Dajia Elementary School 大佳國小

6th Grade Science - 2nd Semester

配合南一書局 自然與生活科技 6下

by Natalie Chen 陳邑寧

Chapter 1 - Simple Machines

Content:

- **Simple machines**
- **Lever**
- **Pulley**
- **Wheel & axle**
- **Gear**

Vocabularies:

- Simple machines
- Lever
- Pulley
- Wheel
- Axel
- Pull (v.)
- Push (v.)
- Ruler
- Force
- Eraser
- Scale

Simple Machines

Watch this video for introduction ->
(Turn on subtitle. Starts at 0:32, ends at 2:33)
https://www.youtube.com/watch?v=wl1-frlRSfc

Video questions 1: What do you see in the video?
Answer: (Students raise their hands and answer.) Golf, baseball bat, rake,…
Video questions 2: What are machine, work and force?
Machine: helps us to do work.
Work: using force to move things.
Force: is a push or a pull that changes the motion or shape of a thing.

Think! Today you and your family are moving into a new house, how do you think the movers move all the heavy furnitures from the truck to inside the house? (Lots of muscles? Magic? No. They use simple machines to help them!)

Simple machines help us do work with less force.

1. Lever: A bar balanced on a fulcrum that can help lift a heavy object.
2. Pulley: uses wheels and a rope to raise, lower or move a load.
3. Wheel & axle: used to carry loads around easily for long distances with less effort.

Lever

- Examples: scissors, teeter-totters, bottle openers, mops, shovels, etc…
- Once you understand how a simple machine works, you will be able to modify or change it to solve different problems.

Experiment (Textbook page 7)

Introduction: Building a lever will help you understand its parts and function. (By changing the setup of the lever, you will discover how the distance between the fulcrum and the load affects the amount of force needed to lift the load and the distance it can be lifted.)

Materials:

- 1 ruler (with holes)
- 2 pieces of erasers

Steps:

Step 1 - Put 1 piece of eraser underneath the middle of the ruler on the table. (The eraser is the fulcrum.)

Step 2 - Put another piece of eraser on one end of the ruler. (The ruler is the arm.)

Step 3 - Make sure the center of the ruler (arm) rests on the 1st piece of eraser (fulcrum).

Step 4 - Lift the 2nd piece of eraser (load) by pressing down on the opposite end of the ruler (arm)

Step 5 - Press down the opposite end of the ruler again, but this time move the pressing point forward towards the middle point a little bit.

Observations:

Observation 1 - Observe the pressure you give during first press

Observation 2 - Observe the pressure you give during second press.

Discussions:

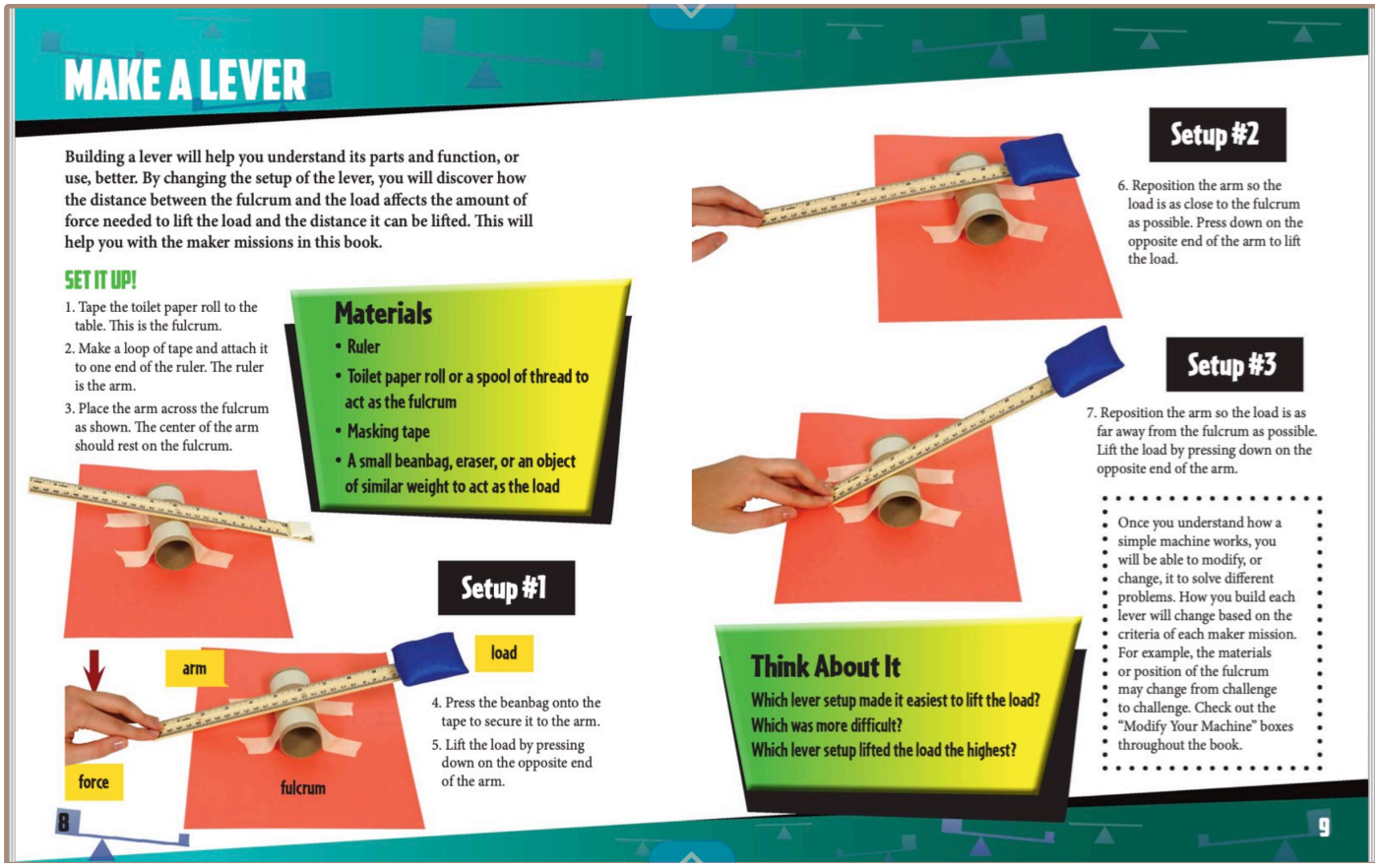
Question 1: Does pressing down on the very end of the ruler feel easier or pressing down in between the very end and the middle point feel easier?

