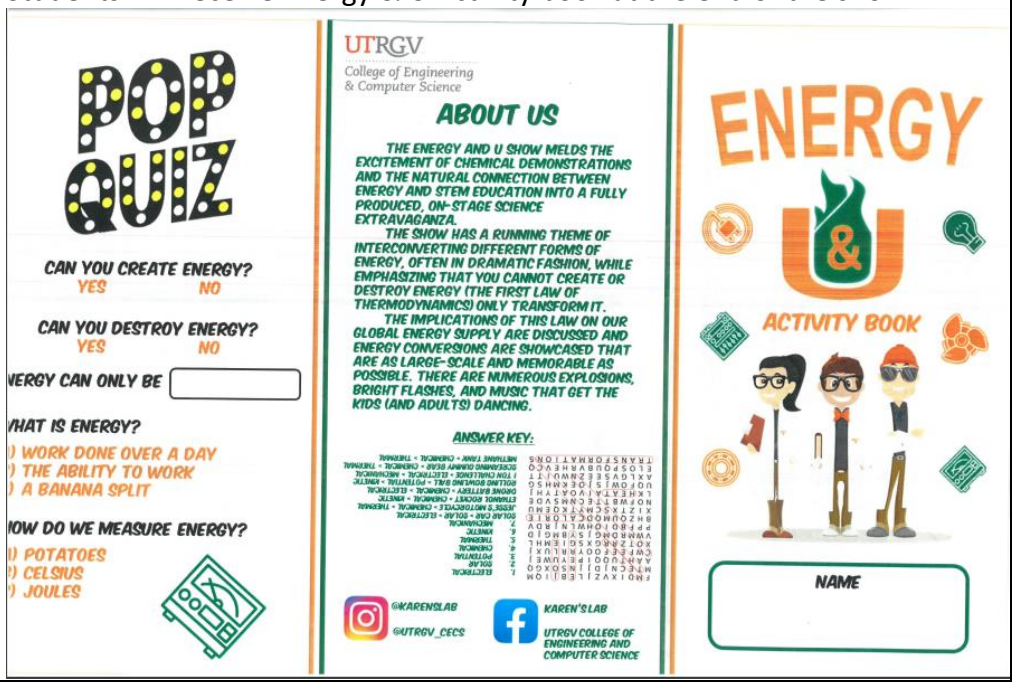
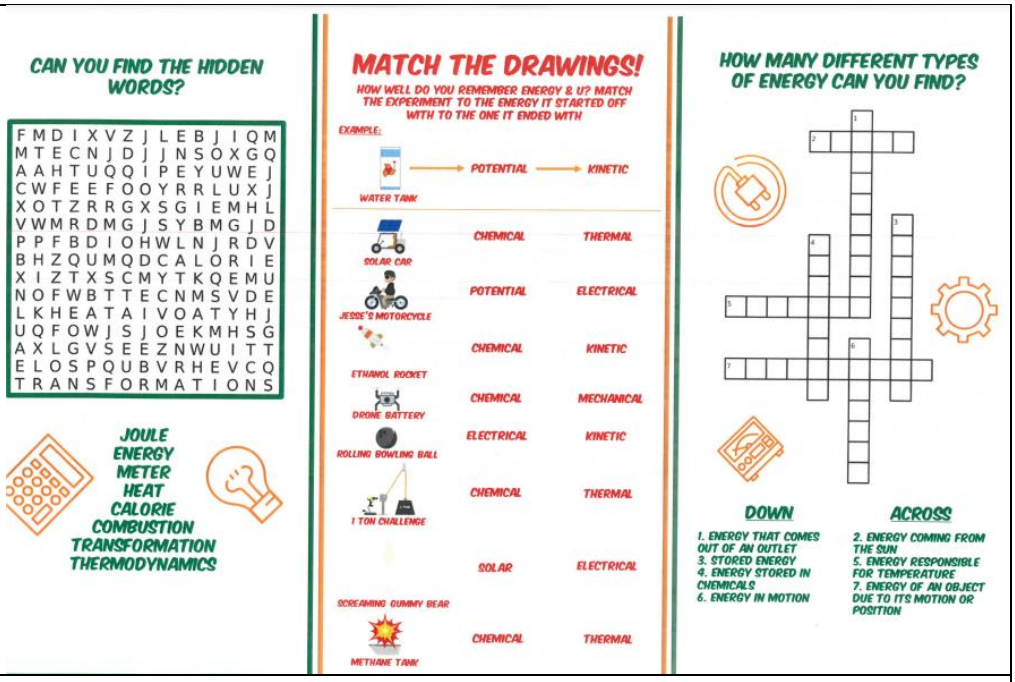
Energy & U Middle School grade Lesson plan	**Lesson Vision**
Lesson Objective What must students be able to do by the end of the lesson?	• The objective of the Energy & U show is to familiarize the students with concepts of energy. What does energy mean for scientist and engineers by introducing different 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	**§112.18. Science, Grade 6, Adopted 2017.** (i) Matter can be classified as elements, compounds, or mixtures. Students have already had experience with mixtures in Grade 5, so Grade 6 will concentrate on developing an understanding of elements and compounds. It is important that students learn the differences between elements and compounds based on observations, description of physical properties, and chemical reactions. Elements are represented by chemical symbols, while compounds are represented by chemical formulas. Subsequent grades will learn about the differences at the molecular and atomic level. (iii) Energy resources are available on a renewable or nonrenewable basis. Understanding the origins and uses of these resources enables informed decision making. Students should consider the ethical/social issues surrounding Earth's natural energy resources, while looking at the advantages and disadvantages of their long-term uses. (C) Force, motion, and energy. Energy occurs in two types, potential and kinetic, and can take several forms. Thermal energy can be transferred by conduction, convection, or radiation. It can also be changed from one form to another. Students will investigate the relationship between force and motion using a variety of means, including calculations and measurements. **§112.19. Science, Grade 7, Adopted 2017.** (C) Force, motion, and energy. Force, motion, and energy are observed in living systems and the environment in several ways. Interactions between muscular and skeletal systems allow the body to apply forces and transform energy both internally and externally. Force and motion can also describe the direction and growth of seedlings, turgor pressure, and geotropism. Catastrophic events of weather systems such as hurricanes, floods, and tornadoes can shape and restructure the environment through the force and motion evident in them. Weathering, erosion, and deposition occur in environments due to the forces of gravity, wind, ice, and water. **§112.20. Science, Grade 8, Adopted 2017.