New SCIENCE Curriculum

Energy
Grade 4

November 27, 2023

Facilitators: Chris Żarski & Ted Zarowny

Land Acknowledgement

In the spirit of reconciliation, we want to acknowledge that this gathering is taking place on traditional lands across the province of Alberta, home to many diverse First Nations, Métis and Inuit peoples. We acknowledge that this land is a traditional meeting ground giving voice to its original peoples and the story of creation of this country in a way that history has forgotten.

The Seven Grandfather Teachings Read by Etienna Moostoos-Lafferty

Photo by Peng Chen on Unsplash

Agenda

1. Looking at The Big Picture - Energy through K-3
   - What is *Movement*?
   - What Moves?
   - What causes objects and people to move?
2. Grade 4 Overview
3. Sample Grade 4 Assessments, Activities and Resources.

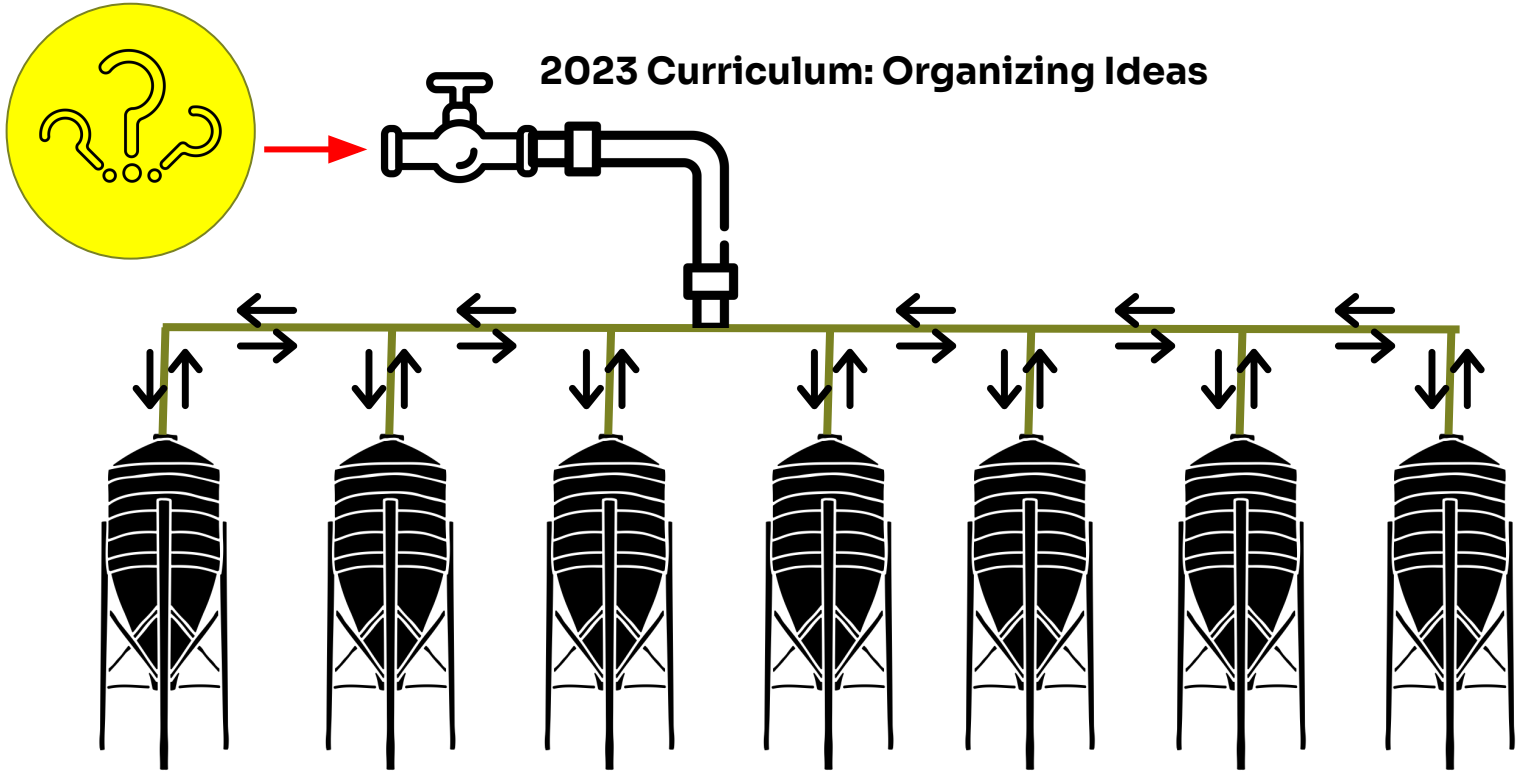
1 The Big Picture





GR. 1	Seasonal Changes	Needs of Animals and Plants	Creating Colour	Building Things	Senses
GR. 2	Small Crawling and Flying Animals	Buoyancy and Boats	Magnetism	Exploring Liquids	Hot and Cold Temperature
GR. 3	Building with a Variety of Materials	Testing Materials and Designs	Rocks and Minerals	Hearing and Sound	Animal Life Cycles
GR. 4	Building Devices and Vehicles	Light and Shadows	Plant Growth and Changes	Waste and Our World	Wheels and Levers
GR. 5	Electricity and Magnetism	Mechanisms using Electricity	Classroom Chemistry	Weather Watch	Wetlands Ecosystems
GR. 6	Air and Aerodynamics	Flight	Sky Science	Evidence and Investigation	Trees and Forests

2023 Curriculum: Organizing Ideas



Matter

Energy

Earth Systems

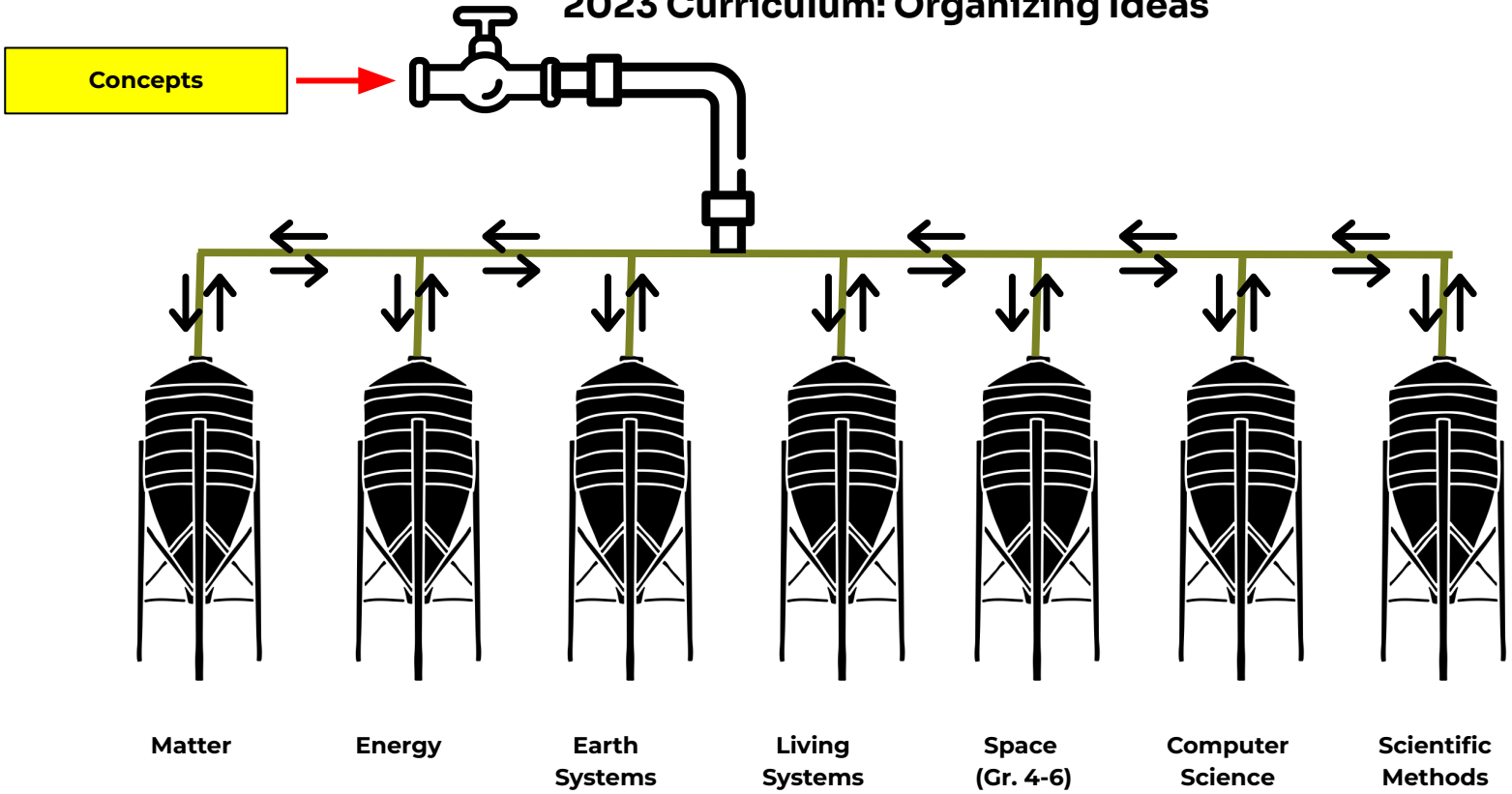
Living Systems

Space (Gr. 4-6)

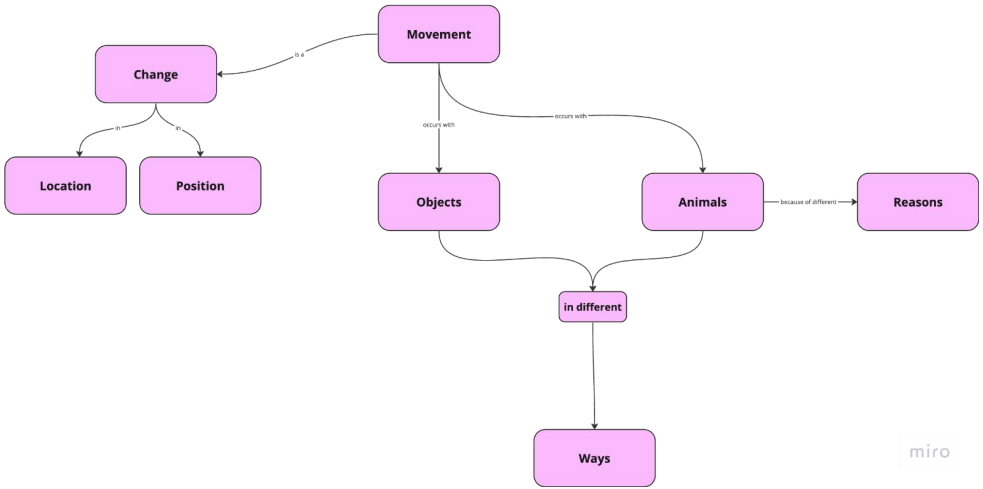
Computer Science

Scientific Methods

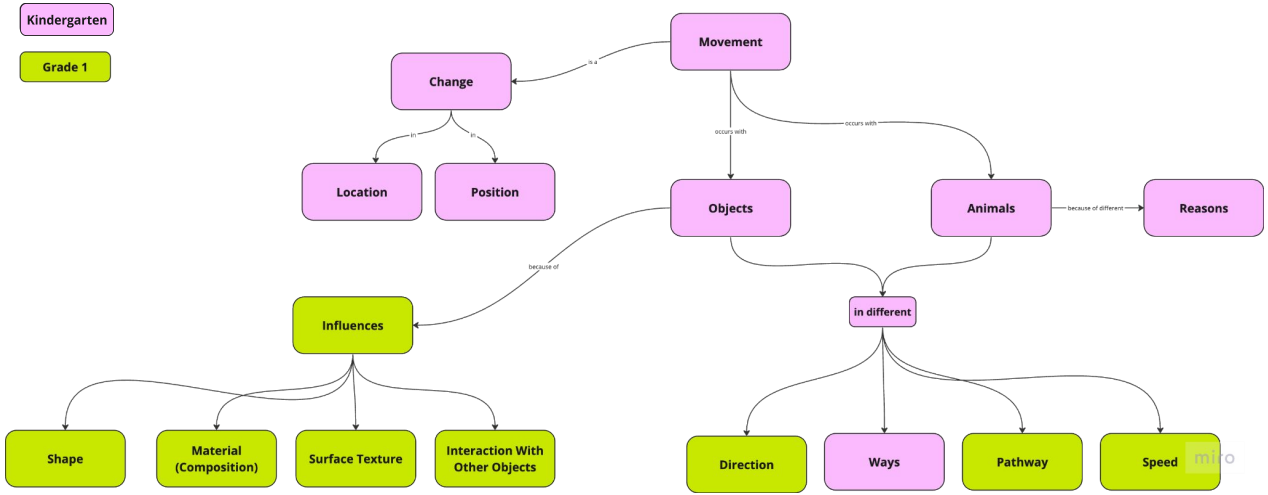
2023 Curriculum: Organizing Ideas



Kindergarten



K-6 Concept Progression: Energy



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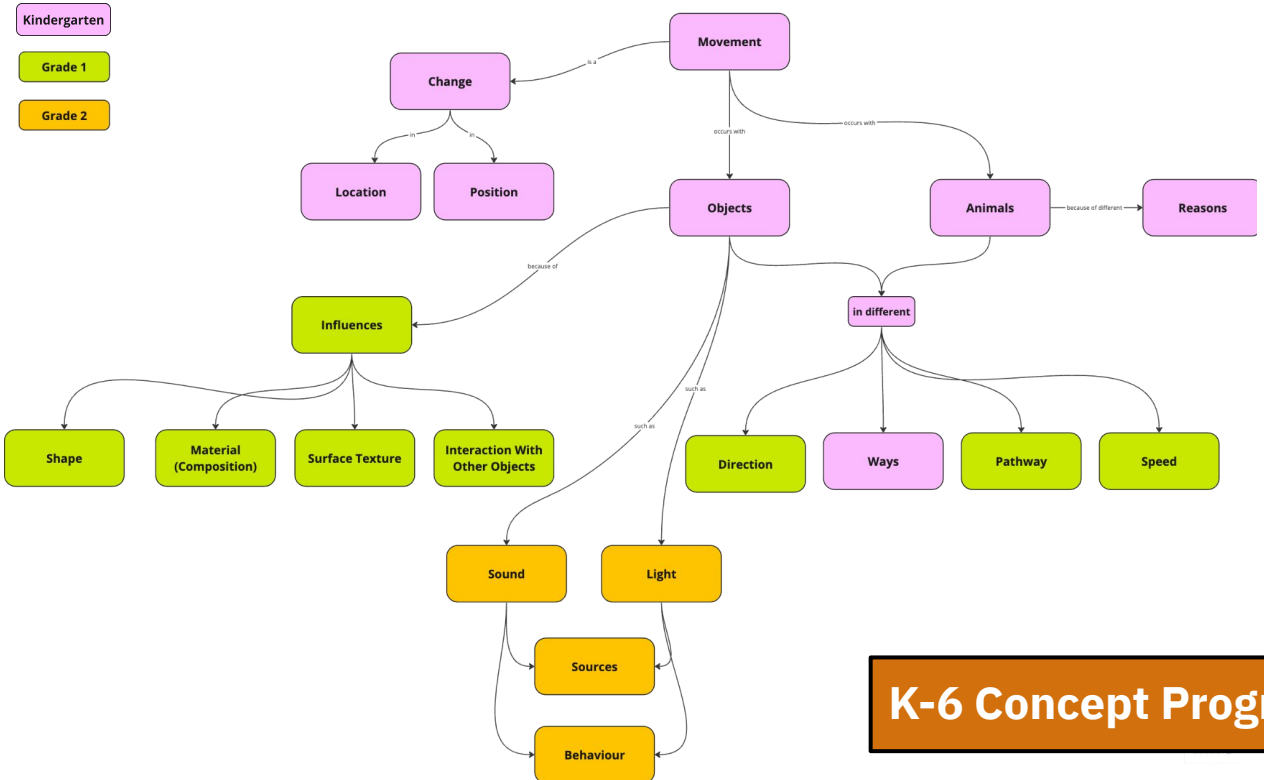

