Name_____ Period _____ Date _____

Water Rockets

Lesson 7: How Much Energy?
A water rocket uses compressed air and Newton's third law to change potential energy into kinetic energy. This energy conversion results in the flight of the rocket. Can you determine the water rocket's change in potential energy?

Doing the Science
1.   You must have completed Lesson 3: How Does the Number of Pumps Affect a Rocket's Flight? and have those data available to complete this activity.
2.   Copy your data from Lesson 3 into Table 1 below.
3.   Before any pumps were added to the rocket, the air pressure inside the rocket was 1.00 atmosphere. Each pump added 1.00 atmosphere (atm) of pressure to the rocket. Use the equation below to find the total air pressure inside the rocket. Record these values in Table 1.

Air pressure = 1.00 atm + number of pumps

Table 1.

Number of pumps	Flight Distance (m)	Air pressure (atm)	Air Volume (L)
0	0	1.00	0.300
2			0.300
4			0.300
6			0.300
8			0.300
10			0.300

4.   Calculate and record in Table 2 the change in air pressure inside the rocket. The change in air pressure can be calculated by using the following formula.

change in pressure = (air pressure) - (original air pressure)

5.   The potential energy of the water rocket is about equal to the change in air pressure times the volume inside the rocket. Since the volume inside the rocket remains about the same, the only factor needed to find the rocket's change in potential energy due to pumping is the number of pumps. Use the following equation to calculate the potential energy of the air particles. Record these values in Table 2.

potential energy of the air particles = (change in pressure) × (volume of air)

Table 2.

Number of pumps	Air pressure (atm)	Change in pressure (atm)	Volume of air (L)	Potential Energy (atm×L)
0	1.00	0	0.300	0
2			0.300	
4			0.300	
6			0.300	
8			0.300	
10			0.300	

Do You Understand?
1.   What effect did increasing the number of pumps have on the potential energy of the air particles inside the rocket? Explain why you think this happened.

2.   What is the relationship between the change in potential energy of the air particles inside the rocket as a result of pumping and the distance the rocket flew?