Life Systems

Structures and Mechanisms

Matter and Energy

Earth and Space Systems

CURRICULUM OVERVIEW

Grade 4

Habitats and Communities
exploring how animals adapt for survival and how plants, animals, and human activities impact the environment

Pulleys and Gears
exploring how pulleys, gears, and screws make work easier, and how their different arrangements serve different purposes

Light and Sound
exploring the different properties of light and sound, such as reflection and absorption, and how they travel through different media

Rocks and Minerals
exploring the rock cycle, mineral and fossil formation, and how salt impacts the environment

Grade 5

Human Organ Systems
exploring the functions of different organ systems in the human body and how they work

Forces Acting on Structures and Mechanisms
exploring how force and distance relate, and how different designs affect the strength and stability of structures

Properties of and Changes in Matter
exploring the properties of different states of matter and the differences between physical and chemical changes

Conservation of Energy and Resources
exploring the different properties of energy and how different forms of energy can be used

Grade 6

Biodiversity
exploring ecosystems, and how plants and animals interact and depend on each other

Flight
exploring the properties of air and how flight is made possible through different forces

Electricity and Electrical Devices
exploring the properties of electricity, the components in a circuit, and how batteries and generators work

Space
exploring how Earth's rotation relates to daily cycles, the phases of the moon, and the concept of orbit and weightlessness

Contents

Understanding Life Systems

In this strand, students will learn about the living world around them. They will explore topics such as plant and animal interaction in communities, the human body and its major organ systems, and the importance of biodiversity.

Understanding Structures and Mechanisms

In this strand, students will learn about the material and mechanical world around them. They will explore topics such as pulley and gear systems, internal and external forces at work in structures and mechanisms, and flight and how it is achieved.

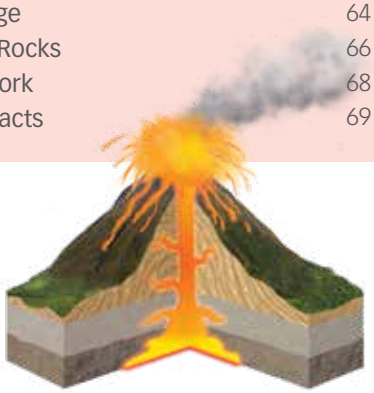
Understanding Matter and Energy

In this strand, students will explore the unseen elements and forces at work in life. They will explore topics such as the properties of light and sound, the different states of matter and changes in matter, and electricity and its various properties.

Understanding Earth and Space Systems

In this strand, students will explore the world and the factors involved at a macroscopic level. They will explore topics such as rocks and minerals, the properties of energy and its various forms, and space and the movement of celestial bodies.

Grade 4



Grade 5

A Understanding Life Systems
Human Organ Systems

B Understanding Structures and Mechanisms
Forces Acting on Structures and Mechanisms

C Understanding Matter and Energy
Properties of and Changes in Matter

D Understanding Earth and Space Systems
Conservation of Energy and Resources

Grade 6

A Understanding Life Systems
Biodiversity

B Understanding Structures and Mechanisms
Flight

C Understanding Matter and Energy
Electricity and Electrical Devices

D Understanding Earth and Space Systems
Space

TEETH ON GEARS

understanding how gears work

Gears are everywhere. We find them in clocks, on bicycles, in cars, and in many machines. They are usually circular and have teeth all around them. Gears are awesome tools that transfer motion.

Difficulty:

Time needed:
1 hour

In this experiment, you will build your own gears and see how they work.

What you need:


thick cardboard


glue


scissors


2 pins


a pencil


2 plastic lids

Go to www.popularbook.ca/downloadcentre to print out an observation chart.

What to do:

1

Cut two thin and long strips of cardboard.

2

Peel off one side of each strip carefully to avoid breaking the "zigzag" structure.

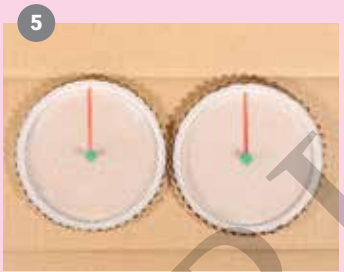
3

Glue the flat side of the strips to the plastic lids to make two "gears".