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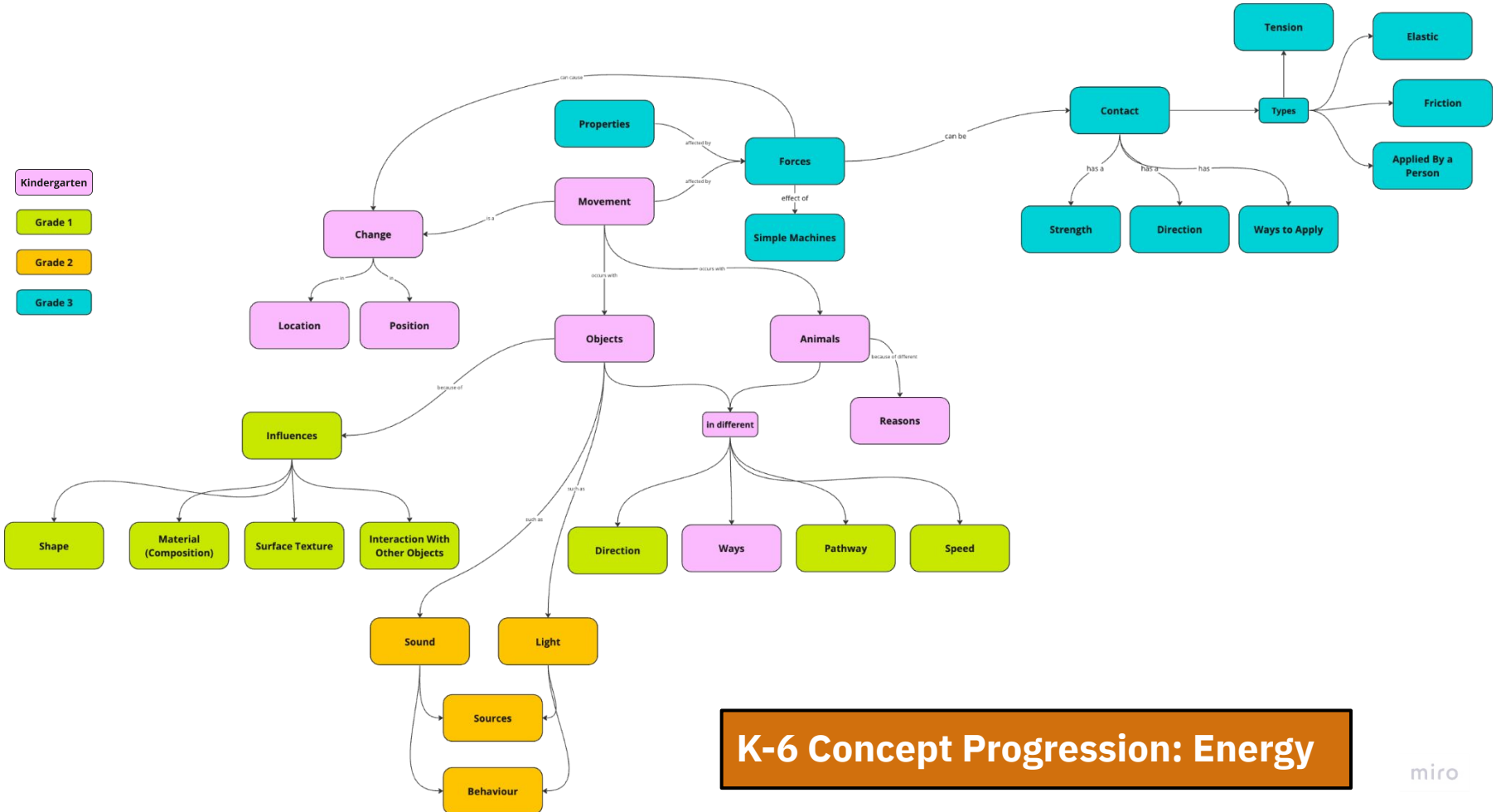

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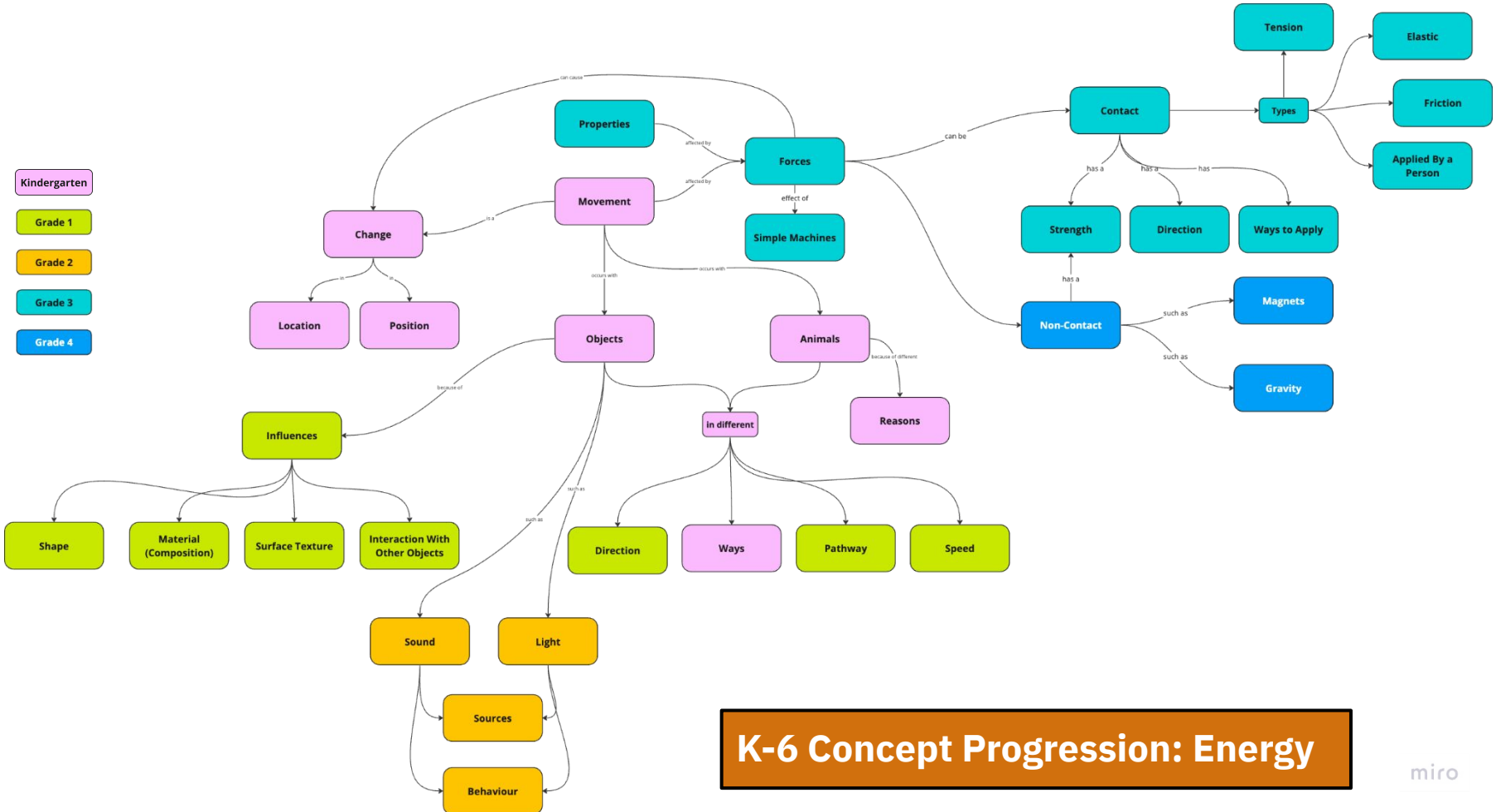

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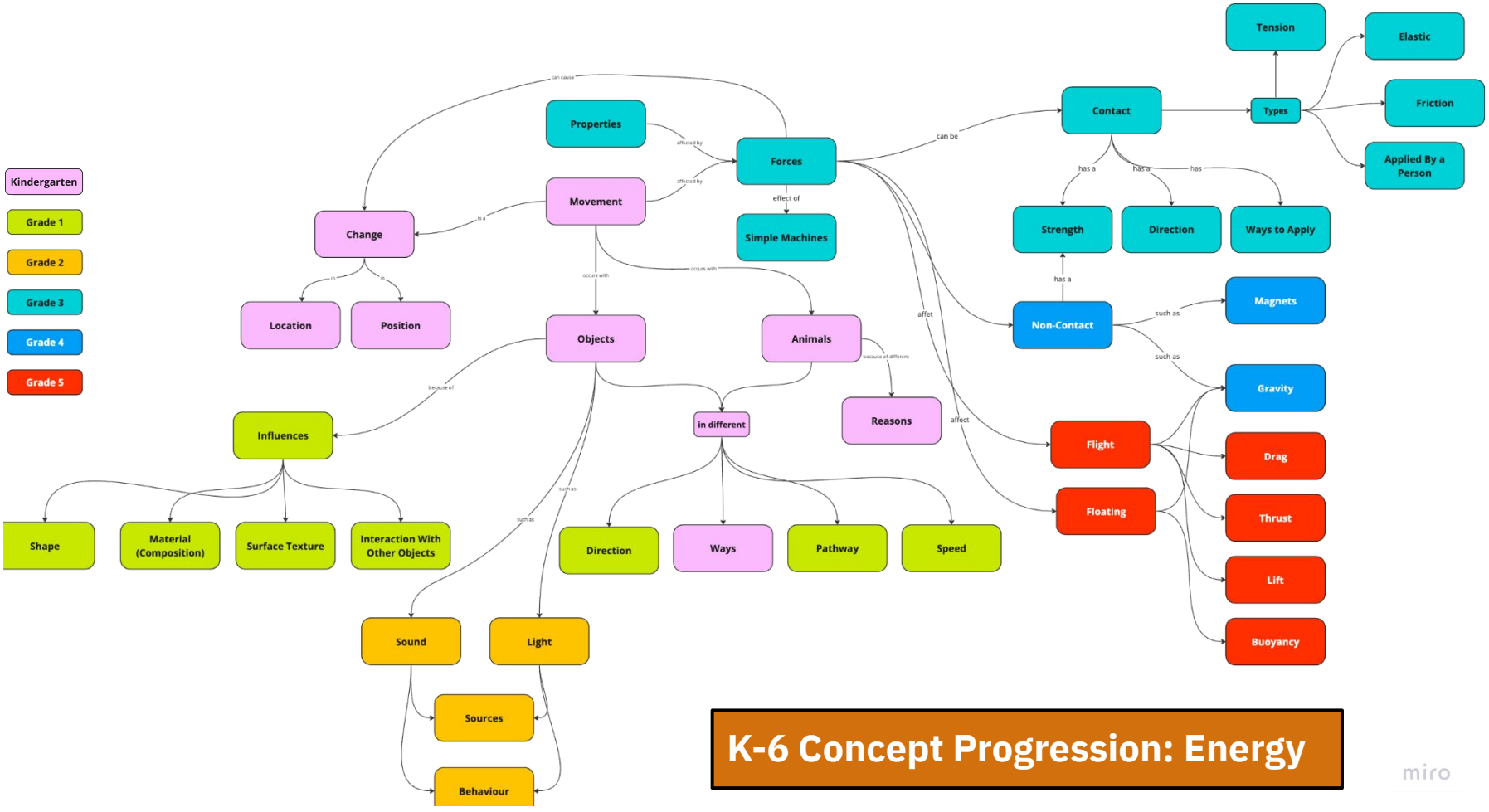
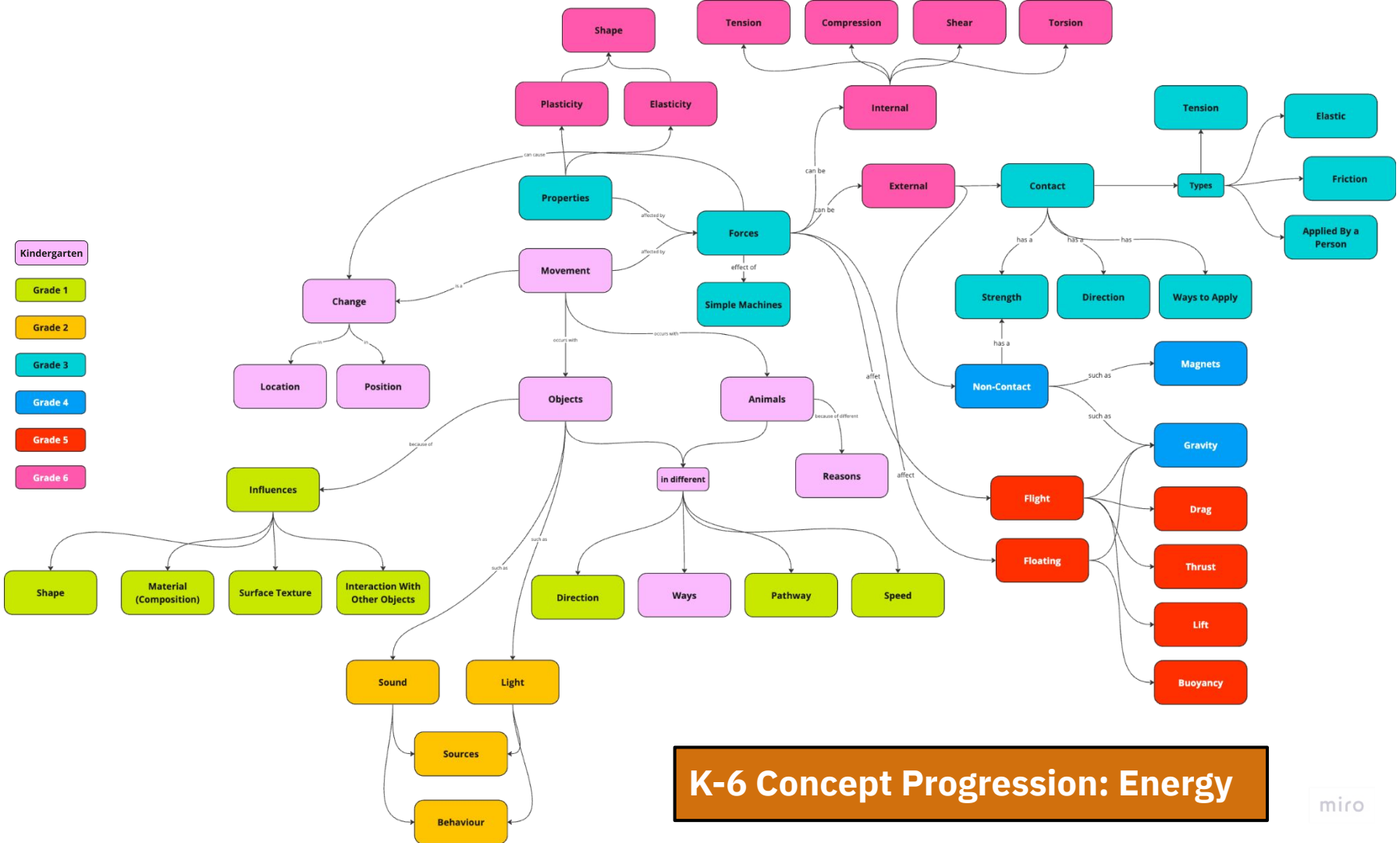


K-6 Concept Progression: Energy


Kindergarten
Grade 1
Grade 2
Grade 3
Grade 4
Grade 5
Grade 6
Shape
Tension
Compression
Shear
Torsion
Plasticity
Elasticity
Internal
Tension
Elastic
Friction
Applied By a Person
Types
Properties
Forces
External
Contact
can cause
affected by
can be
has a
has
Change
Movement
effect of
Simple Machines
Strength
Direction
Ways to Apply
is a
occurs with
Non-Contact
Magnets
Location
Position
Objects
Animals
affect
such as
Gravity
because of
because of different
Influences
in different
Reasons
Flight
Drag
Floating
Thrust
Lift
Buoyancy
Shape
Material (Composition)
Surface Texture
Interaction With Other Objects
Direction
Ways
Pathway
Speed
Sound
Light
Sources
Behaviour
K-6 Concept Progression: Energy
miro

