

# New SCIENCE Curriculum

## Energy Grade 5

November 28, 2023

Facilitators: Chris Źarski & Ted Zarówny

# 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.



# Agenda

1. Looking at The Big Picture - Energy through K-4
  - What is *Movement*?
  - What Moves?
  - What causes objects and people to move?
2. Grade 5 Overview
3. Sample Grade 5 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**

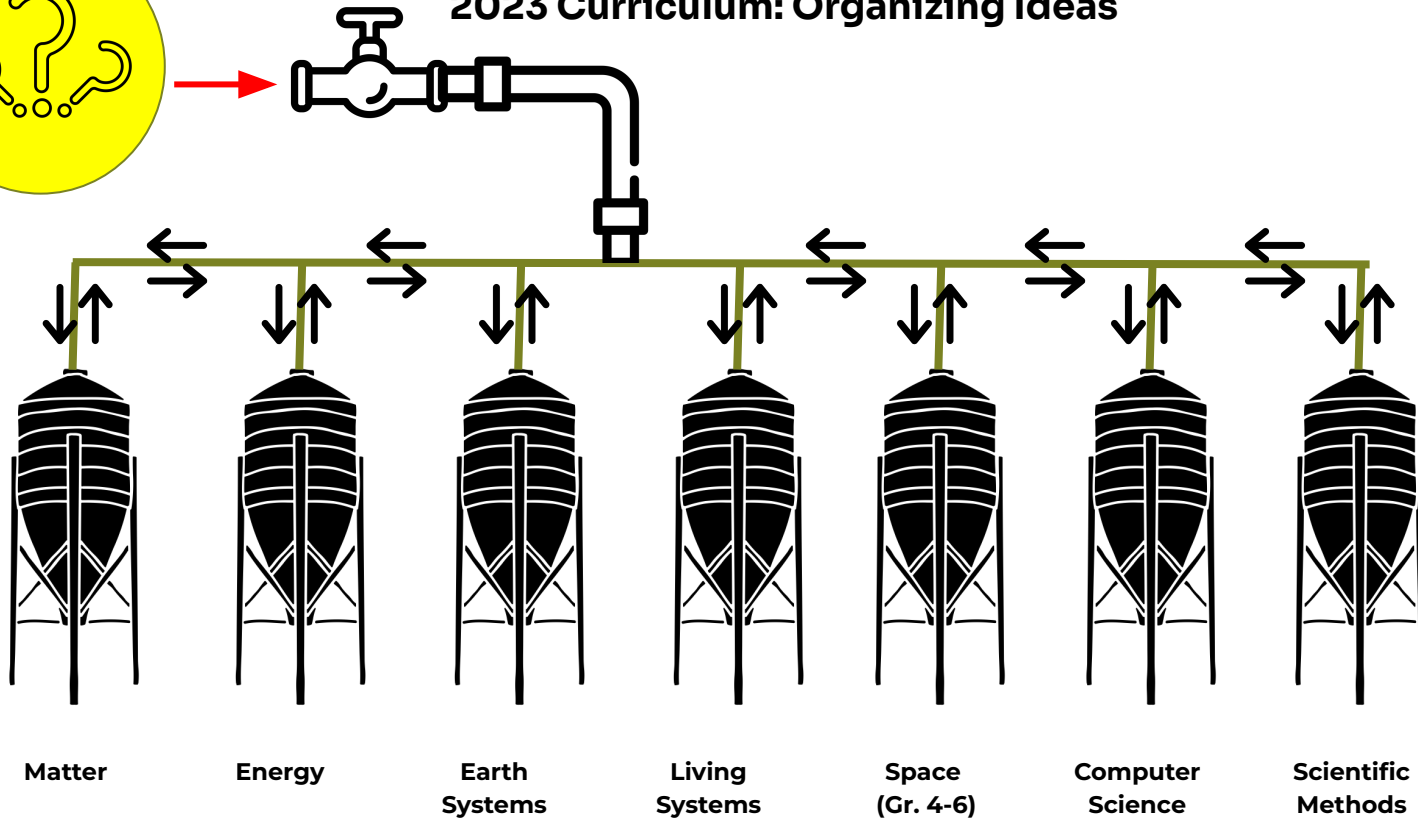
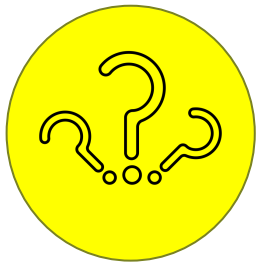
**Flight**

**Sky Science**

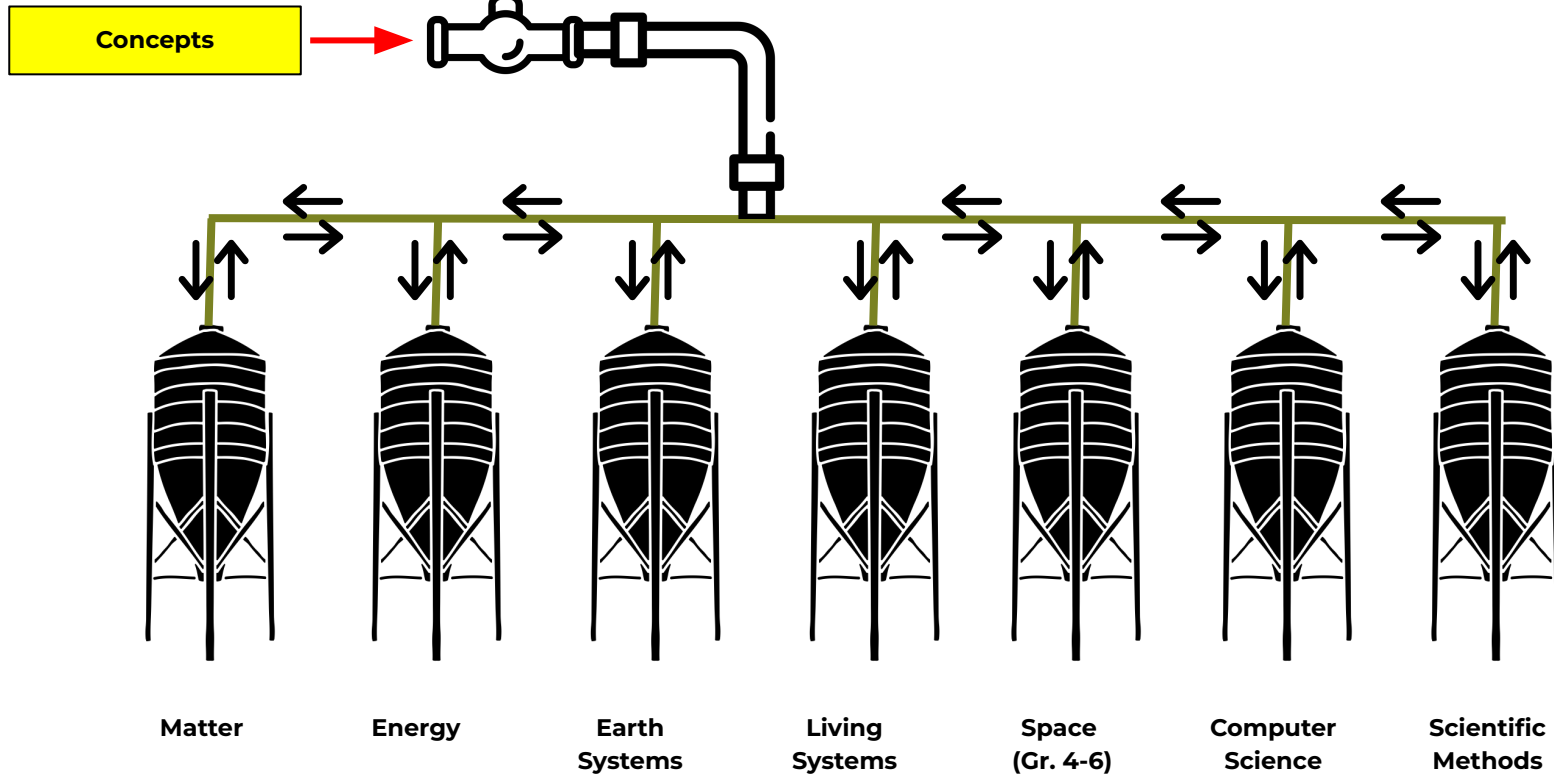
**Evidence and Investigation**

**Trees and Forests**

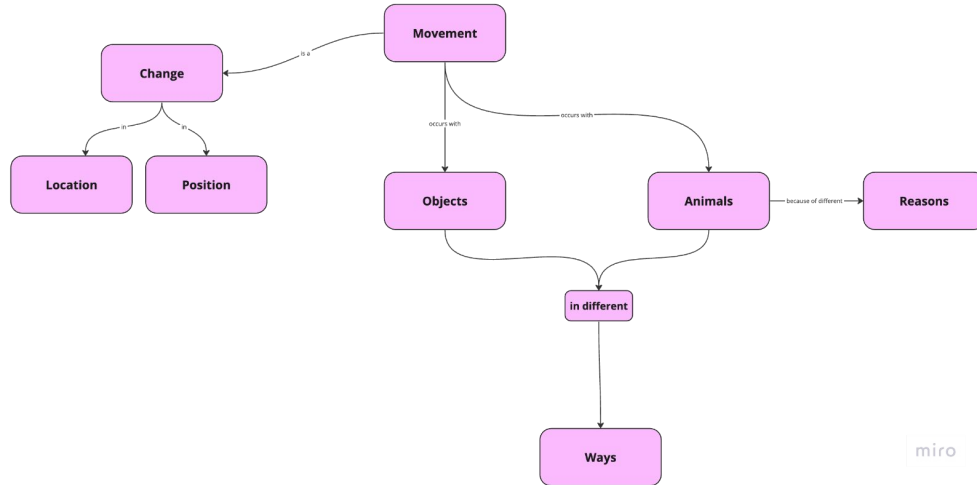
# 2023 Curriculum: Organizing Ideas



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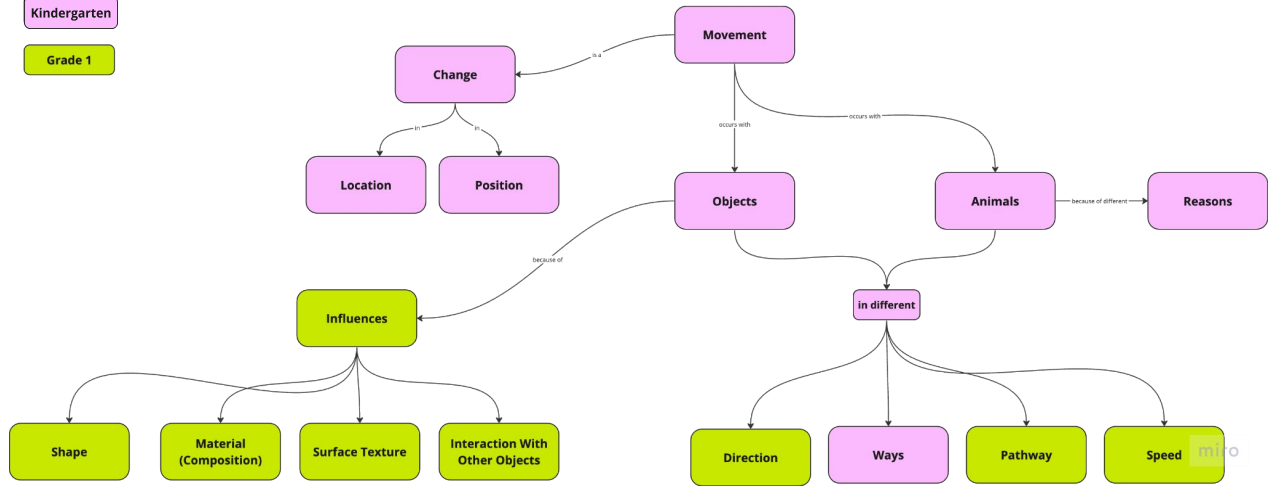
Kindergarten



