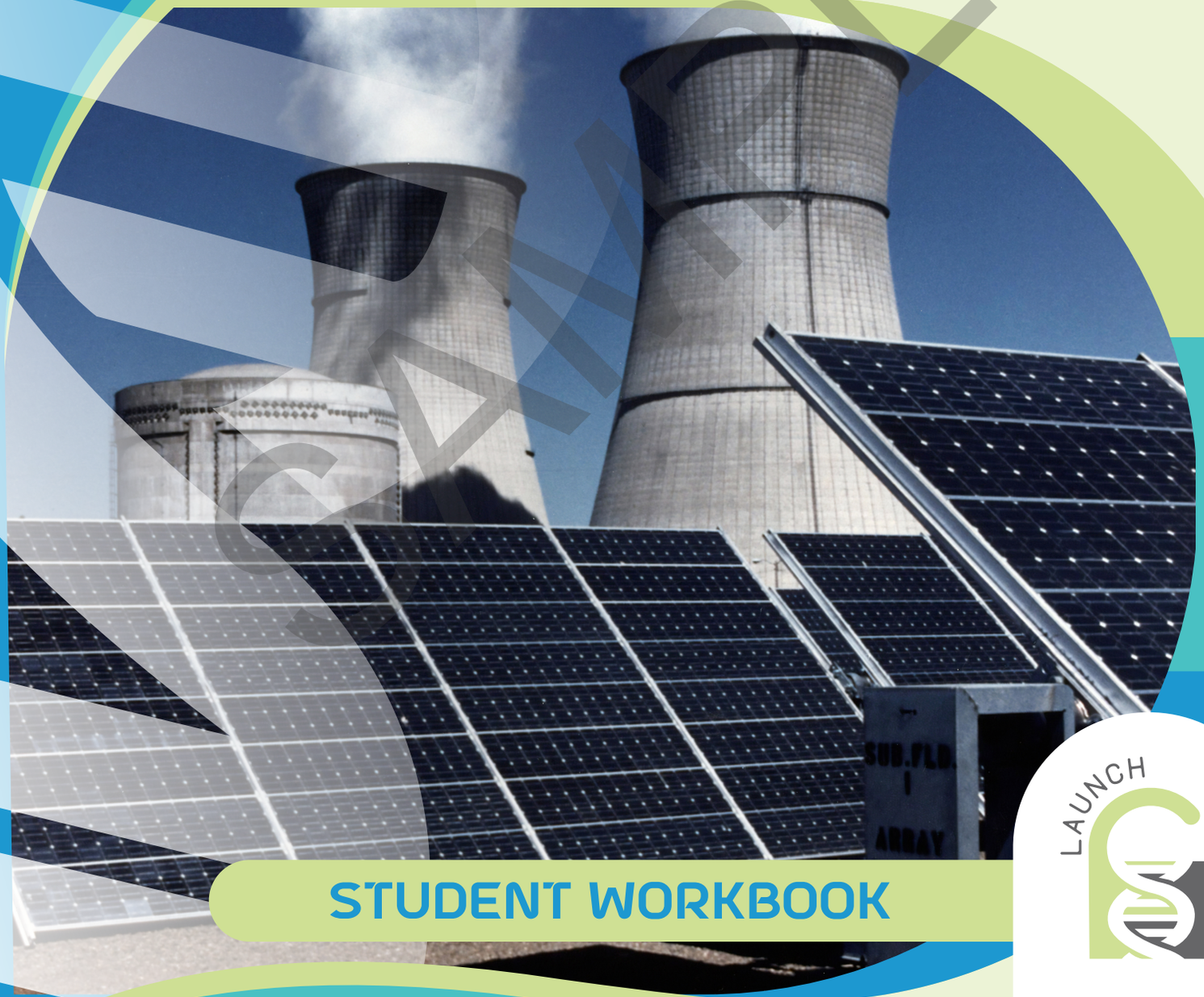
TRANSFORMERS



STUDENT WORKBOOK

LAUNCH

ACTIVITY 1

A "WOW!" WITH WOOL

Energy is not created nor destroyed, but when it transforms, watch out!

1 AN UNUSUAL FIRE STARTER

WHAT YOU NEED: PREPPING THE WOOL

FROM THE KIT:

- ☐ Aluminum pie plate
- ☐ Battery
- ☐ Steel Wool

Prepping the Wool

WHAT TO DO:

1. Break the steel wool into small pieces.
2. Twist one piece into a thick cord. This should be about 15 filaments.
3. Twist one piece into a medium-width cord. This should be about 10 filaments.
4. Twist one piece into a fine cord. This should be about 5 filaments.
5. Clump one piece into a tight ball. Use half of the rest of the filaments.
6. Clump one piece into a loose ball. Use half of the rest of the filaments.