4

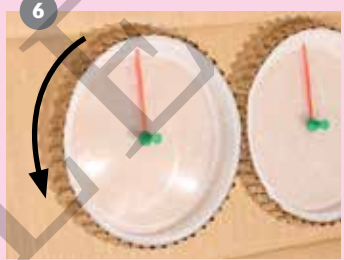
Pin the centres of the lids with the pins to the cardboard.

5



Draw a line on each lid and position it vertically.

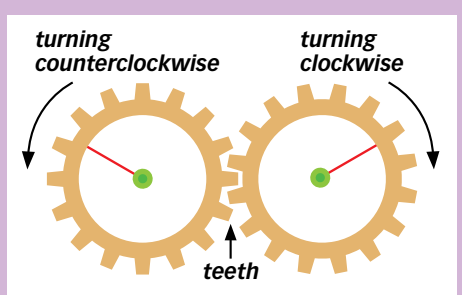
6



Print out the chart online. Turn the gears as instructed and record your observations.

WHAT just happened?

In the experiment, when you turned one gear, the other gear turned too. This happened because the teeth of the gears were in contact. So when one gear turned, its teeth caused the other gear to turn with it but in the opposite direction. It means that when one gear turns clockwise, the other will turn counterclockwise. Gears can work together to change the direction of motion.



Go to www.popularbook.ca/downloadcentre to learn more about gears.

Fun to know

Gear Train

A gear train is a sequence of two or more gears. Each gear in a train causes the next gear to move in the opposite direction. For this reason, it is common to use an odd number of gears in a gear train because the motions can be transferred in the same direction.

The first and the last gears in this gear train will always rotate in the same direction.

DEEP BREATHING

how our lungs work

Breathing air is necessary for keeping us alive. Taking deep breaths of fresh air benefits us in many ways, such as sharpening our mind, improving our blood pressure, and increasing our energy level. Now put your hand on your chest and take a deep breath. Can you feel something moving inside? What is happening inside us that enables us to breathe?

What to do:

Make a hole in the bottle cap using a hammer and a nail to fit the straw.

Cut and make a small hole at the bendy part of the straw. Insert a short straw to make a "Y" shape. Use the glue gun to seal any gaps.

Wrap the balloons tightly to the straws and glue them in place.

Cut off the bottom of the plastic bottle.

Tie a knot at the balloon opening. Cut off the bottom part of the balloon. Then stretch the balloon over the bottle and secure it with tape.

Push and pull the knot of the balloon. What do you see?

Go to www.popularbook.ca/downloadcentre for more detailed instructions.

What you need:

- 3 balloons
- a plastic bottle
- tape
- 2 bendy straws
- a nail
- a hammer
- scissors
- a glue gun

Difficulty:

Time needed: 50 minutes

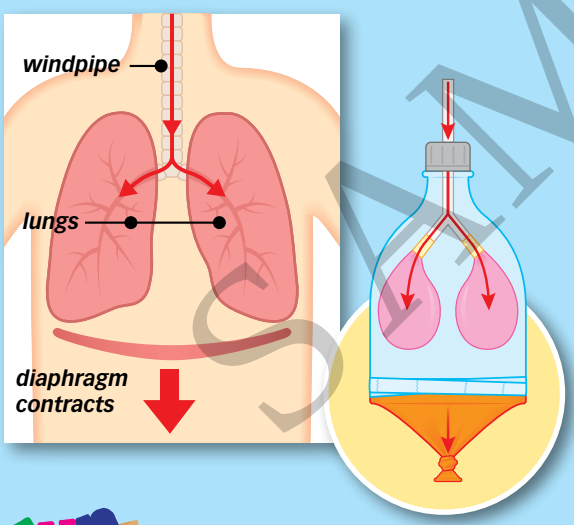
In this experiment, you will learn how human lungs work and how they help us breathe.

WHAT just happened?

