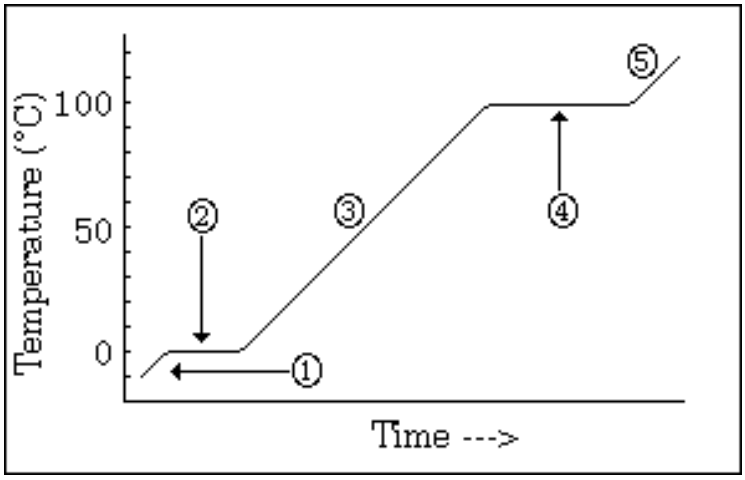
Name_____Date_____

Heating and Cooling Curves

Directions: Answer the following questions using the graph provided.

The diagram below is a plot of temperature vs. time. It represents the heating of what is initially ice at -10°C at a near constant rate of heat transfer.



1. What phase or phase change(s) is present at line segment 1? _____
2. What phase or phase change(s) is present at line segment 3? _____
3. What phase or phase change(s) is present at line segment 4?_____
4. What is the freezing point of the substance in the graph? Label the freezing point on the graph with the letter F. _____
5. At what temperature is the boiling point of the substance? Label the boiling point on the graph with the letter B. _____
6. Explain what is happening to the particles of the substance as time passes along line segment 4. This should be explained in terms of kinetic and/or potential energy._____

_____

7. What letter on the graph represents where the solid is being warmed? _____

8. What happens to the temperature of the substance along line segment 2?

a. The temperature decreases
b. The temperature increases
c. The temperature stays the same
d. The temperature increases and decreases

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Heat Calculations

Directions: Answer the following questions. Be sure to show your work and include units of measurement.

1. How many calories are in 1500 joules?

   Answer_____

2. How many joules are in 3.89 kcal?

   Answer_____

3. 12,980 Calories is how many joules?

   Answer_____

4. How many joules of heat are released when 5.0 grams of water cool from 75°C to 25°C?

   Answer_____

5. A 500 gram piece of iron changes 7 °C when heat is added. How much heat energy produced this change in temperature?

   Answer_____

6. 1200 calories of heat energy is added to a liquid with a specific heat of 0.57 cal/g° C. If the temperature increases from 20 °C to 33° C, what is the mass of the liquid?

   Answer_____

7. When 980 Joules of energy is lost from a 125 g object, the temperature decreases from 45°C to 40°C. What is the specific heat of this object?

   Answer_____

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Heat Calculations Continued

8. How many joules of heat are necessary to raise the temperature of 25 g of water from 10°C to 60°C?

Answer_____

9. How many joules are given off when 50 grams of water undergo freezing?

Answer_____

10. How many joules does it take to melt 45 grams of ice?

Answer_____

11. What mass of aluminum metal would absorb 250,000 J when it melted at its melting point? The heat of fusion for aluminum is 396.6J/g

Answer_____

12. What is the heat of vaporization of unknown substance that absorbs 18,200 J while undergoing boiling and has a mass of 15 g?

Answer_____

Name_____Date_____

Entropy

Directions: Identify if the following show an increase (I), decrease (D) or no change (NC) in entropy.

1. H_2O (g) → H_2O (ℓ) ΔS_____
2. $C_6H_{12}O_6$(s) → $2C_2H_5OH$(ℓ) + $2CO_2$(g) ΔS_____
3. $2NH_3$(g) + CO_2(g) → H_2O(ℓ) + NH_2CONH_2(aq) ΔS_____
4. NaCl(s) → NaCl(aq) ΔS_____
5. Cu(s) → Cu(ℓ) ΔS_____
6. $2NH_3$(g) ⇆ N_2(g) + $3H_2$(g) ΔS_____
7. H^+ (aq) + OH^-(aq) → H2O (ℓ) ΔS_____
8. H_2(g) + Cl_2 (g) → 2HCl(g) ΔS_____

9. Which of the following reactions will have an increase in entropy? Circle all that apply.
   a. SO_3(g) → $2SO_2$(g) + O_2(g)
   b. H_2O(l) → H_2O(s)
   c. Br_2(l) → Br_2(g)

10. Predict the sign of ΔS for the following process and choose the correct reasoning for your prediction: *The mass of nitrogen remains constant.*