Grade 4 Energy
Concept Map

Grade 4 ENERGY
(Note: This is only one possible way to organize the concepts)

Alberta Regional Professional Development Consortia
Adult learning for students' sake

ENERGY (01)

ENERGY (02)

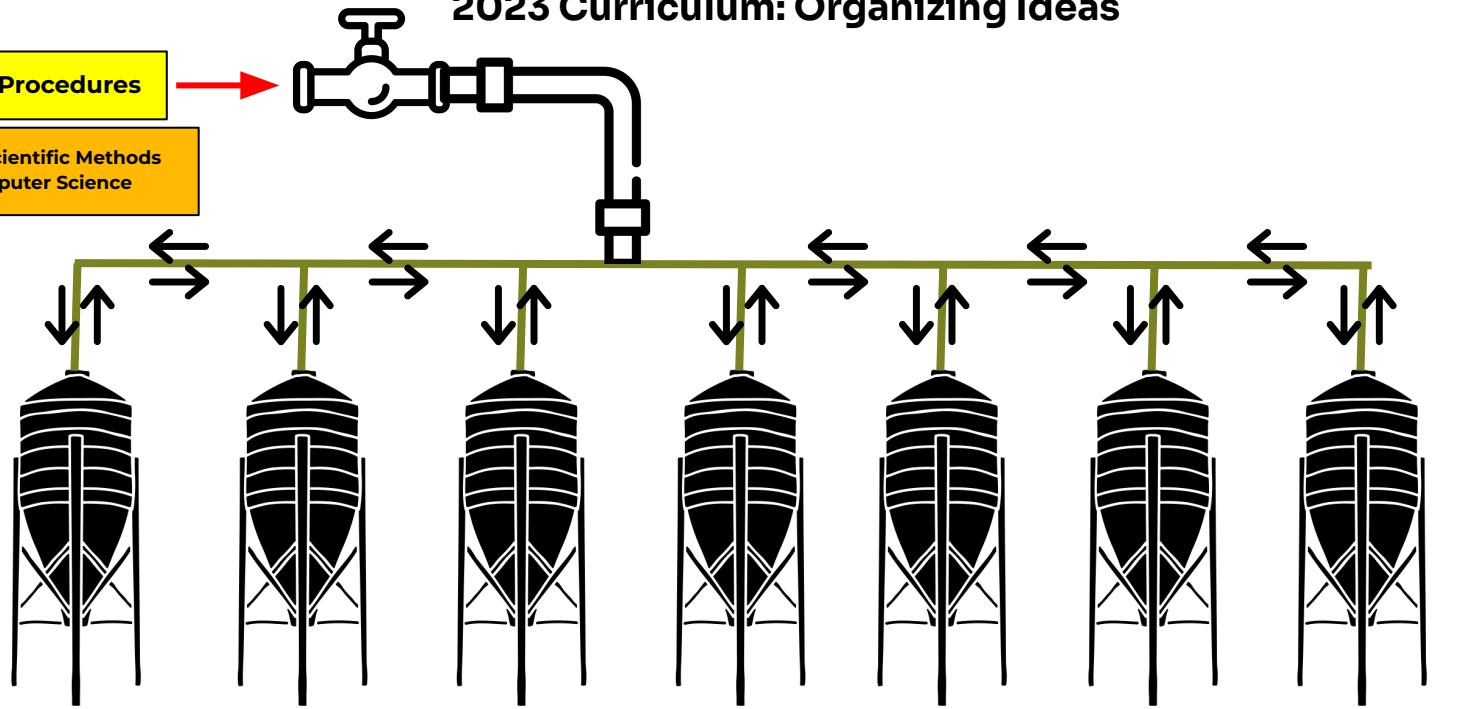
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 5	Grade 6
Guiding Question: *How can humans, animals, and objects move?*	**Guiding Question:** *How can movement of objects be understood?*	**Guiding Question:** *Where do light and sound come from, and how do they move?*	**Guiding Question:** *How can forces relate to changes in movement?*	**Guiding Question:** *How can forces affect objects from a distance?*	**Guiding Question 01:** *How are forces similar and different in water and air?*	**Guiding Question 01:** *In what ways can interactions lead to physical change?*	**Guiding Question 02:** *What are energy resources?*	**Guiding Question 02:** *How are energy resources used?*
Learning Outcome: *Children explore movement of objects, humans, and other animals.*	**Learning Outcome:** *Students investigate the direction, pathway, and speed of moving objects and animals.*	**Learning Outcome:** *Students investigate the behaviours of light and sound.*	**Learning Outcome:** *Students investigate and explain how forces affect the movement of objects.*	**Learning Outcome:** *Students investigate how forces can act on objects without contact.*	**Learning Outcome 01:** *Students investigate and compare how forces affect living things and objects in water and air.*	**Learning Outcome 01:** *Students analyze forces and relate them to interactions between objects.*	**Learning Outcome 02:** *Students investigate and analyze various energy resources.*	**Learning Outcome 02:** *Students evaluate the use of energy resources and explain factors that influence choice.*
KEY CONCEPTS					**KEY CONCEPTS**			
Change	Animal	Characteristics (Materials that Affect Sound)	Change: Movement	Attraction	Buoyancy	Change	Energy	Advantage
Location	Direction	Light Behaviour	Effort	Distance	Effect on Flight (speed, altitude, horizontal and vertical, straight and level)	Elasticity	Energy Needs	Daily Living
Movement	Factor	Pathway: Sound	Force: Applied (stretching, pulling squeezing pushing)	Force: Non-Contact (gravity, magnetic)	Flight	Force: Action	Energy Resource	Disadvantage
Movement: Ways	Influence	Pathway: Light	Force: Contact (applied, friction, elastic/spring)	Gravity	Flight Characteristics	Force: External (applied, friction, elastic/spring)	Resource: Renewable & Non-Renewable	Electricity
Position	Movement	Sound	Force: Direction	Interaction	Fluid	Force: Internal (tension, compression, shear, torsion)		Energy Use Management
Animals	Object	Light Source	Force: Strength	Magnetic Material	Force: Opposing (thrust, drag, weight, lift)	Force: Reaction		Energy Choice Factors
Object	Pathway	Sound Behaviour	Interaction	Magnetism		Interaction		Processed Energy & Non-Processed Energy
Human & Animal	Speed	Vibration	Movement	Poles		Object		
		Sound Source	Property	Properties		Physical Change		
		Sound Characteristics	Simple Machines	Repulsion		Plasticity		
			FNMI: Simple Machines	Strength		Property		

Link: Concept Progressions (ARPDC)

2023 Curriculum: Organizing Ideas

Skills & Procedures

Including Scientific Methods and Computer Science



Matter | **Energy** | **Earth Systems** | **Living Systems** | **Space (Gr. 4-6)** | **Computer Science** | **Scientific Methods**

Learner Outcome Verbs

Verbs are the skills and procedures that students do or perform *to demonstrate knowledge and understanding.*

Learner outcome verbs are those verbs that are identified in the learner outcome

Grade 4 ENERGY Learner Outcome

*Students **investigate** how forces can act on objects without contact.*

4E1 Learning Outcome: *Students **investigate** how forces can act on objects without contact.*

4E1.1 Understanding: *Non-contact forces are invisible forces that can affect objects, materials, and substances.*

4E1.1 Skills and Procedures

- **Describe** how non-contact forces affect objects.
- **Demonstrate** the effect of gravity on an object.
- **Conduct an investigation** to demonstrate magnetic forces on objects.

4E1.2 Understanding: *Magnets interact with each other and magnetic material.*

4E1.2 Skills and Procedures

- **Analyze** interactions between the magnetic poles of magnets.
- Magnetize a material using a magnet.

Teaching for Transfer

Phases of Learning

Hattie, Fisher & Frey: *Visible Learning for Literacy* (2016)

Surface

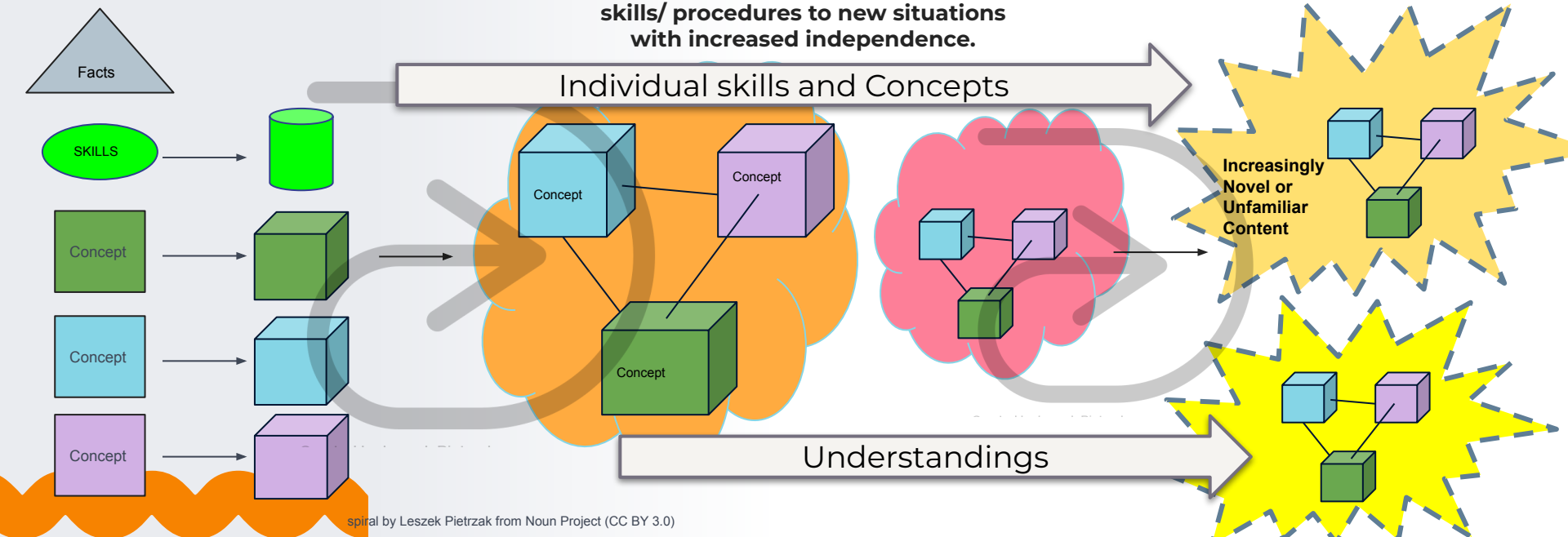
Students are first exposed to individual skills, concepts and their related knowledge.

Deep

Students make connections between concepts to create deeper understanding and appropriately apply skills/ procedures to new situations with increased independence.

Transfer

Students apply concepts, understandings and skills to a variety of novel and unfamiliar contexts.



Planning

Begin With the End In Mind

Stephen R. Covey, 1989

Backward by Design

Grant Wiggins & Jay McTighe, 1998

Learning Outcome
4E1: Students investigate how forces can act on objects without contact.
Understandings
4E1.1 Non-contact forces are invisible forces that can affect objects, materials, and substances.
4E1.2 Magnets interact with each other and magnetic material.

Sample Summative Assessment

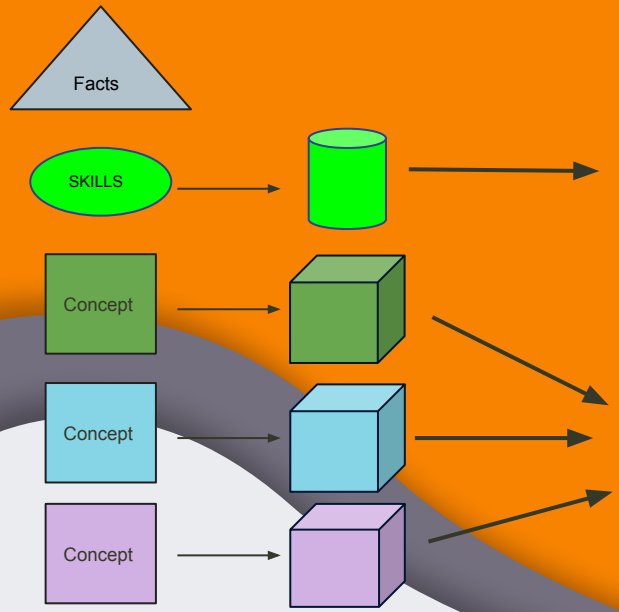
What will students need to know and/or understand in order to be successful?

What will students need to be able to do in order to be successful?

Phases of Learning

Surface

Students are first exposed to individual skills, concepts and their related knowledge.

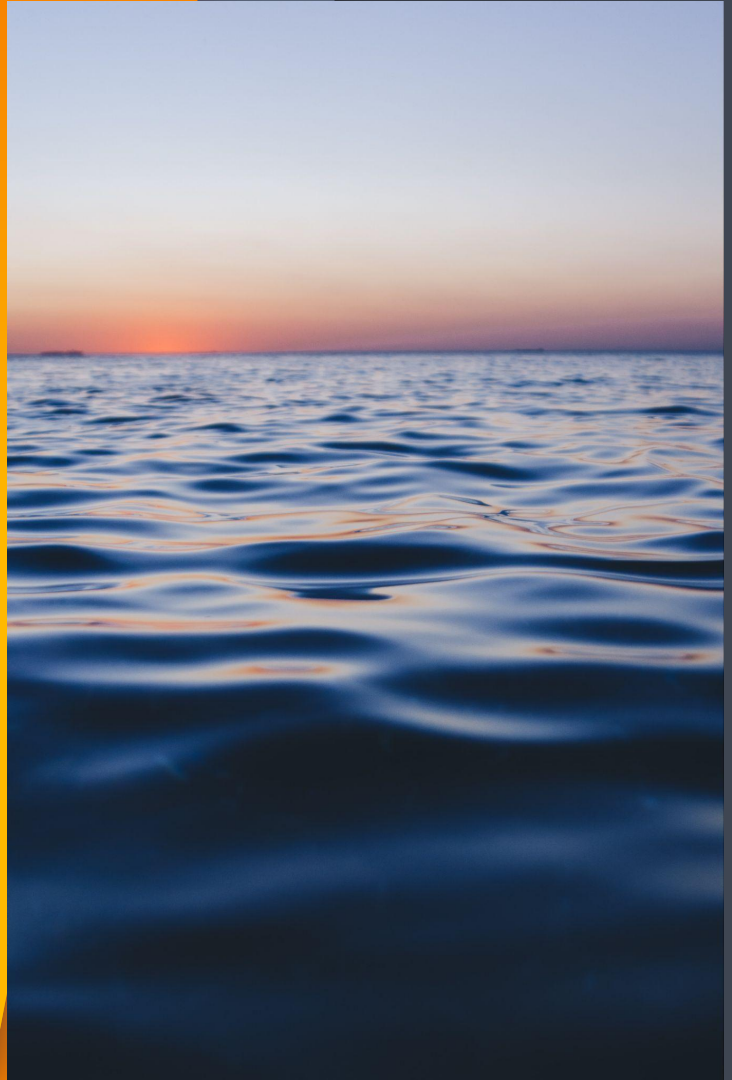


Learning Outcome
4E1: Students investigate how forces can act on objects without contact.

- **Steps in an investigation, measuring.**

Pre Assessment for Prior Learning

- **4E1.1: Concepts such movement, force (types, strength, direction), magnet, magnetic material, attract, repel.**



From Kindergarten

Objects | Properties

What is Movement?

