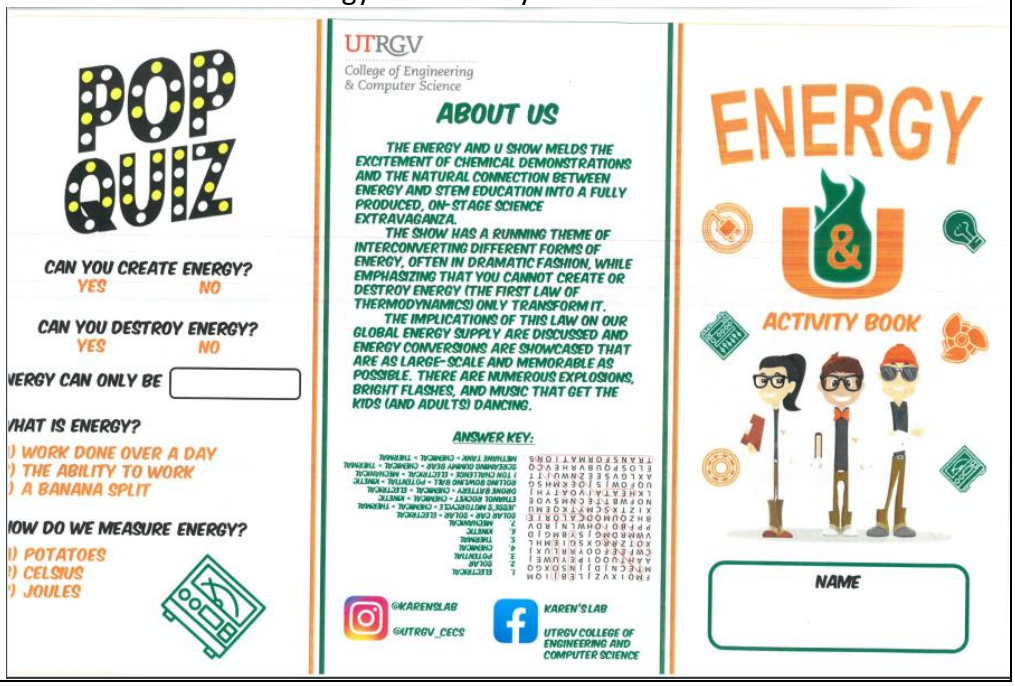
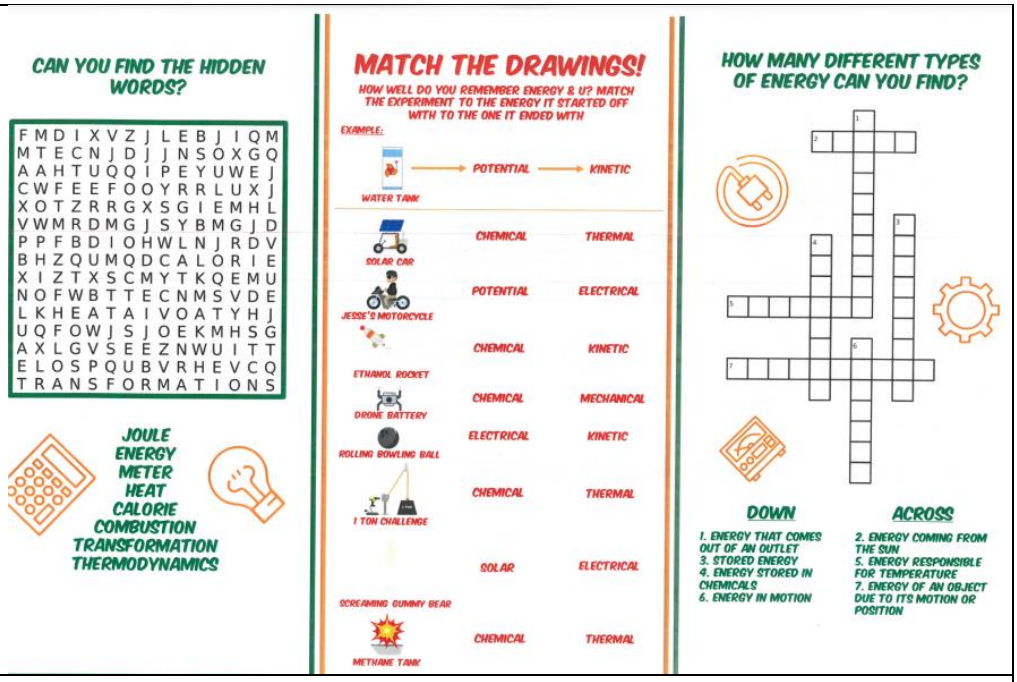
Energy & U 9th – 12th grade Lesson plan	**Lesson Vision**
Lesson Objective What must students be able to do by the end of the lesson?	• The objective of the Energy & U show is to familiarize the students with concepts of energy. By the end of the show students will be reminded about the first law of Thermodynamics, how to measure energy, different types of energy and what can be done with energy thanks to the experiments that will be produced on stage.
TEKS Alignment	**§112.34. Biology (One Credit), Adopted 2017.** (5) Science, systems, and models. A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment. **§112.35. Chemistry (One Credit). Adopted 2017.** **(11) Science concepts.** The student understands the energy changes that occur in chemical reactions. The student is expected to: (A) describe energy and its forms, including kinetic, potential, chemical, and thermal energies; (B) describe the law of conservation of energy and the processes of heat transfer in terms of calorimetry; (C) classify reactions as exothermic or endothermic and represent energy changes that occur in chemical reactions using thermochemical equations or graphical analysis; and (D) perform calculations involving heat, mass, temperature change, and specific heat. **§112.38. Integrated Physics and Chemistry (One Credit), Adopted 2017.** **(5) Science concepts.** The student recognizes multiple forms of energy and knows the impact of energy transfer and energy conservation in everyday life. The student is expected to:

	(A) recognize and demonstrate that objects and substances in motion have kinetic energy such as vibration of atoms, water flowing down a stream moving pebbles, and bowling balls knocking down pins; (B) recognize and demonstrate common forms of potential energy, including gravitational, elastic, and chemical, such as a ball on an inclined plane, springs, and batteries; **§112.39. Physics (One Credit), Adopted 2017.** **(6) Science concepts.** The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum.
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.	• **Mechanical Motion:** Mechanical motion is defined as movement that results from the application of force • **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?	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

• 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*	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 Misconceptions What errors am I on the look-out for?		Most likely misconception can be how the energy is transformed from one to another.