PATHWAYS ACADEMY LESSON PLAN

Subject: _Science   Grade 9-12   Topic: Cellular Diffusion (Biology)

Teacher: Date:

Short Description of Lesson and Materials Needed:
"The Ins and Outs of the Cell Membrane" worksheet Diffusion Lab worksheet Cornstarch Plastic baggie Cold water Iodine astic cup

Massachusetts Curriculum Frameworks Strand(s)/Standard(s):
Strand 2: L.S. 2.1: Relate cell parts/organelles……Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, and active transport).
What will students be able to do at the end of the lesson (core skills/concepts): Students will describe the role of the cell membrane in passive transport of substances into and out of the cell
Procedure: 1. Distribute "The Ins and Outs" of the Cell Membrane worksheet to each student and review as a class, using the whiteboard to recreate the illustration, and answer the accompanying questions, having students fill in their answers.

2. Distribute Diffusion Lab worksheet and materials to each student and, following the directions on the worksheet, have each student conduct the lab at his/her desk. NOTE: Only the teacher should handle the iodine.
3. Following the Lab worksheet, have students make predictions during the 10-15 minutes it takes for the reaction to happen and complete the data table once the students can see the results.
4. Conduct the Post-Lab analysis with the class, having the students fill in their own worksheets.
5. Clean up materials, throw out baggies, rinse cups and have students wash their hands before the break.

Differentiated Instruction: How will you accommodate each student's learning needs in this lesson?

Provide gloves if student is sensitive to touching unfamiliar substances

Scribe as needed

Ask student with kinesthetic needs to be the helper during lab

Use only black marker on the whiteboard for student with visual impairment

How will you address each student's individual IEP goals/objectives within this lesson; please be specific.

: "will use strategies to practice tolerance of dissenting opinions" when peers make different predictions than his

: "will implement strategies such as checklists and verbal or nonverbal cues to help him work independently" Lab worksheet will be modified with boxes to check beside each task and verbal (please write the answer on your worksheet" and nonverbal (pointing to written instructions) cues will be used to keep student on task and as independent as possible

: "will use strategies of previewing the text, making predictions, generating questions, outlining, and summarizing written material across the subject areas" student will make predictions as part of the lesson

: "When student does not understand the directions for completing an academic assignment, he will ask staff for clarification" Student will be asked if the directions make sense to him periodically throughout lesson.

Assessment:

Completed worksheet

Class participation

Lesson Extension:

Watch BrainPop online video on Cellular Diffusion, Active Transport, and Passive Transport

Read pages in Biology textbook that correspond to the subject

Do an online search for other experiments that demonstrate the concept of cellular diffusion/osmosis

Name________________________________

Diffusion Lab

Introduction: In this lab you will observe the diffusion of a substance across a semi permeable membrane to demonstrate how diffusion occurs across a cell's membrane. Iodine is a known indicator for starch. An indicator is a substance that changes color in the presence of the substance it indicates. Watch the teacher demonstration and observe how iodine changes in the presence of starch.

Prelab Observations: Describe what happened when iodine came into contact with starch.

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Procedure:

1. Make a cornstarch solution by mixing one tablespoon of cornstarch with 4 tablespoons of cold water.
2. Put cornstarch solution into a plastic baggie and zip the bag shut.
3. Fill a beaker halfway with water and add five drops of iodine.
4. Place the baggie in the beaker so that the cornstarch mixture is submerged in the iodine water mixture.
5. Wait 10-15 minutes and record your observations in the data table.
6. While you are waiting, complete "What's in the Bag" and "Make Some Predictions" below and complete the cell membrane worksheet.

What's in the Bag?

Think about concentrations. Which substances are more or less concentrated depends on which substance has the most solute dissolved in it.

1. Is the baggie or beaker more concentrated with starch?
2. Is the baggie or beaker more concentrated with iodine?

Make Some Predictions

Remember, molecules tend to move <u>from</u> areas of high concentration <u>to</u> areas of low concentration.