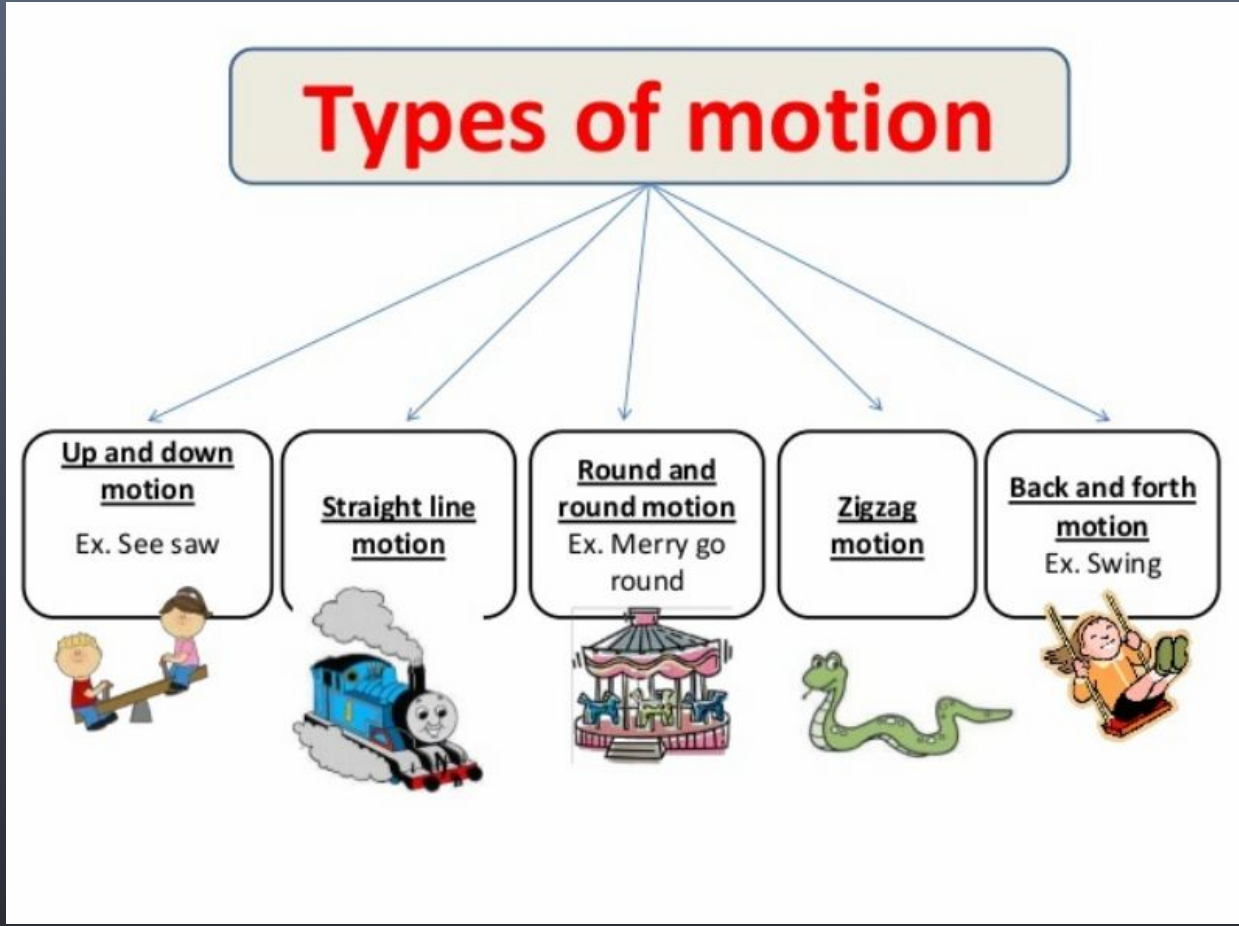
Can you show me what movement is?

Can you show me what movement is not?

How would you explain to someone what movement is?

PE or Outdoor Education Time!

Sidewalk Chalk would be a great tool!



Quizizz Library. Science: Types of Motion

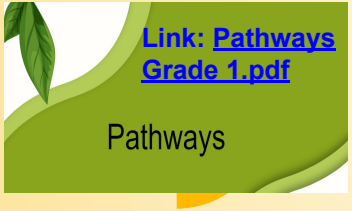
From Grade 1

Aspects of Movement: Direction, Pathway and Speed

Direction

Describing “Up, down, forward,backward, sideways, towards, away from”

Pathway



Movement pathways can be straight, curved, spiral, side-to-side

Speed

Speed - fast, slow, stay the same, change

What influences the way an object can move?

How does shape influence movement?

Let's explore!

How does the material influence movement?

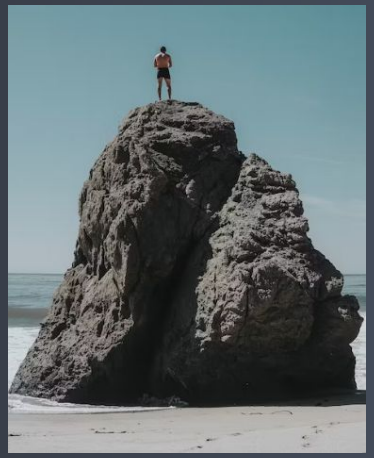


Photo by Andrew Charney on Unsplash

How does the surface texture influence movement?

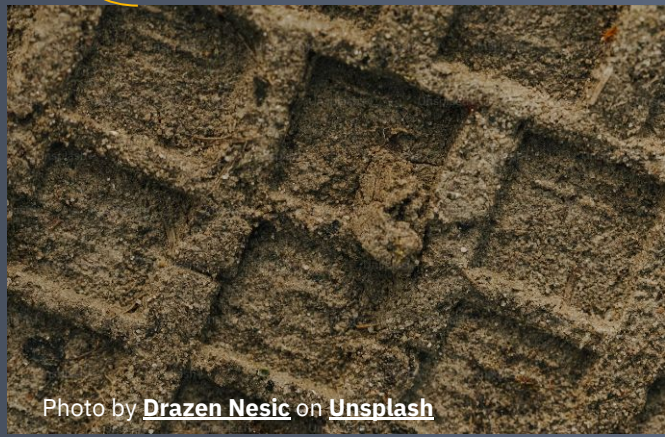


Photo by **Drazen Nesic** on **Unsplash**

From Grade 2

Sound - What Makes the Sound We Hear

Characteristics

Volume (quiet/loud)

Pitch (high/low)

Duration (short/long)

Sources

Vibrations

Objects (musical instruments, objects hitting each other, vocal chords

Materials

Material Characteristics

Size

Texture

Shape

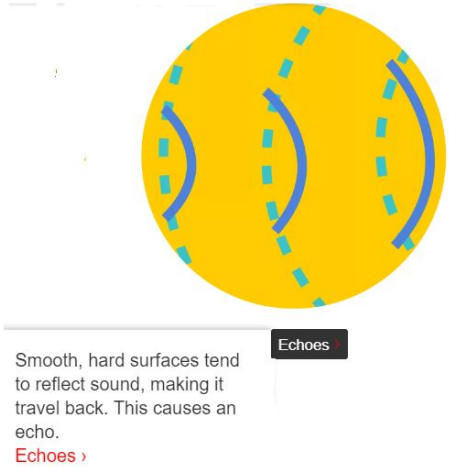
Type of Material

The Science of Sound (Unit)
Janelle Durham - music demonstrates vibrations and the movement of particles.

at pathways do sound travel in?

In a straight line

The Science of the String Phone - SciShow Kids



Bounce off surfaces

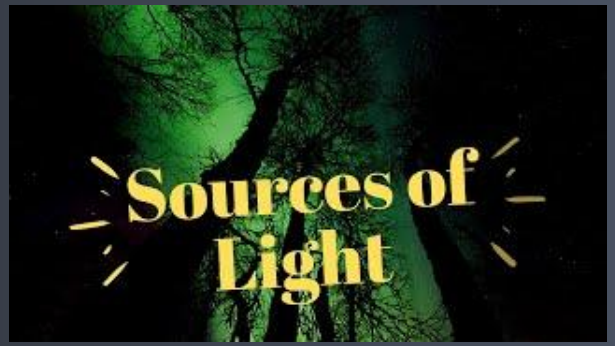
Source: DKfindout

How Sound Travels Across Different Mediums - *Knowledge Platform*

What is *Light?*

- *Light is a form of energy*
- *Light sources emit light*

What is Light? - Twig Science Reporter (Tigtag)



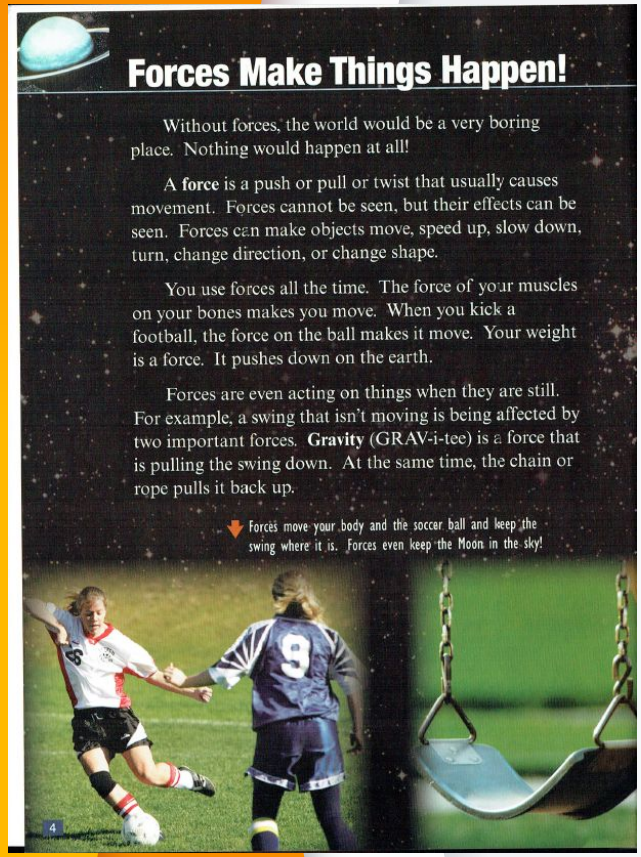
Sources of Light - Ramy Melhem (good foundational/surface level knowledge)

Examples of Natural and Artificial Light - a musical portrayal of natural and artificial examples of light sources.(K8 School Lessons)

Photo by Merrit Thomas on Unsplash

From Grade 3

So what is Force?



Forces Make Things Happen!

Without forces, the world would be a very boring place. Nothing would happen at all!

A **force** is a push or pull or twist that usually causes movement. Forces cannot be seen, but their effects can be seen. Forces can make objects move, speed up, slow down, turn, change direction, or change shape.

You use forces all the time. The force of your muscles on your bones makes you move. When you kick a football, the force on the ball makes it move. Your weight is a force. It pushes down on the earth.

Forces are even acting on things when they are still. For example, a swing that isn't moving is being affected by two important forces. **Gravity** (GRAV-i-tee) is a force that is pulling the swing down. At the same time, the chain or rope pulls it back up.

Forces move your body and the soccer ball and keep the swing where it is. Forces even keep the Moon in the sky!

4

Weir, Jane. Forces and motion. Teacher Created Material. 2007. p.4

Can you identify other examples where forces are used in the time you get up in the morning to getting to your classroom?

Role of forces in our daily lives

Link

Running

Opening a door

Hammering a nail in a wall

Riding a bike

Link

- Contact force
- Applied Force
- Friction

Describe an applied force that you used today.

Contact Forces - Perform or Describe

Applied

Pushing and Pulling

Friction

Pushing and Pulling

Fast or Slow: Friction

Tension

Contact and Non-Contact Forces
@ Tutaway
Guitar string
Wire for a trajectory

Elastic or Spring

10 Models/Examples of Elastic Forces
Source: Studiousguy.com
Shooting Elastics
Slingshot
Bow and Arrow

What could help us make applying force easier?

How Can You Describe Pushes and Pulls?

Pushes and pulls can be different strengths. They can also go in different directions. So you can describe pushes and pulls.

It takes a strong pull for this tractor to start to move a load of lumber.

Weak or Strong

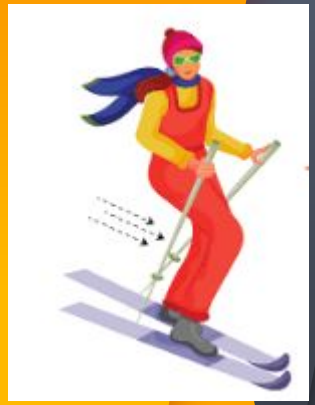
Some pushes and pulls are soft and weak. Some pushes and pulls are hard and strong.

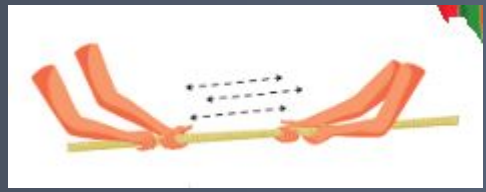
A weak push will move this softball only a little. A soft hit is a weak push.

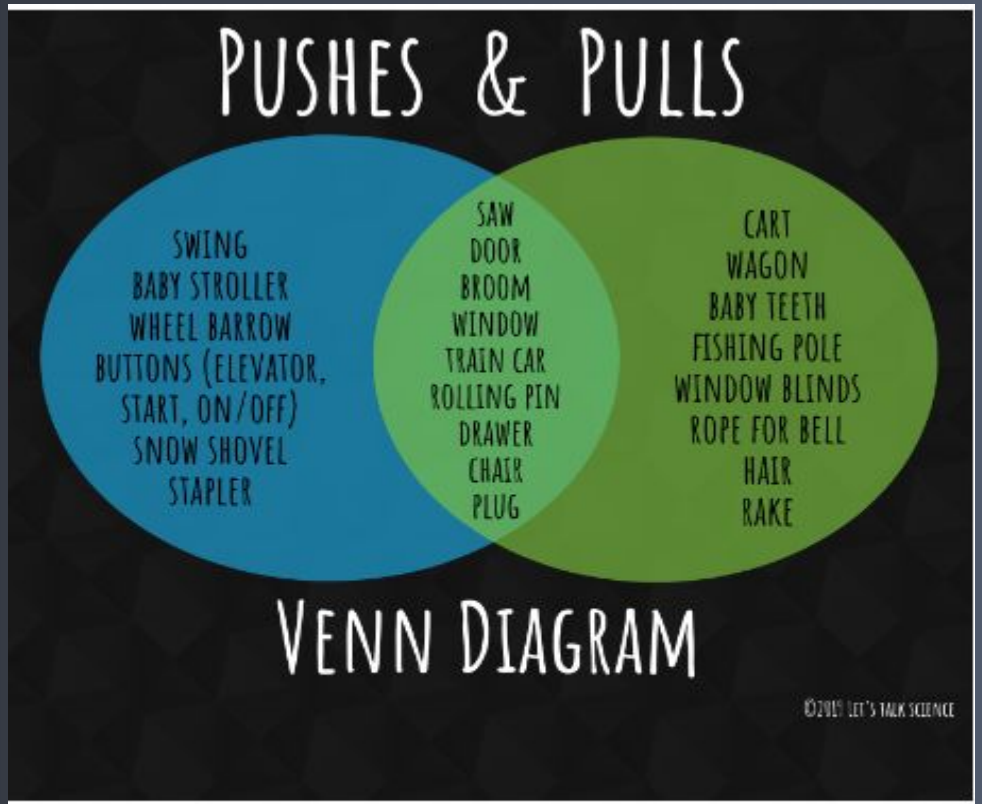
A strong push will make the same ball go far. A hard swing is a strong push.

Source on next slide

Describe the force that exists within each picture song with its strength and direction.







