्रारेड थर्मामीटर (अवरक्त तापमापी) – बिना त्वचा को छुए (दूर से) तापमान मापने वाला उपकरण।
11.	Parallax Error	दोषपूर्ण लंबन त्रुटि (पैलेक्स त्रुटि) – किसी उपकरण को तिरछे कोण से देखने पर होने वाली पठन त्रुटि।
12.	Fever	बुखार – सामान्य से अधिक शरीर का तापमान।
13.	Heat Energy	ऊष्मीय ऊर्जा – किसी वस्तु में मौजूद ऊर्जा जो उसके गर्म या ठंडे होने का आभास कराती है।
14.	Heat Sensor	ऊष्मा संवेदक – तापमान का पता लगाने वाला सेंसर।
15.	Toxic Liquid	विषाक्त तरल – स्वास्थ्य और पर्यावरण के लिए हानिकारक जहरीला द्रव।
16.	Astronomer	खगोलविद – अंतरिक्ष और खगोलीय पिंडों का अध्ययन करने वाला वैज्ञानिक।
17.	Absolute Temperature	परम तापमान – केल्विन पैमाने पर मापा जाने वाला कुल तापमान।

18.	Thermodynamics	ऊष्मागतिकी – भौतिकी की शाखा जो ऊष्मा और तापमान से संबंधित है।
19.	Hygiene	स्वच्छता – कीटाणुओं और संक्रमण से बचने के लिए साफ-सफाई बनाए रखना।
20.	Cross-contamination	क्रॉस-संदूषण – एक वस्तु या व्यक्ति से दूसरे में कीटाणुओं का फैलना।
21.	Submerging	डुबोना – किसी वस्तु को पूरी तरह तरल के अंदर डालना।
22.	Precision	परिशुद्धता / सूक्ष्मता – माप की सटीक होने की क्षमता।
23.	Vertical	ऊर्ध्वाधर / सीधा – जमीन से 90 डिग्री के सीधे खड़े होने की स्थिति।
24.	Immersed	निर्मग्न / डूबा हुआ – किसी तरल पदार्थ के अंदर होना।
25.	Air Temperature	वायु का तापमान – हवा की गर्मी या ठंडक की स्थिति।
26.	Weather Forecast	मौसम पूर्वानुमान – आने वाले दिनों के मौसम का अनुमान लगाना।
27.	Maximum Temperature	अधिकतम तापमान – दिन के दौरान दर्ज किया जाने वाला सबसे ऊंचा तापमान।
28.	Minimum Temperature	न्यूनतम तापमान – दिन के दौरान दर्ज किया जाने वाला सबसे कम तापमान।
29.	Meteorologist	मौसम विज्ञानी – मौसम का अध्ययन और पूर्वानुमान लगाने वाला विशेषज्ञ।

30.	Shiver	कांपना – ठंड लगने पर शरीर द्वारा गर्मी पैदा करने के लिए की जाने वाली अनैच्छिक हलचल।
31.	Expands	फैलाव होना / फैलना – तापमान बढ़ने पर तरल पदार्थ का आयतन में बढ़ना।
32.	Contracts	सिकुड़ना – तापमान कम होने पर तरल पदार्थ का आयतन में कम होना।
33.	Liquid Column	तरल स्तंभ – थर्मामीटर की नली के अंदर बहने वाला पारे या अल्कोहल का धागे जैसा भाग।
34.	Range	परास / सीमा – किसी थर्मामीटर द्वारा मापे जा सकने वाले न्यूनतम और अधिकतम तापमान की सीमा।
35.	Bulb	बल्ब – थर्मामीटर के निचले सिरे पर स्थित तरल से भरा हुआ गोलाकार भाग।
36.	Sealed End	बंद सिरा – थर्मामीटर की कांच की नली का वह सिरा जो पूरी तरह बंद होता है।
37.	Stabilise	स्थिर होना – तरल स्तंभ का ऊपर-नीचे होना बंद होकर एक निश्चित माप पर रुक जाना।
38.	Consistency	संगति / एकरूपता – बार-बार मापने पर एक जैसी या मेल खाती हुई माप प्राप्त होना।
39.	Discrepancies	विसंगतियाँ / अंतर – अलग-अलग मापों या रीडिंग में आने वाला अंतर।
40.	Physiological Factors	शारीरिक कारक – उम्र, गतिविधि या दिन के समय जैसे वे आंतरिक कारक जो शरीर के तापमान को प्रभावित करते हैं।