Answer: Pressing down on the very end of the ruler feels easier.

Question 2: Can you tell me what the fulcrum, arm, load and force are in this setting?

Answer: The eraser in the bottom of the ruler is the fulcrum. The ruler is the arm. The eraser sitting on the ruler is the load. The hand is the force.

Reference



Pulley

Watch this video for introduction ->
SciShow Kids:Need a Lift? Try a Pulley!

https://www.getepic.com/video/49979448/scishow-kids-need-a-lift-try-a-pulley?utm_source=t2t&utm_medium=link&utm_campaign=content&share=30751616755

Experiment (Textbook page 13)

Introduction: Build a pulley to see if a pulley can make work easier or harder.

Materials:

- A stand
- A pulley
- A zip bag
- 2 spring scales
- String
- Some 1 cubic centimeter building blocks

Methods:

Step 1 - Hook one spring scale on to the stand.

Step 2- Put some blocks in the zip bag.

Step 3 - Attach the zip bag to the spring scale and measure the weight.

Step 4 - Remove previous items on the stand.

Step 5 - Hook the pulley on to the stand. Attach one spring scale on each side of the pulley by using strings.

Step 6 - Put the zip bag on one spring scale.

Step 7 - Pull another spring scale with hand till both sides are balanced. (注意一定要垂直向下拉)

Step 8 - Record the number of the force you pull with your hand.

Discussions:

Questions 1 - What direction did the blocks move when pulling?

Answer: Up.

Questions 2 - How much force did you use to make the blocks move?

Answer: same as the weight of the blocks.

⭐**Question 3**: Does using a pulley save effort or require more effort?

Answer: It doesn't save effort, nor does it require more effort. The objects' weight = the force.

⭐**Conclusion:**

A pulley does not make work easier, nor harder.

We call this type of pulley "fixed pulley"定滑輪.

so is there any type of pulley that can make work easier? Yes there is. We call it "**movable pulley**" 動滑輪.

Experiment (Textbook page 15)

Introduction: Make a movable pulley to see if it saves effort.

Materials:

- A stand
- A pulley
- A zip bag
- A spring scale
- String
- Some 1 cubic centimeter building blocks

Methods:

Step 1 - Put the blocks in the zip bag.

Step 2- Measure the weight of the blocks.

Step 3 - Measure the weight of the pulley.

Step 4 - Attach one end of the string on the stand.

Step 5 - Grab the other end of the same string and attach it on the bottom of the spring scale.

Step 6 - Hold the spring scale by hand. (two ends of the string need to be parallel)

Step 7 - Set the pulley on the string and hook the blocks at the bottom of the pulley.

Step 8 - Pull the spring scale with hand till the blocks go up. (注意一定要垂直向上拉)

Discussions:

Questions 1 - What was the direction of the force when pulling the spring scale

Answer: Up.

Questions 2 - How much force did you use to make the blocks move?

