Lecture-Based Questionnaire

1. Short Answer: Define thermodynamic equilibrium as described in the lecture.

Answer: Thermodynamic equilibrium is reached when the macroscopic properties of a system have stopped changing.

2. Multiple Choice: Which of the following best describes the significance of the Zeroth Law of Thermodynamics?

a) It defines the conservation of energy.
b) It allows for the global comparison of temperature using a third system (e.g., a thermometer).
c) It states that heat always flows from hot to cold.
d) It describes the behavior of ideal gases.
Answer: b) It allows for the global comparison of temperature using a third system (e.g., a thermometer).

3. Short Answer: Why is the gas thermometer considered superior to liquid-in-glass thermometers for establishing a universal temperature scale?

Answer: Gas thermometers are preferred because, when dilute, all gases exhibit a linear relationship between their pressure-volume product and temperature, and they agree in between the calibration points (0 and 100 degrees), unlike different liquids which expand at different rates.

4. Multiple Choice: According to the lecture, what specific temperature point is used as a universal standard (273.16 Kelvin) for calibrating the Kelvin scale, due to its unique and reproducible conditions?

a) The boiling point of water at sea level.
b) The freezing point of water.
c) The triple point of water.
d) The temperature at which all gas pressure vanishes.
Answer: c) The triple point of water.

5. Short Answer: What is the primary difference between how heat is

transferred via radiation versus convection?

Answer: Radiation involves the transfer of heat energy through electromagnetic waves without the need for a medium, while convection involves the actual physical movement of the heated medium itself.

6. Multiple Choice: If you have 1 gram of water and increase its temperature by 7 degrees Celsius, how many calories of heat, by definition, have been supplied to the water?

a) 1 calorie

b) 7 calories

c) 14 calories

d) 4.2 calories

Answer: b) 7 calories

7. Short Answer: Explain the concept of "latent heat" in the context of phase changes, using an example from the lecture.

Answer: Latent heat refers to the heat absorbed or released during a phase change (like melting or vaporization) without a change in temperature, such as when ice melts into water at 0 degrees Celsius even as heat is continuously supplied.

8. Multiple Choice: What is the approximate conversion factor found by Joule, linking mechanical energy (Joules) to heat energy (calories)?

a) 1 Joule per calorie

b) 4.2 Joules per calorie

c) 80 Joules per calorie

d) 100 Joules per calorie

Answer: b) 4.2 Joules per calorie

9. Short Answer: How did the understanding of atoms and molecules help physicists redefine heat as a form of energy?

Answer: The understanding that everything is made of atoms and molecules allowed physicists to interpret heat as the kinetic energy of these randomly moving microscopic particles, explaining why mechanical energy can be converted into heat.

10. Short Answer: According to the lecture, what practical advice is given when filling a

gas tank on a hot day, and what physical principle does this relate to?

Answer: On a hot day, one should leave some room at the top of the gas tank because liquids expand when heated; otherwise, the expanding fuel could cause the tank to burst due to volume expansion.