# K-6 Concept Progression: Energy

Kindergarten

Grade 1

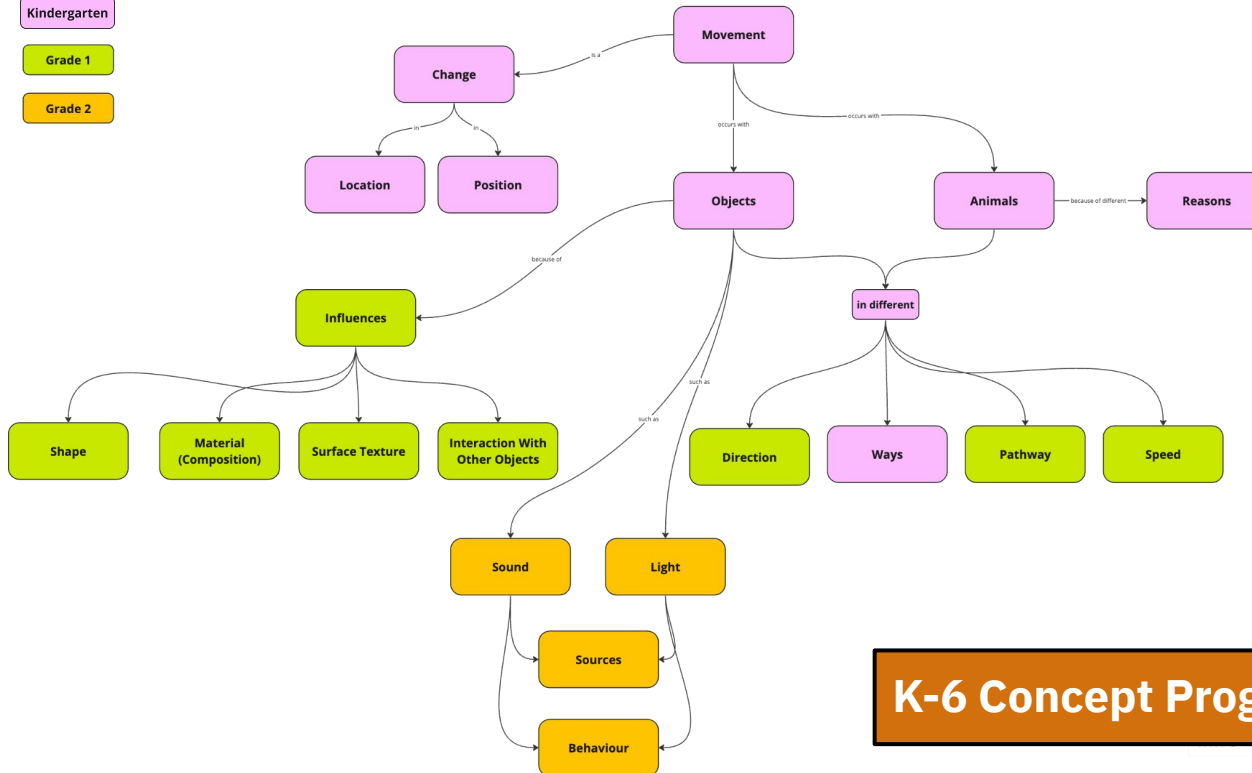


# K-6 Concept Progression: Energy

Kindergarten

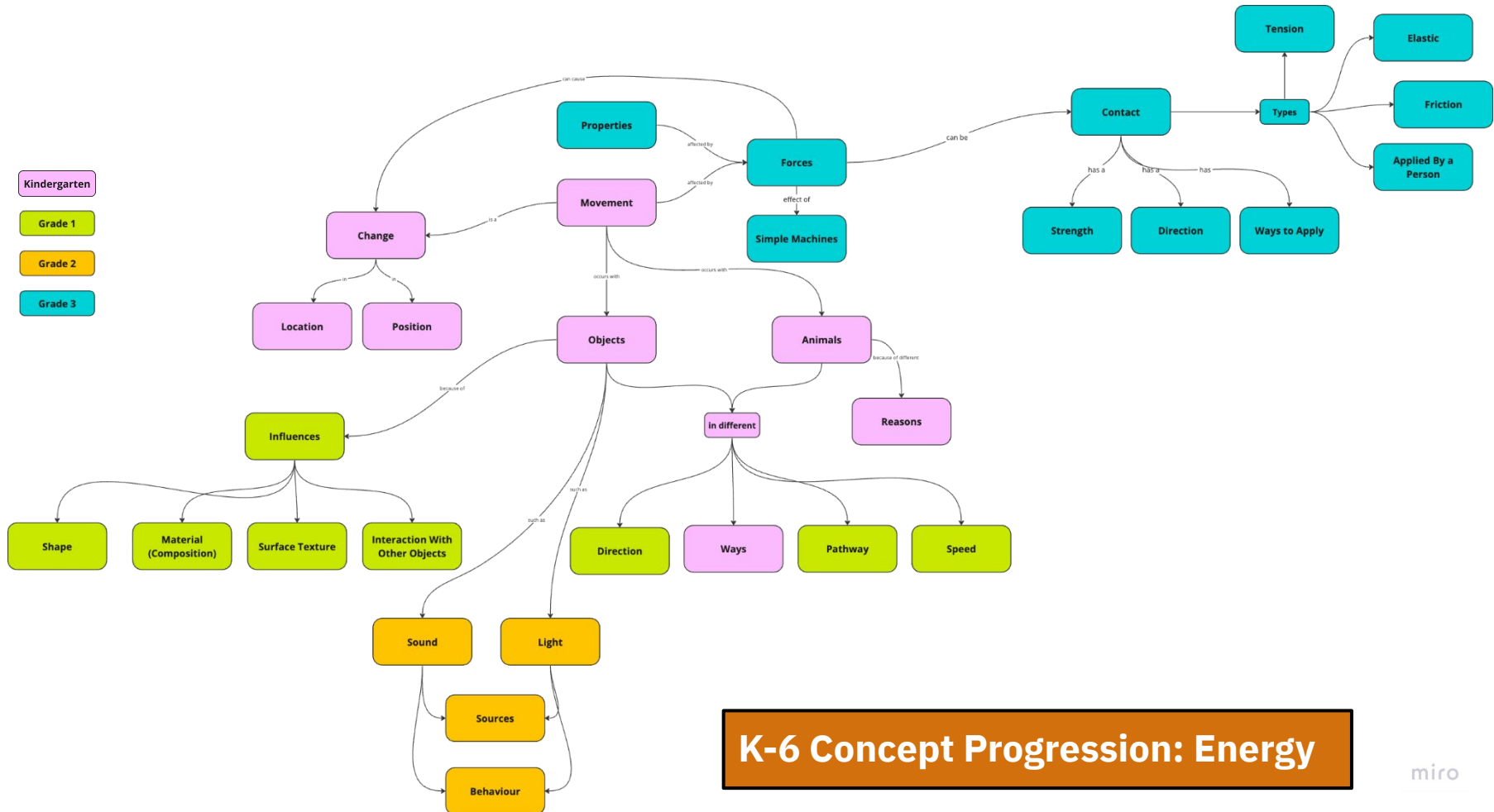
Grade 1

Grade 2



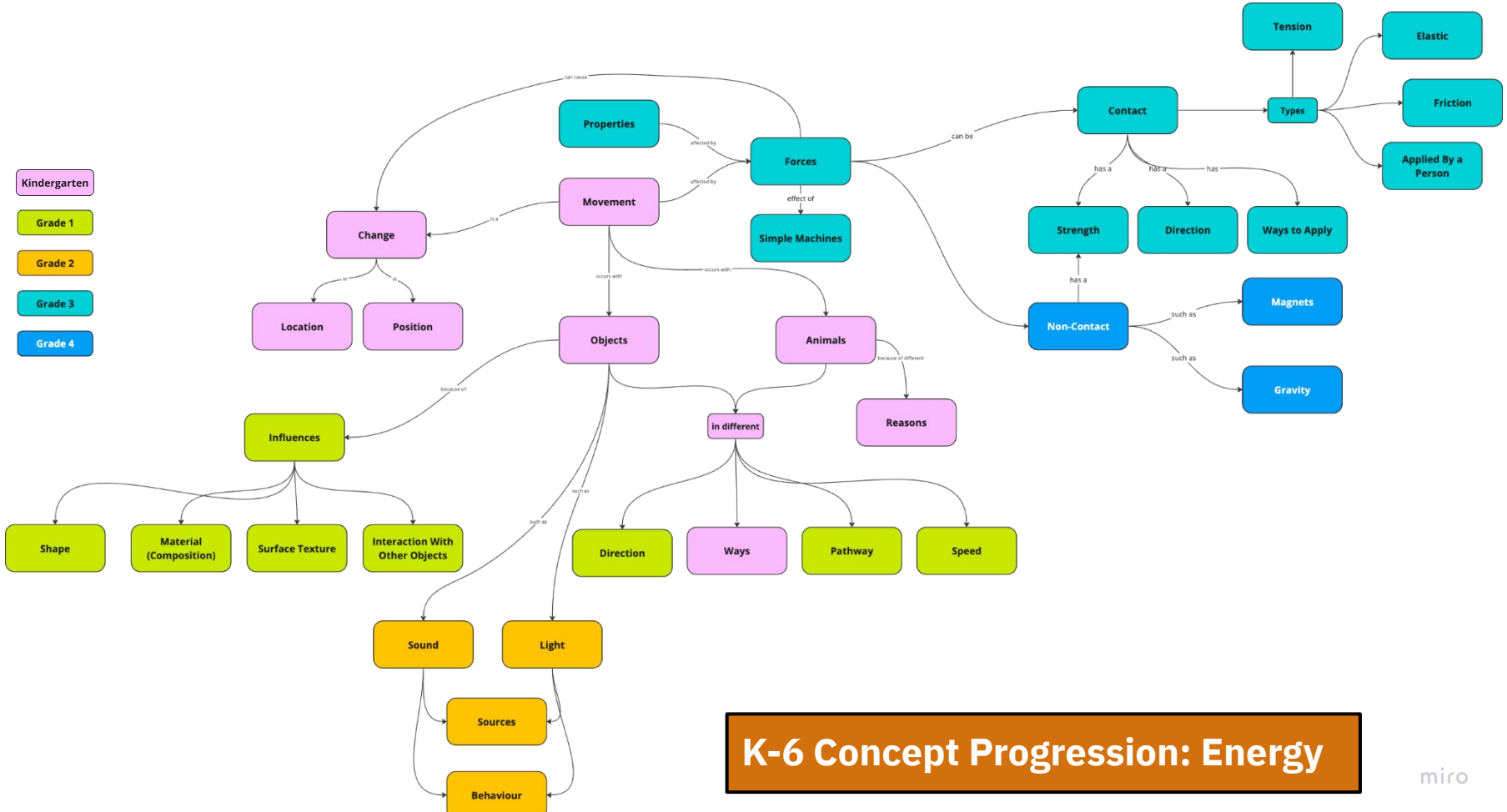
# K-6 Concept Progression: Energy

- Kindergarten
- Grade 1
- Grade 2
- Grade 3



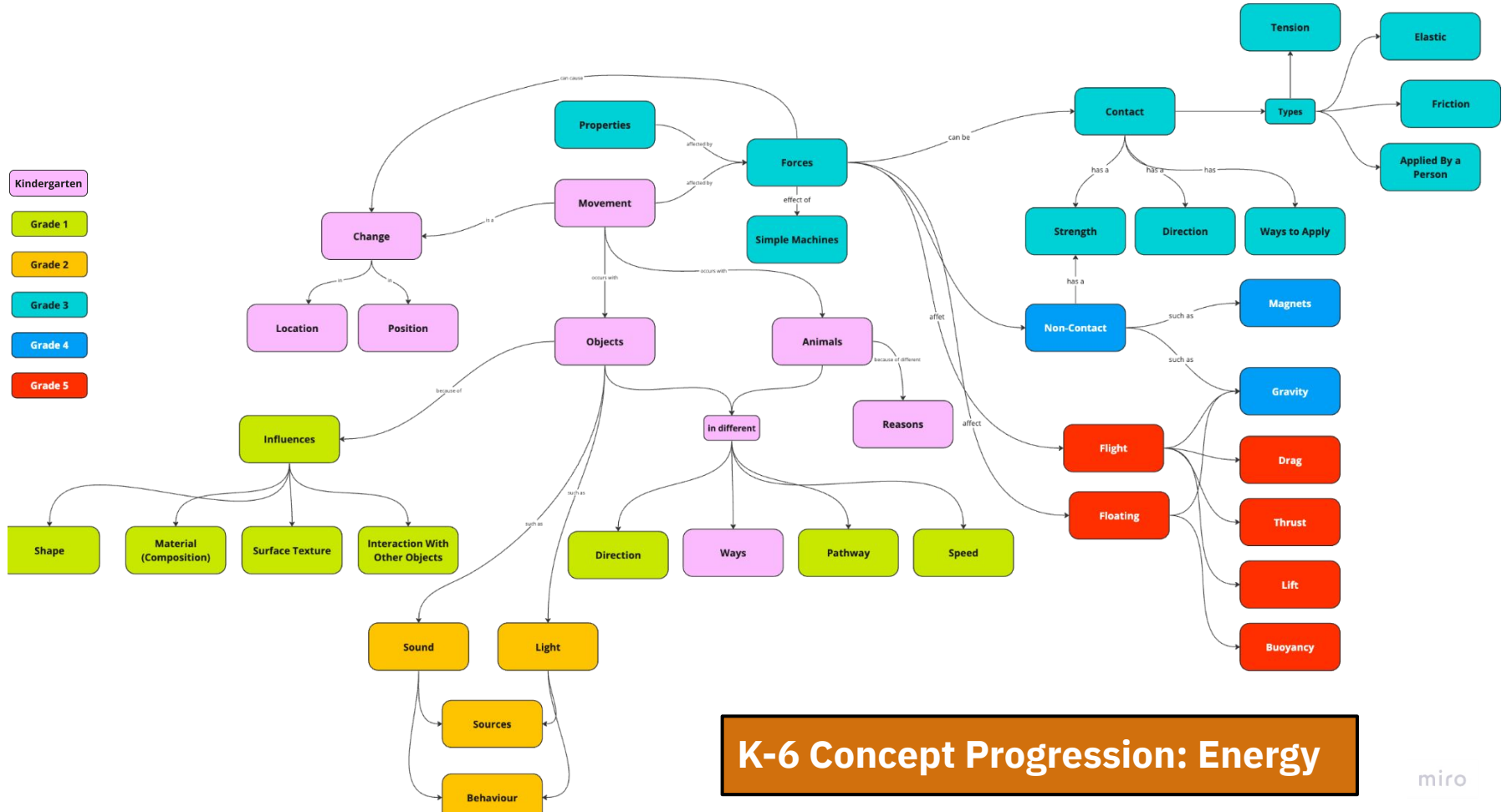
# K-6 Concept Progression: Energy

- Kindergarten
- Grade 1
- Grade 2
- Grade 3
- Grade 4

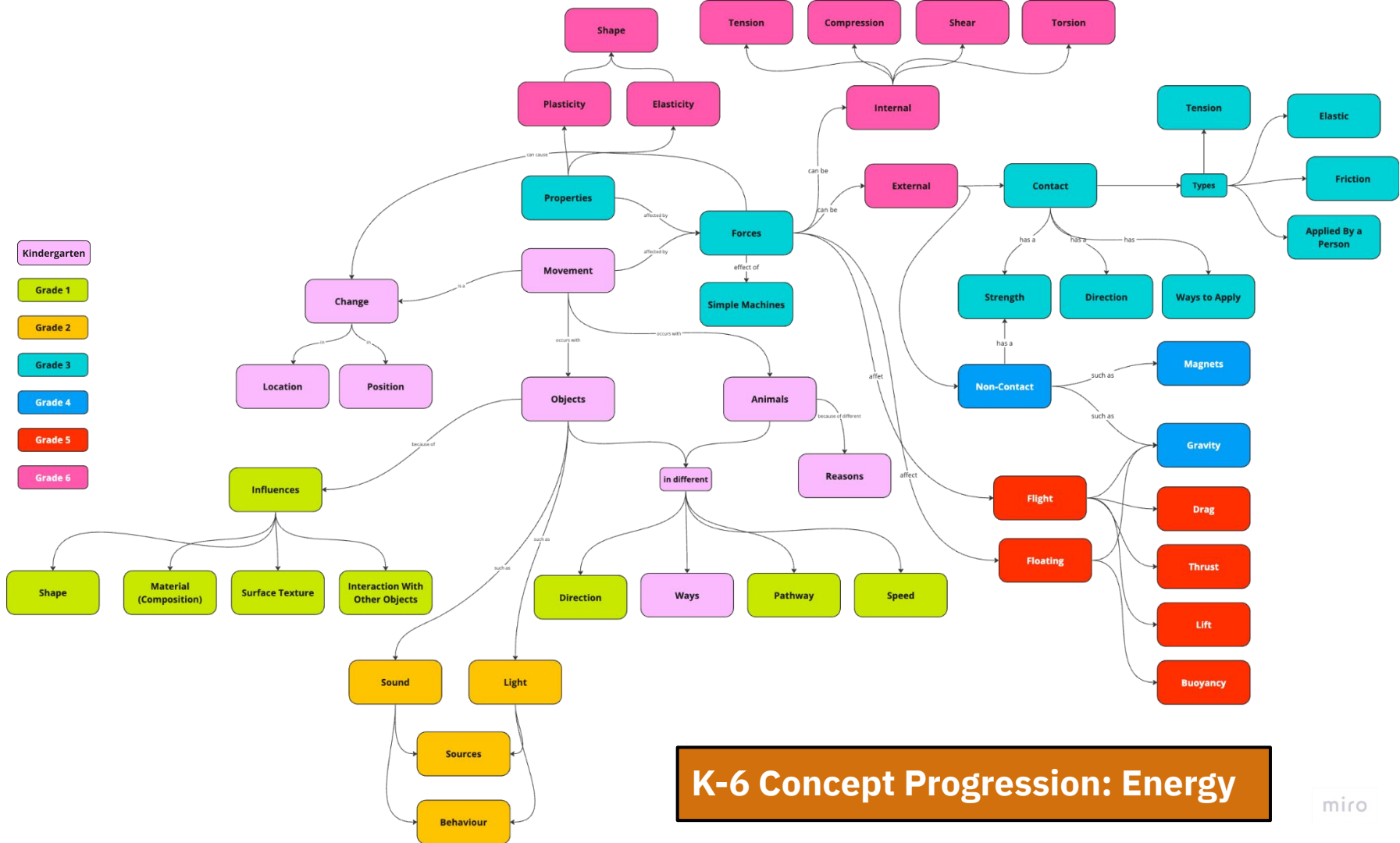


# K-6 Concept Progression: Energy

- Kindergarten
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

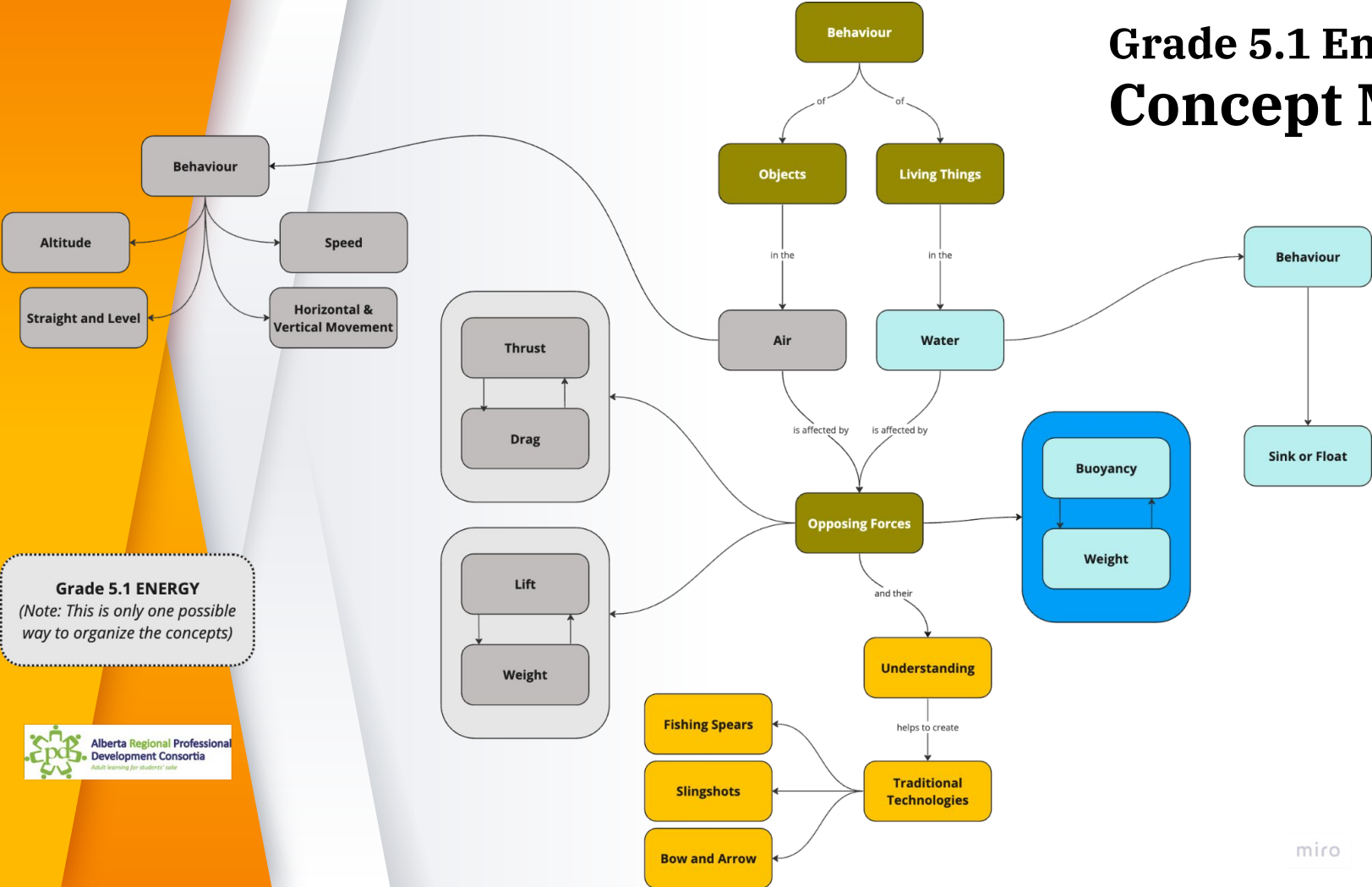


# K-6 Concept Progression: Energy



# K-6 Concept Progression: Energy

# Grade 5.1 Energy Concept Map



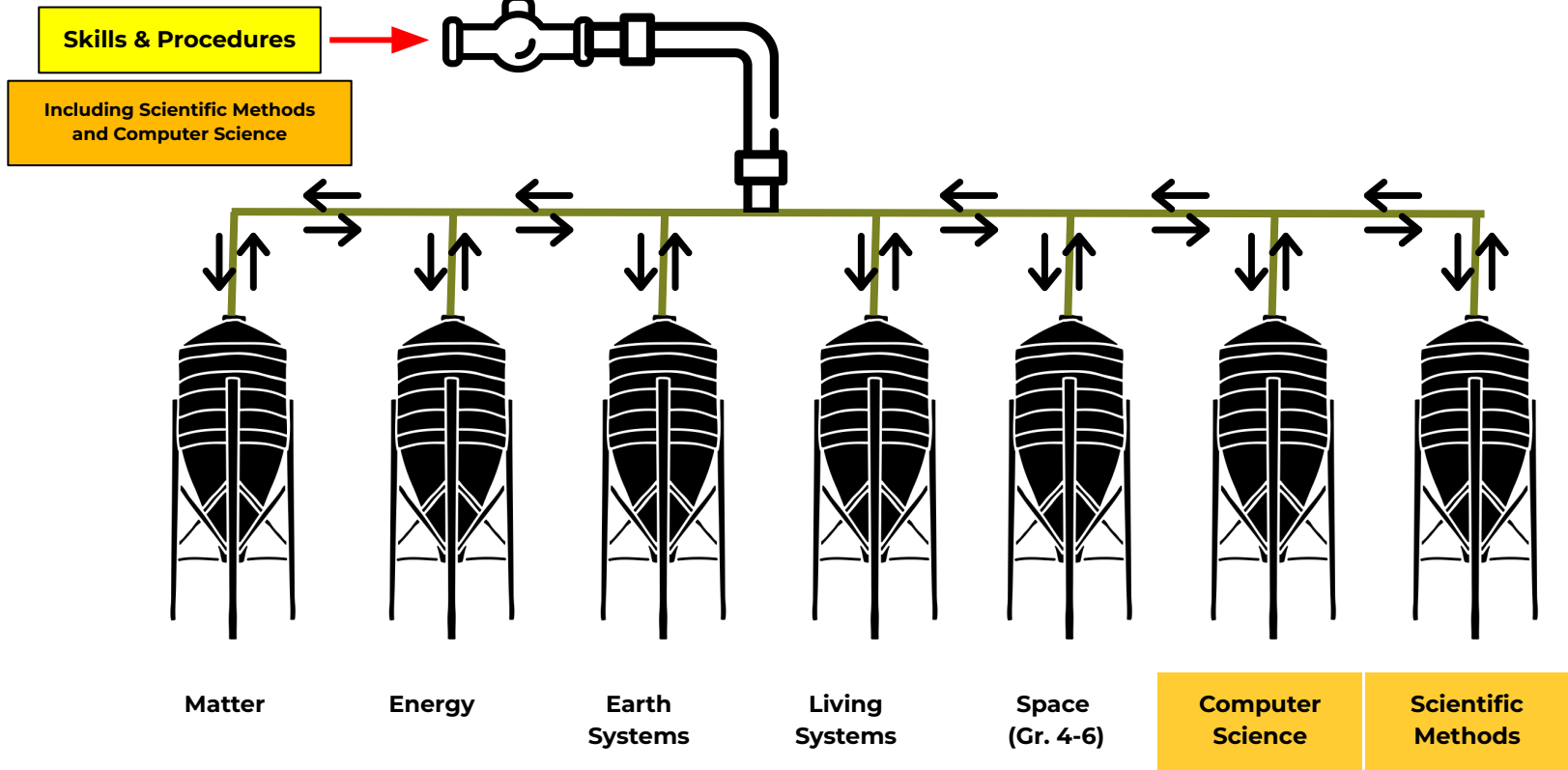
**Grade 5.1 ENERGY**  
*(Note: This is only one possible way to organize the concepts)*

## ENERGY (01)

## ENERGY (02)

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 5	Grade 6
<b>Guiding Question:</b> <i>How can humans, animals, and objects move?</i>	<b>Guiding Question:</b> <i>How can movement of objects be understood?</i>	<b>Guiding Question:</b> <i>Where do light and sound come from, and how do they move?</i>	<b>Guiding Question:</b> <i>How can forces relate to changes in movement?</i>	<b>Guiding Question:</b> <i>How can forces affect objects from a distance?</i>	<b>Guiding Question 01:</b> <i>How are forces similar and different in water and air?</i>	<b>Guiding Question 01:</b> <i>In what ways can interactions lead to physical change?</i>	<b>Guiding Question 02:</b> <i>What are energy resources?</i>	<b>Guiding Question 02:</b> <i>How are energy resources used?</i>
