Energy & U Elementary Lesson plan	**Lesson Vision**
Lesson Objective What must students be able to do by the end of the lesson?	• The objective of the Energy & U show is to familiarize the students with concepts of energy. What does energy mean for scientist and engineers by introducing different experiments. By the end of the show students will learn the first law of Thermodynamics, how to measure energy, different types of energy and what can be done with energy.
TEKS Alignment	**§112.12. Science, Grade 1, Adopted 2017.** (1) In Grade 1, students observe and describe the natural world using their senses. Students do science as inquiry in order to develop and enrich their abilities to understand the world around them in the context of scientific concepts and processes. Students develop vocabulary through their experiences investigating properties of common objects, earth materials, and organisms. (A) A central theme in first grade science is active engagement in asking questions, creating a method to answer those questions, answering those questions, communicating ideas, and exploring with scientific tools in order to explain scientific concepts and processes like scientific investigation and reasoning; matter and energy; force, motion, and energy; Earth and space; and organisms and environment. Scientific investigation and reasoning involves practicing safe procedures, asking questions about the natural world, and seeking answers to those questions through simple observations used in descriptive investigations. (B) Matter is described in terms of its physical properties, including relative size, weight, shape, color, and texture. The importance of light, thermal, and sound energy is identified as it relates to the students' everyday life. The location and motion of objects are explored. **(5) Matter and energy.** The student knows that objects have properties and patterns. The student is expected to: (A) classify objects by observable properties such as larger and smaller, heavier and lighter, shape, color, and texture; (B) predict and identify changes in materials caused by heating and cooling; and **(6) Force, motion, and energy.** The student knows that force, motion, and energy are related and are a part of everyday life. The student is expected to:

(A) identify and discuss how different forms of energy such as light, thermal, and sound are important to everyday life;

§112.13. Science, Grade 2, Adopted 2017

(1) In Grade 2, careful observation and investigation are used to learn about the natural world and reveal patterns, changes, and cycles. Students should understand that certain types of questions can be answered by using observation and investigations and that the information gathered in these investigations may change as new observations are made. As students participate in investigation, they develop the skills necessary to do science as well as develop new science concepts.

(A) A central theme throughout the study of scientific investigation and reasoning; matter and energy; force, motion, and energy; Earth and space; and organisms and environment is active engagement in asking questions, creating a method to answer those questions, answering those questions, communicating ideas, and exploring with scientific tools. Scientific investigation and reasoning involves practicing safe procedures, asking questions about the natural world, and seeking answers to those questions through simple observations used in descriptive investigations.

(5) Matter and energy. The student knows that matter has physical properties and those properties determine how it is described, classified, changed, and used. The student is expected to:

(A) classify matter by physical properties, including relative temperature, texture, flexibility, and whether material is a solid or liquid;

(B) compare changes in materials caused by heating and cooling;

(6) Force, motion, and energy. The student knows that forces cause change and energy exists in many forms. The student is expected to:

(A) investigate the effects on objects by increasing or decreasing amounts of light, heat, and sound energy such as how the color of an object appears different in dimmer light or how heat melts butter;

§112.14. Science, Grade 3, Adopted 2017.

(1) In Grade 3, students learn that the study of science uses appropriate tools and safe practices in planning and implementing investigations, asking and answering questions, collecting data by observing and measuring, and using models to support scientific inquiry about the natural world.

(A) Within the physical environment, students recognize that patterns, relationships, and cycles exist in matter. Students will investigate the physical properties of matter and will learn that changes occur. They explore mixtures and investigate light, sound, and thermal energy in

everyday life. Students manipulate objects by pushing and pulling to demonstrate changes in motion and position.

(5) Matter and energy. The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:

(C) predict, observe, and record changes in the state of matter caused by heating or cooling such as ice becoming liquid water, condensation forming on the outside of a glass of ice water, or liquid water being heated to the point of becoming water vapor; and

(6) Force, motion, and energy. The student knows that forces cause change and that energy exists in many forms. The student is expected to:

(A) explore different forms of energy, including mechanical, light, sound, and thermal in everyday life;

§112.15. Science, Grade 4, Adopted 2017.

(1) In Grade 4, investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. They have limitations and, based on new discoveries, are constantly being modified to more closely reflect the natural world.