1. If the baggie were permeable to starch, which way would the starch move, into the bag or out of the bag?

   ____

2. If the baggie were permeable to iodine, which way would the iodine move, into or out of the bag? ____
3. If the baggie were permeable to iodine, what color would you expect the solution in the baggie to turn? _________________ What about the solution in the beaker? _________________________
4. If the baggie were permeable to starch, what color would you expect the solution in the baggie to turn? __________________ What about the solution in the beaker? _________________________
5. Make a prediction about what you think will happen:

   ____

   ____

   ____

   ____

Data Table

	<u>Starting Color</u>	<u>Color after 15 minutes</u>
Solution in Beaker		
Solution in Bag		

Post Lab Analysis

1. Based on your observations, which substance moved, the iodine or the starch?

   ____

2. How did you determine this?

   ____

   ____

   ____

3. The plastic baggie was permeable to which substance?

   ____

4. What would happen if you did an experiment in which the iodine solution was placed in the baggie, and the starch solution was in the beaker?

   ____

   ____

   ____

   ____

   ____

   ____

5. Why is it *not* a good idea to store iodine in a plastic bag?

   ____

   ____

   ____

THE "INS AND OUTS" OF THE CELL MEMBRANE

Substances must be able to get into and out of a cell in order for the cell to do its job. The passage of these materials takes place through the cell membrane by a process called diffusion [dih-FYOO-zhun]. In diffusion, some molecules may pass through tiny holes in the membrane. Others are carried across the membrane by special "carrier molecules." The molecules that are diffusing move to whichever side of the membrane has a lower concentration of that kind of molecule. For example, dissolved nutrients and oxygen tend to move into the cell. Dissolved wastes, such as carbon dioxide, tend to move out of the cell.

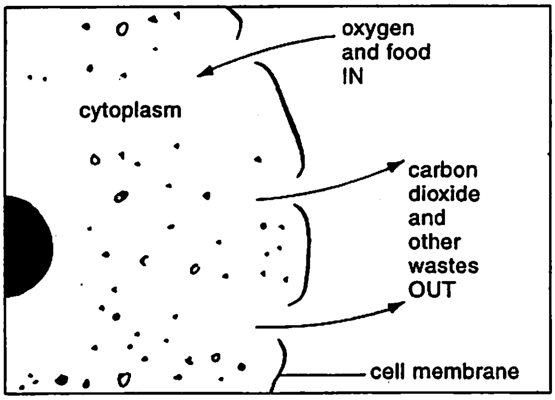

Figure D

The movement of water through a membrane is called osmosis [ahs-MOS-sis]. Osmosis is a special kind of diffusion. What might happen if the amount of water entering and leaving the cell were not controlled? It depends . . . The cell might

a) swell or

b) shrink

Think about each of the following possibilities. Write your answer in the space provided.

What might happen if:

1. too much water moved into a cell? ______________________

2. too much water moved out of a cell? ______________________

3. too little water moves into a cell? ______________________

4. too little water moves out of a cell? ______________________

5. water kept entering a cell and no water left the cell? ______________________

Answer the following questions.

6. What needed materials enter the cell through the cell membrane? ______________________

____

7. What waste materials leave the cell through the cell membrane? ______________________

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PATHWAYS ACADEMY LESSON PLAN

Subject: Science Grade_6-8 Topic: Physics (Rocketry)

Teacher: Date:

Short Description of Lesson and Materials Needed:

Students will explore Newton's third law of motion and its application to launching rockets through a reading and a hands-on activity of launching and testing various sizes of balloon rockets along a string "track".

Materials:

Copy of "The force that drives a space rocket" for each student

Latex balloons in a variety of shapes and sizes

Sturdy string

Oversized straws

Masking tape

Whiteboard & markers

Preprinted data sheet on a clipboard and pencil for each student

Massachusetts Curriculum Frameworks Strand(s)/Standard(s):

Strand 3 Physical Science (Physics) 6-8 L.S. 11: Explain and give examples of how the motion of an object can be described by its position, direction of motion, and speed.