<b>Learning Outcome:</b> <i>Children explore movement of objects, humans, and other animals.</i>	<b>Learning Outcome:</b> <i>Students investigate the direction, pathway, and speed of moving objects and animals.</i>	<b>Learning Outcome:</b> <i>Students investigate the behaviours of light and sound.</i>	<b>Learning Outcome:</b> <i>Students investigate and explain how forces affect the movement of objects.</i>	<b>Learning Outcome:</b> <i>Students investigate how forces can act on objects without contact.</i>	<b>Learning Outcome 01:</b> <i>Students investigate and compare how forces affect living things and objects in water and air.</i>	<b>Learning Outcome 01:</b> <i>Students analyze forces and relate them to interactions between objects.</i>	<b>Learning Outcome 02:</b> <i>Students investigate and analyze various energy resources.</i>	<b>Learning Outcome 02:</b> <i>Students evaluate the use of energy resources and explain factors that influence choice.</i>
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		

# 2023 Curriculum: Organizing Ideas



# Learner Outcome Verbs

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

## Grade 5E1 Learner Outcome

Students **investigate** and **compare** how forces affect living things and objects in water and air.

**5E1.1 Understanding:** *Flight of living things and objects is influenced by opposing forces.*

### 5E1.1 Skills and Procedures

- **Diagram** opposing forces that act on living things or objects in flight.
- **Explain the effects** of thrust and drag on the flight of living things and objects.
- **Explain the effects** of lift and weight on the flight of living things and objects.
- **Observe** living things and objects in flight.
- **Describe** traditional or modern technologies developed by diverse cultures that reflect understanding of forces that affect flight.
- **Construct** a device that can fly.
- **Practise safe and appropriate use** of tools, equipment, and materials while constructing a device.

