



Revised 6/00

Lesson #13
Robots
Grade Level: 5-6

Teachers, this is a basic lesson plan that you may modify at your discretion.

Modifications to video: There may have been changes to the lesson plan since the video was made. This lesson plan reflects the latest updates made as a result of suggestions from teachers who have presented the lesson during the daytime program. Please continue to send us your ideas!

Overall educational objective: Students will learn about the two kinds of fluids: liquids and gases. Students will understand that liquids (water), unlike gases (air), cannot be compressed. This property makes them ideal for hydraulic work applications.

Associated Standard and CORE objectives:

- 3050-0301 Understand the properties of water
- 3050-0302 Cite examples of industrial uses of water

Materials list:

- 9 - Robot arms
- 8 - Pick-up kits containing pick-up items and gold cylinder
- 1 - Hydraulic/pneumatic lift stand
- 2 - Small bottles for stand
- 4 - Bottles of colored water

Lesson activities:

1. Have two students use the hydraulic/pneumatic lift stand to demonstrate the power of water and air. Explain that we use air and water to do work. When air is used, it is called PNEUMATICS. When water or liquid is used, it is called HYDRAULICS. Have the students brainstorm how they have seen pneumatics and hydraulics used to do work. Write the ideas on the board. (examples of pneumatics: dental drill, paint sprayer, nail or staple guns, wrenches at the auto shop, BB guns. hydraulics: automobile brakes, car lifts at the auto shop, hydraulic presses (stamp or shape metals))
2. Have two new students demonstrate the hydraulic/pneumatic lift stand by pushing the syringes as fast as they can. (Caution them not to break the syringes). Have the students identify the differences between the water and air. (Water moves quicker, and goes higher. Air moves slower, and doesn't go as high.) Have one student attempt to resist the lifting power of the liquid syringe by

holding the syringe on the stand at the bottom of its range of travel while the other student pushes on the hand-held syringe. Repeat this process with the air filled syringes.

3. Have the students speculate on what causes the differences between water and air. Explain that air molecules compress (squash together) more than water does, causing the lift to work less efficiently (bottle not lifted as high, motion less smooth). Water (liquids) are more efficient. How do these differences affect the work that air and water do? Refer to the list on the board. Have the students come up with some similarities between the different kinds of work water does (moving or supporting heavy materials, a large force needs to be supplied over a long period of time). Have the students come up with some similarities between the different kinds of work air does (moderate force over a very short period of time, moving or supporting light materials.)
4. Divide the students into teams of four (one or two groups may have three students if necessary). Have each team move to a robot arm. Go over the parts of the robot as a class: Rotating Base, Shoulder, Arm, and Gripper. Have each student hold one of the four syringes on the robot. (With teams of three, one student will need to hold two syringes.)
5. Allow 5-10 minutes for the students to practice gripping and placing the materials (supplied in the pick-up kits) into the deposit cylinder.
6. Prepare a series of tasks you would like the students to perform. Make sure the teams understand they must complete the tasks in order without touching the items.
7. Review the successes and role of cooperation among the teams. Have the students hypothesize how the robot would work if air were used instead of water. (Harder to control, less effective over distance, smaller range of movement.)
8. Call attention to the career fields that are related to this module. Discuss how students might prepare for occupations that interest them.

Teacher tips: Make the following chart on the board and/or use as a handout when teaching about pneumatics and hydraulics:

Ways we use air and water	Advantages	Disadvantages
Pneumatics		
Hydraulics		

- Have one student close his or her eyes while listening to directions from the group. Rotate clockwise so that each member of the group has a turn doing all movements.
- Not all robots look like Rosie on *The Jetsons*. Most do only one movement and perform a very specific task.

Extension: Have a career day when parents that use pneumatics and hydraulics at work can demonstrate equipment at school.

Safety precautions: Caution the students not to pull the plungers out of the syringes, and advise them not to push or pull too fast or hard. If a plunger is pulled out, simply refill the syringe with colored water.

Reference:

National Geographic v192, July '97, p.76-95 "Robot Revolution"

Discusses current trends in robot technology and some of the problems currently facing researchers and developers.

Please make your students aware that this lesson relates to the following:

Career Fields: SCIENCE, TECHNICAL

Occupations: Computer Engineer: Plan, design, and build computers and other related products. They also plan and design computer systems tailored for individual companies and organizations. They might also install these systems or modify already existing ones.



Education: Bachelor's Degree

Hydraulics Engineer: Use hydraulic mechanics along with other forms of engineering to design structures related to irrigation such as dams, drainage systems, power plants, and bridges. They use knowledge concerning water availability in the area when building these structures.

Education: Bachelor's Degree

Mechanical Engineer: They plan and design tools, engines, machines, and other mechanical equipment. They design and develop power-producing machines such as internal combustion engines, steam and gas turbines, and jet and rocket engines. They also design and develop power-using machines such as refrigeration and air-conditioning equipment, robots, machine tools, materials handling systems, and industrial production equipment.

Education: Bachelor's Degree

Review Questions:

1. What the differences between hydraulics and pneumatics?
2. What is the major behavioral difference between air and water when placed under pressure?
3. Why are robots important? What are some everyday examples of robots?
4. Who designs robots?
5. How could you get involved with designing and building robots?