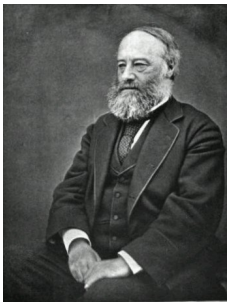
Gravity Power Cars
Filling Up the GFC
Student Inquiry Sheet

Name_____ Class_____ Date_____

Investigation #8: Meet A Famous Scientist Who Invented Ideas About Energy



Every time something changes in the World, energy is transferred from something to something else. In the past, finding out what energy is and how to measure it was very difficult because energy is not like matter that you can hold, put in a container, or weigh. A person who helped invent ideas about energy was **James Prescott Joule,** a famous scientist who, in 1845 A.D. helped explain energy as we know about it today. He noticed that electricity made a wire get hot. He speculated that energy from electricity and heat as well as from gravity, light, movement, etc. were different forms of the same thing. In one famous experiment he demonstrated energy change by using a falling weight to turn a paddle in a tub of water. He then found an increase in the water temperature. This is a lot like the GFC washer experiments.

Joule showed that we can find energy in something by seeing what changes it can cause. We can find GFC washer energy by the motion of the GFC. His ideas were so important that the official unit to measure energy is called a **Joule**.

Energy and motion!

Cars, people, rocks, elephants, leaves, rockets, and everything that moves involves energy transfer with something else. The energy of moving things is called **K**inetic **E**nergy (**KE**). The energy in the GFC is energy that was transferred from sunlight— to plants— to food— to muscles—to washers—to motion. Because of the force of gravity, Earth and washers are pulling on each other and the washers have weight and lifted washers can fall. The GFC then moves as falling washers transfer their energy to the GFC (or maybe because elephants are pushing it).

In most automobiles, the energy to move the car comes from chemical energy in gasoline that is transferred when gasoline burns. One gallon of gasoline contains about 125 million joules of energy and a GFC uses less than 1/2 joule. We usually refer to the amount energy in a car by the number of gallons or liters of gasoline in the gas tank. We measure how well gasoline energy transfers by how far the car goes when burning the gas. If you have a car that goes 20 miles on 1 gallon of gas, how far will it go on 2 gallons under the same conditions?

How Can You Measure Energy in the GFC?

The energy to move the GFC comes from the pull of falling washers. You might say that the washers have "washer energy." However, the washers are not burning and releasing thermal energy (heat) like gasoline.

The energy the hanging washers have in your GFC is called **G**ravitational **P**otential **E**nergy (**GPE**). This is stored energy that can be transferred to Kinetic Energy **(KE)** when the weights fall because of the force of gravity. The washers in the GFC are like "washer gas." But how can we measure the energy from the washers? You could possibly use the number of washers or the weight of the washers, or the height of the washers. Explain how you would do it:

Calculate the Washer Energy in your GFC!

A standard way to measure GPE is to multiply the height of something by its weight caused by the force of gravity. For example, to find out how much energy your washers have, weigh your washers in newton's (N). Then multiply the weight of your washers by how many meters they are lifted. Remember, the unit for measuring energy is a joule (J). So if you have 3 washers that weight 2.4 N and you lift them to 20 cm (or .2m), your equation would read:

2.4 N x .2m = .48 J or about 1/2 or a joule.

To find out the average distance your GFC can travel for every joule of energy, you need to calculate meters per joule. To do this, divide the distance traveled in meters by the energy used. For example, if your GFC moves 2 m by using .5 J of energy, your equation would read:

2 m / .5 J = 4 m/J

Now you try it. How much energy would your washers have if you used 4 washers that weigh 3.5 N lifted to 10 cm?