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**5E1.2 Understanding:** *The relationship between buoyant force and gravity can be used to explain the behaviour of an object in water.*

### 5E1.2 Skills and Procedures

- **Relate** buoyant force and weight to the tendency to float or sink in water.
- **Conduct controlled experiments** to determine if various objects and materials float in different fluids.
- **Construct** a device that can float.
- **Practise safe and appropriate use** of tools, equipment, and materials while constructing a device.

# Teaching for Transfer



# ✖ Phases of Learning

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

## Surface

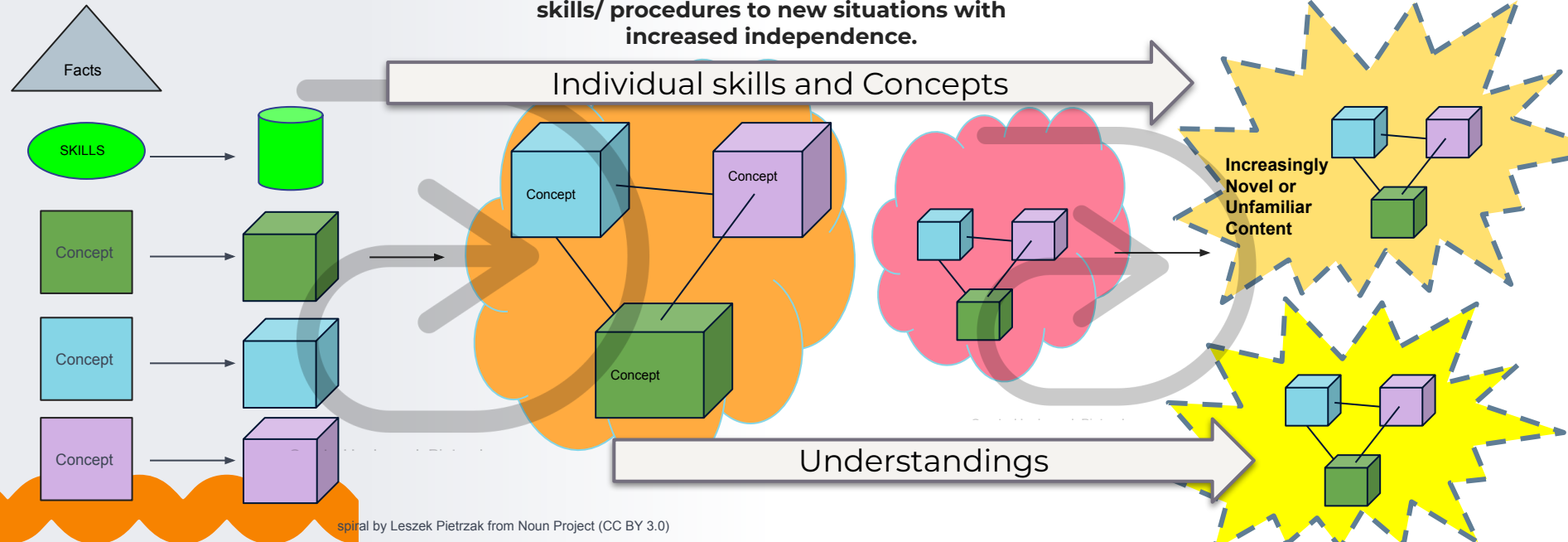
Students are first exposed to individual skills, concepts and their related knowledge.

## 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

**5E1: Students investigate and compare how forces affect living things and objects in water and air.**

## Understandings

**5E1.1: Flight of living things and objects is influenced by opposing forces.**

**5E1.1: The relationship between buoyant force and gravity can be used to explain the behaviour of an object in water.**

### [Sample Summative Assessment](#)

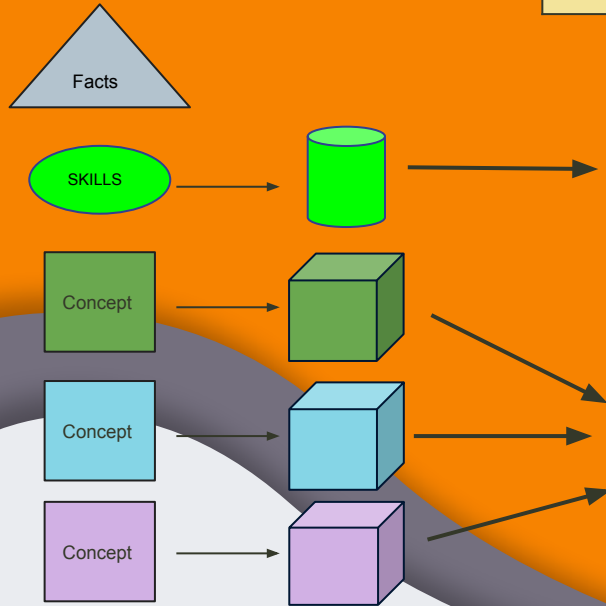
What will students need to know and/or understand in order to be successful?

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

**5E1: Students investigate and compare how forces affect living things and objects in water and air.**

- **Steps in an investigation.**

**Pre Assessment for Prior Learning**

- **5E1.1: Concepts such opposing force, thrust, drag, lift, and weight.**



# From Kindergarten

Objects | Properties

# What is Movement?

Can you show me  
what movement is?

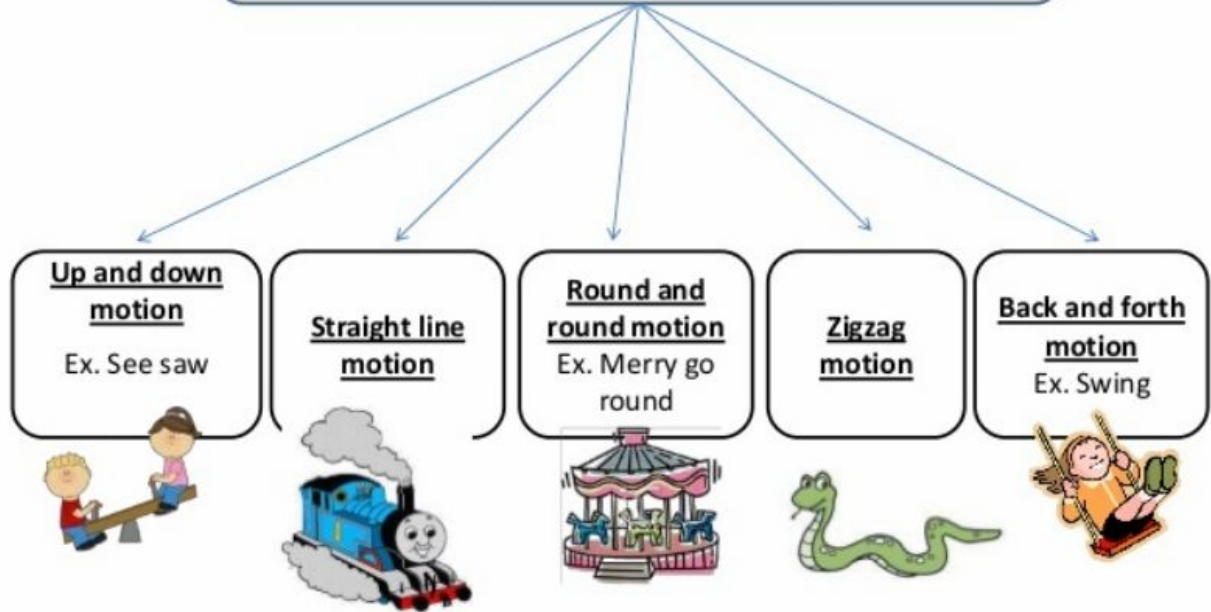
Can you show me  
what movement is  
not?