Answer: less than the weight of the blocks and the pulley combined.

⭐**Question 3**: Does using a movable pulley save effort or require more effort?

Answer: It saves effort.

⭐**Conclusion:** A movable pulley saves effort.

Fixed pulley+ Movable pulley = Compound pulley

Fixed pulley	Movable pulley	Compound pulley
Household elevator	Fitness equipments	Sailboat Boom
Raising flag	Sails	Hoist
Curtain	Cable cars	
	Fishing rod	

Wheel & Axle（輪＆軸）

Can use legos to show this part (starts 2:10)

https://www.youtube.com/watch?v=D-23fWhHDPc

Experiment (Textbook page 19)

Introduction: Make a set of wheel & axle to see if it also save effort.

Materials:

- A stand
- A pulley
- A zip bag
- A spring scale
- String
- Some 1 cubic centimeter building blocks

Methods:

Step 1 - Put the blocks in the zip bag.

Step 2- Measure the weight of the blocks.

Step 3 - Wrap the string around the pulley ? times.

Step 4 - Attach the end of the string on the thicker side (wheel) of the pulley to the spring scale and hold the scale.

Step 5 - Attach the blocks to the end of the string on the thinner side (axle) of the pulley.

Step 6 - Pull the scale up till the blocks move up.

Step 7 - Measure the force.

Step 8 - Switch the scale and the blocks.

Step 9 - Pull the scale up till the blocks move up.

Step 10 - Measure the force.

Discussions:

Questions 1 - How much was the force when the blocks were hooked on the axle?

Answer: Less than the blocks' weight.

Questions 2 - How much was the force when the blocks were hooked on the wheel?

Answer: More than the blocks' weight.

Question 3: Which method does save effort?

Answer: When the blocks were hooked on the axle.

⭐**Conclusion:** When the wheel's radius is bigger than the axle's radius, it saves effort.

Axle is the piece that connects the wheel to the object that you want to move.

Not only cars or bike use wheel & axle. A handle of the faucet on your bathroom sink also works like a wheel & axle. When you turn the handle of the faucet in a circle, it turns the axle to which it is attached.

Gear

Reference video (good explanations for kids but heavy Indian accent.)

https://www.youtube.com/watch?v=BKjo8Usp21k

- Wheels were invented to make things around easier, but there's a way to improve the use of wheels. One discovery is adding teeth to the rim of the wheel. A wheel with teeth is called a "gear".
- When 2 gears fit together, one gear can turn the other without slipping. This is called a "gear train".
- Each gear train has 2 parts - the "driver gear" is the one that you turn, and the "follower gear" is the one that gets turned
- When we turn the driver gear clockwise, the follower gear turns counterclockwise. Gears can change the direction of rotation.
- Bike: the chain forces the follower get to rotate in the same direction as the driver gear. (can bring a bicycle to class for demo)

Examples: bicycle, elevator,

补充：

Videos

Bill Nye the Science - Simple Machines

https://www.youtube.com/watch?v=3btMMCrsHhM

Epic - The Simple Machines Song

https://www.getepic.com/video/68807565/the-simple-machines-song?utm_source=t2t&utm_medium=link&utm_campaign=content&share=30751616755

Books

Epic - Lever

https://www.getepic.com/book/74244799/levers-in-my-makerspace?utm_source=t2t&utm_medium=link&utm_campaign=content&share=30751616755

Chapter 2 - Rusting

Content:

1. **How to write a practical scientific report.**
2. **What causes iron to rust.**
3. **How to prevent iron from rusting.**
4. **Mold**
5. **How to properly preserve food.**

Vocabularies:

- Rust
- Corrosion
- Mold
- Preserve (v.)
- Report
- Oxygen
- Steel wool
- Preserve (v.)

We have seen a lot of things getting rusted. Here are some photos of items getting rusted.

How do you think this happened?

- (students raise their hands and answer)

- Rusting is a type of corrosion.

How to write a practical scientific report

https://www.goodscience.com.au/year-7-science/practical-reports/

Practical reports follow a defined structure. They are broken up into several sections, each with their own heading and specific type of content.

In order:

1. Title
2. Introduction
3. Aim
4. Hypothesis
5. Materials
6. Methods
7. Results (or datas)
8. Discussion
9. Conclusion

Example:

Title: (brief) *Rusty iron*

Introduction: (Purpose. State the problem or question to be answered)

Does water cause iron to rust?

Hypothesis: (testable assumption, possible solution)

The water will cause iron to rust.

Materials: (equipments)

A container, water, steel wool,

Methods:

* *Steps*

Datas:

* *Observations*

Discussion

Questions.

Conclusions: (answers that accept or reject your hypothesis.)