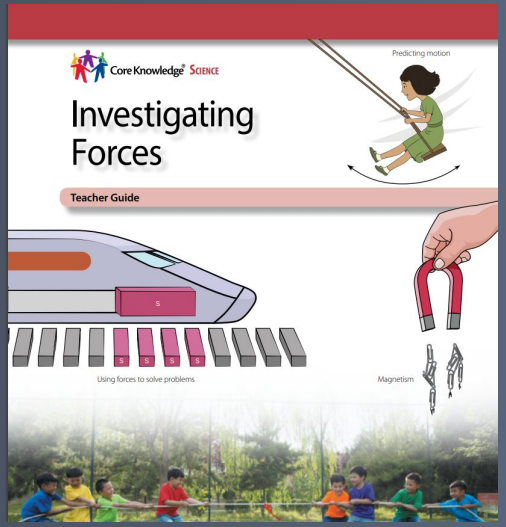
Exemplar Pushes and Pulls Venn Diagram (© 2019 Let's Talk Science).

Can you name some other objects that could fit in the Venn Diagram?

Sample Investigations

Teacher Resources

Activity Pages



Reference in resources at the end

How can *Simple Machines* make moving objects easier?

How Inclined Planes MAKE WORK EASY!

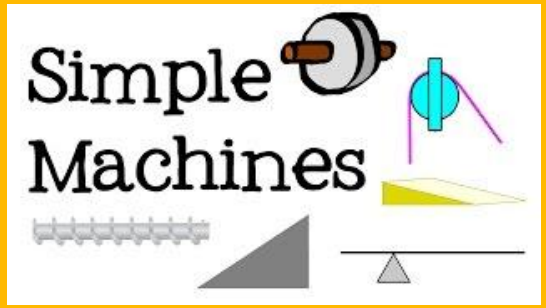
Where do we use inclined planes in daily living?

Simple Machines for Kids | Learn all about the 6 simple machines!

Look around your classroom/bedroom/home. Find some examples of simple machines.

Simple Machines for Kids: Science and Engineering for Children - FreeSchool

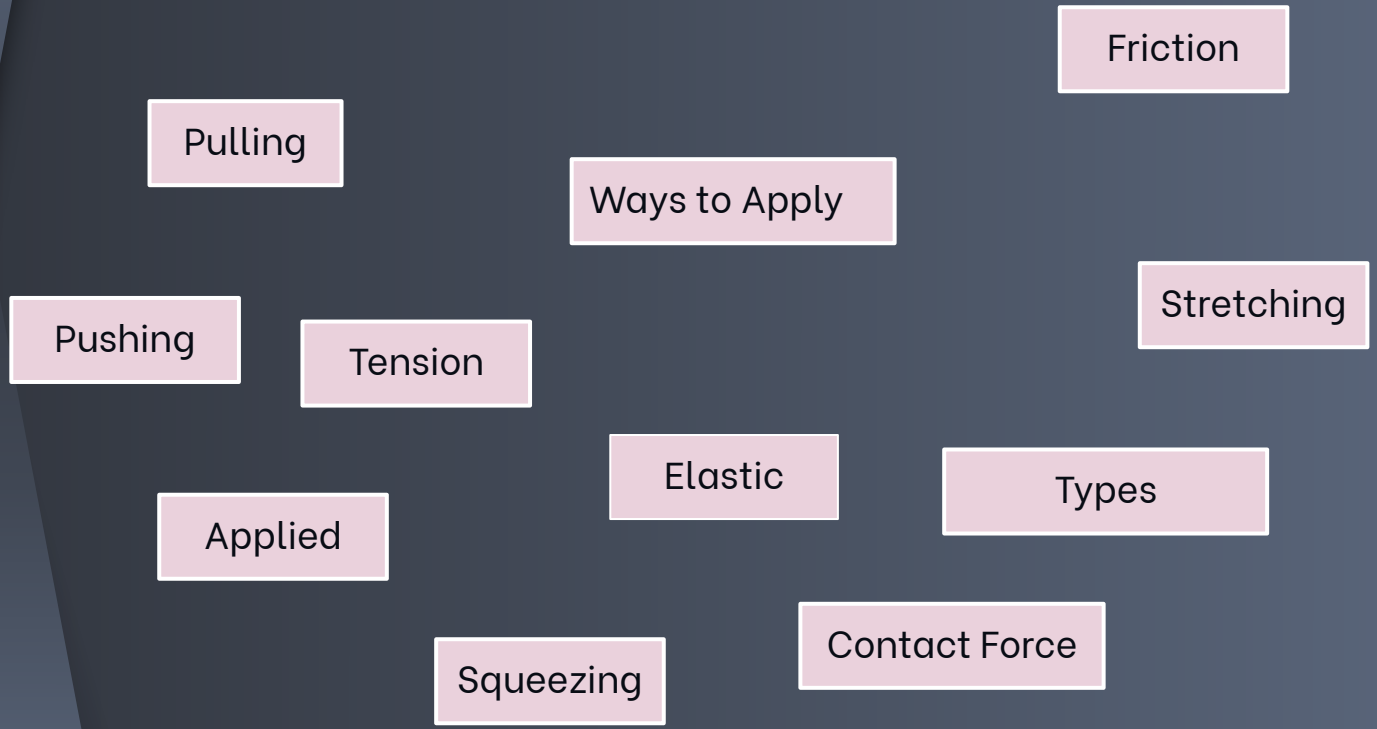
This video also includes history of simple machines.



What is a Concept Map?

- Relationships
- Concept Map

Relate the organizing ideas concepts into a concept map.



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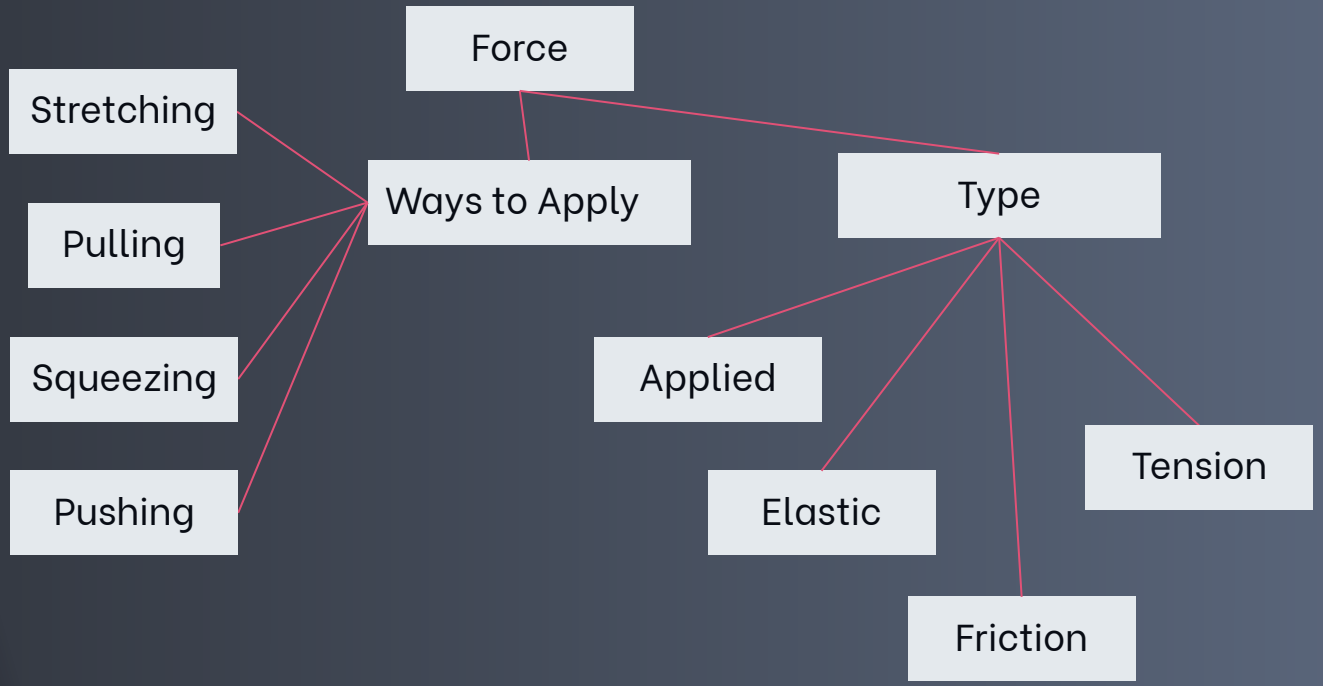
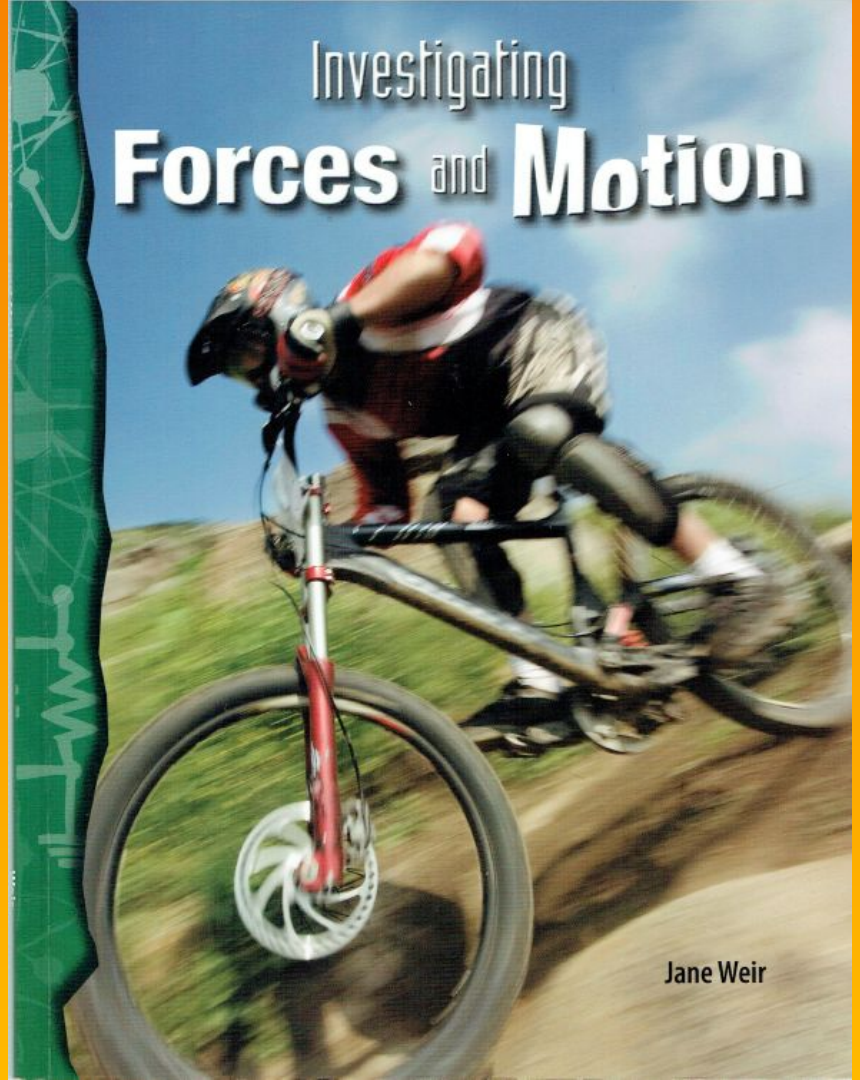
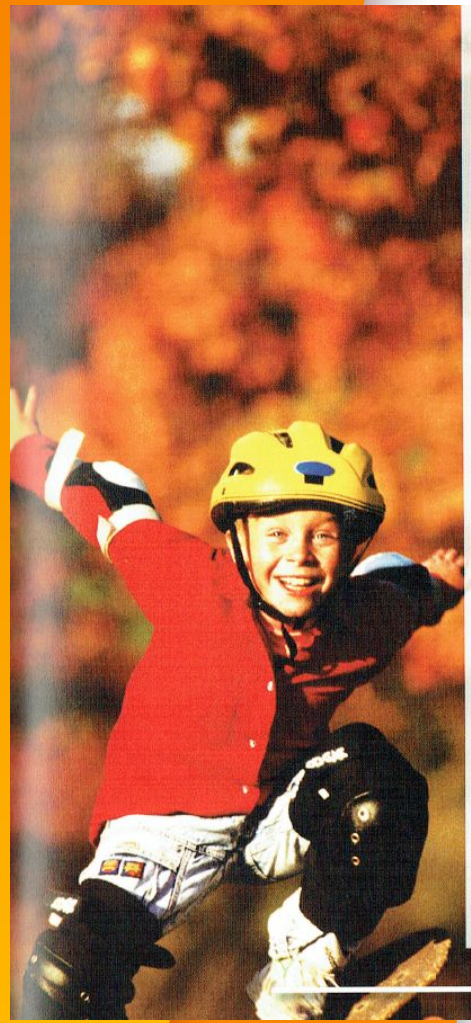


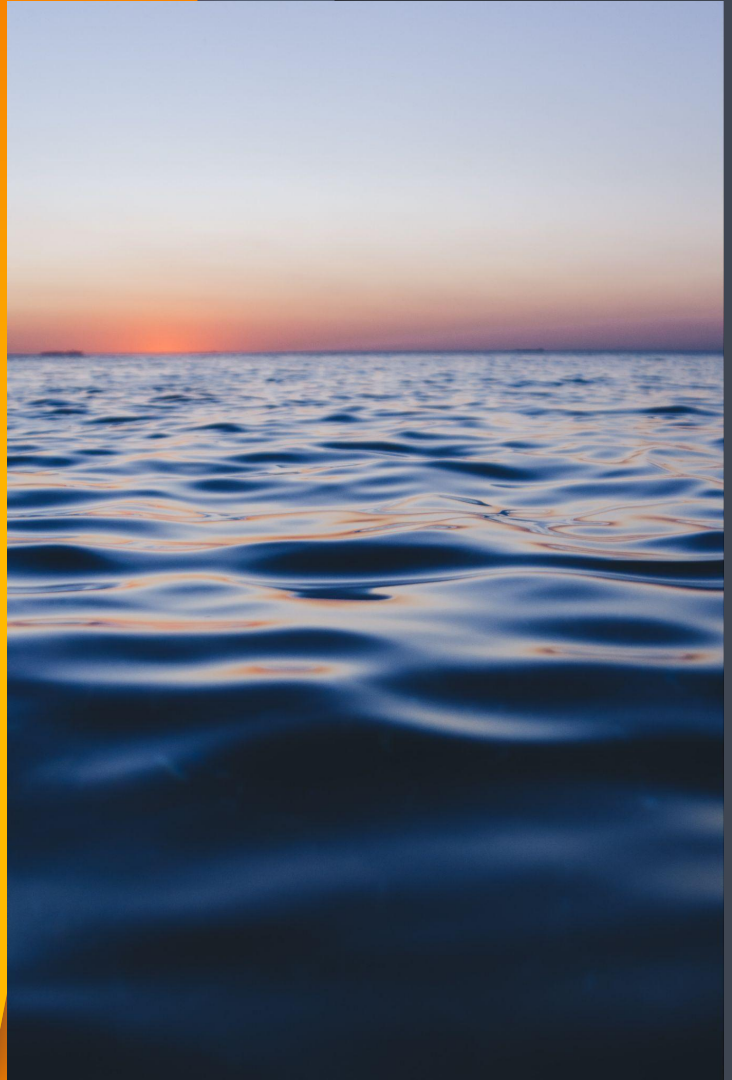
Non-Contact Forces: Grade 4





Doin' an Ollie

Have you ever done an ollie on a skateboard? If you have, you were using physics! All skateboard stunts – even just riding a skateboard – need the use of force to make them happen. To do an ollie, force from three sources is used. The first is the rider's foot pushing down on the tail of the board. This pushes the front of the board up. The second is the ground's reaction when the tail hits the ground. This pushes the back end of the board up. The third force is the rider's foot moving up the board. This tips the board forward so it can land flat at the end of the trick. Without any of the three forces, the rider wouldn't get anywhere at all.

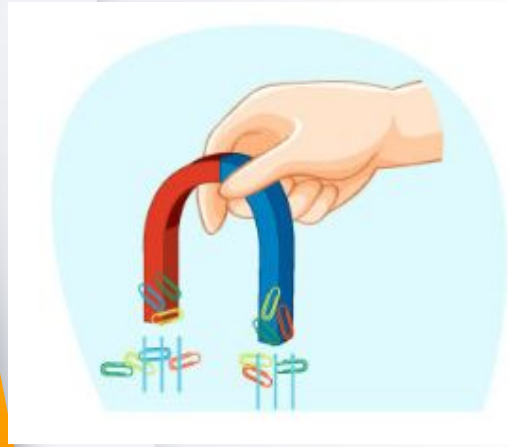


Surface Level

How did it move? I didn’t touch it!!!

