Curriculum Sample Template
Max. 8 Pages

Grade Level	9th Grade	**Content Area**	Science
Course Title (grades 9-12 Only)	Chemistry 1-2		
Expected Prior Knowledge *List the knowledge/skills mastered earlier in the year foundational to the mastery of the Required Standard(s).*	Students are expected to have prior knowledge of and/or skills mastered to: **HS.5.4.1:** Apply the law of conservation of matter to changes in a system. **HS.5.4.2:** Identify the indicators of chemical change, including formation of a precipitate, evolution of a gas, color change, absorption or release of heat energy. **HS.5.4.3:** Represent a chemical reaction by using a balanced equation. **HS.5.4.8:** Quantify the relationships between reactants and products in chemical reactions (e.g., stoichiometry, equilibrium, energy transfers).		
Alignment to Program of Instruction *Describe how the methods of instruction found in this sequence of lessons that align to the Program of Instruction described in the application package.*	Science lessons focus on discovery and experiential-based learning, the development of background knowledge and skills, and a deep understanding of physical science. Direct Instruction includes lecture (structured overview) and small-group (peer partners, research groups) learning activities. Formative assessments include discussions and reflections, Cornell Notes and graphic organizers, and collaborative activities. Summative assessments designed for student mastery of content.		
Standard Number* and Description *The standard number and description of the Required Standard(s) being instructed and assessed to mastery in the curriculum sample.*	HS.5.4.9 Predict the products of a chemical reaction using types of reactions (e.g., synthesis, decomposition, replacement, combustion). HS.5.4.10 Explain the energy transfers within chemical reactions using the law of conservation of energy.		
Materials/Resources Needed *List all items the teacher and students will need for the entire sequence of instruction (excluding common consumables).*	Science Dictionary		

* ***Standard Number****: For English Language Arts (Reading and Writing), use Grade, Strand, Standard (e.g., 3.RI.2). For K-8 Math, use Grade, Domain, Standard (e.g., 6.EE.7). For HS Math, use Conceptual Category-Domain, Standard (e.g., A-REI.6). For Science, use Grade, Strand, Concept, PO (e.g., 4.1.3.1).*

Lesson (add as needed)	**Instructional Strategies**	**Student Activities**
1	**Chemical Reactions** (1) Teacher will introduce the lesson by posing the following question: What happens to a match when lit? (2) Teacher will introduce key vocabulary: chemical property, chemical reaction, reactant, product, and precipitate (3) Teacher will present structured overview of: (a) the difference between physical and chemical changes; (b) the process of a chemical reaction; and (c) the four clues for predicting the products of a chemical reaction.	(1) Students will write a short response to the discussion of the question. (2) Students will document key vocabulary and meanings in their Science Dictionary. (3) Students will take Cornell Notes for: (a) the difference between physical and chemical changes; (b) the process of a chemical reaction; and (c) the four clues to predicting the products of a chemical reaction. (4) **Summative Assessment**: Students will complete Recognizing Chemical Changes Quiz.
2-3	**The Flow of Energy** (1) Teacher will introduce the lesson by posing the following question: Why does lava cool faster in water than in air? (2) Teacher will introduce key vocabulary: systems, surroundings, law of conservation of energy, endothermic process, and exothermic process. (3) Teacher will present structured overview of: (a) the law of conservation of energy; (b) the endothermic process; and the exothermic process. **Types of Chemical Reactions and Transfers of Energy** (1) Teacher will introduce the lesson by posing the following question: What happens to the wax when you burn a candle? (2) Teacher will introduce key vocabulary: combination reaction; decomposition reaction; single-replacement reaction; double-replacement reaction; and combustion reaction. (3) Teacher will present structured overview of: (a) five types of chemical reactions; (b) the reactants and probable products of the chemical reactions; and (d) the energy transfers that occur in chemical reactions.	(1) Students will write a short response to the discussion of the question. (2) Students will document key vocabulary and meanings in their Science Dictionary. (3) Students will take Cornell Notes for: (a) the law of conservation of energy; (b) the endothermic process; and the exothermic process. (4) Students will prepare a graphic organizer with peer partner that identifies and describes four examples of the endothermic process and the exothermic process. **Types of Chemical Reactions and Transfers of Energy** (1) Students will write a short response to the discussion of the question. (2) Students will document key vocabulary and meanings in their Science Dictionary. (3) Students will take Cornell Notes for: (a) five types of chemical reactions; (b) the reactants and probable products of the chemical reactions; and (d) the energy transfers that occur in chemical reactions. (4) **Summative Assessment**: Students will complete Chemical Reactions and Energy Transfers Quiz.