How would you explain to someone  
what **movement** is?

PE or  
Outdoor  
Education  
Time!

Sidewalk  
Chalk  
would be  
a great  
tool!

# Types of motion



From Grade 1

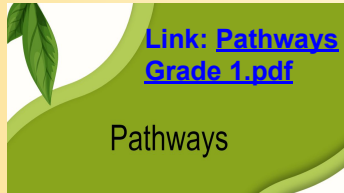
# Aspects of Movement: Direction, Pathway and Speed

## 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?

Let's explore!

How does **shape** influence movement?

How does the **material** influence movement?



Photo by [Andrew Charney](#) on [Unsplash](#)

How does the surface **texture** influence movement?




Photo by [Drazen Nestic](#) on [Unsplash](#)

From Grade 2



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!

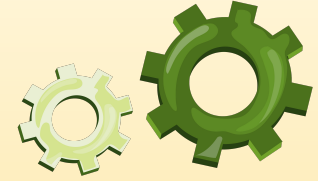


Can you identify other examples where forces are used in the time you get up in the morning to getting to your classroom?

Role of forces in our daily lives

[Link](#)

# 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**

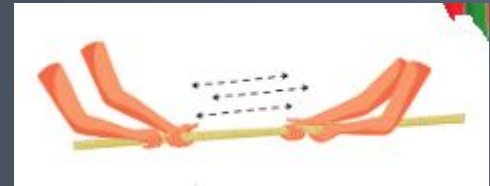
10 Models/Examples of **Elastic Forces**

Source: [Studiosguy.com](http://Studiosguy.com)  
Shooting Elastics  
Slingshot  
Bow and Arrow



What could help us make applying force easier?

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



# What Is an Inclined Plane?



by **TURTLE DIARY**.com



How Inclined Planes MAKE  
WORK EASY!

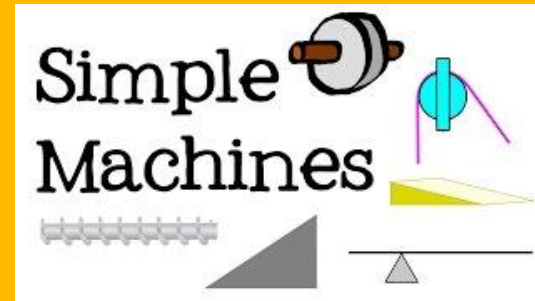
Where do we use inclined planes in daily living?

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

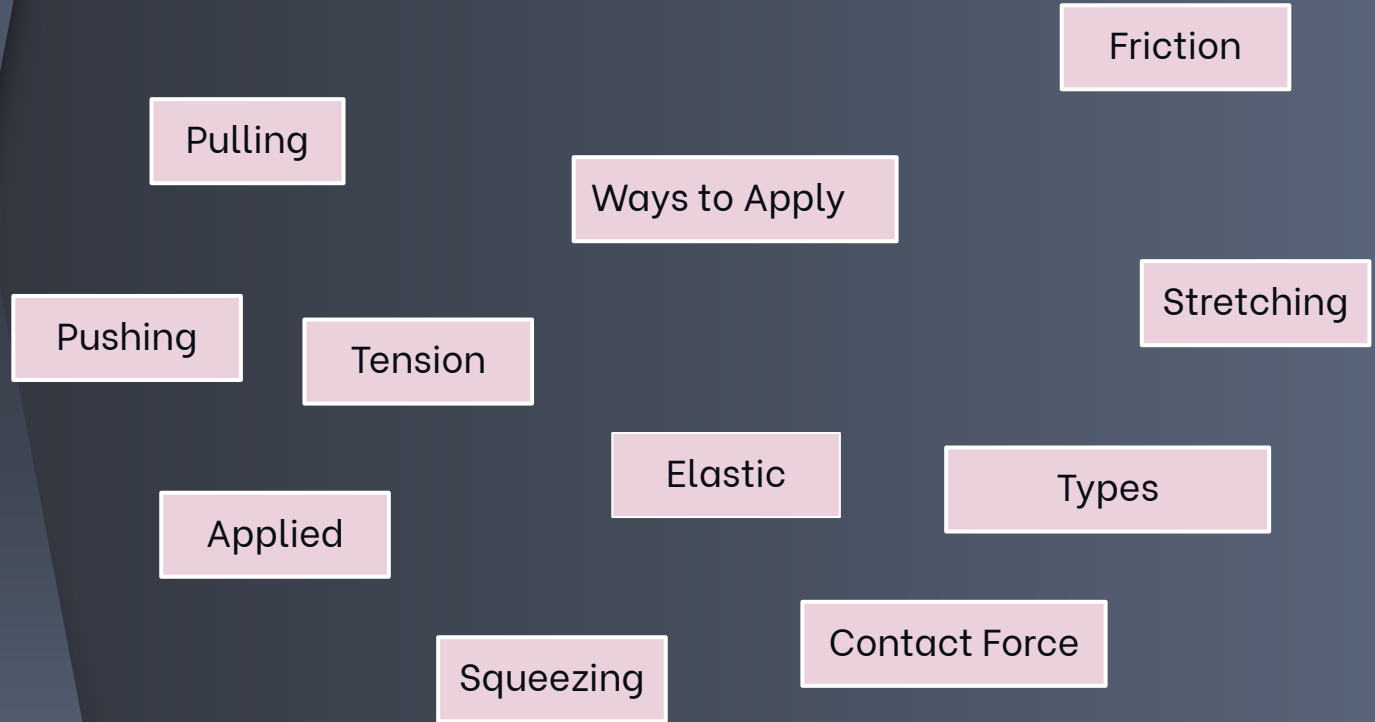
This video also includes history of simple machines.



# What is a Concept Map?

- [Relationships](#)
- [Concept Map](#)

Relate the organizing ideas concepts into a concept map.



# What is a Concept Map?

- [Relationships](#)
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Relate the organizing ideas concepts into a concept map.

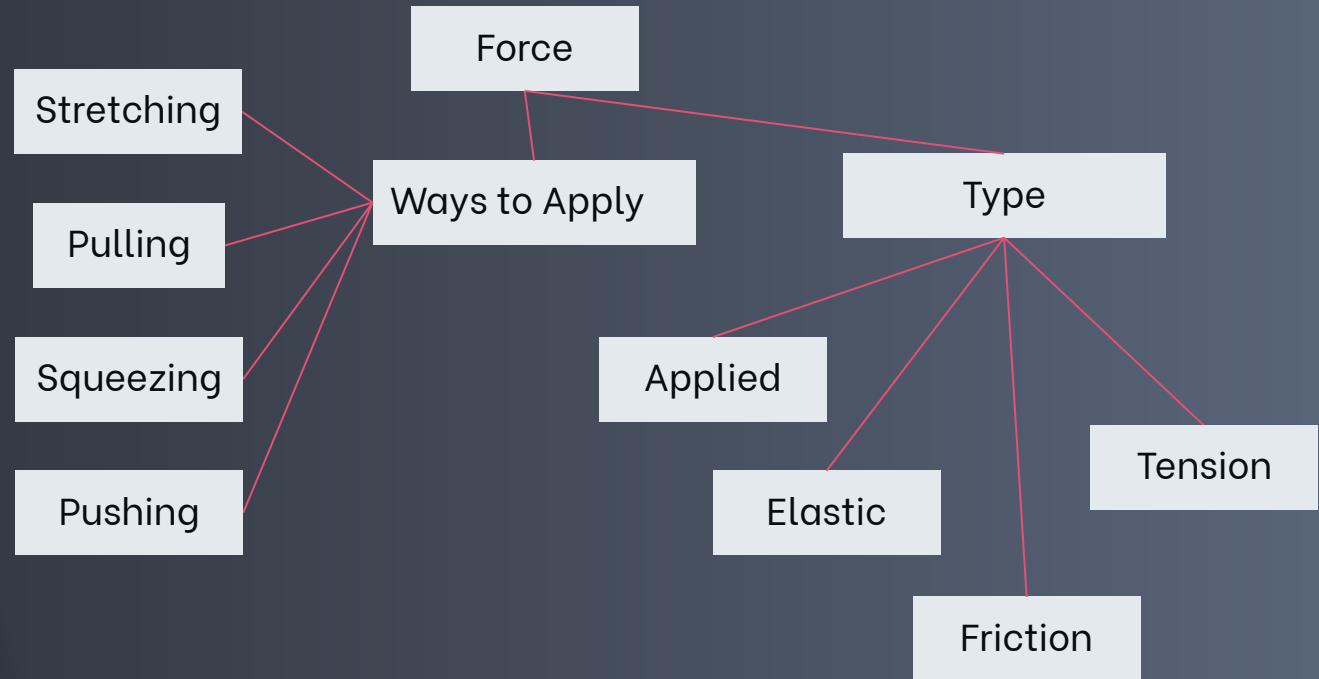
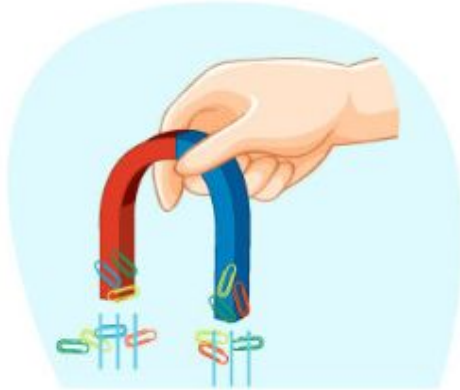




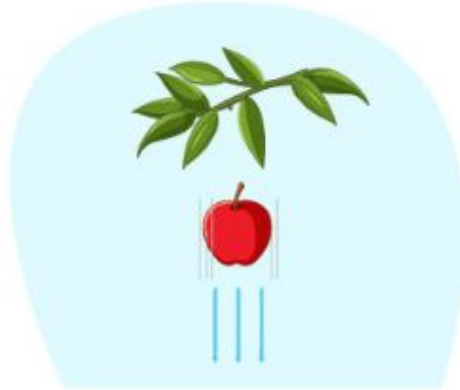
Photo by [Aaron Burden](#) on [Unsplash](#)

# From Grade 4

# Types of Non-Contact Forces



Magnetic Force



Gravitational Force



Electrostatic Force

# 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 on 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

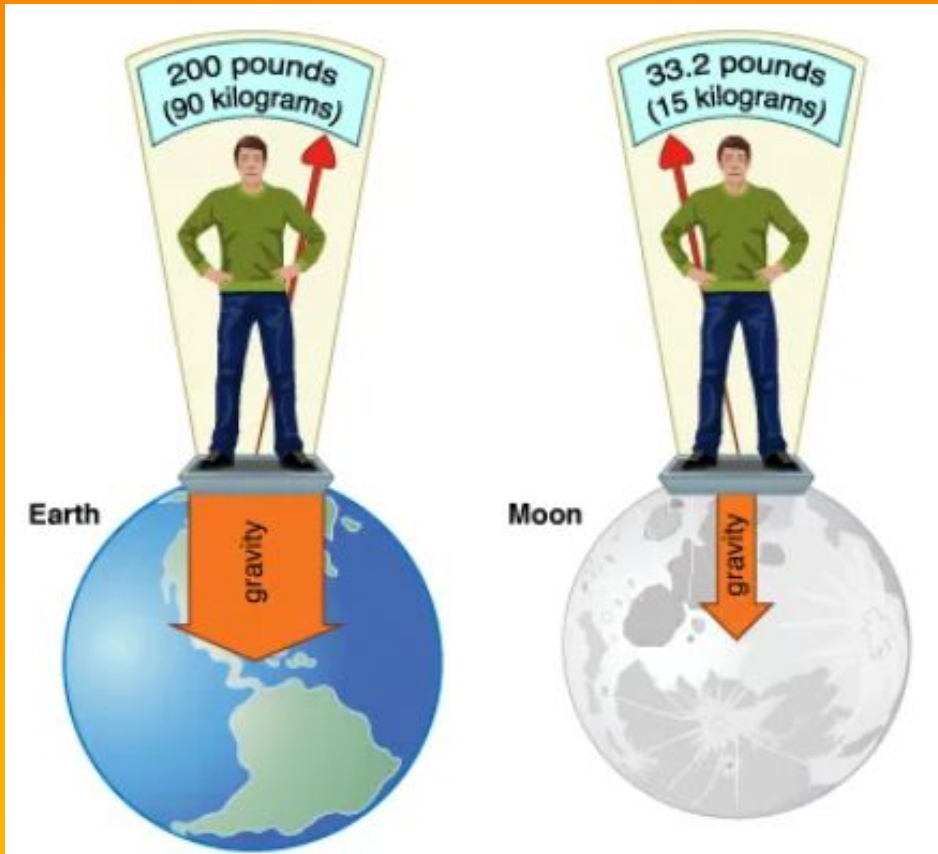
# So What IS Gravity?