Invisible Forces

Types of Non-Contact Forces



Magnetic Force

Gravitational Force

Electrostatic Force

Image source: *Contact and Non-Contact Forces*. GeeksforGeeks.org

Contact Forces

When an object like your school bag is kept on the table, it remains at rest. The bag is in contact with the table which applies some force on it due to its weight and gravity. Such contact force is called Applied Force.

You can't see gravity yet it's doing its job! It is a **non-contact** force

So What IS Gravity?

Gravity is a non-contact force. It is not in direct contact with the bag.

Watch the video “Defining Gravity”

Describe how gravity is an non-contact force that can affect objects, materials and substances. Give two examples different from those in the video.

Surface Level Use of these Skills is Needed for Upcoming Deep Learning Activities

Grade 3:

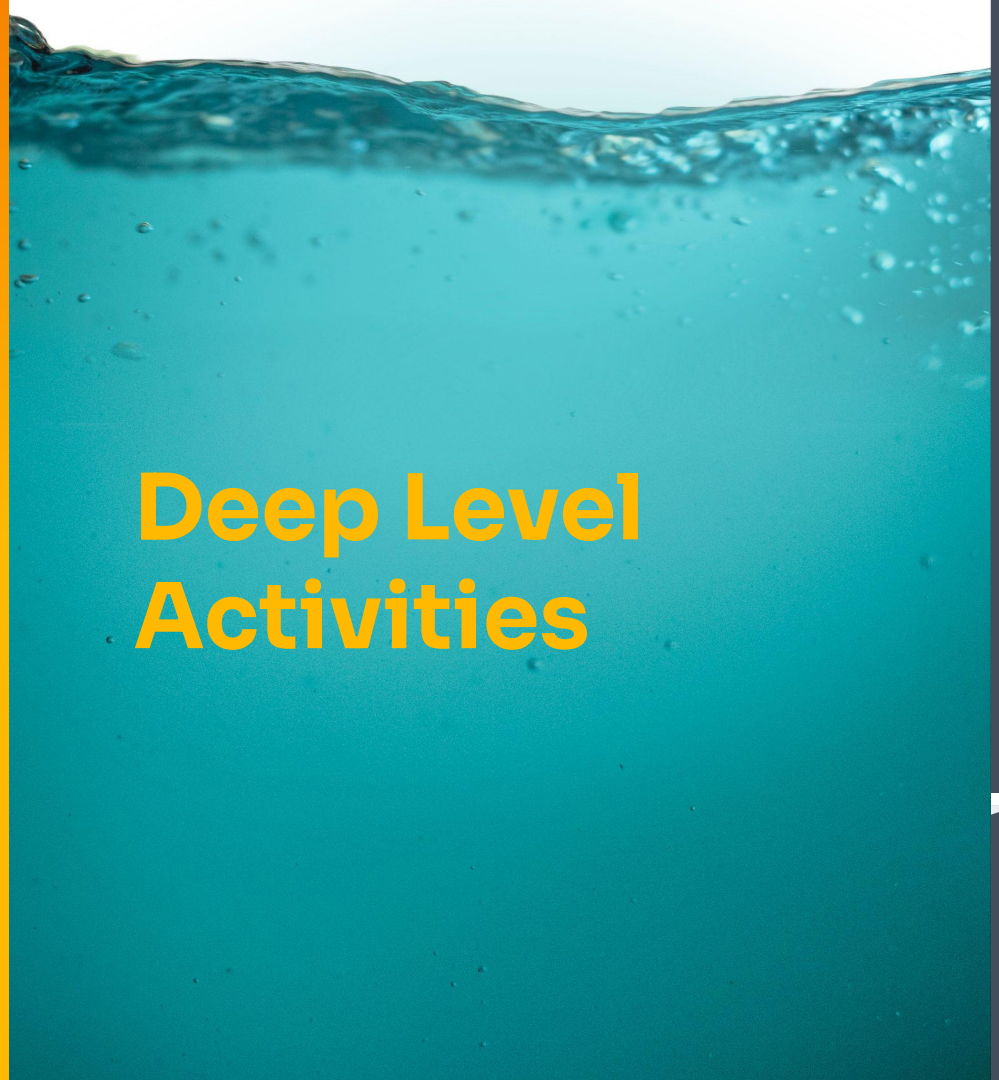
- Divergent (Creative) Thinking

Grade 4: Design Process

- Design Process Information Sheet
- Design Process/Problem Solving Single Point Rubric

What is an Investigation?

- Steps in an Investigation

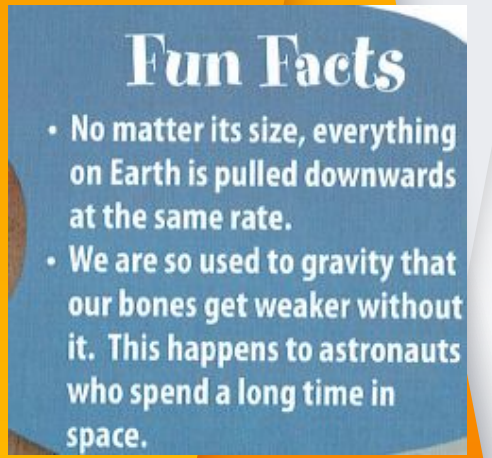


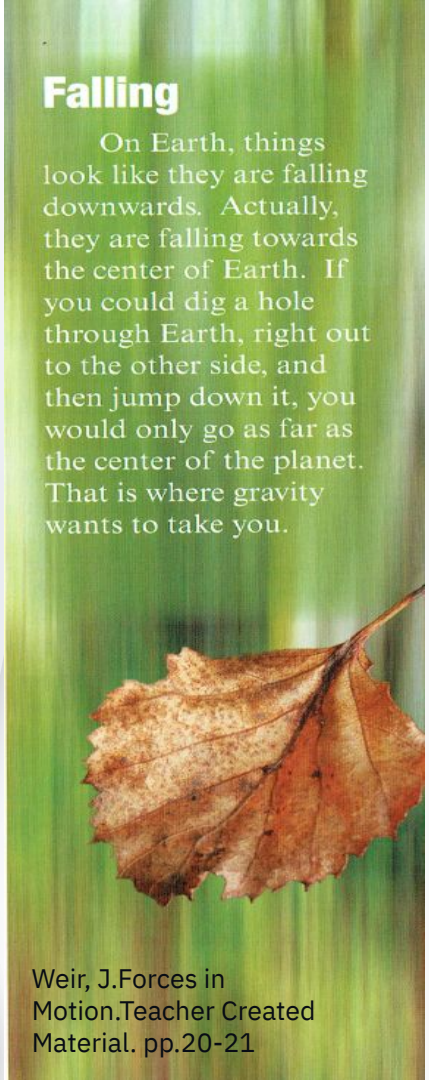
Deep Level Activities

Mass, Matter and Gravity!

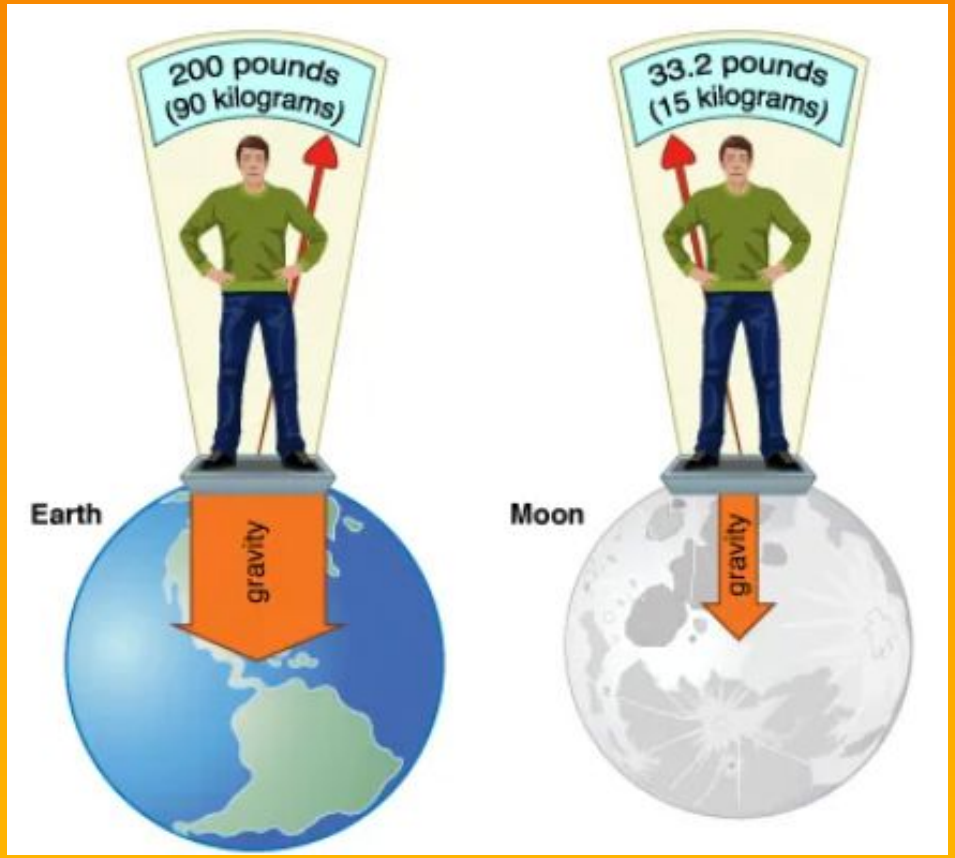
How is gravity affected by mass of an object? The greater the mass of the object, the greater the force of gravity.

Science Trek: PBS



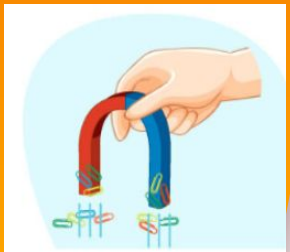


Weir, J.Forces in Motion.Teacher Created Material. pp.20-21



Encyclopedia Britannica Inc. Gravity

Explain how gravity affects the same person's weight on earth and on the moon?



Question: *How can I make a model car move with only magnets?*

Exploration (How do Magnets Work)

a)Provide two bar magnets per pair of students and ask them to see what happens when they lay them on the table end to end. Does it work the same if one magnet is turned 180˚?

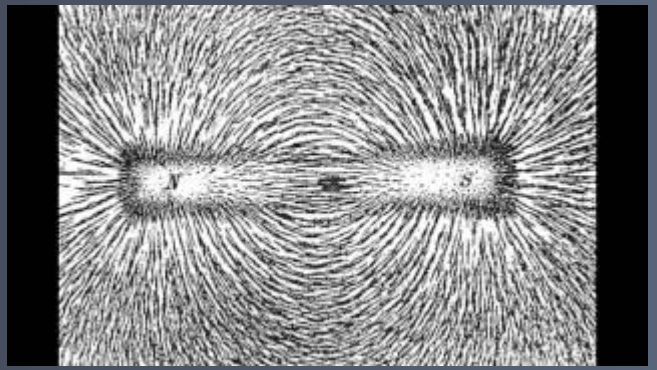
b) have the students each find two items their magnet will stick or pull towards and two that it won't. (Caution them to avoid trying them out on electronics - phones, computers, monitors etc.)

Conduct an Investigation to demonstrate magnetic forces on objects.

Investigation: testing to see what properties of objects react to magnets.

So how does a magnet work? What is *magnetism*? Would it change any of your responses in your Investigation?

Magnets for KidsWork? - **Magnets for Kids | What is a magnet, and how does it work?**
A great “Day 2” recording. Covers most of the terminology surrounding Magnets; provides real world examples.



Magnetism and Electromagnetism: Science Buddies

Types of Magnets

magnetite

atural
found in the ground
always on

Temporary
- man-made
- created by stroking an object with a permanent magnet
- lose their magnetism over time or when dropped or heated

ermanent
man-made, hold their magnetism
usually made of iron
always on

Electromagnet
- iron or steel inside a **coiled** wire connected to an electric current
- stronger than ordinary magnets
- can be turned on and off

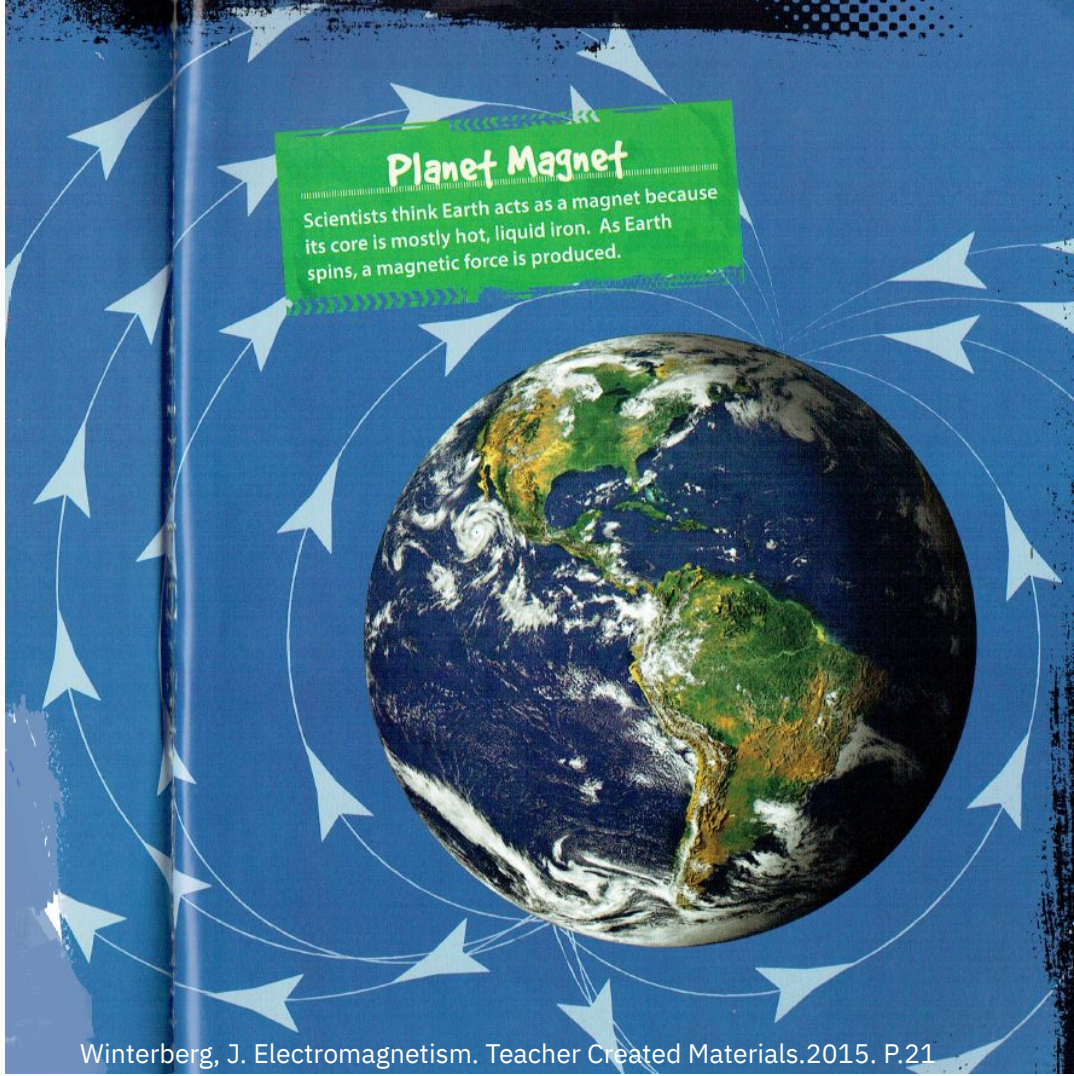
Magnetite - is a metallic,mineral found in the earth - an important iron ore - it sticks to magnets!

