

Unit 9 Outline- Thermodynamics, Reaction Rates, & Chemical Equilibrium Chapters 17 & 18

Essential Skills/ State Standards:

- 9-1. Describe heat, temperature, and heat flow in terms of the motion of molecules (or atoms). (CNS-7a)
- 9-2. Know that chemical processes & phase changes can affect related energy (enthalpy) or Gibbs energy (free energy). (CNS-7b, 7c)
- 9-3. Solve problems involving heat flow and temperature changes, using known values of specific heat ($q = mc + \Delta T$) & latent heat of phase change ($q = m \Delta H$). (CNS-7d)
- 9-4. Know the rate of reactions is affected by concentration of reactants or the increase in concentration of products with time & depends on such factors as: concentration, temperature, and pressure. (CNS-8a, 8b)
- 9-5. Know the definition and role of activation energy & catalyst in a chemical reaction. (CNS-8c, 8d, 8e)
- 9-6. Know how to use LeChatelier's principle to predict the effect of changes in concentration, temperature, and pressure. (CNS-9a)
- 9-7. Know that equilibrium is established when the forward and reverse reaction rates are equal. (CNS-9b)

Vocabulary

- | | | | |
|----------------|-------------------|--------------------------------------|----------------------------|
| • Condensation | • Deposition | • Endothermic | • Heat of reaction |
| • Freezing | • Heat | • Enthalpy | • Le Chatelier's principle |
| • Vaporization | • Temperature | • Specific heat | • Equilibrium |
| • Melting | • Thermochemistry | • $q = mc + c + \Delta T$ | • Activation Energy |
| • Boiling | • Exothermic | • $q = m \Delta H_{\text{vap/boil}}$ | • Catalyst |
| • Sublimation | • Endothermic | • $q = m \Delta H_{\text{melt}}$ | |

Study Guide (Use notes, worksheets, and labs in addition to this study guide)

- According to the collision theory, what 3 things must happen in order for two molecules to react?
Must collide with each other, Must collide with enough energy, & in the correct orientation
- What is the importance of the activation energy in a chemical reaction?
Amount of energy needed for a reaction to occur.
- Using the collision theory, explain if the following would increase/ decrease the rate of reaction:
 $2 \text{HCl(aq)} + \text{Mg(s)} \rightarrow \text{H}_2\text{(g)} + \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$
 - Increase temp: **Increase, molecules collide more.**
 - Increase HCl: **Increase, more collisions because more reactants to collide.**
 - Increase pressure: **Hard to say, wouldn't affect the reaction because none of them are gases. One of the products is a gas, so it might cause the gas particles to collide more with the reactants and could slow it down. Tough call... (that one won't be on the test)**
 - Remove MgCl_2 : **Increase, less products means less chance for them to interfere with reactant collisions.**
 - Add H_2 : **Decrease, more products mean they interfere more with reactants and the reactants would collide less.**
- Identify the following terms with their correct letter from the graph:

• Reactants- J	• Products- I
• Activation energy (number/ letter/ amount)- A (100/ J/mol)	

• Is this reaction exothermic or endothermic?
Endothermic
- Explain how a catalyst affects the activation energy in a chemical reaction. (Also, show on the above graph what a catalyst might do). It **lowers the activation energy (see on graph). Speeds it up by lowering the activation energy.**



18 Reaction Rates And Equilibrium Worksheet Answers

Joacim Rocklöv



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