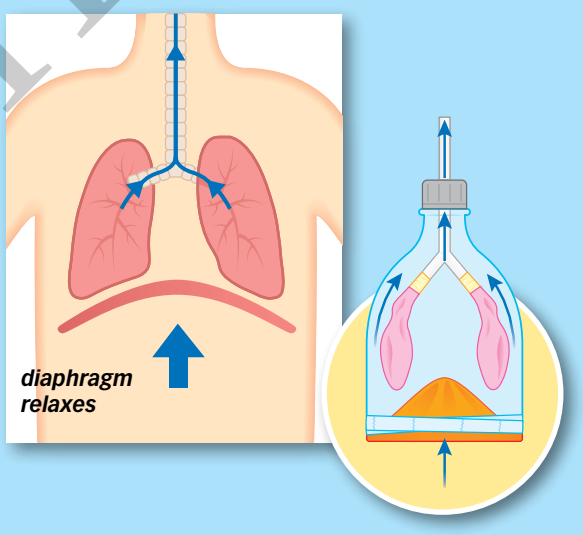
What you have just created is a model of the organs responsible for breathing – the windpipe (the vertical straw), the lungs (the two balloons attached to the straws), and the diaphragm (the balloon at the bottom of the bottle). When you pulled the balloon down, the space inside the bottle got bigger; therefore, air was pulled through the vertical straw and the balloons were inflated. This shows you how your lungs work when you breathe in – the diaphragm goes down and air is pulled into your lungs.

The opposite happened when you pushed the balloon inward. The space inside the bottle got smaller; therefore, air was pushed out from the balloons. This is what happens when you breathe out – the diaphragm goes up and air is pushed out from your lungs.

breathing in



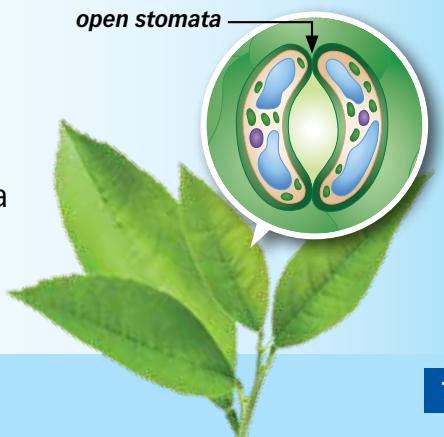
breathing out



Fun to know

Do Plants Breathe?

All plants and animals need air to survive, but plants do not breathe the same way as animals do. Most plants have many tiny openings called stomata on their leaves. Stomata open and close regularly to make sure the plants have enough air they need to stay healthy.



