Science, Technology, Engineering & Mathematics (STEM) Curriculum Integration Program (CIP) (STEM-CIP)

Welcome to the exciting world of STEM. STEM is a new way of learning Science, Technology, Engineering and Mathematics (STEM). These four disciplines are taught together, as one, rather than being taught separately as in the past. The natural connections among the four disciplines have always been there in scientific and engineering research labs, and in professional work settings, but not always in your classroom.

The modules of the STEM-CIP Program have been designed to engage you in stimulating, real and current problems and questions. These problems and questions involve the life, physical, environmental and earth/space sciences, technology, engineering and mathematics — in other words, STEM.

As you learn about STEM you will be acting as an engineer using science, technology and mathematics to solve problems through designing and creating products and processes. Many of these products you already use in some form in everyday life. In the STEM-CIP modules you will design Alka-Seltzer rockets, develop models of amusement park rides, and engineer wind turbines and cars. As you do so, you will follow the same processes and thinking that engineers, scientists and mathematicians use when they solve real world problems and questions.

So sit back and buckle up, and let's launch into the world of STEM!

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Engagement: Let's Soar

Mathematics Readiness Assessment

Mathematics and science go hand-in-hand. Many times mathematics is necessary to understand and work with science concepts. In order to fully understand the science, and be successful with investigations and activities in this module, it is important for your teacher to find out if you already know some mathematics computations and skills. On page 4 of the Student Data and Response Booklet (SDRB) is a mathematics readiness assessment designed for this module. Complete it to the best of your ability. It will not be marked, but it will be used to help your teacher create strategies so that you can successfully complete the activities.

Do You Already Know This Science?

In preparation for your main task in this module, it is important to understand what you already know about rockets and how they are launched. Answer the questions on pages 16–17 of the SDRB. Your responses are not marked and, correct or not, will help guide the lessons in this module.

A Rocket Launch Challenge

Your teacher has been studying about engineering Alka-Seltzer rockets and knows one way to design and launch a rocket. Watch as your teacher demonstrates the launch of an Alka-Seltzer rocket. Observe the launch carefully and then go to page 18 of the SDRB and complete the two questions.

Here is your challenge. You and your group will design, build and launch (this is called engineering) a rocket that will fly higher than any other rocket in the challenge. The rocket you design and launch will be powered by a chemical reaction – an Alka-Seltzer tablet in a liquid.

To compete in this engineering challenge, you will learn about Alka-Seltzer rockets by designing and testing them, as engineers do in their work. Your rocket design and test data will be evaluated using the rubric "Alka-Seltzer Rocket Design" which is located in the SDRB on page 58.

Your Task

In order to participate in the challenge, you must think and work like an engineer, a scientist and a mathematician all at the same time.

We call this STEM (Science, Technology, Engineering and Mathematics), where the four disciplines (subjects) work together.

Your task (and challenge) is to build and launch a rocket that will achieve the highest launch height using Alka-Seltzer and a liquid. As you investigate and design your rocket, think about how you use STEM.

Activity 2: Alka-Seltzer in Water

Activity Description

In this activity, you will investigate the reaction of Alka-Seltzer with water – the action of an effervescent antacid tablet (Alka-Seltzer) with water was responsible for the reaction (launch) of the rocket you observed earlier.

Materials Needed

- 1 effervescent antacid tablet (Alka-Seltzer works well, other brands are available)
- 1 clear container
- Water
- pH indicator (or litmus paper)

Explore

Pour tap water into the clear container. Using the pH indicator, determine whether the water is an acid, base or neutral.

Drop the effervescent tablet into the water and observe what happens.

After any reaction stops, determine whether the solution is acid, base or neutral.

Explain

2a. Refer to page 20 of the SDRB and answer question 2a.

Action and Reaction

A chemical reaction took place when the effervescent antacid tablet (a chemical) was added to water (another chemical). One of the new substances made when the effervescent antacid (Alka-Seltzer) tablet and water react is carbon dioxide gas. The bubbles you see are the carbon dioxide. It is the pressure of the carbon dioxide inside the film canister that causes the rocket to flip its lid and launch (kinetic energy). This build up of gas and pressure (action) causes a reaction (the launching of the rocket).

This action/reaction is known as Newton's Third Law of Motion.

To investigate some other physical and chemical changes in matter, visit the websites below.

http://www.chem4kids.com/files/matter_chemphys.html

http://www.brainpop.com/science/matter/propertychanges/preview.weml

Explain

2b. Using the information about action and reaction, go to page 20 of the SDRB and answer question 2b.

It's About Energy

This module, *3-2-1 Lift Off*, is all about energy. It took energy to launch the rocket. Where did it come from? Well, energy can be stored in chemicals and is called potential energy (PE). The Alka-Seltzer and water both contain potential energy. When that energy is converted (chemical reaction) into motion of the rocket it is called kinetic energy (KE). Potential energy is waiting to be converted into kinetic energy.

Petrol in a fuel tank, food in your stomach, a compressed spring and a weight hanging from a tree are all examples of potential energy. When you lift an object higher, it gains potential energy. The higher you lift it, and the heavier it is, the more energy it gains. For example, if you lift a bowling ball three centimetres in the air and drop it on the roof of your car, it won't do much damage (please, don't try this). But if you lift the ball up thirty metres and drop it on your car, it will put a huge dent in the roof. The same ball dropped from a greater height