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.



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

# Conduct an Investigation to demonstrate magnetic forces on objects.

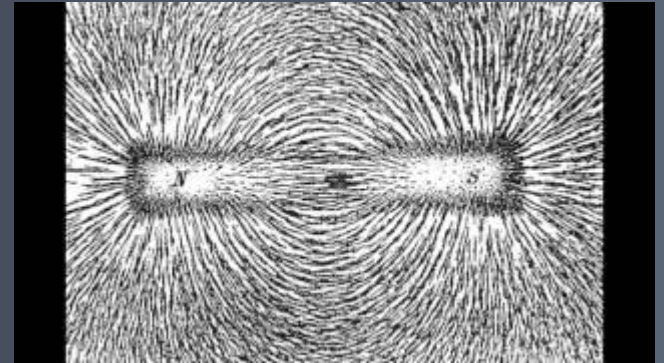
**Investigation:** testing to see what properties of objects react to magnets.

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



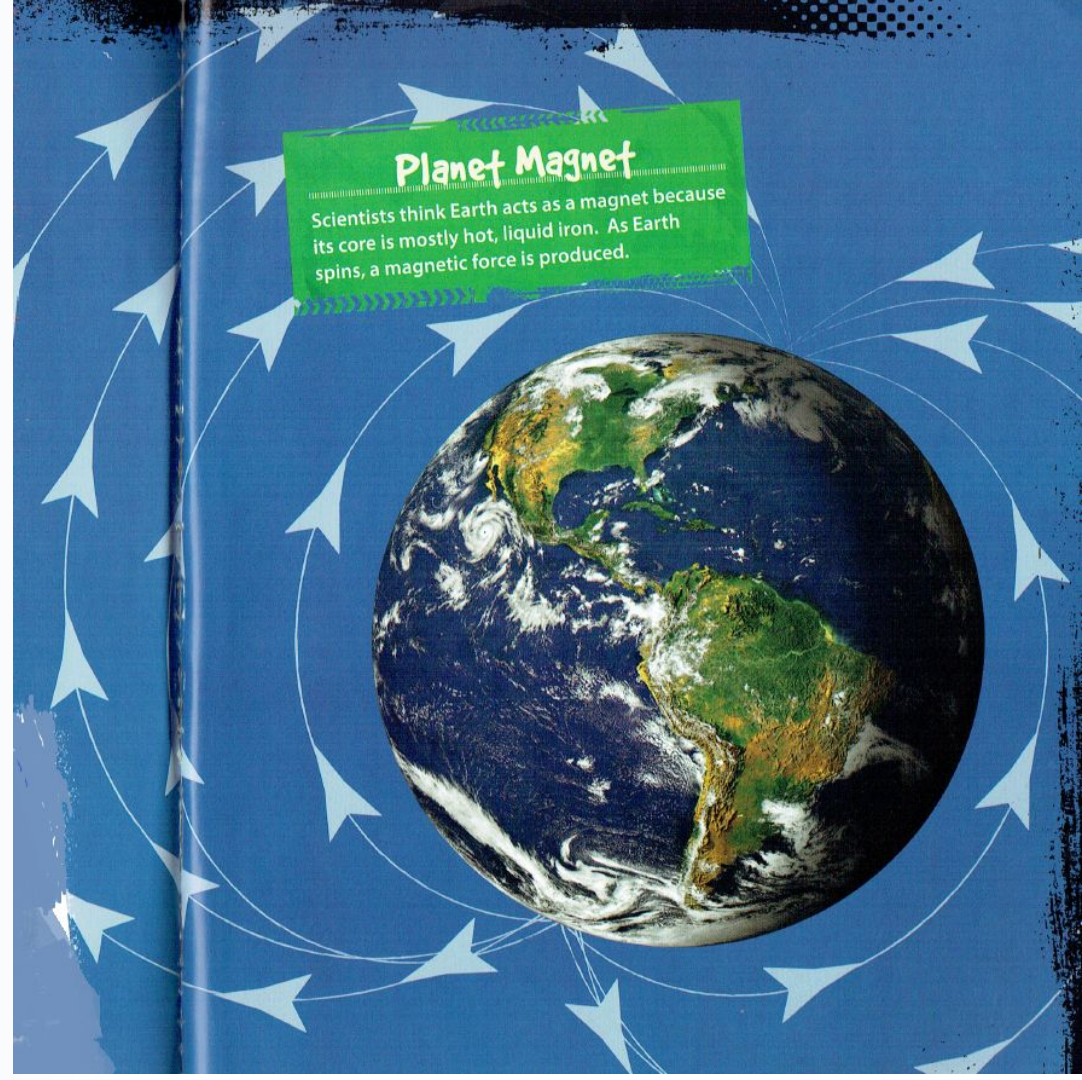
[Magnets for KidsWork? - Magnets for Kids | What is a magnet, and how does it work?](#)

A great "Day 2" recording. Covers most of the terminology surrounding Magnets; provides real world examples.



[Magnetism and Electromagnetism: Science Buddies](#)

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



## ***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.***

# Grade 5

The background features a large orange area on the left and a white area on the right, separated by a diagonal line. The white area has a subtle shadow effect, suggesting a layered or 3D paper-like appearance.

# Design a device that can fly.

- ▶ What materials will you need?
- ▶ Design your device to fly the longest possible length.
- ▶ Measure your results.
- ▶ What adjustments can you make to make it go further? Which of the forces would this adjustment reflect?
- ▶ How did the adjustment improve your flying device?
- ▶ What changes would you need to make if you were going to increase the load (weight) that your flyer is carrying?
- ▶ Add 2 large metal paper clips to each side of the plane.
- ▶ Measure the distance it flies.
- ▶ Do you need to make adjustments? If so, explain.



# Surface Level 5.1

“When lift plus thrust is greater than load plus drag, anything can fly”

*Who said this?*



“ When lift plus thrust is greater than load plus drag, anything can fly”





But really...how do things fly...especially BIG things like planes?



Why can't airplanes fly to space? [Mystery Science](#)

# WHAT FORCES AFFECT FLIGHT?

Four forces act on any object that has achieved flight. The forces that push and pull an object up or down and forwards or back counteract each other during flight.

**Drag** is the force that slows down the movement of an object. Friction and air resistance cause drag. Drag is related to the speed of an object. The faster an object moves, the greater the drag.

These forces affect how a flyer achieves flight. They determine how far, fast, and high a flyer can fly.

The force of **gravity** pulls an object downward toward the centre of Earth. The **weight** of an object is caused by the force of gravity acting on it.

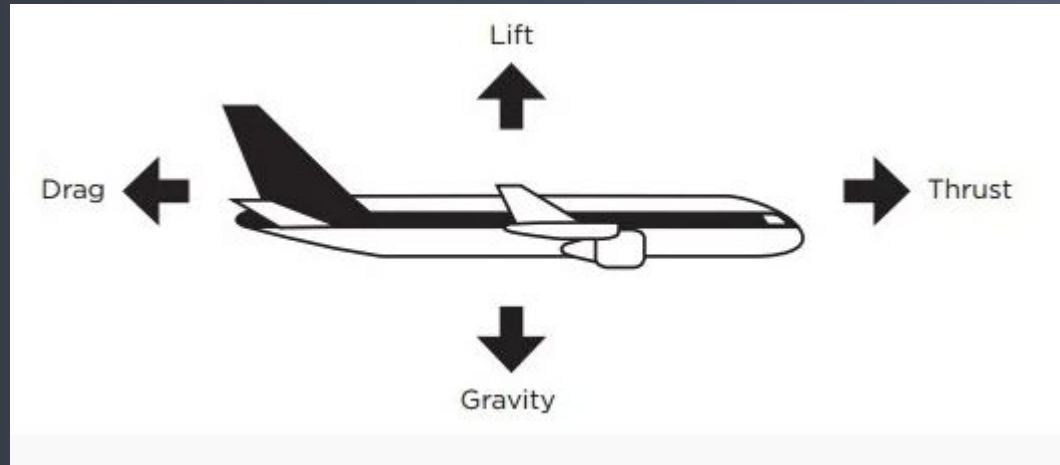


**Thrust** is the force that pushes or pulls an object forwards. Thrust must be greater than drag for a flyer to move forwards.

**Lift** is the force that achieves flight. It occurs at a right angle to the airflow. The movement of air around an object causes lift. Lift acts against the pull of gravity. Flight occurs when lift is greater than an object's weight. As weight increases, lift must also increase to achieve flight.

Chapman, D., Pitts, D., Nixon, H.  
Science 6 Unit 2  
Flight.  
Newfoundland and  
Labrador Science  
Resources. Nelson  
Publishing. p.8-9

*Lift and Gravity & Thrust and Drag are considered pairs of Opposite Forces. Explain why this is true.*



Source: Forces of Flight: [Science World](#)

# BUOYANCY

## Why do some things float in water ...



## ... while other things sink?



Floating Bottle by  
Laymik from Noun  
Project (CC BY  
3.0)

sinking car by Llisole from  
Noun Project (CC BY 3.0)



Buoyant force is an upward force exerted by a fluid that opposes the weight of anything placed in the fluid.

## BUOYANCY

When the buoyant force is **greater than the weight of an object**, the object will **float**.

When the buoyant force is **less than the weight of an object**, the object will **sink**.



An underwater scene with clear blue water and many small bubbles. A white arrow points from the bottom right towards the center. The text 'Deep Level Activities' is written in orange on the left side.

# Deep Level Activities



Photo by [Emiel Molenaar](#) on [Unsplash](#)

*In terms of forces and lift-off, explain why a large plane needs larger wings than a small plane. Relate this discussion to comparing an eagle to a sparrow.*



Stock photo on [Unsplash](#)

**Relate** your understanding of **forces** and **flight** to one of the following man-made tools: Bow and Arrow, Slingshot, Fishing Spear, Javelin or one of your own choosing. Include a labelled diagram in your explanation.

Relate your understanding of forces on objects in flight to how the eagle in the video below can make flight with the salmon in its claws.



Do all liquids have the same buoyant force?  
Investigate: write out the steps and carry out an investigation.

- Select 8-10 different objects that you could test in different liquids. They should be made of a variety of materials or are natural.
- Select three to 4 different liquids such as water, Olive Oil, corn syrup, vinegar or other ones of your own choosing.
- Create a chart to record your predictions and your actual results to carry out the investigation.
- Review your data in order to draw a conclusion.
- If air is a liquid, explain why when you blow up a balloon by mouth and another with helium that they both do not fall to the floor.

- Explain how birds and kites fly using your knowledge of forces and flight.
- Describe the reasons and forces that act on a supertanker that help it float.

