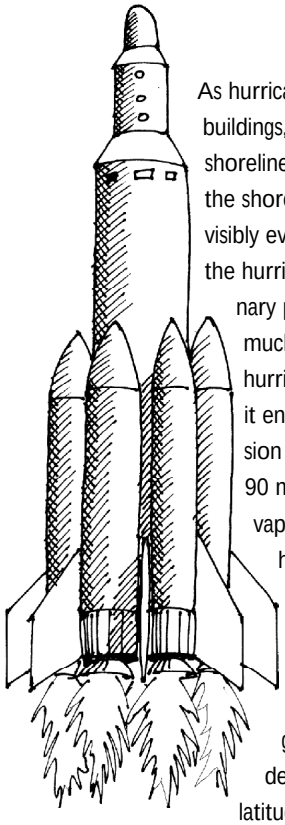
POWER OF A HURRICANE

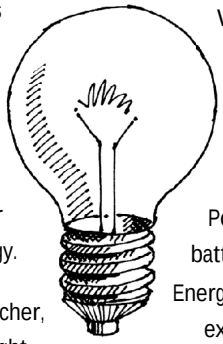


As hurricanes pound into buildings, crash waves onto shorelines, and tear trees from the shoreline, their power is visibly evident. Yet, where does the hurricane gets its extraordinary power and just how much power is in a hurricane? A hurricane gets it energy from the conversion of water vapor to rain. 90 million tons of water vapor are required per hour for a hurricane to form. This volume of water vapor occurs above water that is above 26° Celsius, generally between 10 degrees and 20 degrees latitude in the late summer and early spring.

The change of water from a vapor to a liquid (which is what occurs when clouds form in the atmosphere) is called a phase change. As the water changes from a vapor to a liquid, heat is released. This heat, called latent heat, provides the energy that is required for the formation of a hurricane. About 5 x 10^{11} Joules of energy is added to the hurricane every hour, or 1.4 x 10^{8} Watts. That energy is the power in the surface wind of a hurricane. The rest of the energy will be converted to potential and internal energy and not do any work.

Energy comes in several forms: kinetic energy, gravitational potential energy, elastic potential energy, chemical energy, thermal energy, electrical energy and nuclear energy. Power is defined as the output of energy over a given time period.

Learning Objective: Students will compare different types of energy to begin to understand the amount of energy stored in a hurricane.

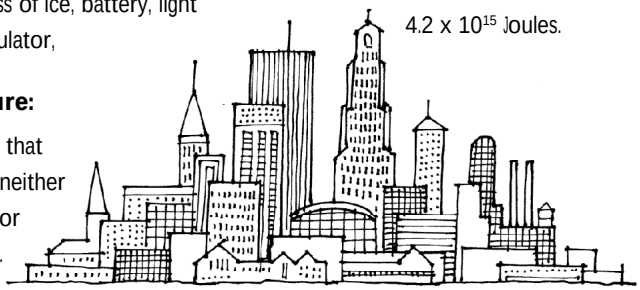


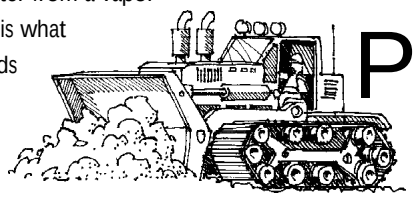
Challenge: Examine other types and amounts of energy.

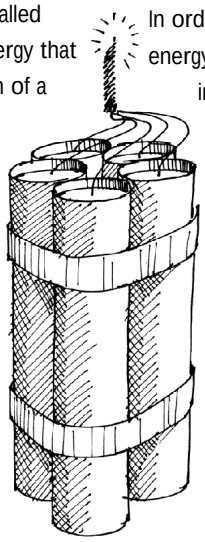
Materials: toy rocket launcher, slinky, glass of ice, battery, light bulb, calculator,

Procedure:

1. Explain that energy is neither created nor destroyed.







In order to allow people to use energy, it needs to be converted into a form that is easy to use.

2. Have students divide into several teams and assign each team one form of energy. Each group has to come up with a way to represent the type of energy that they were assigned, explain how energy is transformed, and compare that to the amount of energy in a hurricane.

3. Have the students calculate the power of the different types of energy using whatever formula is appropriate. Convert the power to Watts (Joules per second).

For comparison:

One horsepower is 746 Watts.

Power of a 100 Watt light bulb is 100 Watts.

Power of the sun is 3.9 x 10^{26} Watts.

Power of a D size alkaline battery is 22.5 Watts.

Energy in a one megaton TNT explosion is 4.2 x 10^{15} Joules.

Energy in ten gallons of gas is 1.1 x10^{12} Joules.

Energy in 1 barrel of oil is 6.3 x 10^{12} Joules.

Power produced by the Hoover Dam is 7 x 10^{14} Watts per year.

Have the students determine how much electrical energy their houses use every month. For example, if a 100 Watt light bulb burns for 10 hours, it uses 1000 Watt-hours, or one kilowatt-hour.

5. What would be some of the problems in attempting to harness the power of the hurricane? (Erratic and unpredictable nature of hurricanes, storage of the energy,