Background Information:

Energy can be defined in many different ways: the ability to do work, the ability to the change the properties of a material, or simply the ability to do "something". Energy is a fundamental property of all material and can be extremely useful. Energy in its various forms is responsible for powering our vehicles, heating our houses, providing light to see, growing plants, and is responsible for our very survival. The biggest source of energy is simply the sun. This activity allows students to experience the conversion between seven different forms of energy: light, thermal, chemical, sound, kinetic, elastic, and electrical energy.

<u>Basic Forms of Energy:</u>

1. Light Energy – Any form of **light** contains energy: Infrared Light, Visible Light, Ultraviolet Light, etc.. The energy in light often gets converted into thermal energy. Light energy can be converted into chemical energy through the process of photosynthesis.

2. Thermal Energy – The energy contained within a substance due to the movement of molecules. If something feels hot or cold to the touch you know that you have just experienced the transfer of thermal energy from one object to another. The transfer of thermal energy is known as heat. If an object feels warm or hot to the touch, thermal energy is being transferred from the object to your hand. If an object feels cool or cold, thermal energy is being transferred from your hand to the object. So if something feels hot, warm, cool, or cold to the touch you are experiencing thermal energy.

3. Chemical Energy – The energy associated with the chemical bonds between elements. Chemical energy is a stored energy that can be released. **Food or batteries** are good examples of stored chemical energy. You can see or feel when stored chemical energy is converted into thermal energy.

4. Sound Energy – Any **audible or inaudible sound** demonstrates sound energy. It is the energy associated with the vibrations of molecules and atoms. Most sound energy is easily detected using our ears, however they can not detect it all!

5. Kinetic Energy – The energy associated with the movement of objects. Anything that is moving has kinetic energy. A **<u>moving</u> car, hand, pencil, molecule, etc…** has kinetic energy (Note: In the *Indiana State Standards* kinetic energy is referred to as **mechanical energy**).

6. Elastic Energy – Anything that can stretch and come back to its original shape is considered elastic. When a **rubber band, balloon, or spring** is stretched it contains elastic energy.

7. Electrical Energy – The energy associated with the separation and movement of charged particles called electrons. Many appliances must be powered using electrical energy by plugging them into an **electrical socket**. Electrical energy is also associated with the force of attraction or repulsion between positively and negatively charged particles which can do work. This can be seen through the force caused by "static cling" or rubbing a balloon on your head and watching it move toward the wall. Batteries convert chemical energy into electrical energy.

According to the First Law of Thermodynamics, energy cannot be created or destroyed; it can only be converted from one form to another. This means that if you identify some form of energy and after some time it no longer appears that that form of energy is present, we know that it did not simply disappear; the original form of energy was converted into a different form of energy. For example, if you are driving down the street in your car, the car has kinetic energy because it is moving. If you take your foot off of the gas pedal, the car will eventually come to a stop.

Did the energy gradually disappear? Is the energy "used up"? No, the energy that was in the form of kinetic energy was converted into thermal energy by friction between the tires and the road, the bearings of the car, and the internal friction of the engine. Because of friction, the kinetic energy was transformed into thermal energy which slightly raised the temperature of the road, tires, bearings, and engine.

Let us follow energy on another journey, highlighting its conversions between various forms, from the sun to the basketball court. The energy from the sun originates from the interior of the sun through a process of nuclear fusion which gives off energy in the form of **light energy**. A tiny fraction of this light energy reaches the Earth where some of it is converted into **thermal energy**, heating up the atmosphere, and some of if is converted by plants, through photosynthesis, into **chemical energy**. This chemical energy is stored inside the plant. If we digest the plants, the stored chemical energy is converted into **thermal energy** to maintain our body temperature. This stored chemical energy can also be converted into **kinetic energy** by our muscles.

Calories are a unit of energy. The more Calories a piece of food contains, the more chemical energy is stored within that piece of food. We can now see that part of the energy needed to move our arms to shoot a basketball ultimately can be traced back to the energy from the sun.

Energy Conversion Activity

Station #1

Directions: Experiment with the radiometer (glass bulb apparatus) and a flashlight. Shine the light on the radiometer.

1. What makes the fins rotate?

2. What seems to be the source of energy used to rotate the fins?

3. What is the energy conversion that took place in this demonstration? Draw an energy flow map.

Station #2

Directions: Examine and try our the toys, then…..

4. What type of energy powers these toys?

5. What types of energy are converted by these toys?

Station #3
Directions: Stretch the band. How much work do you need? Is this difficult or easy?

6. What type of energy is needed to stretch the band?

7. At what point is the energy potential going to be the strongest?

8. When you release the energy, what types of energy are produced from the stored energy?

Station #4
Directions: See which toy is the fastest (Or just wind up the toys and have fun)!

9. What kind of energy must be added to make the toys move? What is going on inside each toy? Are they all the same?

10. The added energy is converted into one form, which is then transformed into another. Describe this transformation process.

Station #5
Directions: Find out all the different ways you can make these objects produce noise.

11. What type of energy must be added to the "instruments" to produce noise?

12. What type of energy do the "instruments" produce?

Station #6
Directions: Look at the examples of FOOD and think about its origin.

13. What type of energy is necessary for the growth of all types of food? What type of energy do plants need to grow?

14. What type of energy is stored in food?

15. How can you use this stored energy? Into what type of energy could it be converted?

Station #7
Directions: Find out what these devices do and what is required to make these devices operate.

16. What type of energy is needed for these devices to operate?

17. What types of energy do these objects produce?

Station #8
Directions: Rub the plastic rod vigorously on the fur. Bring the rod close to the sealed baggies of paper dots and observe what happens.

18. What type of energy do the paper dots exhibit when the rod is brought near?

19. From where did this energy come? What form of energy was responsible for moving the small paper dots?

20. Describe the energy conversion process from beginning to end, from rubbing the rod on the fur to moving the small paper dots.

Energy cannot: be "used up", it is only converted from one form to another!

"Energy cannot be created or destroyed; it can only be changed from one kind to another kind." One of nature's biggest rules!!

**Note: → means "goes into" or "changes into"

Electric socket

Stove

Boiling water

Rising Steam

(Electrical energy) → (Thermal energy) → (Thermal energy) → (Kinetic energy)

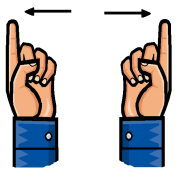
Battery

iPod

(Chemical energy **to** Electrical energy) → (Sound Energy and Light energy)

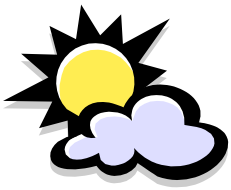
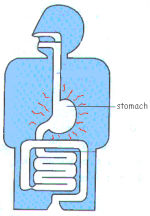
Food

You



Stretched rubber band

(Chemical energy) → (Kinetic energy) → (Elastic energy)

Sun	Plants / Vegetables	You	Movement
			

(Light energy) → (Chemical energy) → (Thermal energy) → (Kinetic energy)

<u>Now you fill in what types of energy are being changed from one kind to another:</u>

1. Kicking a soccer ball.

_____ → _____

2. Watching TV

_____ → _____ and _____

3. Rub your hands together

_____ → _____

4. Batteries → Flashlight

_____ _____

5. A basketball is sitting on the floor. You pick it up and start bouncing it. What are the different kinds of energy are present in this situation? (There are several.)