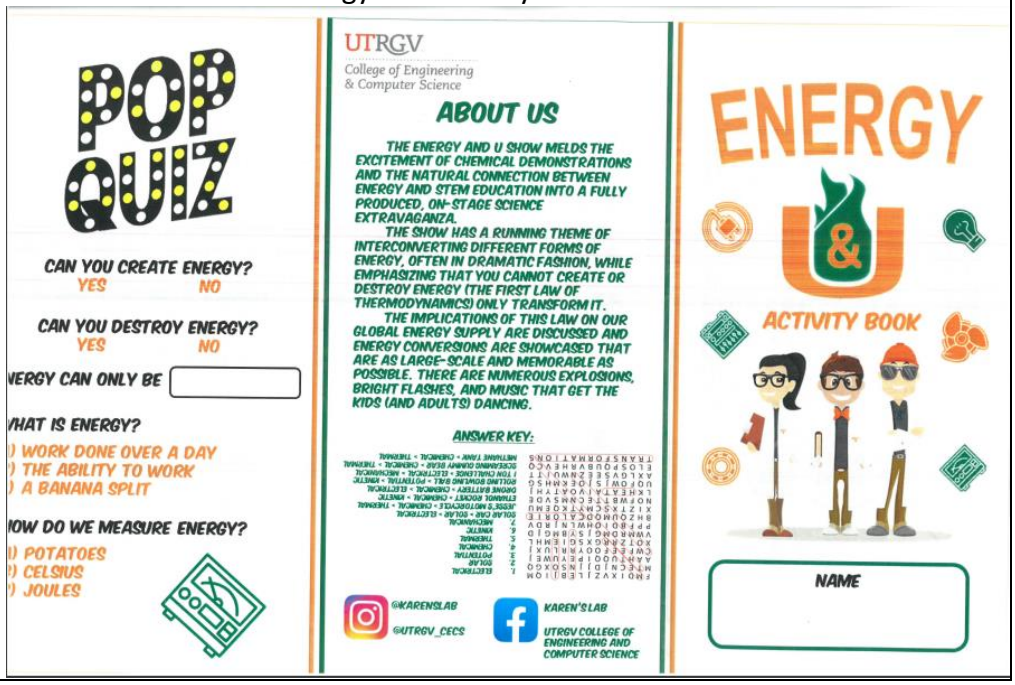
(A) Within the physical environment, students know about the physical properties of matter including mass, volume, states of matter, temperature, magnetism, and the ability to sink or float. Students will differentiate among forms of energy including mechanical, light, sound, and thermal energy. Students will explore electrical circuits and design descriptive investigations to explore the effect of force on objects.

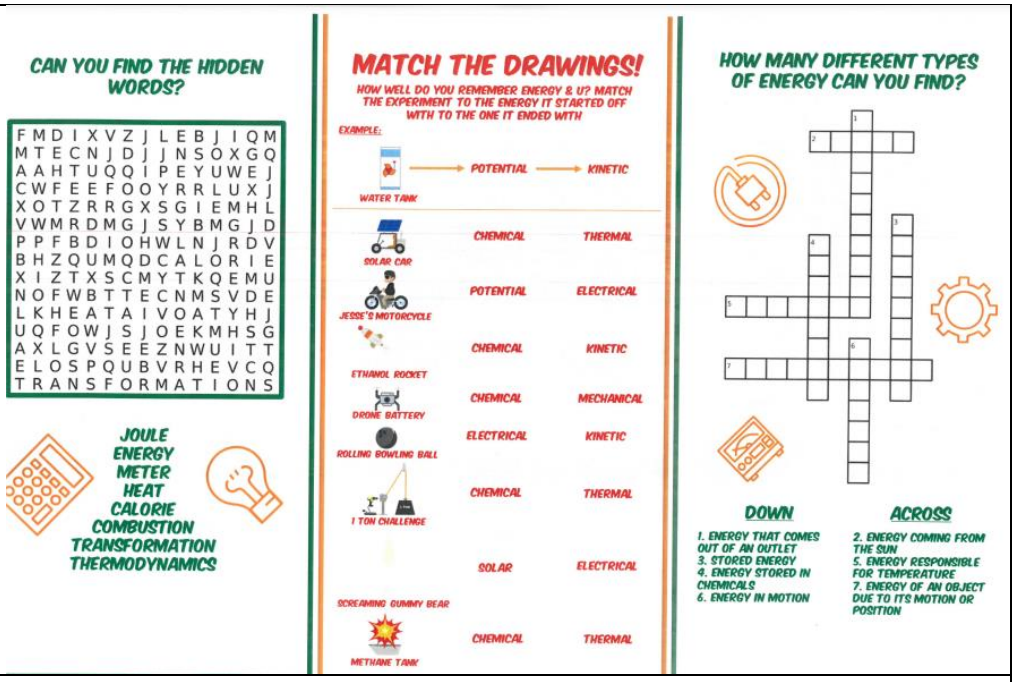
(5) Matter and energy. The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:

(A) measure, compare, and contrast physical properties of matter, including mass, volume, states (solid, liquid, gas), temperature, magnetism, and the ability to sink or float; and

(B) compare and contrast a variety of mixtures, including solutions.