Using your knowledge of buoyancy, compare a speed boat and water crawler.

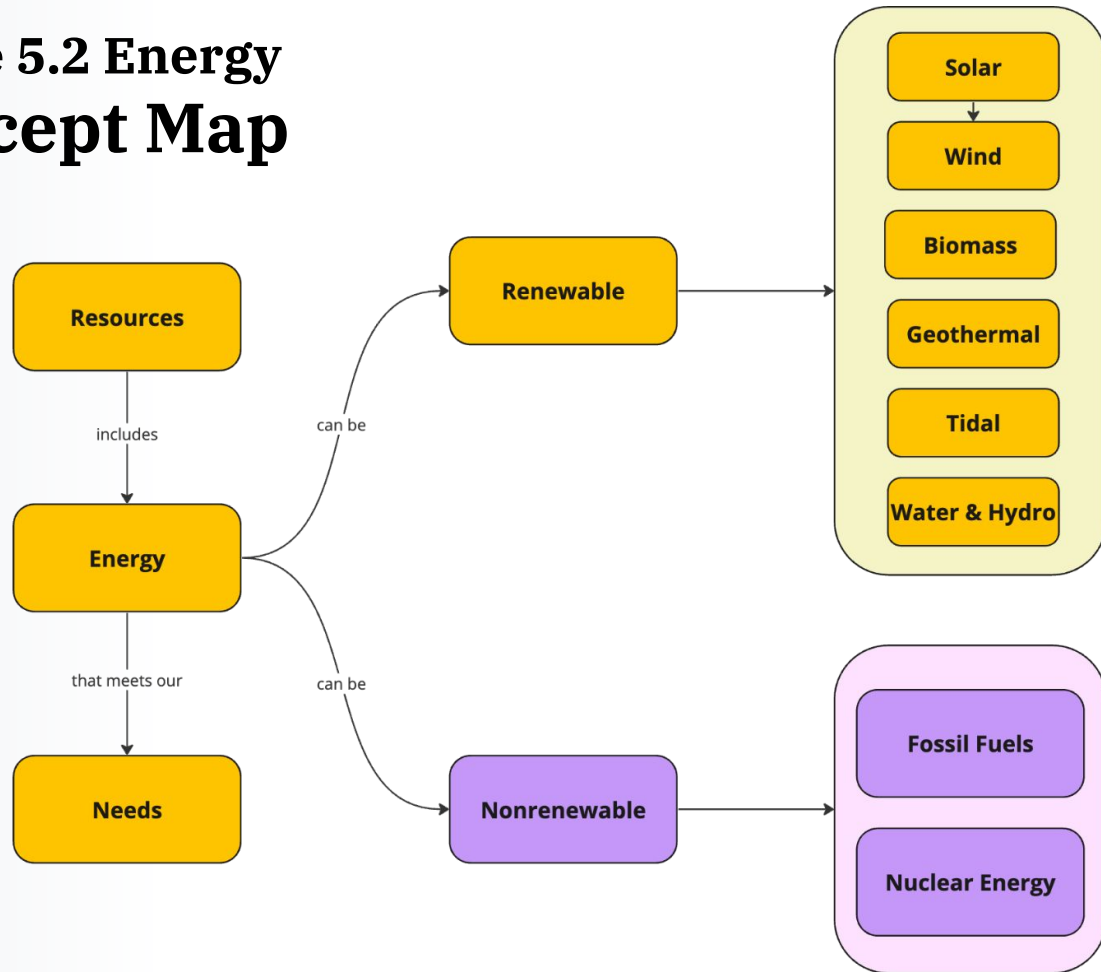
- 5E1: [Sample Summative Assessment](#)



## Surface Level 5.2

# Grade 5.2 Energy Concept Map

**Grade 5.2 ENERGY**  
(Note: This is only one possible way to organize the concepts)



# 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 5E2 Learner Outcome

Students *investigate* and *analyze* various energy resources.

# 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 5E2 Learner Outcome

Students *investigate* and *analyze* various energy resources.

**5E2.1 Understanding:** *Humans rely on energy resources to fulfill energy needs.*

### 5E2.1 Skills and Procedures

- **Compare** renewable energy resources with non-renewable energy resources.
- **Discuss** advantages and disadvantages of using renewable and non-renewable energy resources.
- **Examine** how various provinces and territories throughout Canada fulfill energy needs.



## Learning Outcome

5E2: Students investigate and analyze various energy resources.

## Understandings

5E2.1: Humans rely on energy resources to fulfill energy needs.

### Sample Summative

Assessment: Students investigate renewable energy and nonrenewable energy to identify similarities and differences.

Research Assessment: Single Point Rubric

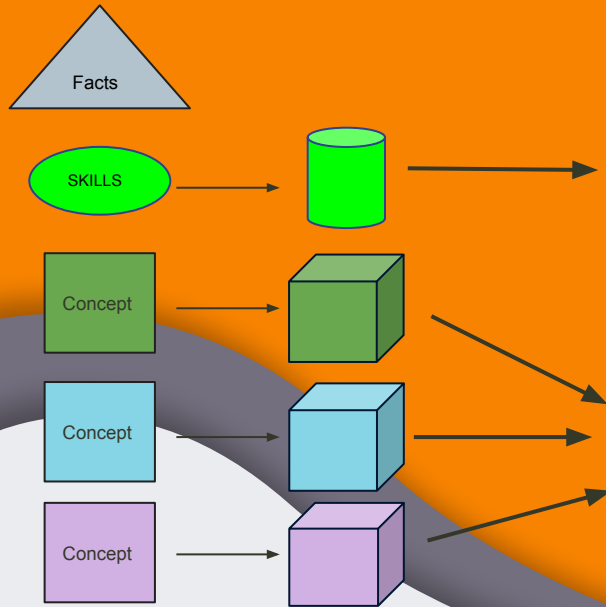
What will students need to know and/or understand in order to be successful?

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

**5E2: Students investigate and analyze various energy resources.**

- **Steps in an investigation; Research Skills**

**Pre Assessment for Prior Learning**

- **5E2.1 Resources, Energy Renewable Energy Resources; Nonrenewable Energy Resources**



# Surface Level

Concept Attainment: What are Resources?



[Dreamstime](#) ID #105234118

**We use  
energy  
everyday!**

**Can you name some  
resources? Do you  
know what we use  
them for?**

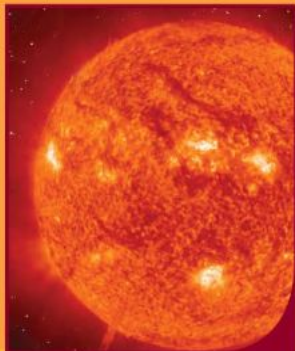
Energy

Written by

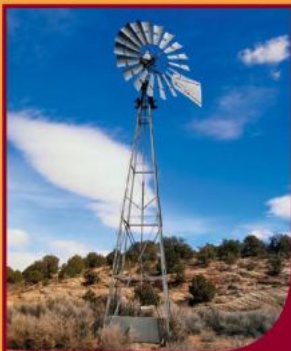
# Renewable Energy

Some forms of energy are available in an almost unlimited supply. This is called renewable energy.

We can get renewable energy from:



The SUN



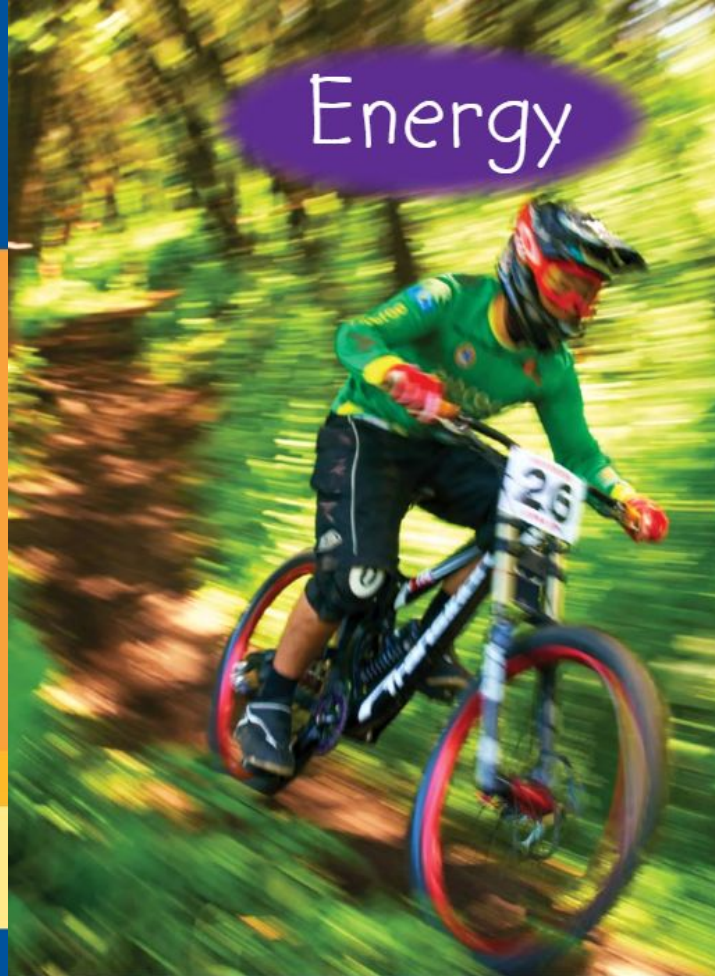
The WIND



The WATER



Energy



CONT  
Energy  
Energy and You  
Renewable Energy  
Energy in the Sun  
Solar Energy  
An Energy Chain  
Energy in the Wind  
Energy in the Water  
Energy in Rubbish  
Index

An underwater photograph showing a clear blue-green water surface with many small bubbles rising. A white arrow points from the bottom right towards the center of the frame. The text 'Deep Level Activities' is overlaid in a bold, orange font on the left side of the image.

# Deep Level Activities



# Canada's Energy - Research!

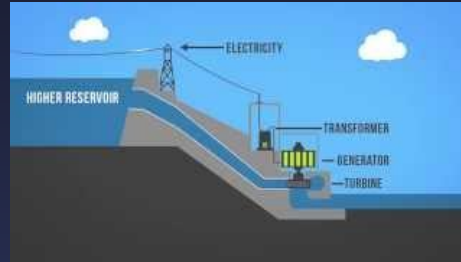
Consider a Case Study approach - students are assigned or select 2 or 3 different energy sources to research, compare and explain their relationships. Reading the book *Energy* by Jo Windsor will provide students sufficient introduction to possible sources renewable energy sources to decide which one(s) interest them most.

OR

Select one source of energy close to your community or that students are familiar with and unpack it as a class modeling the process of research, and explaining the characteristics of the chosen energy form.

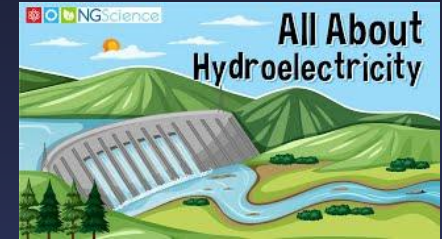
Learning about some sources of energy.

How is wind energy produced?



Hydropower 101

Explaining Hydroelectric power.



This video touches on renewable and nonrenewable sources as well.

What is Solar Energy

# Resources

## Using Natural Resources for Energy

**Focus:** This is a Problem-Based Learning unit in which students build to a capstone lesson and a presentation to the public.

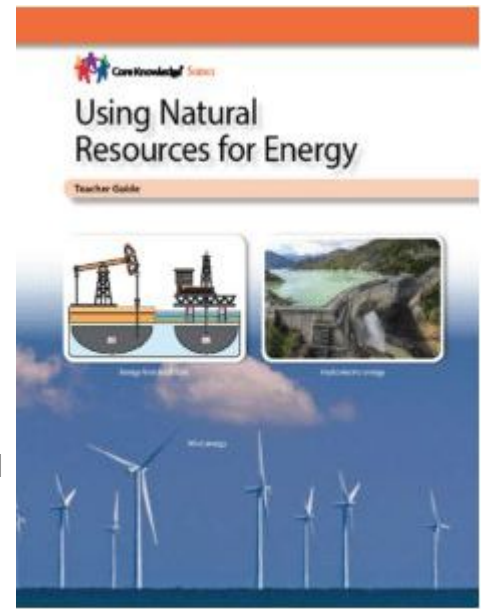
In this unit, students focus on renewable and nonrenewable resources. They study how people use resources for energy. In addition, they examine the engineering design behind new technologies that protect the environment.

