Midterm Study Guide

Mid-First Semester Examination

Academic Year 2025-2026

Subject: Chemistry

Grade 11

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Content: Experience Chemistry

Storyline 2: Understanding Chemical Reactions

- ☐ Investigation 7: Stoichiometry
  - Experience 1: Quantifying Reactants and Products
  - Experience 2: Chemical Calculations
  - Experience 3: Limiting Reagent and Percent Yield
- ☐ Investigation 8: Thermochemistry
  - Experience 1: Energy in Chemical Bonds
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Please study the material listed in the table above with a focus on the points below.

Storyline 2: Understanding Chemical Reactions

Investigation 7: Stoichiometry

Lesson 1: Quantifying Reactants and Products

- Analyze data on proportionality of reactants and products to predict their stoichiometric ratios in the corresponding chemical equation.
- Develop a model that demonstrates conservation of mass in a chemical equation.
- Apply mathematical concepts to interpret a chemical equation.

Lesson 2: Chemical Calculations

- Use dimensional analysis to determine the mass of reactant required to obtain a given amount of product.
- Use the mole ratio in a chemical reaction to relate amounts of participating substances.
- Develop and use a model of different units of measurement.
- Calculate and communicate data on different units of measurement.

Lesson 3: Limiting Reagent and Percent Yield

- Explain the concept of limiting reactant and how it affects the amount of product produced in a reaction.
- Explain theoretical and actual yield and why the former is usually larger than the latter.
- Use computational thinking to predict the grams of product given the grams of reactant.

Investigation 8: Thermochemistry

Lesson 1: Energy in Chemical Bonds

- Explain how molecules must collide with each other with sufficient energy and in the correct orientation for a chemical reaction to take place.
- Represent energy changes in exothermic and endothermic reactions using an enthalpy diagram.
- Calculate enthalpy of reaction from bond energies and molar enthalpy of reaction data.

Lesson 2: Enthalpies of Formation and Reaction

- Explain how Hess's law can be used to calculate the change in enthalpy for a chemical reaction using any number of intermediate compounds.
- Calculate the change in enthalpy for a reaction using the sum of a system of chemical equations or a table of enthalpies of formation.
- Calculate the change in enthalpy for a dissolution process using molar enthalpy of solution.

Lesson 3: Enthalpy in Changes of State

- Understand how and why substances change in enthalpy when transitioning between physical states.
- Calculate the change in enthalpy for state changes between solid, liquid, and gas.
- Describe the link between state change enthalpies and the strength of intermolecular forces.

Stoichiometry

Quantifying Reactants and Products

Lesson 1

1. This chemical reaction follows the law of conservation of mass.

   $Mg(OH)_2\ (aq) + 2HCl(aq) \longrightarrow 2H_2O(l) + MgCl_2\ (aq)$

   Which of the statements are **true**? Select all that apply.

   a. In this reaction, atoms rearrange to form new molecules.
   b. Atoms are created and destroyed in this chemical reaction.
   c. Atoms are neither created nor destroyed in this chemical reaction.
   d. In this reaction, atoms do not rearrange to form new molecules.
   e. In this reaction, the number of atoms of the reactants is the same as the number of atoms of the products.

2. Find the reactant and product molar masses for this photosynthesis reaction reported to one place after the decimal point.

   a. The reactant mass is 186.0 grams, and the product mass is 186.0 grams.
   b. The reactant mass is 186.0 grams, and the product mass is 372.0 grams.
   c. The reactant mass is 372.0 grams, and the product mass is 186.0 grams.
   d. The reactant mass is 372.0 grams, and the product mass is 372.0 grams.

