Subject: Regents Chemistry Grade: 9-12 Unit #: 3 Title: Artist as Chemist

UNIT OVERVIEW

<table>
<tr><th colspan="4">STAGE ONE: Identify Desired Results</th></tr>
<tr><td rowspan="6">Established Goals/Standards</td><td rowspan="6">NYS Chemistry Standards:

3.1v-x, 3.1cc, 3.1ee, 3.1oo, 3.1pp, 3.1ss-yy, 3.2b, 3.3a, 3.3c, 5.2a, 5.2c, 5.2h, 5.2i, 5.2n</td><td colspan="2">Long-Term Transfer Goal</td></tr>
<tr><td colspan="2">At the end of this unit, students will use what they have learned to independently…
Use basic chemical principles to construct a piece of artwork that shows variety of techniques and colors.
Understand and discuss how the physical and chemical properties of element, compounds, and mixtures are fundamental in the creation of colors and textures in the world around them.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>Enduring Understandings
Students will understand that…
Chemistry enhances the quality of life.
Chemistry is found in art.
The structure of matter determines its chemical and physical properties.
Behavior of matter is predictable.</td><td>Essential Questions
Students will consider such questions as…
What makes something art?
What determines properties of matter?
How can we use the predictable nature of matter to produce art works?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>What knowledge will students learn as part of this unit?
The strength of acids and bases is measured on the pH scale from 0 (very acidic) to 14 (very basic). An aqueous solution of a strong acid or base is 100 % ionized. pH □ – log[H□].</td><td>What skills will students learn as part of this unit?
Section 1: Compare and contrast

Section 2: Use models to identify a change in a reaction’s pH.

Section 3: Identify patterns, create models</td></tr>
</table>

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		• **Acid-base indicators** are used to visually estimate the pH of a solution by color. • An **acid** has **properties** of sourness and reactivity with metals, while **bases** are slippery, bitter, and corrosive. • **Weak acids** are not completely ionized in water, having a **pH less than 7** (7 being neutral). **Weak bases** are also not completely ionized and will have a **pH greater than 7**. • The **definition** of an acid or a base has evolved in the last century, with major contributors being **Arrhenius**, **Brønsted and Lowry**, and **G.N.Lewis**. • The **Brønsted-Lowry** definition states that acids are proton donors while bases are proton acceptors. • The **Lewis acid-base** concept is the most general and states that acids are electron-pair acceptors and bases are electron-pair donors. • The **activity series of metals** places the elemental form of each metal in a descending	Section 4: Identify properties, identify costs and benefits, and make estimates using scales. Section 5: Perform accurate laboratory procedures and measurements. Section 6: Make observations, identify patterns, create rules Section 7: create data tables, identify patterns and relationships Section 8: Identify relationships **NYS Process Standards: Analysis, Inquiry, and Design** M1.1 Use algebraic and geometric representations to describe and compare data. • organize, graph, and analyze data gathered from laboratory activities or other sources • measure and record experimental data and use data in calculations S1.1 Elaborate on basic scientific and personal explanations of natural phenomena, and develop extended visual models and mathematical formulations to represent thinking.

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		order of reactivity. A metal higher in the series will reduce and replace a lower metal ion in a solution of its salt. • Families of elements in the periodic table either gain or lose electrons in order to fulfill the **octet rule**, with few exceptions. • Metals typically lose electrons to become **cations,** while many nonmetals will gain electrons to become **anions**. • Bonding in metals is often described as an **electron-sea model** because the **valence electrons** have the ability to move from one atom to another, allowing electrical **conductivity**. • Some **physical properties of metals** are conductivity and malleability, although these properties can be altered by the formation of alloys. For example, gold alloys are harder than pure gold. • Many compounds include specific numbers of loosely bonded water molecules in	• use theories and/or models to represent and explain observations • use theories and/or principles to make predictions about natural phenomena • develop models to explain observations S3.1 Use various means of representing and organizing observations (e.g.,diagrams, tables, charts, graphs, equations, and matrices) and insightfully interpret the organized data. • organize observations in a data table, analyze the data for trends or patterns, and interpret the trends or patterns, using scientific concepts S3.3 Assess correspondence between the predicted result contained in the hypothesis and the actual result, and reach a conclusion as to whether or not the explanation on which the prediction is supported. • evaluate experimental methodology for inherent sources of error and analyze the possible effect on the result • compare the experimental result to the expected result; calculate the percent error as appropriate