How can we temporarily magnetize a material?

Are all magnets the same size and shape? What would happen if you broke a magnet in half? Would it still work? Explain.

Winterberg, J. Electromagnetism. Teacher Created Materials.2015. P.23

Earth is a magnet. How can we use its magnetic forces to navigate? Explain.



Winterberg, J. Electromagnetism. Teacher Created Materials.2015. P.21

Question: *How can I make a model car move with only magnets?*

- ***Design a model vehicle of some type that can independently move through the use of magnets. Explain your design.***
- ***Would your vehicle be able to go up a slight inclined plane? Record this event if possible. How is your vehicle able to achieve this? Explain.***
- ***Is your vehicle able to go forwards and backwards? Record this event if possible.How is your vehicle able to achieve this? Explain.***

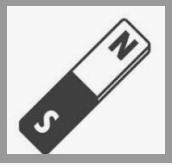
DIY

Question: How can a nail be magnetized?

Investigation & Observation

What does your Data Show?

If I give you the following supplies, how would you build a compass?



Why do farmers sometimes give cattle magnets to swallow? Explain.

Sources: Images: cork Shutterstock.com #187908539; needle #748362310; water bowl #1715809915;bar magnet #1940733799

Comparing Contact and Non-Contact Forces

Review

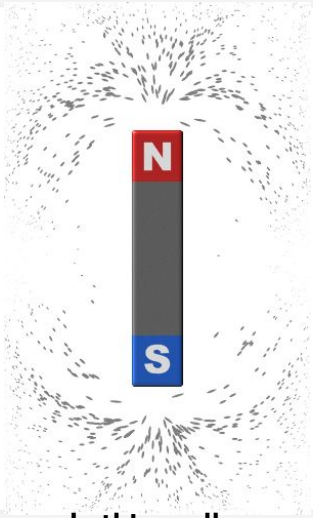
Provide an example that matches the description given:

Contact Force	Non-Contact Force
Contact forces result when there is physical contact or interaction between two objects. Example:	Non-contact forces have no physical contact between objects. Example:
Contact forces can be or not be natural forces. Example:	Non-contact forces are natural forces. Example:
Some Contact Forces include: Friction, Spring, Muscular, Applied, and Normal. Example:	Types of Non-Contact forces are Gravitational, and Magnetic. Example:

Were you listening and watching? What were your wonders?

Could this be possible? Explain.

Great desk tool. How would you make it?



Is this really happening? Explain.

Building on my Understandings

Monster Magnet - How does this work?

This mysterious goo gobbles up everything in its path. It's mesmerizing to watch and a lesson in magnetism.

Source: Science Channel

Computing Science and Energy in Grade 4

Video with Angela Dearing

Slide Deck:

- Gr 4 Energy Connections.pdf

Resources
Another Invisible Force

Gravity

Gravity Compilation: Crash Course Kids
Gravity: We'll learn about why we don't fly off into space, what mass has to do with it, how does air resistance work, and why gravity is different on the moon. In this compilation, Sabrina helps us understand some of these things.

Gravity

Gravity | The Dr. Binocs Show | Learn Videos For Kids

Gravity

Gravity for Kids | Learn all about how gravitational force works

Resources

Magnetism: DIY Science Time: PBS Learning Media - the science crew create a magnet powered car.

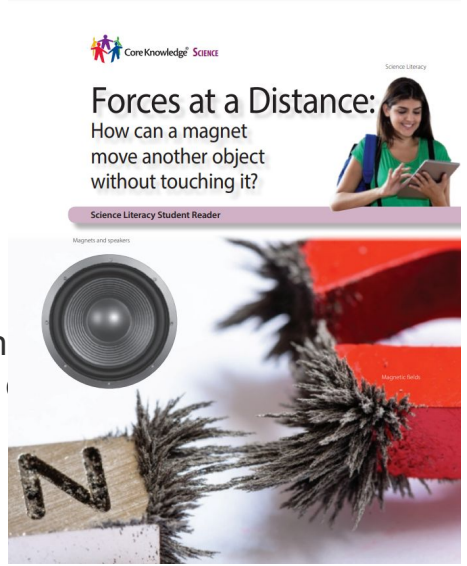
Harness the power of magnets to explore magnetic fields, attraction and repulsion.(26:30 min)

Resources

Forces at a Distance by Core Knowledge

The students investigate the phenomenon of forces that act through a distance, especially in the case of magnetism.How can one thing cause movement in another thing that is not touching it at all? What exists between a magnet and an object that the magnet affects? What is a field? How can we observe the effects a field? This unit allows students to observe the phenomenon of a force acting through a distance in detail and then spend time working with classmates to analyze the shared experience, formulate new questions, and developing new strategies for answering them. Students explore concepts that include the following:

- What causes a speaker to vibrate?
- What can a magnet push or pull without touching?
- What can we figure out about the invisible space around a magnet?
- How does the magnetic field change when we add another magnet to the system?
- How does the distance affect the strength of force pairs in a magnetic field?



Student Resource
Student Procedure (investigations) Resource
Student Work Pages
Teacher Resource

Magnets: Attract or Repel - surface level formative assessment - K5 Learning

Magnetism as a force - surface level formative assessment. K5 Learning

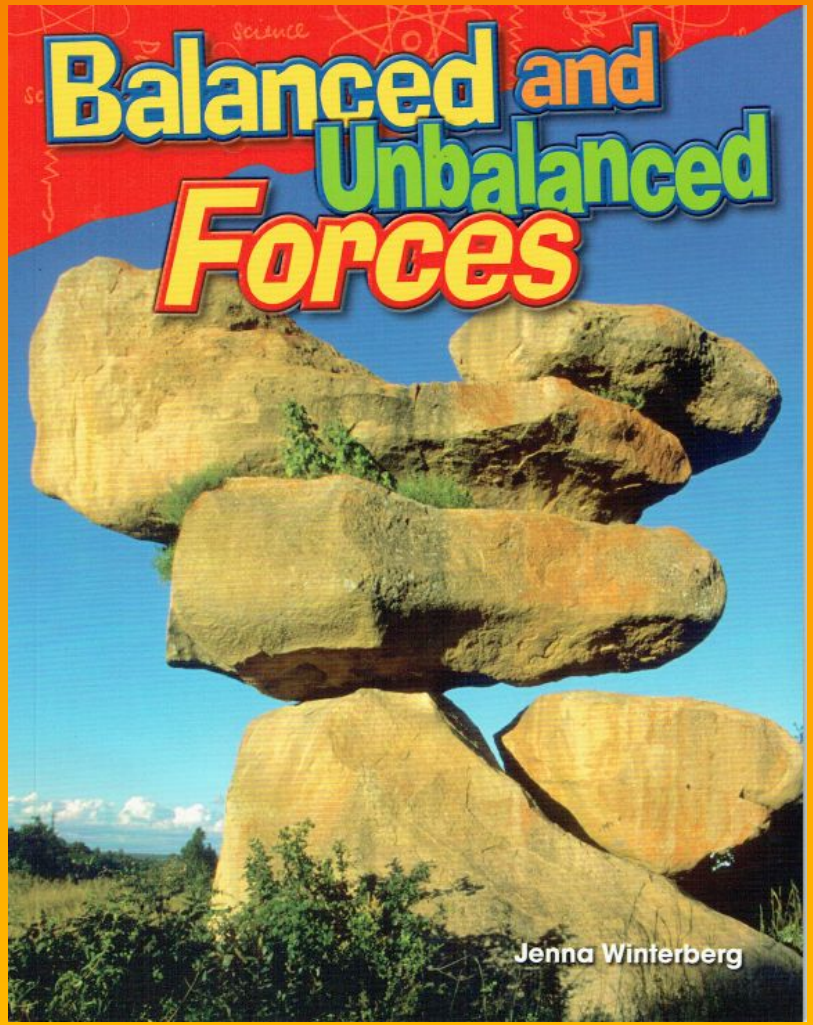
Experiments with Magnets - Magnetism and Learning about Magnets - Layers of Learning

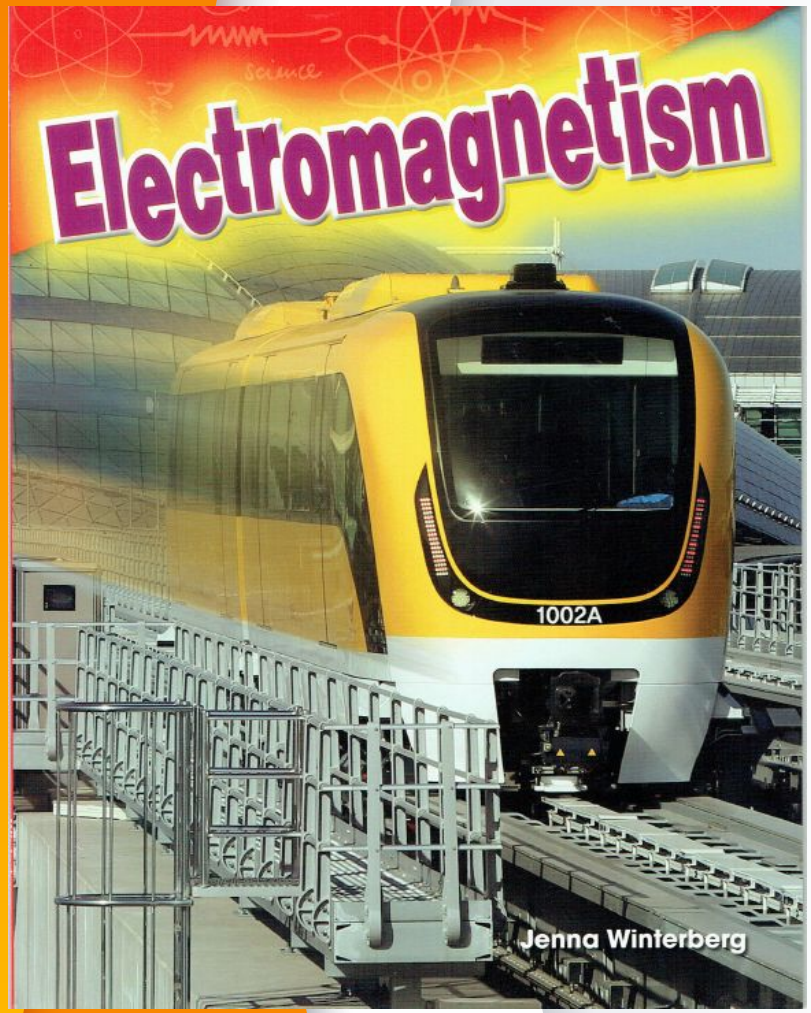
The Science Behind Magnets: How do they Work? - Stuff to Blow Your Kids' Mind #2

Electromagnet -What is it ? For Kids

Do Heavy Objects Actually Fall Faster Than Lighter Objects?

This video will talk about acceleration and air resistance. This should only be considered for enrichment.


Balanced and Unbalanced Forces
Jenna Winterberg

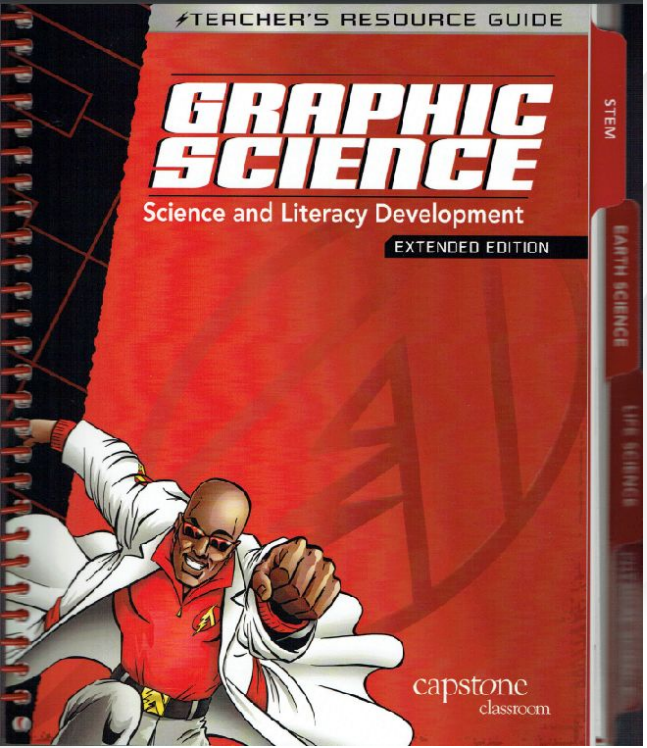

Electromagnetism
1002A
Jenna Winterberg


GRAPHIC LIBRARY
A CRASH COURSE
FORCE
by Emily Sohn
illustrated by Steve Erwin and Charles


SECTION 1
FORCES THAT MOVE US
Super Scientist Max Axiom jumps right into the world of forces and motion at an amusement park.
What a perfect day . . .
SKRAWW!
. . . even though everything feels turned upside down.
Spinning, flying, jumping, and falling are just some of the amazing ways to move.
But there's a lot of science behind the zoom-zoom around us.
4


In fact, the world is full of all kinds of motion.
Everything that moves needs a force to get it moving.
Back for another jump, already?
You bet!
A force is any push or pull on an object. Bungee jumping depends on a force called gravity.
It pulls objects toward each other, and it keeps us on the earth.
Gravity is the reason I fall down, not up or sideways.
5


GRAPHIC LIBRARY
THE ATTRACTIVE STORY OF
MAGNETISM
WITH MAX AXIOM
SUPER SCIENTIST
by Andrea Gianopoulos
illustrated by Cynthia Martin and Barbara Schulz
Magnets have
for thousands
In fac
to abo
Greec
MAGNETIC MA
Magnesi
known a
Magnesi
6
10
But an experiment with the bar magnet, iron filings, and a piece of plastic will help us see it.
filings are drawn
agnet and line up
gnetic field.
up at the poles where
trongest. They spread
away from the poles
eld is weaker.
11



Magnetism Inquiry Guide / Focused Student Input

MyAtom LABORATORIES

Use this guide to investigate a question about the magnetism of a nail or the strength of an electromagnet. Write your lab report in your science notebook.

1. Ask a Beginning Question

How can a nail be magnetized?

What factors affect the strength of an electromagnet?

2. Design an Investigation

Choose one of the questions above. Think about how you can answer the question. Discuss your ideas with the others in your group. Together, design and record a procedure that tests only one variable and produces accurate data. Make sure to write down any safety precautions that you must follow as you test your question. Use these prompts to help you:

- *The question we plan to test is ...*
- *The variable we will test is ...*
- *The variables we will control, or keep the same, are ...*
- *Safety rules we will follow are ...*

3. Record Observations and Data

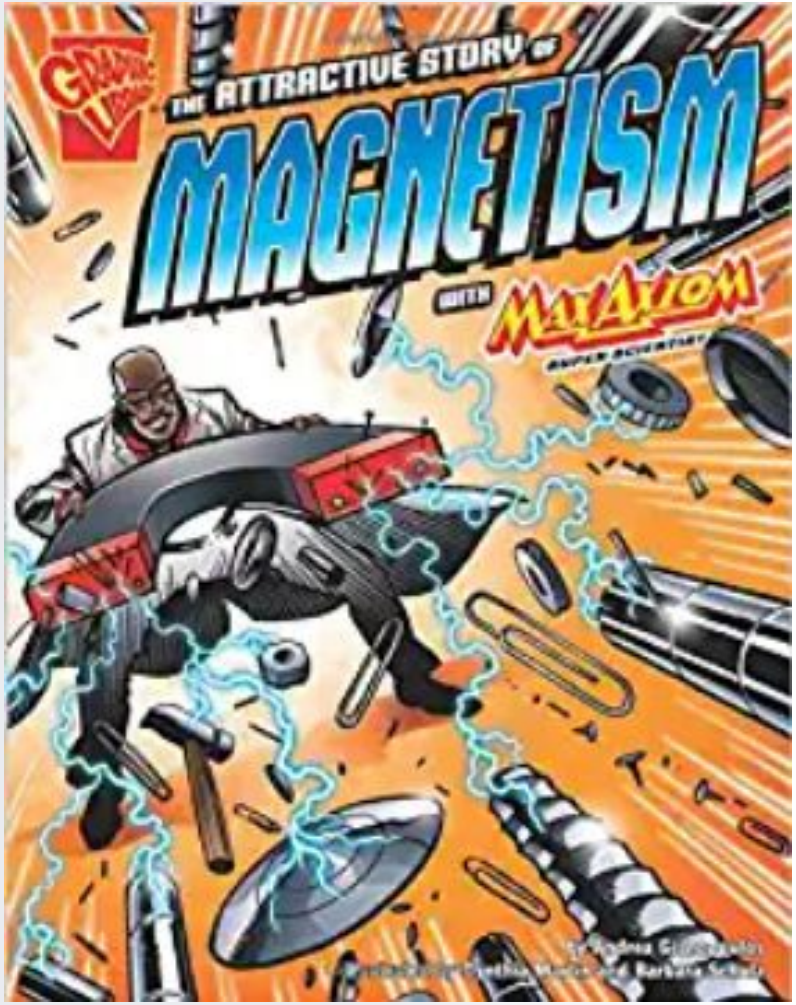
Make a magnet either by magnetizing a nail or by building an electromagnet. Test the strength of your magnet using paper clips or staples. Repeat the trials several times to make sure you are accurate in your measurements. Organize your data in a table such as one of those below. Create a graph to show more patterns or trends.