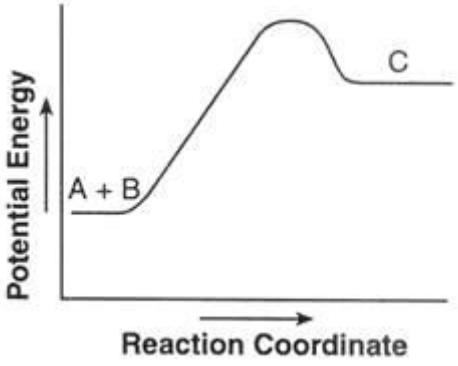
    N_2(g) at 10 atm → N_2(g) at 1 atm

    a. positive; there is an increase in the number of gas molecules
    b. positive; the gas expands into a larger volume
    c. negative; the gas is compressed into a smaller volume
    d. negative; the gas expands into a larger volume

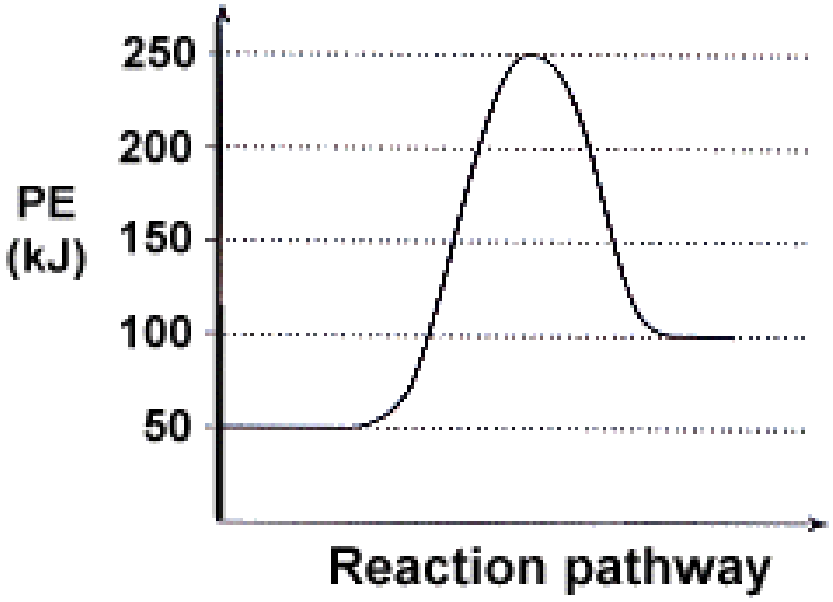
Name_____Date_____

Potential Energy Diagram

1. Does the graph below represent an endothermic or exothermic reaction?



2. The potential energy diagram below represents a chemical reaction:



a) Label the following on the graph above:
   A. Energy of the reactants
   B. Energy of the products
   C. Activation energy of the forward reaction
   D. Activation energy of the reverse reaction
   E. Enthalpy (heat of reaction)
   F. Energy of the activated complex

b) Add a catalyst to the graph.

c) Is this exothermic or endothermic?

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Equilibrium Expressions (K_{eq})

Directions: Write the equilibrium constant expressions for each reaction below.

1. $PCl_5\,(s) + H_2O\,(g) \rightleftarrows 2HCl\,(g) + POCl_3\,(g)$

2. $2SO_2\,(g) + O_2\,(g) \rightleftarrows 2SO_3\,(g)$

3. $Pb^{2+}\,(aq) + 2\ Cl^-\,(aq) \rightleftarrows PbCl_2(s)$

4. $Li_2CO_3\,(s) \rightleftarrows 2Li^+\,(aq) + CO_3^{-2}\,(aq)$

5. $H_2O\,(\ell) \rightleftarrows H^+\,(aq) + OH^-\,(aq)$

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Le Chatelier's Principle

Directions: Answer the following questions using Le Chatelier's Principle.

1) For the reaction below, which way would the equilibrium shift, for each situation below, to the right or to the left?

$$CH_{4\,(g)} + 2H_2S_{\,(g)} \leftrightarrow CS_{2\,(g)} + 4H_{2\,(g)} + \text{heat}$$

(a) Decrease the concentration of dihydrogen sulfide. _____

(b) Increase the pressure on the system. _____

(c) Increase the temperature of the system. _____

(d) Increase the concentration of carbon disulfide. _____

2) What would happen to the position of the equilibrium when the following changes are made to the equilibrium system below?

$$2SO_{3\,(g)} \leftrightarrow 2SO_{2\,(g)} + O_{2\,(g)}$$

(a) Sulfur dioxide is added to the system. _____

(b) Sulfur trioxide is removed from the system. _____

(c) Oxygen is added to the system. _____

3) Fill in the table below using the reaction provided.

$$PCl_5(g) \rightleftarrows PCl_3(g) + Cl_2(g) \quad \Delta H = 87.9J$$

Stress	Shift	$[PCl_5]$	$[PCl_3]$	$[Cl_2]$
Add PCl_5				
Add Cl_2				
Remove PCl_3				
Increase temperature				
Decrease temperature				
Increase pressure				
Decrease pressure				

4) Which of the changes above will result in a change in the Keq constant for this reaction?