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		their formula and are called **hydrates**. • Chemical reactions are recorded in shorthand by using **chemical formulas** and by **balanced equations** so that matter is neither created nor destroyed. • A **double-replacement reaction** is a reaction where either a **precipitate**, water, or a gas is formed as a product. A table of **solubility rules** is useful for predicting this type of reaction. • A **dye** is often a complex **organic molecule,** which binds to the fibers of a material like wool. By adjusting the pH, or by using a **mordant**, the binding can be strengthened. • In the oxidized state, many metal ions exhibit a specific color, which can be seen in **bead tests**. For example, Co^{2+} gives a blue color and Fe^{3+} gives a yellow-colored bead.	**Interconnectedness Common Themes:** 2.4 Compare predictions to actual observations, using test models. • compare experimental results to a predicted value, e.g., percent error 3.2 Extend the use of powers of ten notation to understanding the exponential function and performing operations with exponential factors. • use powers often to represent a large range of values for a physical quantity, e.g., pH scale 5 Identifying patterns of change is necessary for making predictions about future behavior and conditions. **Interdisciplinary Problem Solving** 2 Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.

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			If students are asked to do a project, then the project would require students to: • work effectively • gather and process information • generate and analyze ideas • observe common themes • realize ideas • present results Reference Tables to add: ● Table F ● Table J

STAGE TWO: Determine Acceptable Evidence	
	Assessment Evidence
Criteria for to assess understanding: *(This is used to build the scoring tool.)* ● a demonstration of the techniques involved ● the original work ● a museum placard or pamphlet explaining the chemistry involved	Performance Task focused on Transfer: Art is the result of the human need for self-expression. It tells stories of social injustice, different eras, nationalities, and expresses individuals' feelings from sorrow to joy. Your challenge is to create a work of art that represents you and your culture using appropriate artistic techniques. But before you get anxious, rest assured that you don't need to be "artistically talented" to do well on this challenge. Hard work and creativity will count more than natural ability. Also, there are many ways to express yourself in art. You will be introduced to topics and techniques that you might never have dreamed you had a talent for. So relax and enjoy your voyage into the world of art. In addition to the artwork, you will also need to create an informative museum display that includes the following: ● a demonstration of the techniques involved ● your original work ● a museum placard or pamphlet explaining the chemistry involved

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	Other Assessment Evidence: Lab Journaling for each section: What do you see? What do you think? What do you think now? Chem Essential Questions Chem to Go questions Section quizzes Chapter Mini-challenge Chapter Challenge Chapter test Potential sections to remove: Section 7 and/or 8

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T, M, A *(Code for Transfer, Meaning Making and Acquisition)*	**STAGE THREE: Plan Learning Experiences**	
	Learning Events: ● Section 1: Identify different forms and materials for art, consider the different properties of each material/why it is useful, and create a group definition of art. ● Section 2: Identify pH through the use of indicators and identify a change in a reaction's pH based on the reactants. ● Section 3: Identify relative reactivity of metals, identify direction of electron flow in Voltaic cell, describe process of electroplating, and Reference Table J (ADD IN) ● Section 4: Identify basic properties of metals, identify benefits or alloys, annealing, hardening, and tempering, and estimate percent composition of alloys using coloring. ● Section 5: Remove water from a hydrate and determine the formula of an unknown hydrate. ● Section 6: Write (word) double replacement reactions, identify the formation of precipitates and their chemical formula, develop solubility rules (if you stretch step 5 of the lab), and Reference Table F (ADD IN) ● Section 7: create data tables and identify the relationship between pH and natural dye color and	Evidence of learning: *(formative assessment)*

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	create data tables showing the change in dye color that different mordants have ● Section 8: Identify the relationship between metal oxides and their visible colors	