Chemical Calculations

Lesson 2

1. This chemical reaction follows the law of conservation of mass.

   H_2 (g) + Cl_2 (g) ⟶ 2HCl(g)

   If 3.7 liters of Cl_2 are used for this reaction, how much HCl will be formed? Assume there are enough reactants to complete the reaction and assume the reaction occurs at STP.

   a. 1.3 liters
   b. 3.7 liters
   c. 7.4 liters
   d. 9.3 liters

2. Which of the given mole ratios are possible for the salt formation equation?

   2Na(s) + Cl_2 (g) ⟶ 2NaCl(s)

   a. Na:Cl_2
   b. 2Na:Cl_2
   c. Cl:2NaCl
   d. Na2 :NaCl
   e. Cl_2 :2NaCl
   f. 2Na:2NaCl

Limiting Reagent and Percent Yield

Lesson 3

1. Which statements about limiting and excess reagents are true? Select **all** that apply.
   a. Any reactant that is not used up during the chemical reaction is called a limiting reagent.
   b. Any reactant that is not used up during the chemical reaction is called an excess reagent.
   c. The reactant that determines how much product can be formed during a chemical reaction is called the limiting reagent.
   d. The reactant that determines how much product can be formed during a chemical reaction is called the excess reagent.
   e. The chemical reaction continues after the limiting reagent is used up because some amount of the other reactant remains.
   f. The chemical reaction stops after the limiting reagent is used up even though some amount of the other reactant remains.
2. A reaction produces 14.2 grams of a product. The theoretical yield of that product is 17.1 grams. Which of the statements are true? Select **all** that apply.
   a. The percent yield of the product is 14.2%.
   b. The percent yield of the product is 17.1%.
   c. The percent yield of the product is 83.0%.

d. The percent yield of the product is 120.0%.

e. The actual yield of the product is 14.2 grams.

f. The actual yield of the product is 17.1 grams.

Thermochemistry

Energy in Chemical Bonds

Lesson 1

1. The bond enthalpy of the N-N triple bond is 945 kJ/mol. Which statement about the N_2 molecule is correct?

   a. 315 kJ of energy is released when 1 mole of N_2 is formed.

   b. 945 kJ of energy is absorbed when 1 mole of N_2 is formed.

   c. 1890 kJ of energy is released when 2 moles of N_2 are formed.

   d. 1890 kJ of energy is absorbed when 2 moles of N_2 are formed.

2. The decomposition reaction of ammonia is shown.

   $2NH_3 \longrightarrow N_2 + 3H_2$

   If the bond enthalpy of the N-H bond is 389 kJ/mol, what is the enthalpy of the

   reactants for 2 moles of reactants during the decomposition reaction?

   a. −2334 kJ

   b. −778 kJ

   c. +778 kJ

   d. +2334 kJ

Enthalpies of Formation and Reaction

Lesson 2

1. A student is trying to develop a model of an instant heat pack. What is the essential characteristic of the chemical reaction that the student should use to develop the heat pack?

   a. The standard enthalpy of reaction should be zero.

   b. The standard enthalpy of reaction should be negative.

   c. The enthalpy of formation of reactants should be positive.

d. The enthalpy of formation of products should be negative.

2. Which statements about the standard enthalpy of formation of a compound are **true**? Select all that apply.

    a. It is calculated when all substances are in their gaseous states.

    b. It is calculated when all substances are in their respective states at STP.

    c. It is the enthalpy change accompanying the formation of 1 g of the compound.

    d. It is the enthalpy change accompanying the formation of 1 mole of the compound.

Enthalpy in Changes of State

Lesson 3

1. What characteristics would you expect to find in an experiment that applies heat energy to a substance undergoing a phase change?

    a. The constituent particles of the substance change.

    b. The temperature of the substance keeps increasing as energy is added.

    c. The temperature stops increasing as the structure of the substance changes.

    d. The intramolecular bonds of the substance break, leading to the formation of newer molecules.

2. What is the amount of heat required to melt 2.50 moles of ice? ΔH_{us} = 6.01 kJ/mol

    a. 2.40 kJ

    b. 8.51 kJ

    c. 15.0 kJ

    d. 16.7 kJ

3. Which expression can be used to represent an equivalence of heat of vaporization?

    a. $\Delta H_{vap} = \Delta H_{us}$

    b. $\Delta H_{vap} = \Delta H_{cond}$

    c. $\Delta H_{vap} = -\Delta H_{us}$

    d. $\Delta H_{vap} = -\Delta H_{cond}$