What will students be able to do at the end of the lesson (core skills/concepts):

Students will be able to explain Newton's third law of motion (for every action there is an equal and opposite reaction) and its application in launching a rocket out of the Earth's atmosphere.

Procedure:

1. Ask students what they already know about launching rockets into space. Write all thoughts on the whiteboard, discussing each as appropriate.
2. Distribute copies of "The force that drives a space rocket" to each student and ask for volunteers to read each paragraph, using the whiteboard to show how Newton's third law of motion applies to a rocket and

balloon launch.

3. Write the step-by-step procedure for launching balloon rockets, following the guide, on the whiteboard. Review and ask for questions.
4. Gather materials for the launching of balloon rockets and move students outside to complete activity, measuring and recording the results for different sizes and shapes of balloons. (Allow students to launch balloons free-hand to experience an "unguided" missile launch.)
5. Return inside and discuss results.

Differentiated Instruction: How will you accommodate each student's learning needs in this lesson?

All students: Write class agenda on board prior to beginning class to allow students to form a mental framework for the progression of the period and to strengthen deficits in executive functioning.

Give students a printed copy of the article as well as read it aloud to the whole class to accommodate auditory and visual processing deficits.

: Allowed to wear noise-canceling headphones during outside activity to accommodate sensitivity to loud noises; scribe for data gathering to allow to focus his attention on completing the hands-on activity. Provide a written checklist with each step of the activity written out to accommodate weaknesses in organization.

Encourage him to read aloud to provide opportunities to capitalize on his auditory processing strengths.

: Provide a written checklist with each step of the activity written out to accommodate weaknesses in organization.

: Scribe data table for him to accommodate his reluctance to engage in any writing activity. Have write student responses to multiple choice comprehension questions on the whiteboard to accommodate his kinesthetic needs during class.

How will you address each student's individual IEP goals/objectives within this lesson; please be specific.

: "CTACAD1: Connor will implement strategies such as checklists and verbal or non-verbal cues to help him work independently on academic tasks for 5 consecutive minutes on 4 out of 6 opportunities." will be provided with a checklist outlining each step of the activity.

: "JDACAD4: With maximum staff support, will recognize when he does not understand a mathematical concept or activity and will advocate for himself by directly asking for help in 3 out of 4 opportunities." Staff will frequently check in with to establish his correct understanding of the activity, and he will be asked to summarize one of the paragraphs of the article verbally.

: “NRAAF2: 2. Moving from maximum to minimum staff support, will utilize teacher provided checklists and/or graphic organizers to help him manage multi-step assignments on 3 out of 5 opportunities.” will be given a checklist outlining the steps involved in the activity.

“JLACAD1: 1. will engage in teacher directed academic class for 10 or more minutes in 4 out of 6 opportunities.” 's class participation will be monitored and documented on a scatterplot.

Assessment:

Teacher observation of class participation

Completed datasheets and answers to reading comprehension questions

Oral explanations of Newton’s third law of motion and its application to rocket launches.

