



Work

Explore these exhibits to learn how to make **work** easier when moving people and things.

Think About It

- At each exhibit, where can you find work being done?
- What is doing the work and what is being moved?
- What could you change to make the work even easier or faster?

How to use this guide

To help guide your visit, we have developed this learning pathway to explore a specific topic using some of the exhibit components.

- Look up the words in bold in the vocabulary list on the back.
- Continue your investigations into other areas of the museum by checking out “Where To Learn More” on the back of this page.
- Follow this path as you explore the gallery, try a different path, or create your own path and follow where your curiosity takes you!



Path

HOVERCRAFT

- When is work being done? Is the craft doing work when it lifts, when it hovers, or both?
- Use the railings to push yourself forward in the craft? Now push harder. In which experiment was more work done?



EARTHMOVERS

- Can you find all the **simple machines** in the exhibit?
- How does each simple machine change the **force** you use to make the work easier?



GIVE IT A LIFT

- Try lifting the weight at each station. How does each machine create a **mechanical advantage**?
- How do you think mechanical advantage affects work?



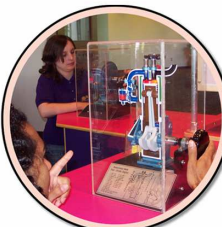
FEEL THE FRICTION

- What are some of the advantages and disadvantages of each vehicle?
- Why do you think the boat requires the least force and energy to move the same **cargo**?



START YOUR ENGINES!

- What are the different forms of **energy** that you can identify in a real working **combustion** engine?
- How do you think the energy changing from one form to another is related to the work being done?



MAGLEV

- Try adding cargo to the train and push it down the track. Can it still move quickly?
- Why do you think a **magnetic levitation** train has more **power** than a regular train?



What's Going On?

Work is done when a force makes an object move. Using more force in order to move a heavier object, or moving an object farther will increase the work being done. Power is the rate at which work is done. If you lift a weight over your head 10 times in 10 seconds, you are doing work. Lifting the same weight 10 times in 5 seconds involves the same amount of work, but you use more power while you are lifting because it was done faster. Work transfers energy from one object to another. The more energy something has, the more work it can do.

Simple Machines are tools that make this easier by allowing us to push or pull objects over increased distances with less work. The different types of simple machines are the: gear, **screw**, **wedge**, **inclined plane**, **wheel and axle**, **pulley** and **lever**.



Where to find more...

Exhibits

- 1
- 2
- 3

Other Experiences

- 1 (ex. Floor Demonstration)
- 2 (ex. Outreach program)

(check for booking availability)

Learn More About It!

Cars And How They Work

DK Publishing, 1992

Claire Llewellyn, Simone Abel
(Illustrator)

And Everyone Shouted, "Pull!": A First Look at Forces and Motion (First Look: Science)

Picture Window Books, 2004

David Macauley and Neil Ardley

The Way Things Work

Dorling Kindersley, 2004

David Macauley

The New Way Things Work

Houghton Mifflin Books, 1998

Deborah Hodge and Ray Boudreau

Simple Machines (Starting With Science)

Kid Can Press, 2000

Sally Nankivell-Aston, et al.

Science Experiments With Simple Machines

Franklin Watts, 2000

Alastair Smith, et al

Energy, Forces & Motion (Library of Science)

Usborne Books, 2002

Physics Learning Resource

<http://web.archive.org/web/20050208005712/http://www.exploratorium.edu/ti/resources/physics.html>

Transportation Educational Links

<http://www.ohtm.org/eduLnksPg.html>



Vocabulary

Cargo – Items carried by a vehicle.

Combustion – The process of converting fuel into energy, often by burning.

Energy – The ability to do work. It can come in many forms, including electrical, heat, mechanical (moving parts), and potential (stored energy).

Force – A push or a pull.

Friction - The force that tends to slow down moving objects that are touching.

Inclined Plane – A flat surface that is slanted, like a ramp.

Lever – A stiff rod or plank that rotates around a fixed point, or fulcrum when an input force is applied. One example is a see-saw.

Magnetic - The ability to be affected by a force called magnetism, sometimes caused by a flow of electricity.

Mechanical Advantage - The benefit created by a machine that enables people to do work while using less force.

Power – The amount of work done in a certain amount of time (Power = Work divided by Time).

Pulley - A simple machine consisting of a rope running over a groove in a wheel. Pulling on the rope changes the direction of the lifting force. A pulley, or system of pulleys, make it easier to lift heavy loads by applying less force over greater distances.

Screw - A cylinder surrounded by an inclined plane that spirals from top to bottom.

Simple Machine - Any device that requires the application of a single force to work. Tools used to make work easier.

Wedge - An inclined plane with either one or two sloping sides that converts motion in one direction into a splitting motion.

Wheel & Axle - A round object or disk revolving around a central axis.

Work – The energy transferred by a force to a moving object (Work = Force multiplied by Distance).

AAAS Benchmarks for Science Literacy

- | | |
|---------------------------------------|-----------------------------------|
| 1: The Nature of Science (A,B,C) | 10: Historical Perspectives (A,B) |
| 2: The Nature of Mathematics (A,B,C) | 11: Common Themes (A,,C) |
| 3: The Nature of Technology (A,B,C) | 12: Habits of Mind (A,B,C,D,E) |
| 4: The Physical Setting (B,C,D,E,F,G) | |
| 6: The Human Organism (D) | |
| 8: The Designed World (A,B,C) | |
| 9: The Mathematical World (A,B,C,D,E) | |

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