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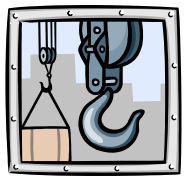
Demo: Master Machines

Pre-Visit Activities

Grades 3-5



Developed 11/07

The following Science Standards of Learning are addressed in the Master Machines Demo:

3.1- The student will plan and conduct investigations in which (a) predictions and observations are made; (b) objects with similar characteristics are classified into at least two sets and two subsets; (c) questions are developed to formulate hypotheses; (j) inferences are made and conclusions are drawn.

3.2- The student will investigate and understand simple machines and their uses. Key concepts include (a) types of simple machines (lever, pulley, screw, wheel and axle, inclined plane, and wedge); (b) how simple machines function; (c) compound machines (scissors, wheelbarrow, and bicycle); and (d) examples of simple and compound machines found in the school, home, and work environment.

4.1- The student will plan and conduct investigations in which (a) distinctions are made among observations, conclusions, inferences, and predictions; (b) hypotheses are formulated based on cause and effect relationships; (c) variables that must be held constant in an experimental situation are defined;

4.2- The student will investigate and understand characteristics and interactions of moving objects. Key concepts include (a) motion is described by an object's direction and speed; (b) forces cause changes in motion; (c) friction is a force that opposes motion; and (d) moving objects have kinetic energy.

5.1- The student will plan and conduct investigations in which (b) estimations of length, mass, and volume are made; (c) appropriate instruments are selected and used for making quantitative observations of length, mass, volume, and elapsed time; (g) manipulated and responding variables are identified; and (h) an understanding of the nature of science is developed and reinforced.

Activities

These activities are intended for use before your visit to the Virginia Air and Space Center. It is beneficial for the students to have some prior knowledge about the content area covered in the program. All of the activities can be tailored to your specific classroom needs, and procedures listed are suggestions for teaching.

Activity 1: Pulleys and Wheels

Materials- For this activity you will need one wooden handle broom per group, one jug filled with sand or water per group, twine or rope, duct tape, paper, pencils, various assortment of wheels (such as plastic cars, round rolling blocks, film canister lids, etc.).

Instructions for building a pulley can be found on this website: http://www.lerc.nasa.gov/WWW/K-12/Summer_Training/KaeAvenueES/pulleys.html. You can print out a copy for each group or student if you like.

Before beginning the activity you will need to separate your students into groups. Once each group has been given all the necessary materials, go over the pulley instructions as a group. See which group can build a fully functional pulley system first. Make sure that the group can demonstrate the pulley's working ability. With a pen and a piece of paper have each group answer the following questions: Was the pulley easy or hard to assemble? Why? How can a pulley be a helpful machine? What work does it do? How could it be helpful in everyday situations? How is a wheel similar to a pulley? Once each group has completed the questions and construction of their pulley systems, see if they can incorporate the use of wheels in their systems to make work even easier. Have the students choose which wheels they would like to use out of the assortment you have given them. When each group has completed their creations, have them share their pulley systems with the other groups.

Discuss the project as a group. What new things did they learn about the two simple machines they incorporated into the project? What are some modern day examples of pulleys people use in everyday life?

Extension- Have your students complete an at home challenge that involves identifying pulleys and wheels. Ask them to see how many pulleys or wheels they can identify in their own homes. Make sure they write them down and can explain their functions.

Activity 2: Levers and Wedges

Materials- For this activity you will need a hammer, a few nails, two apples, something to cut the apples with (such as a butter knife), a block of wood you can hammer the nail into, an unopened can of fruit or vegetables, a can opener, a chair with wheels, and a chair without wheels.

In this activity you will illustrate to your students the ease and working capabilities of simple machines. Explain to your students that you need their help to conduct an experiment on a few of the simple machines. Using the above materials, have each student try to do a task without the use of one of the simple machines. Use the hammer as a lever demonstration. Hammer a nail into the wood block and ask your students to try and pull the nail out, first using only their hands. Without the use of a hammer the student will find this task extremely difficult. You can also use the apple and a butter knife to demonstrate a lever. Ask a student to break open the apple without the use of a lever. Use the unopened can of fruit to show a wedge demonstration. Ask one of your students to open the can without the use of a wedge. Once the can is

opened explain that a can opener is not only a wedge but that it contains three other simple machines. It also has a working lever, screw, and wheel and axle. Something as simple as a can opener is an example of a compound machine. Have an open discussion with your students about the definition of a compound machine. A compound machine is made up of two or more simple machines.

Extension: Have your students conduct the same kind of experiments on other simple machines. For example, use a chair with wheels and one without to demonstrate how hard it would be to push a student across the floor in a chair without wheels. Get your students involved by having them come up with input for the experiments.

Resources

Websites

http://42explore.com/smplmac.htm

http://www.proteacher.com/110064.shtml -this site has various lesson plans on the simple machines and wonderful ways to integrate them into your classrooms.

http://outreach.rice.edu/~dgabby/science/simp_mach/ -The web quest research project on this page is highly suggested and a lot of fun.

http://teacher.scholastic.com/dirtrep/simple/index.htm

http://www.edheads.org/activities/simple%2Dmachines/glossary.htm

http://sln.fi.edu/qa97/spotlight3/spotlight3.html

Books

Forces and Machines. Sinclair MacLeod. 1993.

Janice VanCleave's Physics for Every Kid. Janice VanCleave. 1991.

Machines (Make it Work). David Glover. 1999.

Machines (Make it Work! Science Series: The Hands-on Approach to Science). David Glover, and Jon Barnes. 1997.

Projects with Machines. John Williams. 1992.