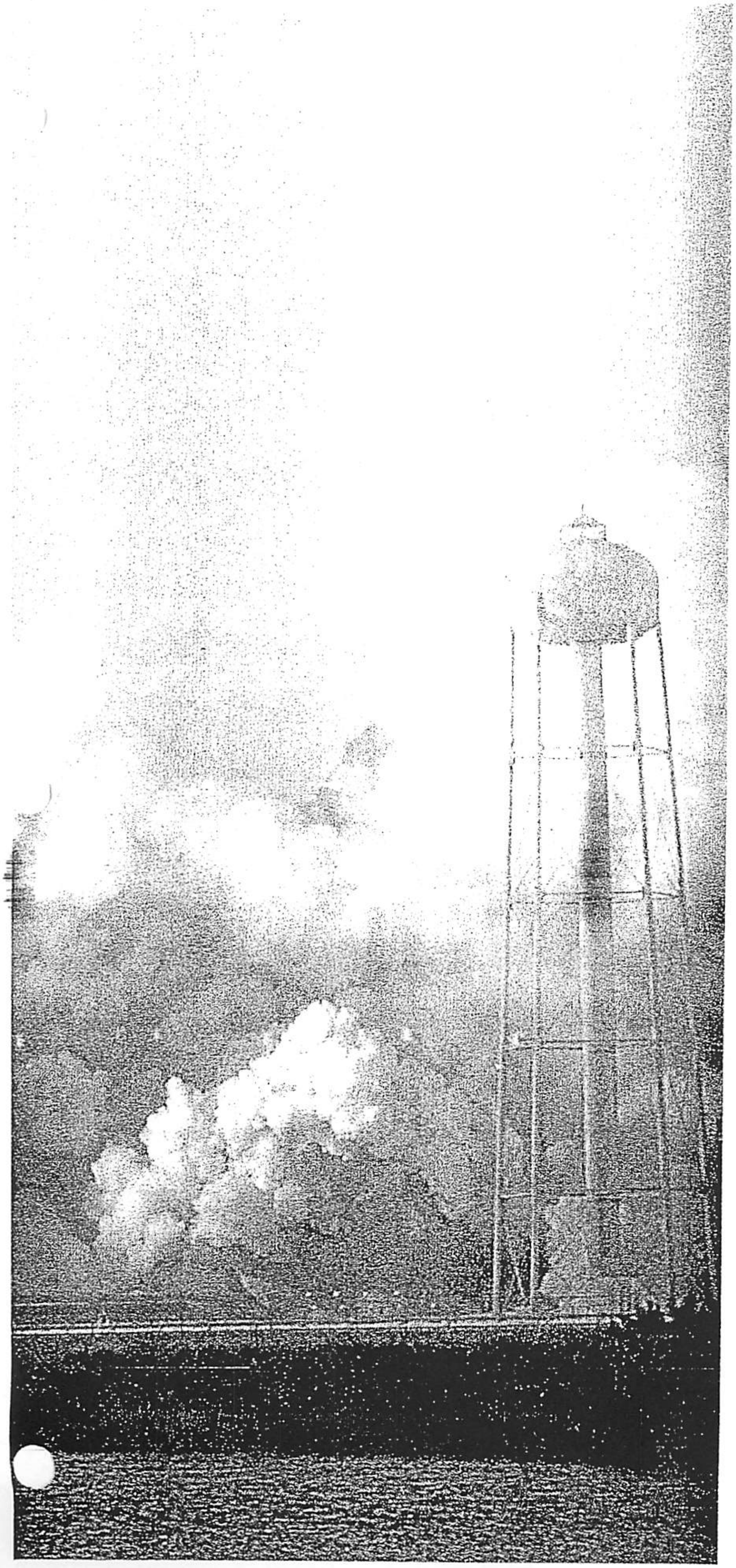
Lesson Extension

Build and test multi-stage balloon rockets

Explore http://spaceplace.nasa.gov/en/kids/ds1_mgr.shtml to engage in games, projects, animations.

Watch “October Sky”