Exercise

1. Intext Questions (page no 108)

1. **What is the average normal body temperature on the Celsius scale?**
 - **Answer:** The average normal body temperature on the Celsius scale is approximately 37.0 °C.
2. **Name the device used to measure body temperature.**
 - **Answer:** A thermometer is used to measure body temperature.
3. **What is the SI unit of temperature?**
 - **Answer:** The Kelvin (K) is the SI unit of temperature.
4. **Which thermometer became popular during the COVID-19 pandemic?**
 - **Answer:** Non-contact infrared thermometers became popular during the COVID-19 pandemic.
5. **What is the formula to convert Celsius to Kelvin?**
 - **Answer:** The formula to convert Celsius to Kelvin is $K = ^\circ C + 273.15$.

2. Intext Questions (page no. - 111)

1. The **laboratory** thermometer is used to measure temperatures in scientific experiments.
2. A laboratory thermometer typically uses **mercury** or alcohol to measure temperature.
3. The smallest temperature value a laboratory thermometer can read is determined by its **precision / divisions**.
4. The temperature difference between the highest and lowest recorded temperatures during a day is called the **daily range (or temperature range)**.
5. The **maximum** temperature is the highest temperature recorded during the day.

Exercises:

A. Choose the correct option

1. What device is used to measure body temperature?

- Answer: b. Clinical Thermometer
- 2. What is the normal body temperature on the Celsius scale?
 - Answer: c. 37.0 °C
- 3. Which scale is most commonly used in scientific studies?
 - Answer: c. Celsius
- 4. Which thermometer became popular during the COVID-19 pandemic?
 - Answer: c. Infrared Thermometer
- 5. What type of thermometer is used in scientific experiments?
 - Answer: b. Laboratory Thermometer

B. Fill in the blanks

1. The **clinical** thermometer is used to measure body temperature.
2. The Kelvin scale starts at **absolute zero (-273.15 °C)**, the lowest possible temperature.
3. A **laboratory** thermometer is used in scientific experiments.
4. The normal body temperature on the Fahrenheit scale is **98.6 °F**.
5. **Parallax** error occurs when an instrument is read from an angle.

C. Write T for true and F for false statements (पृष्ठ 112)

1. The Celsius scale is primarily used in the United States. **(False)** *(The Fahrenheit scale is used there)*
2. A digital thermometer uses mercury to measure temperature. **(False)** *(Digital ones use heat sensors)*
3. Infrared thermometers can measure temperature without touching the object. **(True)**
4. Laboratory thermometers have a wider temperature range than clinical thermometers. **(True)**

5. The Kelvin scale is not used in scientific research. **(False)** *(It is primarily used in scientific research)*

6. Match the following columns

Column A	Column B
1. Clinical Thermometer	d. Measures body temperature
2. Laboratory Thermometer	a. Has a range of -10 °C to 110 °C
3. Normal body temperature	e. About 37 °C or 98.6 °F
4. Kelvin	b. SI unit of temperature
5. Fahrenheit	c. Temperature scale where water freezes at 32 °F

E. Answers the following questions in 20–30 words

- What is the main purpose of a clinical thermometer?**
 - Answer:** A clinical thermometer is primarily used to measure the temperature of the human body, especially when someone is feeling sick to check for a fever.
- How does an infrared thermometer work?**
 - Answer:** An infrared thermometer measures a person's temperature from a distance using infrared technology without requiring direct contact with the skin.
- Why is it important to clean a thermometer before and after use?**
 - Answer:** Cleaning a thermometer with soap and water before and after use ensures proper hygiene and prevents the spread of germs, infections, and cross-contamination.
- What is the Kelvin scale used for?**
 - Answer:** The Kelvin scale is primarily used in scientific research and calculations involving thermodynamics, and it is also the SI unit of temperature.
- Explain why touch is not a reliable method to measure temperature.**

