**Name:** _____ **Class:** _____ **Date:** _____ **ID: A**

# Chem Sem 2 Midterm 2 Review Sheet 06 07

**Modified True/False**
*Indicate whether the sentence or statement is true or false. If false, change the identified word or phrase to make the sentence or statement true.*

____ 1. *Decreasing* the concentration of reactants increases the collision frequency between reacting particles _____.

____ 2. Increasing the *concentration* of a substance increases the kinetic energy of the particles that make up the substance _____.

____ 3. Catalysts increase the rates of chemical reactions by *raising* the activation energy of the reactions _____.

____ 4. *Increasing* the surface area of a reactant increases the rate of the reaction _____.

____ 5. Raising the temperature of a reaction increases the rate of the reaction by increasing the *energy* of the collisions between reacting particles _____.

**Completion**
*Complete each sentence or statement.*

Use each of the terms below just once to complete the passage.

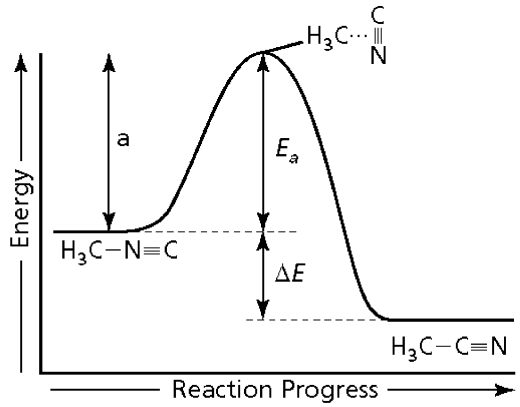
| | | |
|---|---|---|
| collision theory | activated complex | transition state |
| activation energy | reaction rate | mol/(L·s) |

According to the (1)_____, atoms, ions, and molecules must collide in order to react. Once formed, the (2) _____ is a temporary, unstable arrangement of atoms that may then form products or may break apart to reform the reactants. This physical arrangement is known as the (3) _____. Every chemical reaction requires energy, and the minimum amount of energy that reacting particles must have to form the activated complex is the (4) _____. In a chemical reaction, the (5) _____ is the change in concentration of a reactant or product per unit time. It may be expressed using the units of (6) _____.

6. The word used to fill in blank #1 is _____.
7. The word used to fill in blank #2 is _____.
8. The word used to fill in blank #3 is _____.
9. The word used to fill in blank #4 is _____.
10. The word used to fill in blank #5 is _____.
11. The word used to fill in blank #6 is _____.

**Short Answer**

Use the energy diagram for the rearrangement reaction of methyl isonitrile to acetonitrile to answer the following questions.




12. What kind of reaction is represented by this diagram, endothermic or exothermic?
13. What is the chemical structure identified at the top of the curve on the diagram?
14. What does the symbol $E_a$ represent?
15. What does the symbol $\Delta E$ represent?

**Problem**

16. What is the volume of 2.3 mol $Cl_2$ at 290 K and 0.89 atm?
17. How many moles of a gas will occupy 2.50 L at STP?
18. What volume is occupied by 0.580 mol of gas at 98.4 kPa and 11°C?
19. Calculate the volume of chlorine gas at STP that is required to completely react with 3.50 g of silver, using the following equation: $2Ag(s) + Cl_2(g) \rightarrow 2AgCl(s)$.
20. What is the percent by mass of 92.3 g of potassium fluoride (KF) dissolved in 1000.0 g of water?

For Problems 8 & 9, refer to the following: A 500.0 g-sample of aqueous hydrogen peroxide ($H_2O_2$) contains 31.50% $H_2O_2$ by mass.

21. Find the mass of hydrogen peroxide in the solution.
22. Find the mass of water in the solution.
23. If 24.0 mL of methanol ($CH_3OH$) is dissolved in 48.0 mL of water, determine the percent by volume of methanol in the solution.
24. A 0.600-L sample of a 2.50M solution of potassium iodide (KI) contains what mass of KI?

25. A 22.0-mL sample of 12M $H_2SO_4$ is diluted to a volume of 1200.0 mL. What is the molarity of the diluted solution?

26. What is the molarity of a solution that contains 20.45 g of sodium chloride (NaCl) dissolved in 700.0 mL of solution?

27. Copper metal has a specific heat of 0.385 J/g·°C and a melting point of 1083°C. Calculate the amount of heat required to raise the temperature of 22.8 g of copper from 20.0°C to 875°C.

28. How many degrees of temperature rise will occur when a 25.0-g block of aluminum absorbs 10.0 kJ of heat? The specific heat of aluminum is 0.897 J/g·°C.

29. At body temperature, 2404 J is required to evaporate 1 g of water. After vigorous exercise, a person feels chilly because the body is giving up heat to evaporate the perspiration. A typical person perspires 25 mL of water after 20 minutes of exercise. How much body heat is used to evaporate this water?