** (C) Force, motion, and energy. Students experiment with the relationship between forces and motion through the study of Newton's three laws. Students learn how these forces relate to geologic processes and astronomical phenomena. In addition, students recognize

	that these laws are evident in everyday objects and activities. Mathematics is used to calculate speed using distance and time measurements. **(5) Matter and energy.** The student knows that matter is composed of atoms and has chemical and physical properties. The student is expected to: (E) investigate how evidence of chemical reactions indicates that new substances with different properties are formed and how that relates to the law of conservation of mass.
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. • **Chemical Energy:** Energy stored in the bonds of chemical compounds that may be released during a chemical reaction. • **Combustion Energy:** Helps to provide energy to cars and motorcycles to run on heat. Combustion is a chemical reaction that occurs between a fuel and an oxidizing agent that produces energy • **Renewable Energy:** Renewable energy is energy derived from natural sources that are replenished at a higher rate than they are consumed. • **Exothermic Reaction:**This process of combustion releases energy, and when energy is released from a chemical reaction it is commonly known as an exothermic reaction. An easier way to remember what an exothermic reaction is, the word 'therm' means heat and 'exo' means exit or moving out, therefore heat is being released from a reaction
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	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.

• 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*	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 Misconceptions What errors am I on the look-out for?		Most likely misconception will be that energy can be created or destroyed.