Lecture-Based Questionnaire

1. According to the lecture, what defines a system as being in a state of thermal equilibrium?

a) Its temperature is rapidly changing due to external forces.
b) It is completely isolated from the outside world and cannot exchange energy.
c) Its macroscopic properties, such as temperature, have stopped changing over time.
d) All its constituent atoms and molecules have stopped moving.
Answer: c) Its macroscopic properties, such as temperature, have stopped changing over time.

2. State the Zeroth Law of Thermodynamics as described in the lecture.

Answer: If system A and system B are at the same temperature, and system B and system C are at the same temperature, then system A and system C are at the same temperature.

3. What is the primary advantage of using a gas thermometer for temperature measurement, as discussed in the lecture?

a) It is simpler to construct than liquid-based thermometers.
b) It does not require calibration at 0 and 100 degrees Centigrade.
c) Dilute gases expand linearly and consistently, agreeing across different gas types between fixed points.
d) Gases are readily available universally, unlike water.
Answer: c) Dilute gases expand linearly and consistently, agreeing across different gas types between fixed points.

4. What is the absolute zero of temperature, according to the lecture, and what physical phenomenon points to its existence?

Answer: Absolute zero is the lowest possible temperature where the product of pressure and volume (PV) for an ideal gas vanishes (or the pressure of a gas at constant volume vanishes).

5. How is "one calorie" defined according to the lecture?

a) The amount of heat required to raise the temperature of one kilogram of water by one degree Centigrade.
b) The amount of energy lost by one gram of water when its temperature drops by one degree Centigrade.
c) The amount of heat required to raise the temperature of one gram of water by one degree Centigrade.
d) The amount of heat transferred during a phase change of one gram of water.
Answer: c) The amount of heat required to raise the temperature of one gram of water by one degree Centigrade.
6. What is the key distinction between specific heat and latent heat in the context of heating a substance?
Answer: Specific heat is the heat required to change the temperature of a substance without changing its phase, while latent heat is the heat required to change the phase of a substance without changing its temperature.

7. Which of the following describes the heat transfer mechanism known as convection?

a) Heat transfer through direct contact between stationary particles in a medium.
b) Heat transfer by electromagnetic waves that do not require a medium.
c) Heat transfer through the bulk movement of fluid (liquid or gas) currents.
d) Heat transfer primarily occurring in a vacuum.
Answer: c) Heat transfer through the bulk movement of fluid (liquid or gas) currents.
8. What was the main conclusion of Joule's experiment regarding heat and mechanical energy?
Answer: Joule's experiment demonstrated a fixed proportionality (conversion factor) between lost mechanical energy (measured in Joules) and gained heat (measured in calories).

9. According to the lecture, what is "heat" at the microscopic level?

a) It is a caloric fluid that flows from hot to cold objects.

b) It is the potential energy stored within the bonds of atoms.

c) It is the macroscopic kinetic energy of an object in motion.

d) It is the random kinetic energy of the constituent atoms and molecules.

Answer: d) It is the random kinetic energy of the constituent atoms and molecules.

10. Explain the concept of a "reservoir" in thermodynamics.

Answer: A reservoir is a body so large that its temperature remains essentially unchanged even when significant amounts of heat are added to or removed from it.