The water does cause iron to rust.

What causes iron to rust

Experiment #1 (textbook page 34)

Purpose 目的: To find out if water causes iron to rust.

Hypothesis推測: Water will cause iron to rust.

Materials:

2 steel wool, tweezer, 2 zip bags, water

Methods 方法:

Step 1 - Grab two pieces of steel wool (same size). Dip one piece in water and keep another piece dry.

Step 2 - Put both pieces of steel wool in separate zip bags, and zip the bags.

Step 3 - Let them sit for awhile and observe changes of both steel wools.

Datas:

The one that was dipped in the water has rusted.

The one that stayed dry still looks the same.

Conclusion:

Water does cause iron to rust.

How to prevent iron from rusting

Do you know any ways to prevent iron from rusting? Any examples? (Students raise their hands and answer)

- Stainless contains a minimum of 10.5% chromium. This chromium reacts quickly with surrounding oxygen to form a thin oxide layer on the steel's surface. The chromium oxide clings to the steel. It protects iron from rusting.
- Keep items away from water. Stay dry.
- Add a layer of lubricant to separate it from water.

Mold

Describe what molds look like.

Molds take a variety of forms and textures. They can be white, black yellow, blue, or green and often look like discoloration or stain to a surface. They can also have a velvety, fuzzy, or rough appearance, depending on the type of mold and where it is growing.

What causes molds to grow?

Molds reproduce by many tiny spores (孢子). The spores are invisible seeds to the naked eye that float through the air and deposit on surfaces. When the temperature, moisture, and available nutrient conditions are correct, the spores can form into new mold colonies where they are deposited.

How to properly preserve food

- Chilling
- Freezing
- Sugaring
- Salting
- Canning
- Vacuum Packing

Chapter 3 - Earth

Content:

- **Habitats**
- **Adaptation**
- **Invasive alien species**
- **Humans & Environment**
- **Save resources**

Vocabularies:

- Habitat
- Adapt (v.)
- Survive (v.)
- Predator
- Desert
- Forest
- Ocean
- Animal
- Plant
- Pollution
- Global warming
- Recycling

(Suggestion) Watch this video first -

https://www.youtube.com/watch/CxrlEajA398

Habitats:

- Polar habitats
- Deserts
- Forests
- Freshwater habitats
- Ocean habitats
- Rainforests
- Grassland habitats

There are more….

HABITAT	ANIMALS
Forest	Elephant, Lion, Tiger, Bear, Giraffe
Tree	Snake, Monkey, Birds, Skunk, Squirrel
House	Spider, Ant, Cat, Dog, Lizard
Pond	Frog, Duck, Fish
Farm	Pig, Chicken, Cow, Goat, Sheep
Sea	Octopus, Clam, Jellyfish, Shark, Whale
Beach	Starfish, Turtle, Crab
Field	Grasshopper, Cow, Buffalo, Dragonfly
Soil	Earthworm, Centipede
Both Land & Water	Frog, Crocodile, Turtle

Questions:

- Are you familiar with these habitats? Please describe these habitats with your own knowledge (temperature, humidity).
- What animals are in these habitats? Lets start with desert first. (then move on to the next habitat)

Adaptation:

Animals and plants live in each habitat. They adapt to the habitat to survive. An animal adapts to the temperature to find food and to avoid predators. Adapting helps the animal to survive.

For example, polar bears have a thick layer of blubber to stay warm in their cold habitat. Penguins have blubber and dense feathers to stay warm. Think about how you stay warm when your habitat is cold.

Invasive alien species:

Species that have become established in areas outside their natural range are known as "alien species". ... However; when alien species are capable of causing significant harm to our environment, the economy or to society, they are referred to as "invasive alien species".

Humans & Environment

Air pollution

Air pollution is a type of environmental pollution that affects the air and is usually caused by smoke or other harmful gases, mainly oxides of carbon.

Water pollution

Water pollution occurs when harmful substances—often chemicals or microorganisms—contaminate a stream, river, lake, ocean, or other body of water, degrading water quality and rendering it toxic to humans or the environment.

Global Warming

Global warming is the long-term heating of Earth's climate system due to human activities.

Impacts:
temperature rises, water shortages, increased fire threats, drought, weed and pest invasions, intense storm damage and salt invasion,…

Take action:
Power your home with renewable energy, reduce water waste, use LED lightbulbs, etc…

Save resources

- Hydroelectricity
- Wind power
- Fossil fuel power
- Nuclear power
- Marine energy
- Solar power
- Geothermal energy
- Biomass energy

Log in to *Epic School* for children's books

https://www.getepic.com/app/edu-dashboard

user: nchen2@inside.artcenter.edu

pw: 12345678

https://www.education.com/worksheet/article/simple-machines/