

Lecture-Based Questionnaire

1. What is the primary focus of the next four lectures in this thermodynamics unit?

Answer: The study of heat, temperature, and related concepts.

2. Multiple Choice Question: Which of the following best describes a system in thermal equilibrium?

- a) Its temperature is rapidly changing due to external influences.
- b) Its macroscopic properties, such as temperature, have stopped changing.
- c) Its atoms and molecules are perfectly still.
- d) It is actively exchanging heat with its surroundings to reach a stable state.

Answer: b) Its macroscopic properties, such as temperature, have stopped changing.

3. State the Zeroth Law of Thermodynamics.

Answer: If system A and system B are each in thermal equilibrium with a third system C, then A and B are in thermal equilibrium with each other.

4. Multiple Choice Question: Why is the boiling point of water considered an unreliable fixed point for temperature scales at different locations?

- a) It requires specialized equipment to measure accurately.
- b) It changes significantly with altitude and atmospheric pressure.
- c) Water molecules behave unpredictably at boiling temperatures.
- d) Modern thermometers are not capable of measuring it precisely.

Answer: b) It changes significantly with altitude and atmospheric pressure.

5. What fundamental property of dilute gases makes them ideal for defining a universal temperature scale compared to liquids?

Answer: For dilute gases, the product of pressure and volume (PV) is linearly dependent on temperature, and all dilute gases exhibit this same linear behavior between fixed points.

6. What is "absolute zero" and what is its value in the Centigrade scale?

Answer: Absolute zero is the lowest possible temperature at which the pressure of any gas vanishes when extrapolated, and its value is -273.16 degrees Centigrade.

7. Multiple Choice Question: In the equation $Q = mc\Delta T$, what does 'c' represent?

- a) The caloric fluid of the substance.
- b) The coefficient of linear expansion.
- c) The specific heat of the material.
- d) The thermal conductivity of the material.

Answer: c) The specific heat of the material.

8. Describe what happens to the temperature of a substance during a phase change (e.g., melting ice into water) even when heat is continuously added.

Answer: During a phase change, the temperature of the substance remains constant even as heat is added; the added heat is instead used to change the physical state of the substance (e.g., converting solid to liquid).

9. Multiple Choice Question: Which method of heat transfer involves the actual physical movement of the heated medium?

- a) Radiation
- b) Conduction
- c) Convection
- d) Transpiration

Answer: c) Convection

10. What was the significance of Joule's experiment with the paddle wheel in water?

Answer: Joule's experiment demonstrated that a fixed amount of mechanical energy could be converted into a fixed amount of heat, establishing heat as a form of energy and allowing for the determination of the mechanical equivalent of heat (4.2 Joules per calorie).