- **Answer:** Our sense of touch is influenced by previous conditions and sends mixed signals to the brain, making it incapable of accurately measuring exact temperatures.
- 6. **What is the normal body temperature in Celsius?**
 - **Answer:** The average normal body temperature on the Celsius scale is approximately 37.0 °C.
- 7. **Why is parallax error a concern when reading a laboratory thermometer?**
 - **Answer:** Parallax error occurs when an instrument is read from an angle, which can cause inaccurate temperature readings if the eye level is not aligned with the liquid column.
- 8. **How does a laboratory thermometer differ from a clinical thermometer?**
 - **Answer:** Clinical thermometers have a restricted temperature range tailored for the human body, whereas laboratory thermometers have a much wider range (e.g., -10 °C to 110 °C) for scientific experiments.
- 9. **What role does air temperature play in weather forecasting?**
 - **Answer:** Air temperature is a crucial parameter monitored at weather stations to understand and predict weather patterns, helping people plan activities and stay safe.
- 10. **What safety precautions should be taken when using a mercury thermometer?**
 - **Answer:** Avoid breaking it because mercury is a toxic liquid metal that poses serious health and environmental risks, and dispose of it carefully if damaged.

F. Answers the following questions in 60–80 words

1. **Describe the steps to measure body temperature using a digital thermometer.**
 - **Answer:** First, wash the tip of the thermometer with soap and water to ensure it is clean and dry it with a tissue. Turn on the thermometer and reset it if necessary. Place the thermometer gently under your tongue, close your mouth, and wait until it beeps or flashes to indicate completion. Finally, remove it, read the temperature on the digital display, and clean it again after use.
2. **Explain the differences between the Celsius, Fahrenheit, and Kelvin scales.**
 - **Answer:** The Celsius scale sets water's freezing point at 0 °C and boiling point at 100 °C, and is widely used worldwide. The Fahrenheit scale sets water's freezing

point at 32 °F and boiling point at 212 °F, commonly used in the USA. The Kelvin scale is the SI unit starting at absolute zero without using degrees, primarily used in scientific research.

3. **Discuss the importance of monitoring air temperature for weather predictions.**

- **Answer:** Monitoring air temperature helps meteorologists track daily maximum and minimum temperatures, understand seasonal changes, and analyze weather patterns. This data is essential for issuing accurate weather forecasts, helping people prepare for daily activities, and ensuring public safety against extreme weather conditions.

4. **Why did infrared thermometers become popular during the COVID-19 pandemic?**

- **Answer:** Infrared thermometers became popular during the COVID-19 pandemic because they can measure a person's temperature from a distance using infrared technology. Since they do not require direct contact with the skin, they significantly reduce the risk of spreading germs, infections, and cross-contamination among people.

5. **Explain the proper technique for using a laboratory thermometer in an experiment.**

- **Answer:** Hold the thermometer vertically so the liquid column rises or falls freely. Ensure the bulb is immersed in the substance being measured without touching the bottom or sides of the container to prevent heat transfer errors. Read the temperature while the thermometer is still immersed, keeping your eye level aligned with the liquid column to avoid parallax errors.

6. **Discuss why body temperature varies among individuals.**

- **Answer:** Individual body temperature can vary slightly due to several physiological factors such as age, time of day, and physical activity levels. For instance, younger children often have slightly higher body temperatures than adults, while older adults may show slightly lower readings even when completely healthy.

G. Assertion/Reason Questions

1. **Assertion:** Digital thermometers are safer than mercury thermometers.
Reason: Mercury is a toxic substance that can be harmful if the thermometer breaks.

- **Answer: a. Both Assertion and Reason are correct, and Reason is the correct explanation.**

2. **Assertion:** A laboratory thermometer should not touch the bottom of the container.

Reason: Contact with the container could result in inaccurate temperature reading.

- **Answer: a. Both Assertion and Reason are correct, and Reason is the correct explanation.**

3. **Assertion:** Infrared thermometers are safer than mercury thermometers.

Reason: Infrared thermometers do not require direct contact to measure temperature.

- **Answer: a. Both Assertion and Reason are correct, and Reason is the correct explanation.**

J. Life Skills

- **Question:** What should you do if you suspect you have a fever?
- **Answer: c. Use a thermometer to check your temperature and inform an adult.**

K. Solve the Crossword Puzzle

Across: 5. **Fahrenheit** (Temperature scale used in the USA) 6. **Infrared** (Type of thermometer used during COVID-19) 7. **Celsius** (Temperature scale where water freezes at 0°C) 8. **Kelvin** (SI unit of temperature)

Down:

1. **Clinical** (Type of thermometer for body temperature)
2. **Parallax** (Error caused by viewing at an angle)
3. **Mercury** (Liquid used in some thermometers)
4. **Fever** (Higher than normal body temperature)