

## Chemistry: Introduction to Energy Problem Set

1. Define the following terms

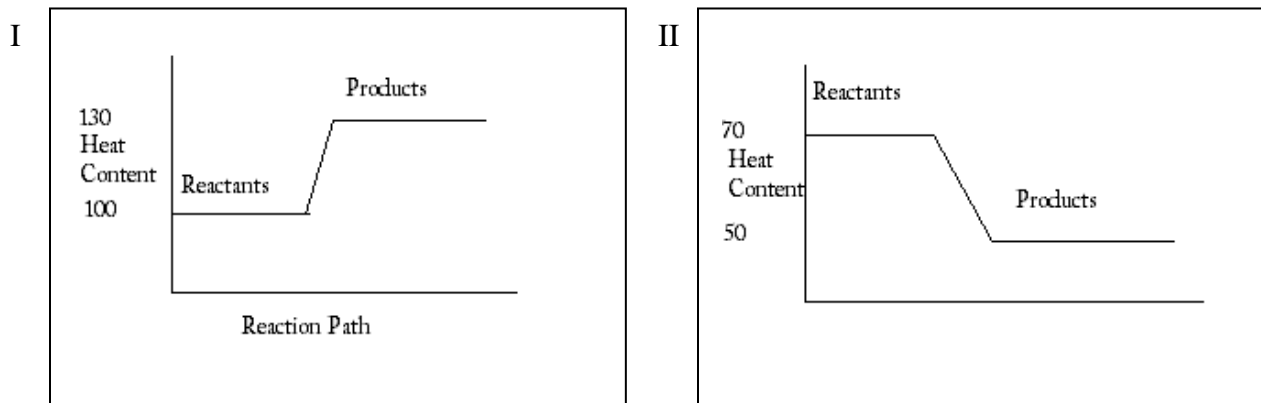
- a. Heat
- b. Temperature
- c. Exothermic
- d. Endothermic
- e. Heat Content
- f. Change in Heat Content

2. Why does a mixture of 0 °C ice and 0 °C water stay constant (no ice melts and no water freezes)

3. Identify the following processes as being endothermic or exothermic

- a. melting lead
- b. freezing water
- c. boiling water
- d. condensing steam
- e. burning wood
- f. removing water from a hydrate
- g. decomposing a compound
- h. temperature increases
- i. temperature decreases

4. Use the following diagrams to answer the following questions



For diagram I

- a. What is the amount of energy (number) stored in the reactants?
- b. What is the amount of energy (number) stored in the products?
- c. What is the change in energy in the reaction?
- d. Is this reaction endothermic or exothermic?

For diagram II

- e. What is the amount of energy (number) stored in the reactants?
- f. What is the amount of energy (number) stored in the products?
- g. What is the change in energy in the reaction?
- h. Is this reaction endothermic or exothermic?

5. Draw Heat Content Diagrams for the following conditions

- a. Reactants = 110       $\Delta H = +25$       Products = ?
- b. Reactants = 75       $\Delta H = -30$       Products = ?
- c. Reactants = ?       $\Delta H = +40$       Products = 120
- d. Reactants = ?       $\Delta H = -20$       Products = 50
- e. Reactants = 90       $\Delta H = ?$       Products = 115
- f. Reactants = 40       $\Delta H = ?$       Products = 20

6. It takes 100 calories to raise 10 grams of water 10 degrees Celsius

- a. 100 calories will raise ?? grams of water 20 degrees Celsius.
- b. 100 calories will raise 5 grams of water ?? degrees Celsius.
- c. 100 calories will raise 30 grams of water ?? degrees Celsius
- d. 100 calories will raise ?? grams of water 50 degrees Celsius

## Chemistry: Introduction to Energy Problem Set Answers

- 1a. Heat = transfer of energy due to temperature differences
  - 1b. Temperature measures the average kinetic energy of a system
  - 1c. Exothermic reactions release energy
  - 1d. Endothermic reactions absorb energy
  - 1e. Heat Content describes the total energy in a material
  - 1f. Change in heat content measures the energy change between reactants and products.
2. Heat energy cannot transfer to melt or freeze unless there is a difference in temperature.
- 3a. Melting lead = endothermic
  - 3b. Freezing water = exothermic
  - 3c. Boiling water = endothermic
  - 3d. Condensing steam = exothermic
  - 3e. Burning wood = exothermic
  - 3f. Removing water from a hydrate = endothermic (remember the lab???)
  - 3g. Decomposing a compound = endothermic
  - 3h. Temperature increases = exothermic
  - 3i. Temperature decreases = endothermic
- 4a. Reactants energy = 100
  - 4b. Products energy = 130
  - 4c. Energy change = +30
  - 4d. Endothermic = gains energy (+30)
  - 4e. Reactants energy = 70
  - 4f. Products energy = 50
  - 4g. Energy change = -20
  - 4h. Exothermic = loses energy (-20)
- 5a. Products = 135
  - 5b. Products = 45
  - 5c. Reactants = 80
  - 5d. Reactants = 70
  - 5e.  $\Delta H = +25$
  - 5f.  $\Delta H = -20$
- 6a. 50 grams water
  - 6b. 20 degrees Celsius
  - 6c. 3.33 degrees Celsius
  - 6d. 2 grams