The energy we use is derived ultimately from Earth's natural resources, which can be classified as either nonrenewable or renewable.

**Renewable energy sources include:** Wind, Hydroelectric, Solar, Geothermal, Tidal

**Nonrenewable energy sources include:** Fossil fuels, Nuclear

\*\*\* This resource will help students to understand the different forms of energy



[Student Resource](#)  
[Teacher Resource](#)

# Assessment

*Wind turbines use blades to collect the wind's energy. Explain how wind flowing over the blades creating lift similar to the effects on an airplane's wings.*

*In Greece, many people have their water tanks on their rooftops. Research and explain how this works.*



Source: [Reddit ID#bw57570](#)

A **TRUE** BOOK™

# Wind Power

## Alternative Energy

Wind turbine technicians often work 260 feet (79 meters) or more in the air.



MATTHEW ZIEM

 SCHOLASTIC

A **TRUE** BOOK™

# Geothermal Energy

## Alternative Energy

Lava from eruptions at Mount Etna can reach a temperature of up to 2,102 degrees Fahrenheit (1,150 degrees Celsius)!



LAURIE BREARLEY

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# Solar Power

Alternative Energy

This solar power plant  
in Nevada uses more  
than 10,000 mirrors!



LAURIE BREARLEY

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# Water Power

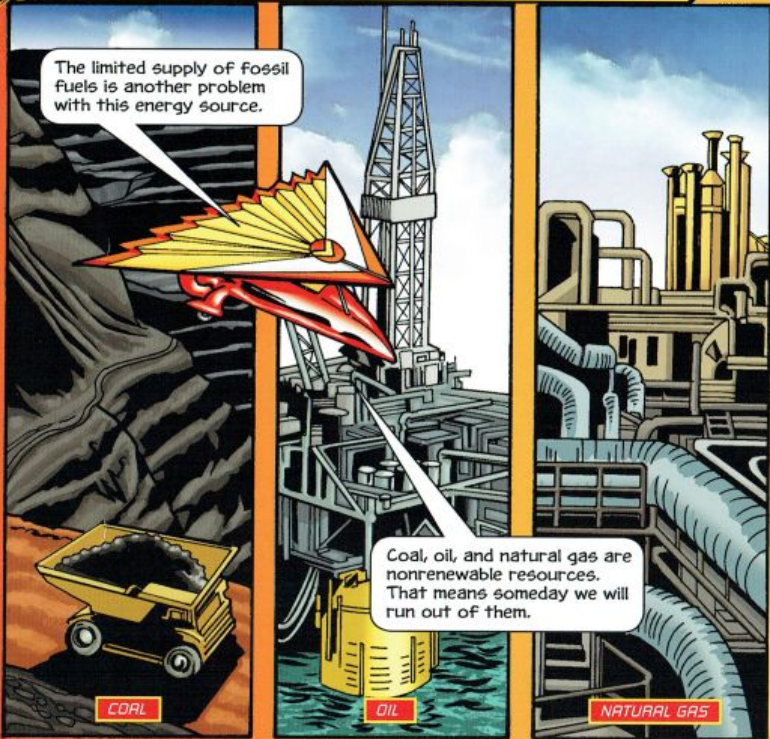
Alternative Energy

Water power provides  
less than 7 percent  
of U.S. electricity.



LAURIE BREARLEY

 **SCHOLASTIC**



The limited supply of fossil fuels is another problem with this energy source.

Coal, oil, and natural gas are nonrenewable resources. That means someday we will run out of them.

To confront issues with natural resources, scientists are working on ways to use renewable energy.

Energy sources like wind, solar, and hydro are renewable. The sun, wind, and crops are renewable energy sources.



Renewable energy sources like wind, water, and geothermal energy are naturally replenished.

**CLEAN COAL** ACCESS GRANTED, MAX AXIOM

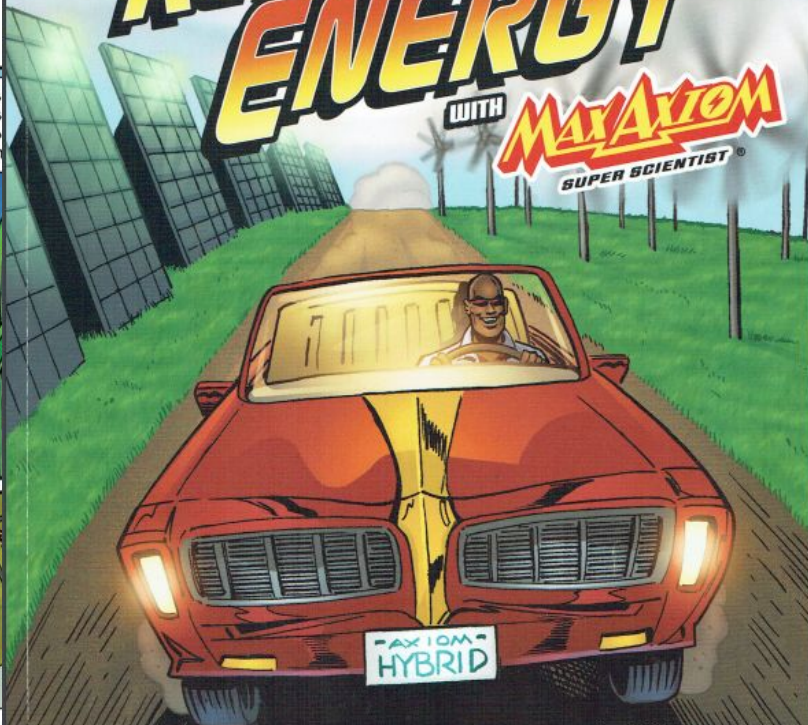


Researchers have developed ways to clean coal by removing pollutants before it is burned. But pollutants like carbon dioxide must be captured and stored to prevent them from being released into the air. Carbon storage technology is still experimental and expensive.

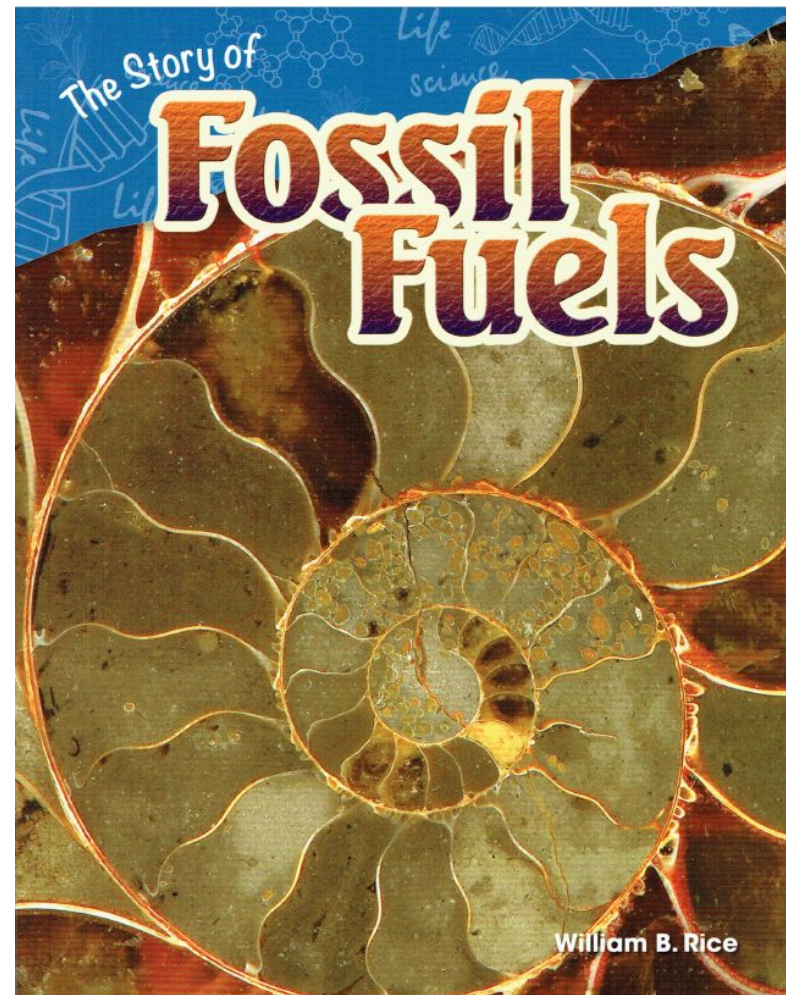
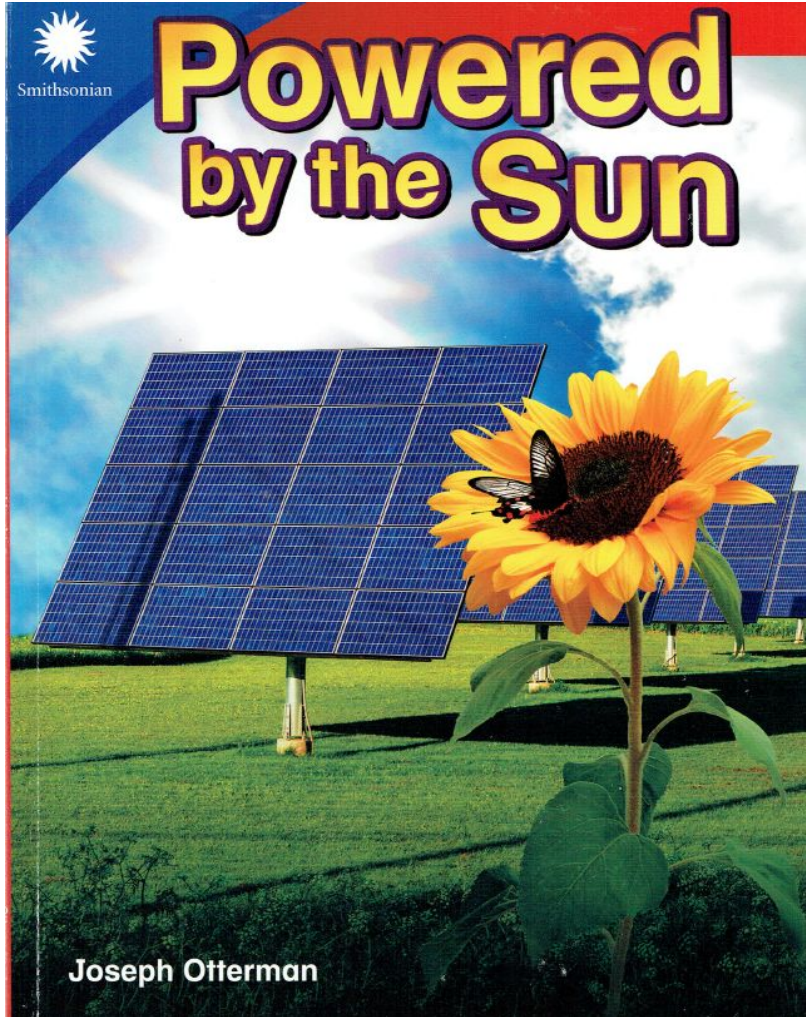


A REFRESHING LOOK AT **RENEWABLE ENERGY**

WITH **MAX AXIOM** SUPER SCIENTIST



by Katherine Krohn  
illustrated by Cynthia Martin and Barbara Schulz



# Computing Science and Energy in Grade 5

**Video with Angela Dearing**

**Slide Deck:**

- [Gr 5 Energy Connections to Computer Science.pdf](#)



# Thanks!

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Chris Zarski [chris.zarski@arpdc.ab.ca](mailto:chris.zarski@arpdc.ab.ca)

Photo by [Lee Jeffs](#) on [Unsplash](#)





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