Research and build a replica of an actual American spacecraft



The force that drives a space rocket

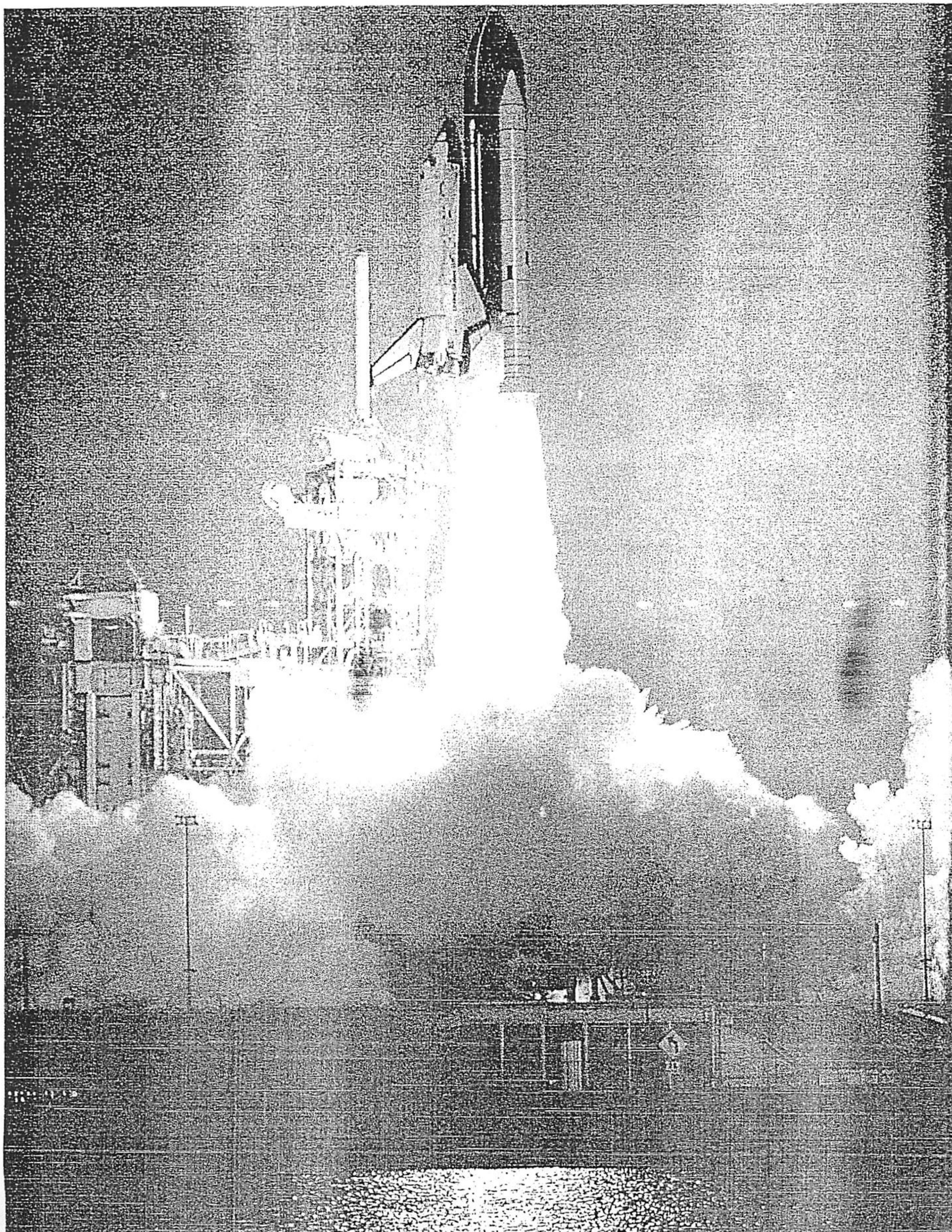
On April 12, 1981, the first space shuttle, *Columbia*, lifted off from Cape Canaveral on its maiden flight into space. *Columbia* was powered by three liquid-fuelled engines and a pair of giant strap-on, solid-fuel boosters, and was controlled by five sophisticated, interlinked computers. But despite the space shuttle's apparent complexity, the basic principle that makes it work is exactly the same as that behind a simple firework rocket or a balloon that zooms across the room when you let go of its neck. It is the principle of action and reaction.

In the 17th century, the English physicist Sir Isaac Newton summed up one of the basic rules of the Universe in the statement: 'Action and reaction are equal and opposite.' For example, when the neck of an inflated balloon is released, and air rushes out through the aperture, the equal and opposite reaction to the escaping rush of air pushes the balloon forward.

Unlike a balloon, a rocket does not contain compressed gas. Instead, it manufactures gas by burning solid or liquid fuels. But once the gas has been produced, the principle is the same. As the hot exhaust gases escape from its rear, the rocket is pushed forward in an equal and opposite reaction to the rush of escaping gases. But, unlike a balloon, which darts in all directions, the rocket is designed to keep a stable course.

