COSMIC ROCKET

A. OVERVIEW

Subject	Physics/ Chemistry
Age	6-10
Duration	60 minutes
Focus	A rocket is powered by the release of energy from a chemical reaction. Newton's laws of motion cause the rocket to be propelled upwards.
Goals	Students will learn: 1. What happens when an acid reacts with a base. 2. How Newton's laws of motion are applied in a rocket.
Objectives	After completing this section, students will know more about what is involved when a base reacts with an acid, and the laws of physics involved in the working of a rocket.
Materials	Cosmic rocket kit and lesson plan Vinegar Baking soda
Introduction	Background reading – chemical reactions and Newton's laws of motion Class discussion: acids and bases, and the application of Newton's laws of motion in a rocket
Practical	Students will assemble cosmic rockets.
Extensions	Investigation and discussion points

B. BACKGROUND READING

Set the background reading as a homework assignment the day before the planned rocket race car lesson. This lesson will cover 'chemical reactions' and Newton's laws, and provide a springboard for discussion on the working of a rocket.

Review

Start the lesson by reviewing the reading.
Important points students should understand:
- Chemical reactions can be a source of energy.
- Laws of physics are at work in a rocket to help propel it into the air

Reading material

When two or more chemical substances are mixed together, a chemical reaction occurs. When an acid reacts with a base, several things are produced. They are water, carbon dioxide and a salt product. When the amount of carbon dioxide produced builds up, the pressure also increases, and this can be used as a source of fuel, e.g. in a rocket.

In a real rocket, fuel is burnt inside which causes hot gases to shoot out of the back of the rocket. This propels the rocket forward according to Newton's Third Law, which states that every action creates an equal but opposite reaction. The force that pushes the gases out of the back of the rocket is the action. The rocket moving forward in an upward direction is the reaction. Since rockets are heavy, it takes a large force to make a rocket speed up to the point where it can escape the Earth's gravity (Newton's Second Law states that the force is proportional to the mass and acceleration.). Once the rocket is in motion, it keeps moving in a straight line until another force makes it turn or stop. This is the result of Newton's First Law, which states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force.

C. CLASS DISCUSSION

Answer these questions.

• In an acid-base reaction, what are the products? (The products are water, carbon dioxide and a salt.)

• Acids are things that usually taste sour and sting when they get in your eye or a cut. Bases are things that usually feel slippery or taste bitter. Name some examples of acids and bases that we can found in the kitchen. (Examples of acids are vinegar and soft drinks. Examples of bases are soap and baking soda.) But be careful that you do not try to taste household products as they might be harmful.

• Identify Newton's three laws of motion and state how they are at work in a rocket.

Newton's Law of Motion	Application
First Law: an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force	A force needs to be applied before the rocket can lift off or stop.
Second Law: force is proportional to the mass and acceleration	The speed of the rocket is determined by the mass of the rocket and the force produced by the fuel.
Third Law: for every action there is an equal and opposite reaction	The force produced by the fuel propels the rocket forward.

• Instead of using a water rocket, what other objects can you use to create a similar thrust to drive the race car?

• What other source of renewable energy can we use to drive a race car? (hint: wind)

D. PRACTICAL

Each group of students requires 1 kit and 1 instruction sheet. Select the relevant information from the instructions if necessary. Go through the safety warnings given in the instructions with the class before assembly.

Check each group's finished model and supervise the test runs.

E. EXTENSIONS

• What is the reaction that takes place inside the rocket?

• What causes the build-up of pressure inside the rocket?

• What makes the rocket shoot up into the air?

• Does the amount of vinegar and baking soda used affect how far the rocket moves?

• What other things can you use instead of vinegar and baking soda?

• How can you modify the rocket to make it move faster/farther?

• Find out what substances are used as fuel in a real-life rocket.

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