(6) Force, motion, and energy. The student knows that energy exists in many forms and can be observed in cycles, patterns, and systems. The student is expected to:

	(A) differentiate among forms of energy, including mechanical, sound, electrical, light, and thermal; **§112.16. Science, Grade 5, Adopted 2017.** (1) In Grade 5, scientific investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world. **(5) Matter and energy.** The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to: (A) classify matter based on measurable, testable, and observable physical properties, including mass, magnetism, physical state (solid, liquid, and gas), relative density (sinking and floating using water as a reference point), solubility in water, and the ability to conduct or insulate thermal energy or electric energy.
Exit Ticket What formative assessment will students complete during class that shows mastery of the objective? *Attach file or provide image of exit ticket here.*	Students will receive Energy & U Activity book at the end of the show 

	
Exemplar Response How will a student show mastery on the exit ticket? • Include criteria or success for an open-ended response • Write student exemplar written work or explanation	Students should be able to answer correctly to the Pop quiz and be able to differentiate the different types of energy and match them with the drawings. 
Key Points	
KNOW (WHAT) What concepts and ideas must students learn to master the objective?	Students need to demonstrate mastery on the following concepts: • **Energy**: Capacity to do work • **Joule:** Unit of Energy • **Potential Energy:** Energy that is stored in an object due to its position.

Consider academic vocabulary that needs to be taught for students to be successful.	• **Kinetic Energy:** Form of energy that an object or a particle has due its motion • **1st Law of Thermodynamics:** Energy can neither be created or destroyed. Only transformed.
WHY Why is this lesson important for students to learn? What real world connection can you help them make?	We are driven by the ideas of getting students excited about science, engineering, going to college and how those concepts can be used in our every day life. Having the concept of Energy well defined will not only help them in their science classes but will give them a different perspective of how the world really works.
Planning for the Lesson Cycle	
Lesson Opening • Frame the Lesson • Activate prior academic knowledge • Hook students' interest *Attach file or provide description*	The MC of the show will start with defining the concept of energy, when do we utilize it as well as asking if energy can be created or destroyed. After talking with the students the MC will be presenting the Experimentors.
Introduce Key Points How will students internalize key points? • Introduce the key points one by one • example or model after each Key Point • Open-ended questions that will reveal student understanding of key points. *Attach file or provide description of how teacher will introduce key points*	Experiments: **Water Tank, and What is a Joule?** The objective of this experiment is to familiarize the student with concepts of energy. What does energy mean for scientists and engineers, how to measure energy, different types of energy (e.g., potential and kinetic energy), and what can be done with energy. A water tank is pumped to transfer water and the amount of energy to pump water is measured. Engineering applications include the design of hydroelectric dams to take advantage of the conversion of water's potential energy to kinetic energy, and then to electrical energy. **One Ton Challenge** The objective of this experiment is to familiarize the student with concepts of energy. What does energy mean for scientists and engineers, how to measure energy, different types of energy (e.g., potential and kinetic energy), and what can be done with energy. A water tank is pumped to transfer water and the amount of energy to pump water is measured. Engineering applications include the design of hydroelectric dams to take advantage of the conversion of water's potential energy to kinetic energy, and then to electrical energy. **"The Screaming Gummy Bear"**

	The objective of this experiment is to learn how to measure energy in foods while emphasizing to the audience the importance of a balance diet. The student will familiarize with general concepts of thermodynamics. What is a calorie and how to measure calories in foods? A celery and a gummy bear are burned with an oxidant to estimate the joules in each one and compare. **Combustion Energy** The objective of this experiment is to understand about the combustion energy process and learn how a motorcycle operates under combustion reaction with gasoline. **Solar Car** The purpose of this demonstration is to show that energy can be converted from light into electricity. The students will be able to understand that the sun contains solar energy, and this can be harnessed, stored, and used. In addition, how renewable energy differs from nonrenewable energy. Concepts for this demonstration include, light, electricity, chemical reactions, potential energy, fossil fuels and renewable energy. The students will be able to identify these key components throughout the demonstration. **Methane Combustion Experiment** The objective of this experiment is to learn about the chemical compound methane, where does it come from, what is it use for, and what is the effect of methane in the environment. A methane combustion experiment is performed and estimate how much energy is released. **Operate a Drone** The purpose of this demonstration was to show how battery power can be used to operate a drone at remote distances. The students will be able to understand how a chemical reaction within a batter can power multiple electrical motors at high rpm. In addition, how an electrical signal can be used to communicate with a drone at far distances. Concepts for this demonstration include electrical energy, chemical energy, potential energy, energy signals and conversion of energy. The student will be able to identify these key features by the end of the demonstration. **Ethanol Bottle Rocket** In this experiment the student will learn about different kinds of energy including chemical energy, thermal energy, radiant energy, sound energy, and mechanical energy. Additionally, the student will learn about two chemicals, ethanol and methanol. They will know about the dangers, the uses, and the reaction that it can cause if placed near heat.	
Likely Misconception		Most likely misconception will be that energy can be created or destroyed.

S What errors am I on the look-out for?		