Temperature

Introduction to Temperature

Temperature is a fundamental concept that measures how hot or cold a body is. It provides a quantitative way to express the degree of heat within a substance or object. A hotter body has a higher temperature compared to a colder one, indicating that it contains more thermal energy.

Understanding temperature differences helps analyze heat transfer, as heat naturally flows from a body with a higher temperature to one with a lower temperature. This principle is essential in understanding natural phenomena such as weather patterns and changes in the state of substances (melting, boiling, or freezing). Temperature also affects daily life, influencing clothing choices, device functionality, and industrial machinery.

Historical Development of Temperature Measurement

17th Century: Galileo introduced the **thermoscope**, an early device to detect temperature changes.

1714: Fahrenheit introduced the mercury thermometer and the Fahrenheit scale.

1742: Celsius introduced the **Celsius scale**, which became widely used in scientific and everyday contexts.

Temperature Scales

Temperature is measured using different scales, each designed for specific purposes:

i. Celsius (°C):

Used in scientific and everyday applications.

Freezing point of water: 0°C.

Boiling point of water: **100°C** (at standard atmospheric pressure).

ii. Fahrenheit (°F):

Common in the United States.

Freezing point of water: 32°F.

Boiling point of water: 212°F.

iii. Kelvin (K):

Used in scientific research (SI unit of temperature).

Starts at absolute zero (0 K), where particle motion ceases.

- Freezing point of water: **273.15 K.**
- Boiling point of water: **373.15 K.**

Temperature Scale Conversions

The temperature scales are interrelated through conversion formulas:

Celsius to Kelvin K = °C + 273.15Kelvin to Celsius °C = K - 273.15Celsius to Fahrenheit $°F = \frac{9}{5} + (°C) + 32$ Fahrenheit to Celsius $°C = \frac{5}{9} (°F - 32)$

Important Temperature Points

Freezing Point: The temperature at which a liquid turns into a solid.

Example: Water freezes at 0°C.

Boiling Point: The temperature at which a liquid turns into a gas.

Example: Water boils at 100°C.