Magnet Strength

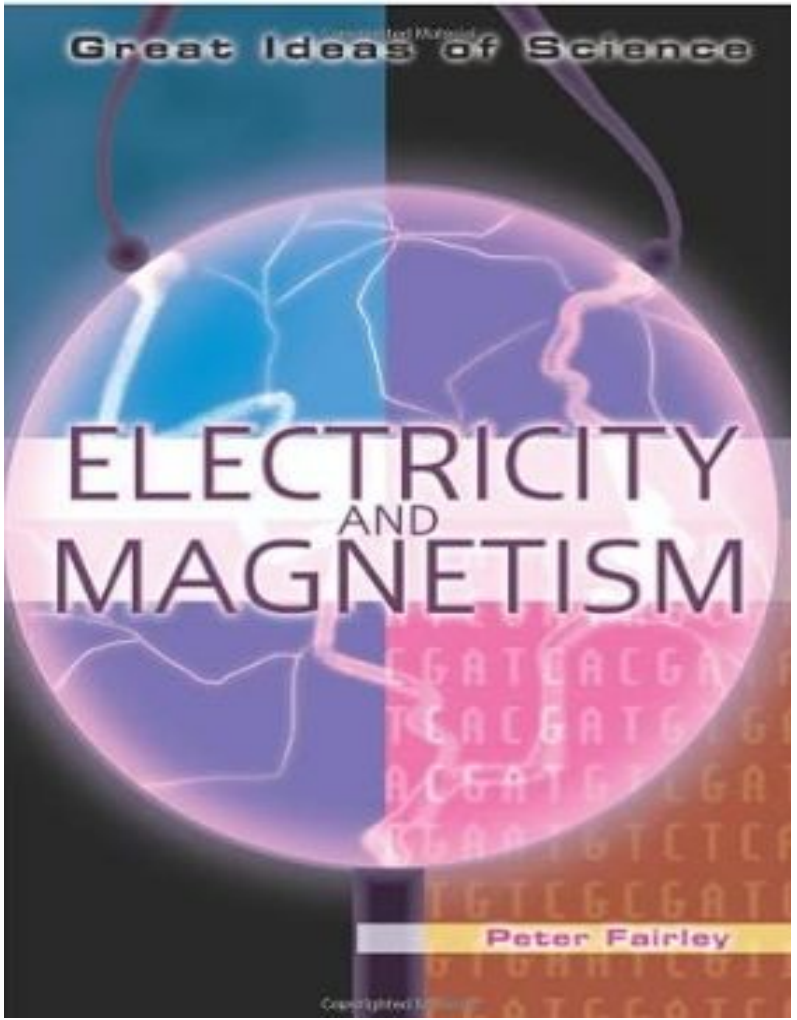
Number of Times the Iron was Rubbed	Number of Staples Picked Up		
	Trial 1	Trial 2	Trial 3
5			
10			
15			
20			
25			

Magnet Strength

Number of Wire Coils	Number of Paper Clips Picked Up		
	Trial 1	Trial 2	Trial 3
5			
10			
15			
20			
25			

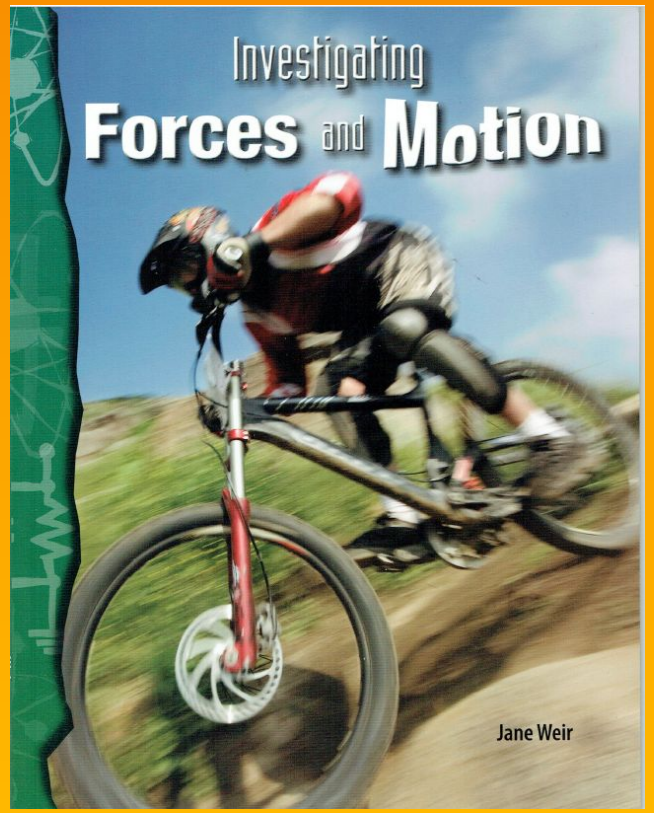


Author: Andrea Gianopoulos



Author: Peter Fairley

Resources



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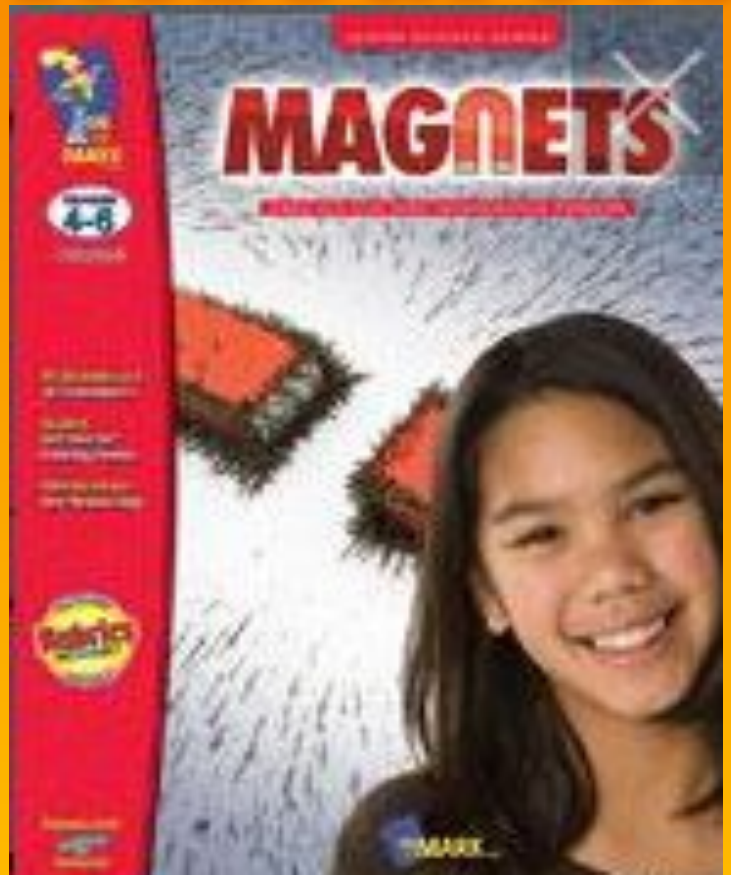

On the Mark Press

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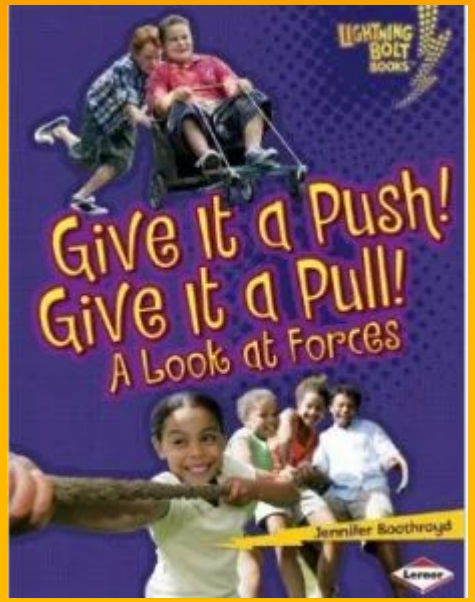
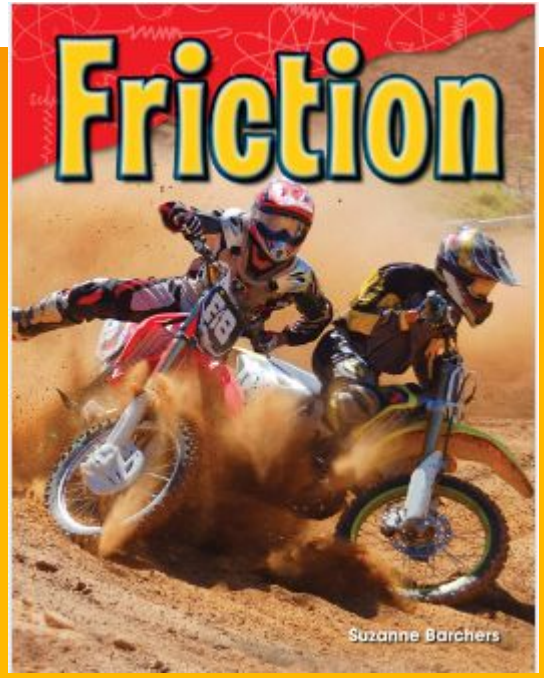
Possible Book Resources to consider

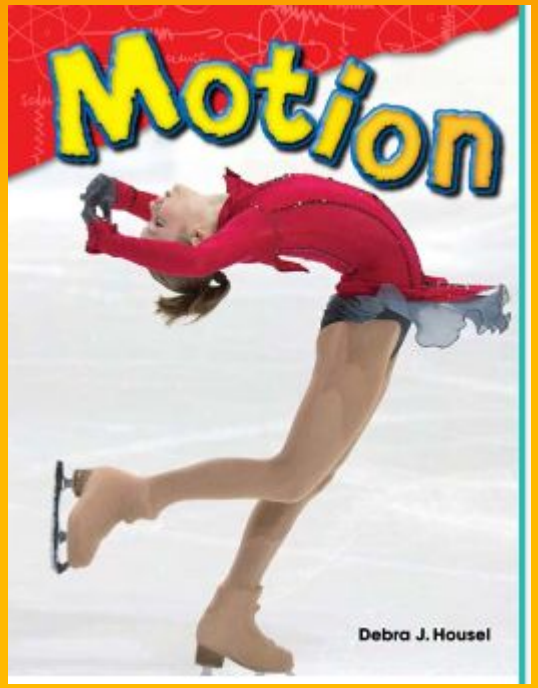


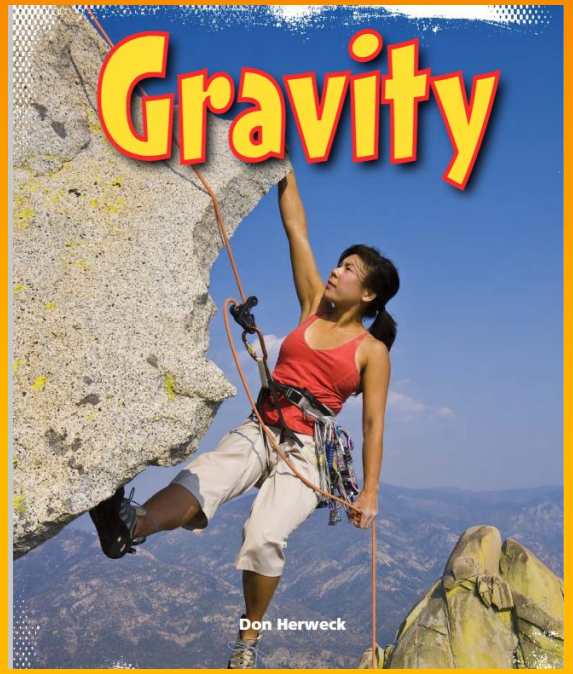
Jennifer Boothroyd



Suzanne Barchers

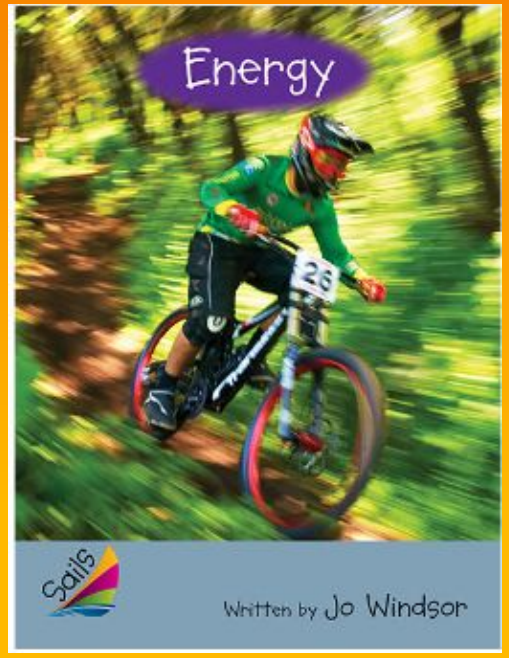
Do you like sports? Well, then you must love friction! Read on.



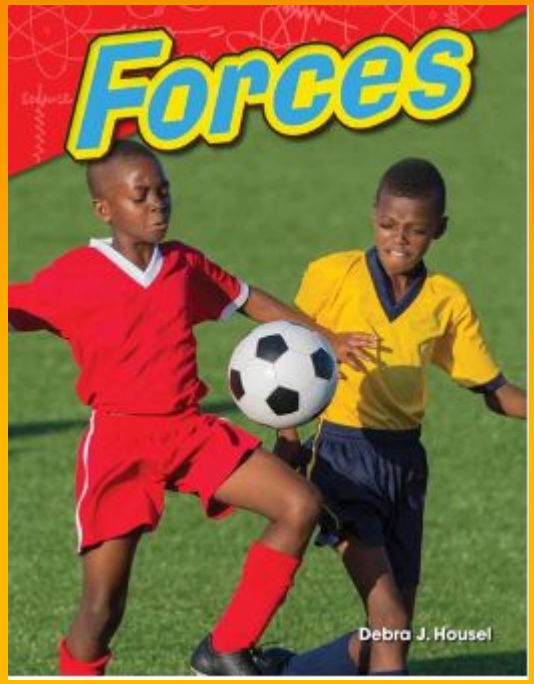


Don Herweck

Gravity keeps your two feet on the ground, but it also helps explain what's going on in space!



Pearson Canada - Sails Series



Debra J. Housel

Gravity helps you sled down a hill. Friction helps you control your skateboard. What other forces help you?

Thanks!

Ted Zarowny ted.zarowny@arpdc.ab.ca

Chris Zarski chris.zarski@arpdc.ab.ca

Photo by Lee Jeffs on Unsplash

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