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ONTARIO SCIENCE CENTRE

Exhibit Inquiry

Pulleys and Gears

Grade 4 - 8

An agency of the Government of Ontario

ONTARIO SCIENCE CENTRE

Pulleys & Gears

Have students look for the following exhibits related to pulleys and gears during their visit to the Ontario Science Centre:

Simple Machines in Action

Where to go:

KidSpark Entrance (Level 4)
Keep the Ball Rolling
(The Rhoads Sculpture)

What it's about:

Pulleys, gears, inclined planes and levers are all a part of the Rhoads sculpture. Students can investigate how simple machines work together in this fun and whimsical piece of art.

What to say and do:

- How many different kinds of simple machines (*Pulley, gear, inclined plane, lever, wheel and axle*) can you find in this exhibit?
- From start to finish, track the simple machines a ball passes through.

Feel the Mechanical Advantage

Where to go:

Science Arcade (Level 6)
Strength is Not Always the Answer

comparing them at this exhibit. The exhibit also highlights the trade-off between effort and distance.

What to say and do:

- Make predictions about which system will require the least amount of effort (easiest) to lift the load (6 kg weight). Test your predictions. Which was the easiest to use?
- Ask the students for suggestions why one system requires more or less effort. (*Prompt them by asking how many ropes share the load; the effort required is proportionate to the number of load-bearing ropes.*)
- How does the effort required by the system compare to the distance required to raise the load? (*Prompt students by asking them to compare the number of times the rope leads to and from the load. [Do not include the rope leading to the handle.] Then check the distance needed to lift the load the same height. [Look at the coloured indicators.*] *Effort is inversely proportionate to distance.)*

Simple Machines at Work

Where to go:

Entrance (Level 2)

What it's about:

The elevator and escalator located at the front entrance by the Shoppers Drug Mart® Omnimax® Theatre have clear sides allowing students to see all the simple machines at work.

What to say and do:

- Identify the simple machines you can see in the elevator and escalator. (*Gears, wheel and axle, inclined plane*)
- Watch the elevator and escalator to see how they work. Where is the load for each? (*Escalator: people on each step; elevator: people in the elevator car.)*
- Look at the elevator door open and close. Can you figure out how the simple machines above the door control the movement? (*A gear and chain push and pull levers to open and close the door.*)

Resources Pulleys & Gears

Vocabulary

Bevel gear	Gears that mesh at an angle.
Block and tackle	A system of two or more pulleys with a rope or cable threaded between them, usually used to lift or pull heavy loads.
Chain or belt	Connects two separated wheels so that as one turns, the other will turn in the same direction.
Combined pulley system	A fixed pulley and a movable pulley joined to combine the advantage of the two (changed direction and less effort).
Counterweight	A weight that balances another weight.
Effort	The force applied to a machine in order to produce an action.
Fixed pulley	A pulley that is attached to a fixed point and is used to change the direction of a force.
Force	A push or a pull by one body on another; forces can change the speed or direction of a moving object.
Friction	Resistance encountered by a moving object.
Gear	A toothed wheel that engages another toothed mechanism in order to change the speed or direction of transmitted motion.
Gear train	A collection of gears used to transmit power.
Inclined plane	A ramp that reduces the force necessary to lift a weight.
Lever	A rigid bar that pivots about a point (fulcrum) and is used to move or lift a load at one end by applying force to the other end.
Load	Force and weight on structure.
Mechanical advantage	Describes how much a machine multiplies the force put into it.
Movable pulley	A pulley that is not attached and allows the lifting force to be less than the force of the load (also called free pulley).
Pulley	A simple machine consisting of a wheel with a groove through which a rope can run.
Rack and pinion	A wheel gear (the pinion) meshes with a toothed rack; converts rotary to linear motion (and vice versa).
Spur Gear	Gear wheels that mesh in the same plane.
Wheel and axel	A lever that rotates in a circle around a cylindrical rod.
Worm gear	A gear consisting of a shaft with a screw thread (the worm) that meshes with a toothed wheel (the worm wheel); it changes the direction of the axis of rotary motion.

Internet Links

Marvellous Machines
http://www.galaxy.net/~k12/machines/

How Gears Work
http://www.howstuffworks.com/gears.htm

PLEASE NOTE: Programs and exhibits are subject to change without notice.