Subject: Regents Chemistry	Grade: 9-12	Unit #: 5	Title: Ideal Toy

UNIT OVERVIEW

<table>
<tr><th colspan="4">STAGE ONE: Identify Desired Results</th></tr>
<tr><td rowspan="7">Established Goals/Standards</td><td rowspan="7">NYS Chemistry Standards:

3.1w, 3.1y, 3.2c-h, 3.2j-l, 3.3b, 3.4a-c, 4.2b, 4.2c, 5.2a, 5.2g, 5.2l-n</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, including gas laws, to construct a toy for a selected age group.
● Understand and describe how various chemical process and gas interactions are present in many everyday items found in their community.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>Enduring Understandings
Students will understand that…
● Chemical principles are involved in many toys.
● The nature of matter determines its use.
● The behavior of gases is predictable.
● Energy can be transferred in many ways; energy is transformed in chemical reactions.</td><td>Essential Questions
Students will consider such questions as…
● How are chemical principles used by the toy industry?
● How do physical and chemical properties of matter relate to its use?
● How do gases behave?
● How is energy released from matter?
● How can energy be harnessed to do useful work?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>What knowledge will students learn as part of this unit?
● Electrochemical cells (batteries) produce voltage based on the relative metal activities of the electrodes.</td><td>What skills will students learn as part of this unit?
Section 1: Create models.

Section 2: Create predictive models.</td></tr>
</table>

		• The **half-reactions** that are taking place at the **anode** and **cathode** can be explained in terms of **oxidation** and **reduction**. • **Oxidation** is the loss of electrons in a reaction; **reduction** is the gain of electrons. **LEO** the lion says **GER**rrrr is a helpful mnemonic device. • The size and shape of a molecule depends on what atoms are contained in the molecule. • **London dispersion forces** are the weak **intermolecular forces** in **nonpolar** molecules, such as the **hydrocarbons**. • In **polar covalent** molecules the strength of the intermolecular forces depend on the **electronegativity** of the atoms and their intramolecular orientation. • Some **physical properties**, like **melting point** and **boiling point**, increase regularly as the molecular size of a family of compounds becomes larger.	Section 3: Identify patterns and relationships, derive Boyle's Law. Section 4: Identify patterns and relationships, derive Charles's Law, and create models. Section 5: Use accurate laboratory processes and measurements. Section 6: Apply experimental data, use dimensional analysis accurately. Section 7: Use dimensional analysis, create models. Section 8: Use accurate laboratory processes, compare and contrast. **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 • recognize and convert various scales of measurement

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		• **Boyle's law** states that the product of the pressure and volume of a sample of gas will equal a constant when the temperature is constant. P_1V_1 □= P_2V_2 • **Charles's law** states that the volume of a sample of gas is directly related to the temperature (**kelvins**) when the pressure is constant. $V_1/T_1 = V_2/T_2$ • Producing rocket fuels requires an understanding of the following type of reactions: **synthesis**, **single-** and **double-replacement**, and **decomposition**. • Using Avogadro's gas law with Charles's and Boyle's laws allows for the development of the combined gas law $P_1V_1/T_1 = P_2V_2/T_2$ • From the **combined gas law** the **ideal gas equation** can be developed: PV = nRT. This equation allows the determination of any one of the variables (*P,V,T, n*) when the other three are known.	• use knowledge of geometric arrangements to predict particle properties or behavior M2.1 Use deductive reasoning to construct and evaluate conjectures and arguments, recognizing that patterns and relationships in mathematics assist them in arriving at these conjectures and arguments. • interpret a graph constructed from experimentally obtained data M3.1 Apply algebraic and geometric concepts and skills to the solution of problems. • state assumptions which apply to the use of a particular mathematical equation and evaluate these assumptions to see if they have been met • evaluate the appropriateness of an answer, based on given data 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

		• At the same temperature, all gases have the same **kinetic energy**. KE = (1/2)mv^2. It follows that a heavier gas moves more slowly than a lighter gas. • **Graham's law of effusion** states that the rate of **effusion** is inversely proportional to the square root of the density of the gas. In comparing the effusion rate of two gases, note that since the volume is constant, then molecular mass values can be used instead of density. V_1/V_2 = sqrt(m_2/m_1) • **Thermoset** plastics are rigid and cannot be remolded after they set. • **Thermoplastics** differ from the thermoset plastics since they can be reheated and reformed to different shapes. • Plastics are **polymers** and built from **monomers**. An example is **polyethylene,** which contains ethylene monomers.	• develop models to explain observations S2.1 Devise ways of making observations to test proposed explanations. • design and/or carry out experiments, using scientific methodology to test proposed calculations S2.4 Carry out a research plan for testing explanations, including selecting and developing techniques, acquiring and building apparatus, and recording observations as necessary. • determine safety procedures to accompany a research plan 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 **Interconnectedness Common Themes**

			2.2 Collect information about the behavior of a system and use modeling tools to represent the operation of the system. • show how information about a system is used to create a model, e.g., kinetic molecular theory (KMT) 2.3 Find and use mathematical models that behave in the same manner as the processes under investigation. • show how mathematical models (equations) describe a process, e.g., combined gas law 4.2 Cite specific examples of how dynamic equilibrium is achieved by equality of change in opposing directions. • explain how a system returns to equilibrium in response to a stress, e.g., LeChatelier's principle **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. 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

STAGE TWO: Determine Acceptable Evidence	
	Assessment Evidence
Criteria for to assess understanding: *(This is used to build the scoring tool.)* ● Create a toy targeted for a specific age group. ● Prepare a written proposal about your toy to submit to the board. ● Prepare a three-minute	Performance Task focused on Transfer: Your challenge is to create a toy that uses various chemical and/or gas principles. The toy should be appealing to a certain age group of your choice. You will need to prepare a presentation for the board of the toy company. Your presentation should include: ● A written proposal, either a detailed drawing or a mock prototype of the toy, any potential hazards or waste-disposal issues, and a cost analysis of the item for manufacturing. Your presentation will be evaluated on the quality of your visual aids or your prototype, the quality of your presentation, the explanation of the chemistry involved, and the quality of your written proposal. You will need to complete the following tasks: ● Create a toy targeted for a specific age group. ● Prepare a written proposal about your toy to submit to the board. ● Prepare a three-minute presentation for the board to promote your toy.

presentation for the board to promote your toy.	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 5(?) and 8

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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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Based on UbD (ASCD) by G. Wiggins and J. McTighe