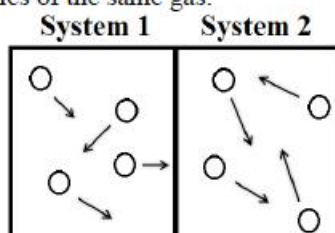
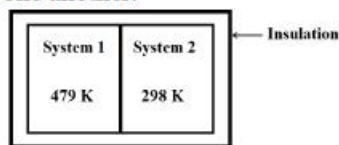


Thermodynamics
6.1 Endothermic and Exothermic Processes
6.2 Energy Diagrams
6.3 Heat Transfer and Thermal Equilibrium
Worksheet Key

- 1) Use the Boltzmann distribution curves from the slideshow to relate temperature to the motions of particles.
- 2) Arrows were used to represent the relative velocities of the particles in the following two pure samples of the same gas.



- a. Is System #2 at a higher or lower temperature than System #1? Justify your answer.
 - b. Will kinetic energy be transferred from one of these systems to the other? Justify your answer in terms of molecular collisions.
- 3) Consider the following two systems, which are housed in rigid containers that are in thermal contact with one another.



- a. If the insulation of the outside of the two systems prevents any energy from flowing into the surroundings, will the energy lost by System #1 be greater than, less than or equal to the energy gained by System #2.
 - b. Identify the type of energy that is transferred from System #1 into System #2. Justify your answer.
- 4) Two solutions at 25°C were mixed in a beaker. A precipitate formed and temperature of the new solution dropped to 19°C.
 - a. Did the amount of energy contained by the system increase, decrease, or remain the same? Justify your answer.
 - b. Was the chemical reaction that took place endothermic or exothermic?
 - c. Did the amount of energy contained by the surroundings increase, decrease, or remain the same? Justify your answer.

- 5) A student puts a beaker with 150 mL of distilled water a hotplate. The temperature of the water increases from 22°C to 85°C.
- Did the amount of energy contained by the 150 mL of water increase, decrease, or remain the same? Justify your answer.
 - Was this process endothermic or exothermic for the water? Explain.
- 6) A gas contracts from 4.26 L to 1.89 L in a cylinder under a constant external pressure of 1.10 atm. The temperature of the system remained the same during this process. Was this process endothermic or exothermic? Justify your answer.
- 7) 1354 J of heat was absorbed by a balloon from the surroundings, which causes the gas inside the balloon to expand from 2.31 L to 3.98 L under a constant external pressure of 1.07 atm.
- Was the absorption of 1354 J of heat from the surrounding an exothermic or endothermic process? Justify your answer.
 - Was the expansion of the balloon endothermic or exothermic? Justify your answer.
- 8) Draw a symbolic representation that demonstrated the flow of energy between the system and the surroundings for an exothermic process.
- 9) The following questions pertain to the burning or methane gas, CH_4 , in the presence of oxygen.
- Sketch a reaction energy diagram for the reaction.
 - Is this reaction endothermic or exothermic?
 - Did heat flow into or out of the system?
- 10) Identify and describe the energy changes that take place when sample of sugar, $\text{C}_6\text{H}_{12}\text{O}_6$ dissolves in a pure sample of water.