Columbia's three liquid-fuelled engines, which together burn 100 tons of fuel a minute, produce a downward stream of gases that cause an opposite, upward force or reaction of 640 tons. The gases from the two solid-fuel boosters produce a reaction of 2400 tons. The total upward reaction on the shuttle is therefore more than 3000 tons. But the fully fuelled shuttle weighs only 2000 tons, so the reaction is sufficient to lift it off the ground and accelerate it towards space. Once in space, the shuttle goes into its regulated orbit around the Earth.

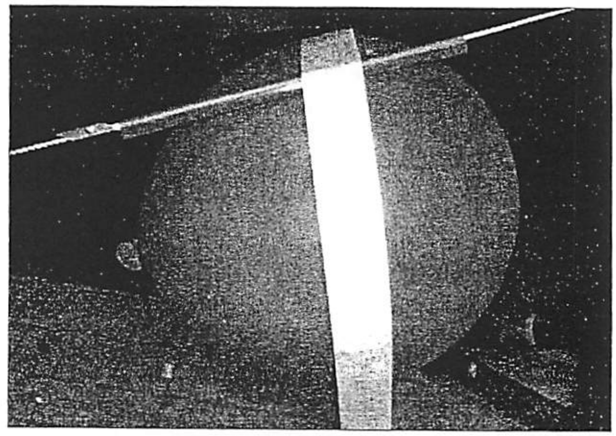
The first reusable spacecraft *Spewing flames and clouds of smoke, the space shuttle* Columbia *blasts into space on one of its many voyages. Its twin rocket boosters strapped to the large fuel tank fall away after two minutes and parachute back to Earth, to be used again. The large tank is jettisoned six minutes later, and breaks up on its way down through the atmosphere. The shuttle itself eventually returns to Earth, intact.*



Model to Make:

Launch a Balloon Rocket

Zoom into the next room or across your yard with a balloon rocket. Like all rockets, balloon rockets move forward by pushing gas (in this case, air) backward.



Materials

- Latex balloons
- Sturdy string
- Straws
- Masking tape

Procedure

1. Set up the flight line. Stretch the string between two trees or fenceposts outside or between doorknobs or cabinet handles inside. Tie one end of the string to an anchor (tree or doorknob), thread a straw onto the string, and then tie the second end of the string to the far anchor. Make the string as taut as you can without damaging the anchors or breaking the string. To do this, tie a loop into the string 3 feet (1 meter) from the second anchor. Loop the string around the anchor and back through the loop. Pull on the free end of the string to tension the string, and then secure it with an overhand knot. Make sure that you've chosen a location where people won't hurt themselves by walking into the string.

2. Take two strips of masking tape about 1 inch (2.5 centimeters) long and tape them to your shirt or pants. This isn't to make a new fashion statement; it's to reduce the stickiness of the tape so you can remove it without ripping the balloon later. Inflate a balloon and hold the neck shut. Peel the tape off your clothes and use the two strips to attach the balloon to the straw. The balloon nozzle should be pointing away from the intended direction of travel.

3. Release the nozzle. Lift off!

Explanation

The balloon should have traveled at least 20 to 30 feet (6 to 9 meters). The air at higher pressure inside the balloon pushed out the mouth, launching the balloon forward. If the balloon didn't fly well, try it again and make sure the balloon is aligned parallel to the string. If the balloon isn't aligned, the balloon will spin around the guide string and not go anywhere.

See how far you can get a balloon rocket to travel. Have student teams measure and record the distance of each launch. Will a two-balloon rocket go twice as far as one? Better check it out.

Learning Moments

Some students may attach the balloon facing the wrong direction. Let them release the balloon and realize their error. Then help them understand by asking in what direction the force has to be to propel the rocket along the string. Balloons attached somewhat sideways to the straw will twirl around the string as they move forward. Ask teams what causes the spinning and help them recognize that it represents a loss of energy that could propel the rocket further.

Rocket-powered History:

First American in Space

Commander Alan Shepard was the first American to fly in space. He launched aboard a Redstone rocket on May 5, 1961.