Simple Machines Workshop

Enhances the "Much Work with Little Effort" assembly by allowing students to manipulate and explore Dr. Quark's unique collection of machines designed expressly for use in the show and these workshops.

1. Mystery Machines - identify three different types of machines and learn the trade off between "effort" and "distance" - or "power" and "speed"
2. Pulley Tug o' War - who is stronger? one kid with a pulley or four kids against her?
3. 10 foot lever - What can you lift?
4. Puzzle Station - can you figure out how a scale works? also identify simple machines from around the house
5. Crank-o-matics - learn for real how a wheel and axle work with races and "drag" races

Quick Facts

* 30 student maximum; 25 students ideally
* requires at least 5 parent volunteers to spend the day helping to supervise stations (only as many stations will be offered as can be supervised)
* 45 minutes
* grades 2 and up
* 3 workshop minimum
* Follows "Much Work with Little Effort"

Primary Goal: to expand students hands-on experience and vocabulary in Physics through demonstrations involving effort, resistance, and simple machines.

Secondary Goal: to give students an opportunity to see how math and physics are combined, and to reassure them that what they learn in school applies to "real life."

Equipment: 10' lever and fulcrum, meter stick balances, scales (spring and balance), tug o' war pulley, various wheel and axle apparatus, screwdrivers and screws, mystery machines (simple pulley, multiple pulley, wheel and axle, inefficient lever).

Activities

Activity 1: Where does Energy come from?

Group discussion resulting in the realization that all the energy we use (except nuclear) comes from the sun. Energy runs Simple Machines which come in five types, Pulley, Inclined Plane, Lever, Wheel and Axle, and Screw.

Activity 2: How does a pulley work?

Students will have the opportunity to have a tug o'war with a pulley to see how far you must pull the rope to pull the blocks together and how much easier it is.

Activity 3: How does a lever work?

Students will balance themselves on the large lever with the fulcrum off center and see how the weight balances and why.

Activity 4: How does a wheel and axle work? or Why does my bike go fast in high gear unless I'm going uphill?

Students will have the opportunity to experiment with the wheel and axle apparatus - seeing what pulls the fastest and what pull the strongest.

Activity 5: Can you tell what simple machine is the "best" without seeing it?

Students will get to pull strings on the Mystery Machines and observe how far the opposite end moves. From these observations, some students will be able to identify (hypothesize) which machines work the best. After all students have tried and guessed, scales will be used to show what "effort" is required to move a specific "resistance" with each machine.

Activity 6: What good is a machine that makes a job "harder"?

Some students will have noticed that with the wheel and axle and the "backwards" lever mystery machine, the effort was more than the resistance. (Useful for Viking

catapults (3rd class lever), throwing a baseball, launching a jet from an aircraft carrier (pulley), starting a car (push downhill), making your bike go fast on the flats, screw toy....

Activity 7: When do I ever use simple machines?

At the puzzle station students will have the opportunity to try 4 of the 5 simple machines in forms they may find in their homes or school: balance (lever), ramps (inclined plane), screw driver (screw), egg beater (wheel & axle).

Additional Activities you can do on your own:

Activity "Friction": How can we reduce friction?

Using a spring scale to slide the weights, students can try different surfaces (and substances) to see what uses the least effort. Rolling friction should prove the least. If this is of interest to the class, it should probably precede use of the inclined plane trials. Teachers wanting to pursue this activity should provide their own test substances - trials will be done on a smooth tabletop and could get messy. I suggest a large piece of sand paper, water, paraffin, soapy water, soap, vegetable oil (spray on), WD - 40 , a pan of ice, a rubber mat, waxed paper, cloth,...and something with wheels. If you have some spring scales and things to drag (I use hockey pucks with hooks on them) you can do this as a lab prior to my arrival. Topics which can be introduced are friction, reading an instrument, force, effort, and resistance.

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Students and teachers with questions, comments, or suggestions for other things you'd like to see can write Dr. Quark at the above address! He loves mail and will try to answer what he gets!