Discussion Guide for

SIMPLE AND COMPOUND MACHINES

OBJECTIVES

- To teach the concepts behind simple machines and compound machines.
- To identify the six types of simple machines and show how simple machines can he combined into compound machines.
- To explain the concepts of work, resistance, and force.
- To teach scientific principles in the context of everyday examples.

SYNOPSIS

No matter how high the "tech" in our lives, much of the actual work we do is accomplished by six simple machines: the lever, wheel and axle, pulley, wedge, inclined plane, and screw. This program introduces simple machines to school audiences, and in the process, shows how everyday objects and experiences can be examples of physics at work. Two junior high students visit the local equipment rental and repair shop for a little help with their Science Fair project on machines. The woman who runs the shop gives the kids a tour and lesson, beginning with definitions of "machine" and "work." That background places all of her examples and explanations in just the right context for learning. As the tour proceeds, the students learn the vocabulary needed both to get a grip on the concepts and to obtain a sense of physical laws at work. The shop owner illustrates each type of machine with common and sometimes surprising examples: scissors, door knobs, screwdrivers, and water faucets, chain hoists, a loading ramp, knives, nails and can openers. The kids also examine the ways that simple machines can be combined into various compound machines.

QUESTIONS TO ASK BEFORE VIEWING

1. What machines can you find in this classroom? (List on the board without comment.)

2. Classify these machines into some kind of order. You might think of more than one system of classification. (Accept all suggestions. Although the ultimate goal of the lesson is to focus on simple machines, it will be useful for kids to impose some kind of organization on the list- perhaps according to function or source of power. Youngsters might even use "simple machines" as a category.)

3. There are two category headings into which all machines can be grouped. Do you know what they are? (If students don't know, tell them.)

4. Ask the class to place all the items on the list into one or the other of these two categories. (Accept all suggestions.)

QUESTIONS TO ASK AFTER VIEWING

1. What is the definition of "machine"? (Something that does work.)

2. Name the six types of simple machines. (The lever; wheel and axle; pulley; wedge; inclined plane; and screw.)

3. What is the definition of "compound machine"? (A combination of simple machines.)

4. How does the shop owner define "work" in the program? ("Work is done when a force causes an object to move-when something is moved a distance by force.")

5. On the board, have a student draw a simple diagram showing the elements of a lever. Don't label the elements yet. (The diagram should include the lever, the fulcrum, and the object to be moved. If the first volunteer doesn't get it right, ask another student to make necessary additions or corrections.)

6. Now name each of the elements in the diagram. (Effort, fulcrum, effort arm, resistance, resistance arm.)

7. The program talks about the tradeoff in using a lever. What is meant by that? (Force on the resistance will increase-and less effort is required-if you move the effort arm a greater distance. You will need mote of an effort if you move the effort arm only a short distance.)

8. How do you change the relative lengths of the effort arm and the resistance arm? (By moving the fulcrum.)

9. What are examples of levers shown in the film? (Scissors, metal cutter, nutcracker, tongs, broom, mop, baseball bat, crowbar, claw hammer, wheelbarrow, can opener, boat oars, fishing rod, tweezers, and the handle of an auto jack.)

10. In what way is the lever similar to the wheel and axle? (The wheel and axle is a form of lever in which the edge of the wheel acts as the effort end and the center of the axle is the fulcrum.)

11. Recall some examples of wheel and axle machines shown in the film. (Ice cream maker, doorknob, screwdriver, egg beater, pencil sharpener, bicycle pedals, clock, roller-skates, can opener, car steering wheel, and water faucet.)

12. What is the work of a fixed pulley? (It changes the direction of force.)

13. What is the work of a moveable pulley? (It multiplies the effort and therefore increases force.)

14. How ate pulleys illustrated in the film? (Flag pole, hoist, crankshaft, sails on boats, and curtain openers.)

15. What is the work of an inclined plane? (It decreases the effort needed to raise or lower an object.)

16. Name some examples of the inclined plane at work. (Stairs, ladders, downhill roads, slides, and ramps.)

17. Why are wedges used? (To multiply the force needed to penetrate very hard objects.)

18. How are the inclined plane and wedge similar? (The wedge is two inclined planes back-to-back.)

19. What tools make use of the wedge? (Knife, nail, chisel, plow blade, needle, can opener, ax, paper cutter, and doorstop.)

20. Why do sharpened knives work better than dull knives? (By decreasing the thickness of the cutting edge, less effort is needed to move through the object being cut.)

21. What simple machines are at work in a wood screw? (Wedge, inclined plane, wheel and axle.)

22. What examples of screws are shown in the program? (Light bulbs, bolts, drill bits, clamps, cat jacks, and bottle tops.)

23. Does the students' choice of topic for a Science Fair project seem like one that will be easy or difficult to develop? (Easy, because of the ready availability of real-life examples.)

24. Look back at the list we made before seeing the film. What changes or additions would you make to the list?

PROGRAMS DETAILS

LENGTH:

22 minutes

SUBJECT AREAS:

Physical Science

AUDIENCE LEVELS:

Junior/Senior High

ORDER NUMBER:

1-9776SG

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