Subject: Regents Chemistry Grade: 9-12 Unit #: 4 Title: Chemical Dominoes

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:

3.1ll, 3.4a, 3.3c, 3.2b, 3.2k, 3.2j, 3.1k, 3.1rr, 3.4f, 4.1c, 3.3a</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…
● Apply chemical principals to real-life situations to solve problems or create solutions.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>Enduring Understandings
Students will understand that…

• Design processes are open-ended and involve principles as well as practical experience.

• Why change happens is controlled by various factors that compete with each other.

• Structure informs properties of materials.</td><td>Essential Questions
Students will consider such questions as…

• How do you design a robust and repeatable process that makes something?

• How do you control the direction a change will take?

• How can you take advantage of knowledge of a material’s properties to make the material do something?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>What knowledge will students learn as part of this unit?

Entropy is a thermal energy process and is frequently thought to be a measure of the disorder in a system. A substance in the gas phase will have more entropy than that substance in the solid phase.</td><td>What skills will students learn as part of this unit?

Section 1: follow directions; design and conduct experiments to optimize results; present findings; evaluate findings and draw conclusions</td></tr>
</table>

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		Standard temperature and pressure (STP) are the conditions of 1 Atmosphere and 273 Kelvin. Much of the mathematics in chemistry is found in **stoichiometric** and thermodynamic calculations. Using a **balanced equation**, the quantities of reactants and products can be calculated. The **metal activity series** is used in **single-replacement reactions** and in making an **electrochemical cell**. **Fluorescence** is the immediate emission of light by an atom as an electron returns from an **excited state** to its **ground state**. The light is the same wavelength as what was absorbed by the atom, taking it from a **ground state** to an **excited state**. **Phosphorescence** is a process similar to fluorescence where light is emitted by an atom or molecule but, unlike fluorescence, the light persists after the exiting source is removed.	Section 2: design and experiment to answer a question; use a table to collect data; use models to represent molecules; analysis of chemical equations Section 3: develop a procedure to answer a question given materials and method limitations; determine a rule from a pattern; use an analogy to determine how to solve a mathematical problem Section 4: follow instructions to make an electrical circuit; evaluate the effectiveness of a chemical reaction; analysis of information to draw a conclusion; predict results of an experiment based on given information; follow procedures to conduct an experiment Section 5: observe and record results; compare and contrast; follow procedures to conduct an investigation; drawing a conclusion based on data Section 6: follow instructions to conduct a testing apparatus; observe; make predictions; organize data in a table; use diagrams to

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		An **electrolyte** is an ionic substance which will conduct electricity in solution or when molten. The **rate of a chemical reaction** is dependent on several factors, such as **temperature**, **surface area**, **concentration**, and, if available, the use of a **catalyst**. All chemical reactions have an energy barrier that must be overcome and this is called the **activation energy**. The **law of conservation of energy** states that energy states that energy cannot be created or destroyed. If the **system** under study gains energy (**endothermic**), then the **surroundings** must lose energy. If the system loses energy (**exothermic**), then the surroundings must gain energy. According to the **Gibbs free energy** equation, a reaction will be **spontaneous** if it is exothermic and entropy is increasing. If it is endothermic and entropy is decreasing, it will not be spontaneous. Other combinations of	represent molecular interactions; use drawings to represent experimental set-up; Section 7: observe; hypothesize; make laboratory measurements; draw conclusions based on evidence; organize data in a table; summarize; design an experiment Section 8: organize data in a table; follow instructions; predict; observe; explaining relationships; use models to explain particle behavior; compare and contrast **NYS Process Skills-** **Analysis, Inquiry, and Design** S1.1 Elaborate on basic scientific and personal explanations of natural phenomena, and develop extended visual models and mathematical formulations to represent thinking. • 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

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		enthalpy and entropy will depend on their values and the temperature. $\Delta G = \Delta H - T\Delta S$	S2.1 Devise ways of making observations to test proposed explanations. • design and/or carry out experiments, using scientific methodology to test proposed calculations 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. **Interconnectedness: Common Themes**

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			Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions. Examples include: • use the concept of systems and surroundings to describe heat flow in a chemical or physical change, e.g., dissolving process Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design. 2.1 Revise a model to create a more complete or improved representation of the system. • show how models are revised in response to experimental evidence, e.g., atomic theory, Periodic Table 2.2 Collect information about the behavior of a system and use modeling tools to represent the operation of the system.

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			2.4 Compare predictions to actual observations, using test models. **Interdisciplinary Problem Solving** 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. 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 **NYS Regents Chemistry Reference Tables-** Table A – Standard Temperature and Pressure

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			Table I – Heats of Reaction (ΔH) Table J – Activity Series Table M: Acid base Indicators Table T – Mole Calculations

STAGE TWO: Determine Acceptable Evidence	
	Assessment Evidence
Criteria for to assess understanding: *(This is used to build the scoring tool.)* • How many chemical reactions or physical changes must you use? • How well does your prototype work? • How entertaining is the display? Colorful? Funny? Surprising? • How many tries should a team get to make the demonstration work for the audience? • How sturdy is the prototype? • How can you tell if the prototype is targeted to the appropriate age group? • How enjoyable will it be for people to build?	Performance Task focused on Transfer: You have been asked to develop a Chemical Dominoes toy that meets all the requirements set by the company. The sequence must run successfully if set up properly. This will require testing to make sure the process works reliably. You will demonstrate your final product to an audience of executives at the toy company. You will be required to present a prototype of your product and all the accompanying materials. During your demonstration, you will briefly explain the chemistry behind each step of the sequence. You will also provide a detailed written explanation of how the chemistry behind your Chemical Dominoes works. If the company decides to produce your product, they will want to patent it. To make this possible, you must keep an extremely complete notebook, carefully recording everything you try in developing this product and the results of each experiment (for every component, not just the whole product all together). This will allow the company to show the lawyers the extent of your investigation into the effects you studied, and document the failures as well as the successes that went into your invention. Pay particular attention to recording each step you go through in setting up the completed sequence, as well as any troubleshooting you do to make everything work together in a sequence (including any problems that must be solved at the last minute). Other Assessment Evidence: Journaling

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For the written material you submit: • Have all safety issues been addressed? • How understandable are the directions and the diagram for assembly? • How clear and accurate are the explanations of the chemistry?	What do you see? What do you think? What do you think now? Chem Essential Questions Chem to Go questions Chapter Mini-challenge Section quizzes Chapter test

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T, M, A *(Code for Transfer, Meaning Making and Acquisition)*	**STAGE THREE: Plan Learning Experiences**	
	Learning Events:	Evidence of learning: *(formative assessment)*

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