5. Two aqueous substances in a glass beaker chemically react, and the temperature of the water in the beaker rises.

a. Have the surroundings gained or lost energy? How do you know?

gained heat, b/c the H₂O got warmer

b. Has the system gained or lost energy? How do you know?

lost energy, b/c the surroundings gained energy

c. Is the reaction endothermic or exothermic? ___*exo*___

6. Which of the following is true for an exothermic reaction?

(a.) The strength of the bonds in the products exceeds the strength of the bonds in the reactants.

b. The activation energy is always greater than the activation energy for an endothermic reaction.

c. Energy is absorbed over the course of the reaction.

d. The products have less thermal energy than the reactants.

Reaction Coordinate
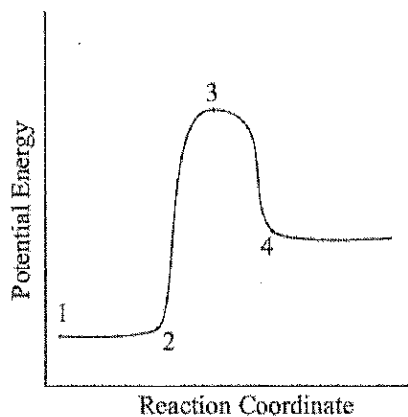
7. The distance between which two points is equal to the enthalpy change for this reaction?

a. Points 1 and 2   (c.) Points 1 and 4

b. Points 1 and 3   d. Points 2 and 3

8. The distance between which two points is equal to the activation energy for this reaction?

a. Points 1 and 2   c. Points 1 and 4

(b.) Points 1 and 3   d. Points 3 and 4

**9.** Consider the following reaction showing photosynthesis:

$$6\,CO_2(g) + 6\,H_2O(l) \rightarrow C_6H_{12}O_6(s) + 6\,O_2(g) \qquad \Delta H = +2800\ kJ/mol$$
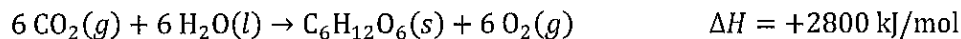
Which of the following is true regarding the thermal energy in this system?

(a.) It is transferred from the surroundings to the reaction.

b. It is transferred from the reaction to the surroundings.

c. It is transferred from the reactants to the products.

d. It is transferred from the products to the reactants.

$$C(s) + 2\,S(s) \rightarrow CS_2(l) \qquad \Delta H = +92.0 \text{ kJ/mol}$$

10. Which of the following energy level diagrams gives an accurate representation of the above reaction?

(A)

(B)

(C)

(D)

$$CH_4(g) + 2\,O_2(g) \rightarrow CO_2(g) + H_2O(l) \qquad \Delta H = -890 \text{ kJ/mol}$$
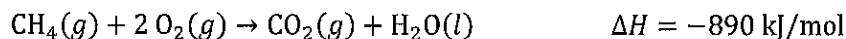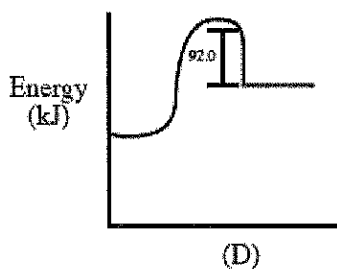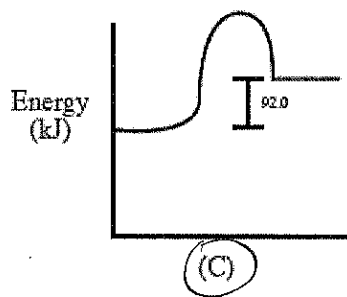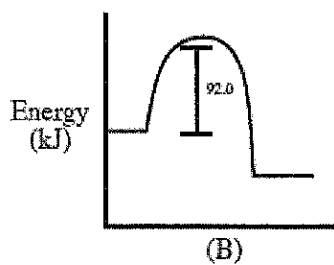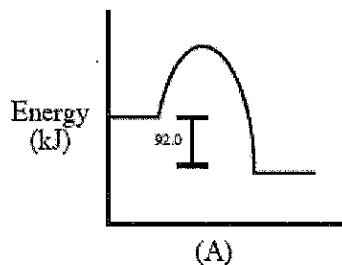
11. Regarding the reaction above, how much heat is absorbed or released when 2.0 mol of CH_4(g) reacts with 2.0 mol of O_2(g)? ← limiting!   excess

a. 890 kJ of heat is released.   c. 1780 kJ of heat is released.

b. 890 kJ of heat is absorbed.   d. 1780 kJ of heat is absorbed.

$$2.0 \text{ mol } O_2 \times \frac{1 \text{ mol rxn}}{2 \text{ mol } O_2} \times \frac{-890 \text{ kJ}}{1 \text{ mol rxn}} = -890 \text{ kJ}$$

13. Identify each of the following phrases/pictures as describing an endothermic or exothermic process:

exo   a.   The reactants have more potential energy than the products.

endo b.   A liquid evaporates.
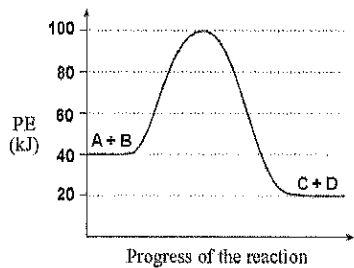
exo   c.   ΔH is negative.

endo d.   An aqueous chemical reaction occurs, and the temperature of the water drops.

endo f.   The products have more potential energy than the reactants.

exo   g.   A chemical reaction occurs, and the container becomes hot to the touch.

endo h.   ΔH is positive.

exo   i.   A gas condenses.

exo   e.

endo j.