مدارس البكالوريا
BACCALAUREATE SCHOOLS

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

**Storyline 4: The Dynamics of Chemical Reactions**

☐ Investigation 13: Acid-Base Equilibria

- Experience 1: Acids, Bases, and Salts

- Experience 2: Strong and Weak Acids and Bases

- Experience 3: Reactions of Acids and Bases

- Experience 4: Buffers and Equilibria

**Materials Included**

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| | 4- Buffers and Equilibria | 222-225 |

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.

**Storyline 4: The Dynamics of Chemical Reactions**

**Investigation 13: Acid-Base Equilibria**

Lesson 1: Acids, Bases, and Salts

- Define acids and bases and explore conjugate acid-base pairs.

- Analyze data on pH relationships.

Lesson 2: Strong and Weak Acids and Bases

- Analyze the differences between strong acids and bases and weak acids and bases.

- Explore the relationship between $H_3O^+$ concentration and pH.

Lesson 3: Reactions of Acids and Bases

- Explore acid-base neutralization reactions.

- Investigate titrations with strong/weak acids and bases.
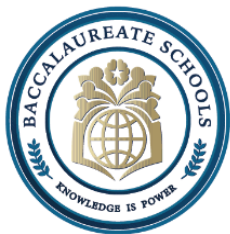
- Use mathematical thinking to determine concentrations by titration.

Lesson 4: Buffers and Equilibria

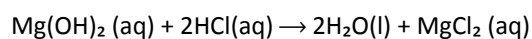- Classify and model salt solutions.

- Discover patterns in buffers.

- Describe buffer systems and explore examples of them.

**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) $\longrightarrow$ 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) $\longrightarrow$ 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.

**Acid-Base Equilibria**

Acids, Bases, and Salts

Lesson 1

1. Bases dissolve in water. Determine which equations represent bases in water. Select all that apply.

a. $NH_3 + H_2O \leftrightharpoons NH_4^+ + OH^-$

b. $NH_3 + H_2O \leftrightharpoons NH_2 + H_3O^+$

c. $CH_5N + H_2O \leftrightharpoons C_5H4_4N^- + H_3O^+$

d. $C_5H_5N + H_2O \leftrightharpoons C_5H_5NH^+ + OH^-$

Strong and Weak Acids and Bases

Lesson 2

1. A chemical entity is in a state of equilibrium in its aqueous solution. In this state, the entity ionizes to an extent of 10% to form its conjugate base and H3O + . What will happen when a strong acid is added to this solution?

a. $OH^-$ concentration will increase

b. $OH^-$ concentration will decrease

c. $H_3O^+$ concentration will increase

d. $H_3O^+$ concentration will decrease

Reactions of Acids and Bases

Lesson 3

1. Neutralization is a reaction between an acid and a base. Which equations represent a neutralization reaction? Select **all** that apply.

a. $HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O(l)$

b. $Zn(s) + 2HCl(aq) \longrightarrow ZnCl_2 (aq) + H_2(g)$

c. $H_2SO_4(aq) + ZnO(s) \longrightarrow ZnSO_4(aq) + H_2O(l)$

    d. $3HCl(aq) + Fe(OH)_3(s) \longrightarrow FeCl_3(aq) + 3H_2O(l)$

    e. $Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(aq) + H_2O(l)$

    f. $Mg(s) + 2NaOH(aq) \longrightarrow Mg(OH)_2(aq) + 2Na(s)$

2. How many milliliters of 2.8M NaOH is needed to neutralize 11.6 mL of 3.0M $H_2SO_4$?

    a. 2.8 mL

    b. 3 mL

    c. 11.6 mL

    d. 25 mL

Buffers and Equilibria

Lesson 4

1. Select **all** the reactions that produce an acidic salt.

    a. hydrochloric acid and lithium hydroxide

    b. hydrochloric acid and sodium bicarbonate

    c. nitric acid and barium hydroxide

    d. acetic acid and sodium hydroxide

    e. phosphoric acid and potassium hydroxide

    f. sulfuric acid and ammonia