# Chem Sem 2 Midterm 2 Review Sheet 06 07
# Answer Section

## MODIFIED TRUE/FALSE

1. ANS: F, Increasing
2. ANS: F, temperature
3. ANS: F, lowering
4. ANS: T
5. ANS: T

## COMPLETION

6. ANS: collision theory
7. ANS: activated complex
8. ANS: transition state
9. ANS: activation energy
10. ANS: reaction rate
11. ANS: mol/(L·s)

## SHORT ANSWER

12. ANS:
    exothermic
13. ANS:
    the activated complex
14. ANS:
    the activation energy
15. ANS:
    the net energy released from the exothermic reaction

## PROBLEM

16. ANS:
    $V = nRT/P = (2.3 \text{ mol})(0.0821 \text{ L·atm/mol·K})(290 \text{ K})/0.89 \text{ atm} = 62 \text{ L}$
17. ANS:
    $n = \frac{V(1 \text{ mol})}{22.4 \text{ L}}$; $n = \frac{(2.50 \text{ L})(1 \text{ mol})}{22.4 \text{ L}} = 0.112 \text{ mol}$

18. ANS:

$PV = nRT;\ V = \frac{nRT}{P};$

$V = \frac{(0.580\ \text{mol})(8.31\ \text{L} \cdot \text{kPa/mol} \cdot \text{K})(284\text{K})}{98.4\text{kPa}}$

$= 13.9\ \text{L}$

19. ANS:

$3.50\ \text{g Ag}\left(\frac{1\ \text{mol Ag}}{107\ \text{g Ag}}\right)\left(\frac{1\ \text{mol Cl}_2}{2\ \text{mol Ag}}\right)\left(\frac{22.4\ \text{L Cl}_2}{1\ \text{mol Cl}_2}\right)$

$= 0.366\ \text{L Cl}_2$

20. ANS:

$\text{mass of solution} = \text{mass of solute} + \text{mass of solvent}$

$\text{mass of solution} = 1000.0\ \text{g} + 92.3\ \text{g} = 1092.3\ \text{g}$

$\text{Percent by mass} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100\%$

$= \left(\frac{92.3\ \text{g}}{1092.3\ \text{g}}\right)(100\%)$

$\text{Percent by mass} = 8.45\%$

21. ANS:

$\text{Percent by mass} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100\%$

$\text{Mass of solute} = \frac{\text{percent by mass}}{100\%} \times \text{mass of solution}$

$= \left(\frac{31.50\%}{100\%}\right)(500.0\ \text{g})$

$\text{mass of solute} = 157.5\ \text{g}\ (H_2O_2)$

22. ANS:

mass of solution = mass of solute + mass of solvent
mass of solvent = mass of solution – mass of solute
= 500.0 g – 157.5 g
mass of solvent = 342.5 g ($H_2O$)

23. ANS:

$\text{volume of solution} = \text{volume of solute} + \text{volume of solvent}$

$\text{volume of solution} = 24.0\ \text{mL} + 48.0\ \text{mL}$
$= 72.0\ \text{mL}$

$\text{Percent by volume} = \frac{\text{volume of solute}}{\text{volume of solution}} \times 100\%$

$= \left(\frac{24.0\ \text{mL}}{72.0\ \text{mL}}\right)(100\%)$

$\text{Percent by volume} = 33.3\%$

24. ANS:

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{liters of solution}}$$

$$\text{moles of solute} = \text{molarity} \times \text{liters of solution}$$
$$= (2.50 \text{ mol KI}/\cancel{L})(0.600 \cancel{L})$$
$$\text{moles of solute} = 1.50 \text{ mol KI}$$

$$(1.50 \cancel{\text{mol KI}})\left(\frac{1.66 \text{ g KI}}{1 \cancel{\text{mol KI}}}\right) = 249 \text{ g KI}$$

25. ANS:

$$M_1V_1 = M_2V_2$$

$$M_2 = M_1\frac{V_1}{V_2} = (12M)\left(\frac{22.0 \cancel{\text{mL}}}{1200.0 \cancel{\text{mL}}}\right)$$

$$= 0.22M \text{ } H_2SO_4$$

26. ANS:

$$(20.45 \cancel{\text{g NaCl}})\left(\frac{1 \text{ mol NaCl}}{58.44 \cancel{\text{g NaCl}}}\right) = 0.3499 \text{ mol NaCl}$$

$$(700.0 \cancel{\text{mL}})\left(\frac{1 \text{ L}}{1000 \cancel{\text{mL}}}\right) = 0.7000 \text{ L}$$

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{liters of solution}}$$

$$= \frac{0.3499 \text{ mol NaCl}}{0.7000 \text{ L}} = 0.4999 \text{ mol NaCl/L}$$

$$\text{Molarity} = 0.5000M \text{ NaCl}$$

27. ANS:

$$q = c \times m \times \Delta T$$

$$q = 0.385 \cancel{\text{J/g}\cdot\text{°C}} \times 22.8 \cancel{\text{g}} \times (875 \cancel{\text{°C}} - 20.0 \cancel{\text{°C}}) \times \frac{1 \text{ kJ}}{1000 \cancel{\text{J}}} = 7.51 \text{ kJ}$$

28. ANS:

$$q = c \times m \times \Delta T$$

$$\Delta T = \frac{q}{c \times m}$$

$$(T_{final} - T_{initial}) = 10\,000 \cancel{\text{J}}/(25.0 \cancel{\text{g}} \times 0.897 \cancel{\text{J/g}}\cdot\text{°C}) = 446\text{°C}$$

29. ANS:

Convert the 25 mL of water to grams of water.

$$25 \cancel{\text{mL}} \times 1 \text{ g}/1 \cancel{\text{mL}} = 25 \text{ g}$$

$$25 \cancel{\text{g}} \times 2404 \cancel{\text{J/g}} \times \frac{1 \text{ kJ}}{1000 \cancel{\text{J}}} = 60 \text{ kJ}$$