PREDICT: In the second part of this experiment, you will be touching the end of the battery to the different pieces of wool and the pie plate. Predict what you think will happen to each piece of wool and the pie plate. Will it make a spark? Catch fire? Blow up?

Thick cord:

Medium-width cord:

Fine cord:

Tight ball:

Loose ball:

Pie plate:

2 BURN, BABY, BURN

WARNING! Be careful with fire and flame. Don't use in windy areas or near objects that can catch fire.
WARNING! Batteries can be dangerous. Store away from metal objects. Only use with an adult's supervision.

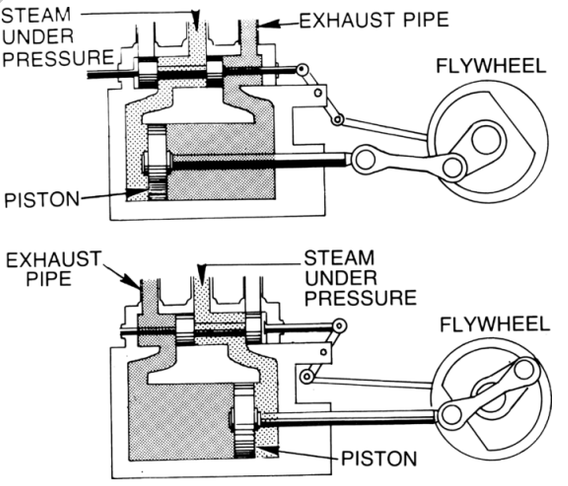
Unlike a lightbulb, the wires of steel wool are made mostly of iron (light bulbs use tungsten) and are exposed to air. When the temperature changes, the iron (Fe) reacts faster with the oxygen (O_2) in the air, resulting in the conversion of Fe and O_2 to Fe_2O_2. This produces iron II oxide (or rust) due to **oxidation,** the process where a molecule or atom loses electrons. Oxidation is a **combustion reaction,** or a chemical reaction where a substance reacts with an oxidant (oxygen gas) to produce heat (or light) and a new product.

Iron	+	Oxygen	→	Iron oxide
$2Fe$	+	$3O_2$	→	$2Fe_2O_2$

In Activity 2, the spiral spins above the boiling water. When you turn on your stove or other heat source to boil water, the energy from that heat source is transferred into energy that results in boiling water. This energy transfer is why the water boils. When the water boils, some of the water becomes steam that rises and pushes the spiral, converting the energy from the steam into movement of the spiral.

A similar process happens with a steam engine. Fuel is heated when coal is burned, producing steam that pushes a piston. When the piston is pushed, the wheel rotates and the steam engine moves.

Energy transfers from the battery to sparks in Activity 1 and from heat to movement in Activity 2, obeying the **Law of Conservation of Energy.** It states that energy cannot be created or destroyed; it cannot disappear nor appear randomly, but can change from one type or form to another.



The changing from one type or form of energy to another is known as **energy transfer** (or energy conversion). In line with the law of conservation of energy, during energy transfer, the same amount of energy exists before and after, but in different types or forms. Therefore, the same amount of energy existed before and after the energy was converted to boil water. The same is true for the energy transfer that occurred to make the spiral spin.

6 TYPES AND FORMS

Energy can transfer from one object to another or be converted from one type or form to another, but what are those types and forms?

The other value required to calculate the amount of work performed is **distance,** the total length traveled by an object, is often expressed in meters (m). Therefore, work is expressed in N•*m*. Once you have these values, you can calculate the amount of work completed. Let's work through an example together.

Your mom asks you to mow the lawn, which is 300 m. Because the gas-powered mower is broken, you have to use a push mower. In order to push the mower, you use 50 N of force.

$$work = force \times distance$$
$$work = 50\ N \times 300\ m$$
$$work = 15{,}000\ N \cdot m$$

While work is expressed in N•*m*, it can also be expressed in Joules (J).

$$1\ J = 1\ N \cdot m$$

Therefore, the 15,000 N•*m* of work you produce to mow your law can also be referred to as 15,000 J.

THINK ABOUT IT!

Try out an example for yourself! Your parent is driving the family car home from work when it breaks down on the side of the rode 9 *m* from the driveway. It takes your parent 100 *N* to push the car. How much work will your parent have to perform to get the car all the way home?

Power

With values for force, distance, and work, you are one step closer to calculating the amount of power required for the work to be completed. **Power** is the rate at which work is done, so more power means that the work is completed more quickly, while less power means that it is completed more slowly. To calculate power, you need values for work and time and the amount of time required to complete the job. Often power is recorded in watts, where one watt is equivalent to one Joule/second.

LAUNCH

SCIENCE UNLOCKED

Contact us at: www.homesciencetools.com/customer-service/

A Product of Homesciencetools.com

Kit	SU-ENTRAN
Instructions	IN-ENTRANS
Revision Date	3/2021