4	**Chemical Reactions Lab**	**Chemical Reactions and Energy Transfers Lab** (1) **Summative Assessment:** Students will work in research groups to conduct the Chemical Reactions and Energy Transfers Lab by: (a) reading the Experiment Guide; (b) performing the experiment in strict accordance with procedures; (c) preparing the Experiment Report; and (d) participating in a post-experiment discussion with another research group.

Summative Assessment Items and Scoring: *Below, provide at least three Summative Assessment items that together accurately measure student mastery of the application of the content and/or skills as defined by the grade-level rigor in the Required Standard(s). For each assessment item, provide an answer key or scoring rubric which clearly describes how assessment items are to be scored and how points will be awarded, such that mastery of the application of the content and/or skills as defined by the grade-level rigor in the Required Standard is clearly demonstrated by an acceptable score.*

1. **Recognizing Chemical Changes Quiz:** Assessment is scored on a 35 point scale and each answer is worth 5 points. Students will score 28 out of 35 points (80%) to demonstrate mastery.
2. **Types of Chemical Reactions Quiz:** Assessment is scored on a 75 point scale and each question is worth 5 points. Students will score 60 out of 75 points (80%) to demonstrate mastery.
3. **Chemical Reactions and Energy Transfers Lab – Experiment Report:** Assessment is scored on a 115 point scale and each questions is worth 5 points. Students will score 92 out of 115 (80%) to demonstrate mastery.*

*assessment independent from instruction

Recognizing Chemical Changes Quiz

Score: _____

For each example, identify the clue or clues for predicting the products of a chemical reaction.

1. Lighting a Bunsen burner.
2. Holding a piece of magnesium ribbon in a burner flame until it ignites.
3. Adding sodium chloride solution to 5 mL of silver nitrate solution.
4. Adding potassium chromate solution to 5 mL of silver nitrate solution.
5. Adding a piece of mossy zinc to 5 mL of sulfuric acid.
6. Adding a marble chip to 5 mL of sulfuric acid.

Answer Key

1. Transfer of energy (heat and light)
2. Transfer of energy (heat and light)
   Change in color (white powder)
3. Change in color
4. Formation of precipitate
5. Formation of gas
6. Formation of gas

Chemical Reactions and Energy Transfers Quiz

Score: _____

Identify the reactants, products, and energy transfers for each type of chemical reaction list on the table below.

Chemical Reaction	Reactants	Products	Energy Transfers
Combination			
Decomposition			
Combustion			
Single-replacement			
Double-replacement			

Answer Key

Chemical Reaction	Reactants	Products	Energy Transfers
Combination	two or more	only one	Exothermic
Decomposition	only one	two or more	Endothermic
Combustion	element or compound plus oxygen	one or more oxides	Exothermic
Single-replacement	one element and one compound	a different element and compound	Depends
Double-replacement	two compounds	two other compounds	Depends

Chemical Reactions Lab
Experiment Guide

In this experiment, you will learn to differentiate between the five general types of chemical reactions. Some of the reactions you will perform; others will be demonstrated by your teacher. From observations, you will identify the products of each reaction and determine the type of reaction that has taken place.

PURPOSE

To predict the products of chemical reactions and classify the chemical reactions based on five general categories.

OBJECTIVES

(1) Predict the products of chemical reactions; (2) Observe different types of chemical reactions; and (3) Classify chemical reactions according to reaction categories.

MATERIALS

Student Experiments

Safety goggles and apron; 0.1M copper (II) sulfate - CuSO4; 2 small test tubes; iron filings – Fe; centigram balance; 0.1M lead (II) nitrate - $Pb(NO_3)_2$; dropper pipet; 0.1M potassium iodide – KI; 2 medium test tubes; 6M hydrochloric acid – HCl; test-tube rack; magnesium turnings – Mg; crucible tongs; 2 wood splints; gas burner; book of matches; ring stand; 3% hydrogen peroxide – H_2O_2; utility clamp

Teacher Demonstrations

Electrolysis apparatus; utility clamp; rubber stopper - one-holed; sodium hydrogen carbonate – $NaHCO_3$, large test tube; glass tube of 25 cm in length - bent at 90 angle in center; wood splints; matches; gas burner; limewater, saturated solution of calcium oxide - CaO; ring stand

