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## Understanding Life Systems

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Students will study ecosystems and their biotic and abiotic elements. They will understand how energy is transferred through producers, consumers, and decomposers within an ecosystem. Furthermore, students will learn that matter is cycled in various cycles in the environment. They will also learn that successions, including primary and secondary successions, occur naturally over time. The impacts of human activities on ecosystems and measures taken by the government to protect ecosystems will also be discussed.

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## Understanding Structures and Mechanisms

Students will classify structures as frame, shell, and solid structures, as well as combinations of them. They will investigate the centre of gravity and symmetry of a structure and how they affect a structure's stability. The factors that affect the amount of force acting on a structure will also be studied. Students will explore what can cause structures to fail and what factors should be considered to prevent structural failures. Moreover, they will examine the properties of different materials and how these properties make the materials suitable for certain structures.

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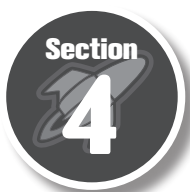
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## Section 3

### Understanding Matter and Energy

Students will be introduced to the particle theory of matter and understand that all matter is made up of particles. They will explore the distinction among pure substances, mechanical mixtures, and solutions using the theory. Students will learn to identify the solute and solvent in a solution and explore the common processes used to separate mixtures. Additionally, students will learn how to dispose of harmful substances and use non-toxic substances in place of toxic ones.

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## Understanding Earth and Space Systems

Students will examine the renewable and non-renewable sources of heat. They will investigate the effects of heat on different states of matter and how the particle theory of matter explains these effects. Students will also be introduced to the three ways of heat transfer: conduction, convection, and radiation. They will learn that some materials conduct heat well while others insulate people and things from heat, and some materials absorb heat while others reflect heat. Moreover, they will examine the greenhouse effect through their understanding of heat.

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# 2 Centre of Gravity

A structure's centre of gravity is an important element to consider when designing a structure. We depend on our body's centre of gravity to do daily activities. In this unit, you will examine where the centre of gravity is in a structure, and how a structure's centre of gravity affects its stability.



**After completing this unit, you will**

- know the meaning of an object's centre of gravity.
- understand that a structure's centre of gravity affects its stability.

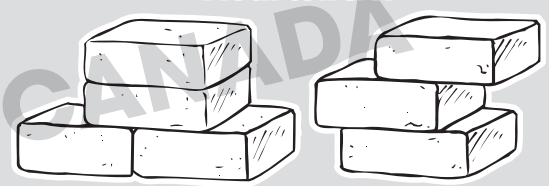
*We are smart to use a balancing pole. It lowers our centre of gravity to make us more stable.*

## Vocabulary

**centre of gravity:** the point of an object where all the mass seems to be concentrated

**stable:** unlikely to move; firmly in place

### block towers:

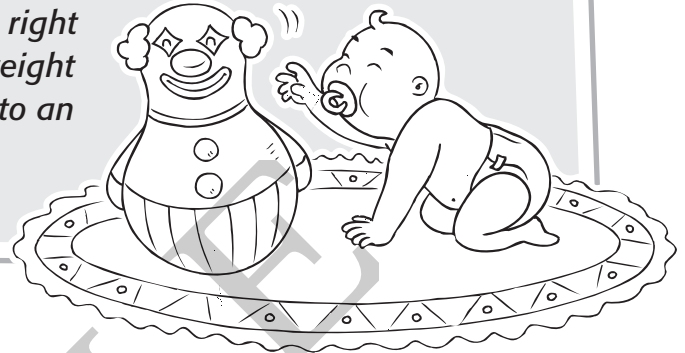


**stable**

**not stable**

## Extension

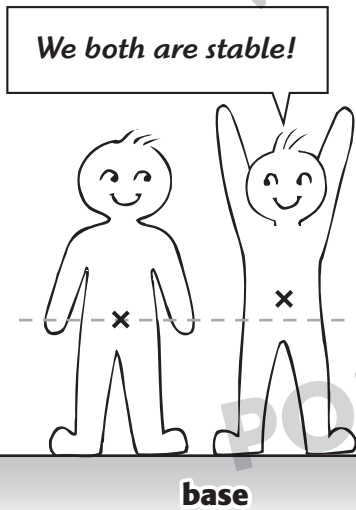
When you were a baby, you might have played with tumbler toys. Tumbler toys are shaped like clowns or animals from the waist up and shaped like a hemisphere from the waist down. The rounded bottom half of a tumbler toy is weighted, while the top half is hollow, making the toy very bottom-heavy. No matter how hard a child pushes it, a tumbler toy is always able to right itself. Do you know how a tumbler toy's weight and shape allow it to always spring back to an upright position?



### A. Fill in the blanks with the given words.

**Centre of Gravity**    **irregularly**    **mass**    **stable**    **regularly**  
    **centre**    **balance**    **changes**

The 1. \_\_\_\_\_ of gravity is the point on a body or object where all the 2. \_\_\_\_\_ seems to be concentrated. In a 3. \_\_\_\_\_ shaped object, like a cube or ball, that point is the geometric centre. In 4. \_\_\_\_\_ shaped objects, it is not as easy to find. In objects



that shift or move, like our bodies, the centre of gravity 5. \_\_\_\_\_ with each new position.

An object is 6. \_\_\_\_\_ only if its centre of gravity is directly above its base or point of 7. \_\_\_\_\_.



## Experiment

### Introduction

*A difference in temperature within a fluid causes convection currents. Does it matter if there is a larger or smaller degree of difference?*



### Hypothesis

Choose your hypothesis.

- Convection currents move faster with a greater difference in temperature.
- Convection currents move slower with a greater difference in temperature.
- There is no change in convection currents with a greater or smaller difference in temperature.

#### Steps

1. Fill the food container with cold water.
2. Fill the glass with warm water.
3. Add a few drops of food colouring to the glass of water.






#### Materials

- *a big see-through food container*
- *a small heavy glass*
- *tap water*
- *food colouring*
- *plastic wrap*
- *an elastic band*
- *a sharpened pencil*

4. Cover the glass with plastic wrap and secure it with the elastic band.
5. Place the glass in the bottom of the food container with cold water.
6. Use the pencil to carefully poke a hole in the plastic wrap so that the coloured water starts to escape.
7. Record your observations.
8. Empty the water in the food container and the glass. Repeat steps 1 to 7 with water that is colder, and then hotter, than the warm water used in the glass at the first time.



**Result**

Experiment 1	Experiment 2	Experiment 3
 <b>Temperature of water</b> warm _____	 <b>Temperature of water</b> _____	 <b>Temperature of water</b> _____
<b>Description</b> _____ _____	<b>Description</b> _____ _____	<b>Description</b> _____ _____

**Conclusion**

The hypothesis was: \_\_\_\_\_  
 \_\_\_\_\_

My experiment \_\_\_\_\_ the hypothesis.  
 supported/did not support