PROCEDURES

1. Observe all lab safety procedures.

For Student Experiments

2. Iron metal and copper (II) sulfate solution. Half-fill a small test tube with copper (II) sulfate solution. Add about 2 g of iron filings to the solution. After 5 minutes, record your observations.
3. Lead (II) nitrate and potassium iodide solutions. Put 2 mL of lead (II) nitrate solution into a small test tube. Add 5–10 drops of potassium iodide solution. Record your observations.
4. Magnesium metal and hydrochloric acid. CAUTION: Hydrochloric acid is corrosive. Half-fill a medium-sized test tube with 6M hydrochloric acid. Place the test tube in a test tube rack and add several magnesium turnings. Identify any gas that forms by using crucible tongs to hold a burning wood splint at the mouth of the test tube. Record your observations.
5. Action of heat on hydrogen peroxide. Add 2 mL of 3% hydrogen peroxide solution to a medium-sized test tube. Clamp the test tube to a ring stand. CAUTION: Make sure that the mouth of the tube is pointed away from you and away from everyone else. Heat the solution very gently. Identify any gas that forms by using crucible tongs to insert a glowing wood splint into the mouth of the test tube. Record your observations.

For Teacher Demonstrations

6. Action of electricity on water (electrolysis). Water can be broken down into its component elements by passing electricity through it. This process is called electrolysis. Make observations of the reaction during a 10-minute period.
7. Action of heat on sodium hydrogen carbonate. Solid sodium hydrogen carbonate will be heated strongly in a large test tube for 2 minutes. The gas that is given off will be tested by exposing it to a burning splint and by bubbling it through limewater. Record your observations of these tests.
8. Follow your teacher's instructions for proper disposal of the materials.

Chemical Reactions Lab
Experiment Report

Observations

Chemical Reaction	Predictions	Observations	Reaction Type
1-Iron metal and copper (II) sulfate solution			
2-Lead (II) nitrate and potassium iodide solutions			
3-Magnesium metal and hydrochloric acid.			
4-Action of heat on hydrogen peroxide			
5-Action of electricity on water (electrolysis).			
6-Action of heat on sodium hydrogen carbonate.			

Analyses and Conclusions

1. Predict the products for each chemical reaction.
2. Record you observations for each chemical reaction.
3. Classify each of the observed chemical reactions as one of the five types of chemical reactions.
4. In which reactions was there observed a color change?
5. In which reactions was energy absorbed?
6. In which reactions was energy given off?
7. In which reactions was a gas produced?
8. In which reactions was a precipitate formed?

Answer Key

Observations

Chemical Reaction	Predictions	Observations	Reaction Type
1-Iron metal and copper (II) sulfate solution	Single element New compound	The blue color of the solution fades. A dark, solid material forms on the Fe.	single replacement
2-Lead (II) nitrate and potassium iodide solutions	Two New Compounds	When the two colorless solutions are mixed, a yellow precipitate is formed.	double replacement
3-Magnesium metal and hydrochloric acid.	Single Element New Compound	A gas is produced from the solution. The Mg metal disappears. The burning splint causes an explosion in the mouth of the test tube.	single replacement
4-Action of heat on hydrogen peroxide	Gas in the air One or more new compounds	Bubbles form in the solution (the solution is not boiling). The glowing splint bursts into flame.	combustion
5-Action of electricity on water (electrolysis).	Gas in the air One or more new compounds	A gas is produced at each electrode. The volume of gas (H_2) formed at one electrode is twice the volume of gas (O_2) formed at the other electrode.	combustion
6-Action of heat on sodium hydrogen carbonate.	Gas in the air One or more new compounds	The burning splint is extinguished when placed in the gas. The limewater turns milky when the gas is bubbled through.	combustion

Analyses and Conclusions

1. Predict the products for each chemical reaction. (See above.)
2. Record you observations for each chemical reaction. (See above.)
3. Classify each of the observed chemical reactions as one of the five types of chemical reactions. (See above.)
4. In which reactions was there observed a color change? (1, 2)
5. In which reactions was energy absorbed? (4, 5, 6)
6. In which reactions was energy given off? (1, 3)
7. In which reactions was a gas produced? (3, 4, 5, 6)
8. In which reactions was a precipitate formed? (2)