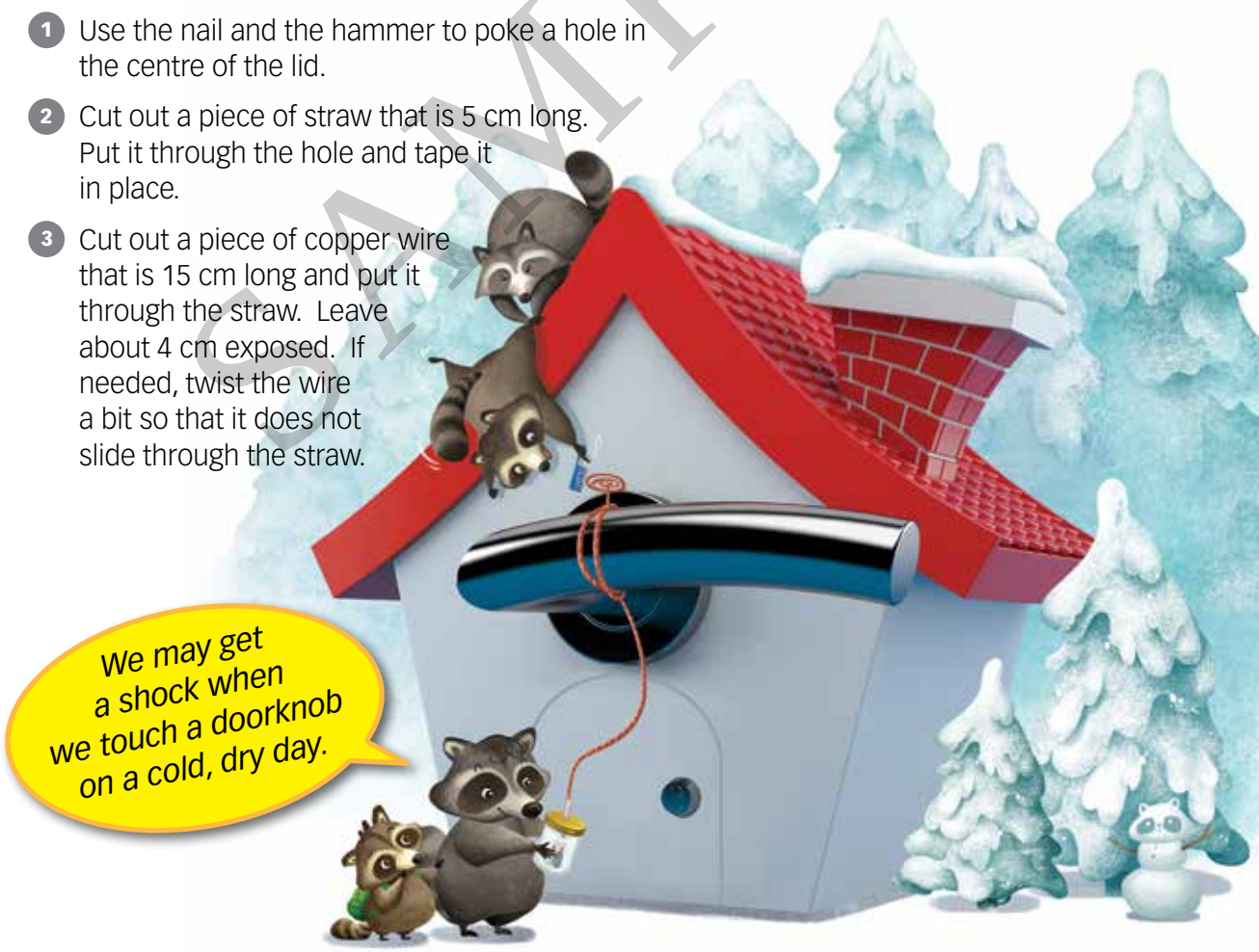
Have you ever been zapped when you touched a metal doorknob on a cold, dry day? Do you know why? It was due to static electricity. The buildup of negative charges jumped from your hand to the doorknob, so it gave you a little shock. Since no one likes being shocked or zapped, are there ways to detect static electricity so that we can "see" its presence?

A STATIC DETECTOR

building an electroscope to detect static electricity

What to do:

1. Use the nail and the hammer to poke a hole in the centre of the lid.
2. Cut out a piece of straw that is 5 cm long. Put it through the hole and tape it in place.
3. Cut out a piece of copper wire that is 15 cm long and put it through the straw. Leave about 4 cm exposed. If needed, twist the wire a bit so that it does not slide through the straw.



What you need:

- a clear jar with a lid
- aluminum foil
- a plastic comb
- copper wire
- tape
- a hammer
- a straw
- a nail
- scissors

Difficulty:

Time needed:
1 hour

In this experiment, you will build an electroscope to detect the presence of static electricity.

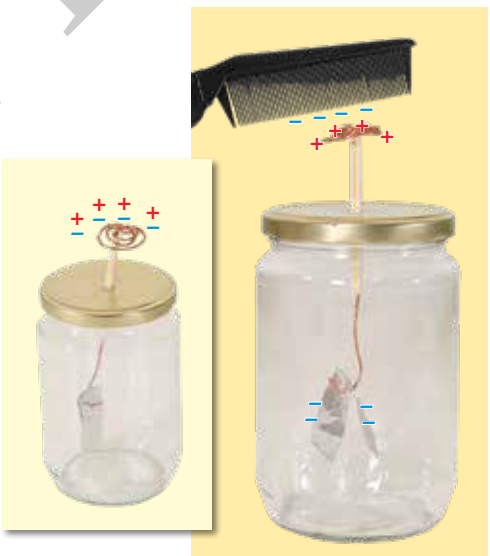
an electroscope

4. Curl the wire outside the straw into a spiral to create a flat surface. Bend the other end of the wire to make a hook.
5. Cut out two pieces of 4-cm-by-2-cm aluminum foil. Poke a small hole into each. Hook them to the wire.
6. Secure the lid to complete your electroscope.
7. Brush your hair with the plastic comb. Place it near the spiral but do not let the comb touch it. Observe what happens to the pieces of aluminum foil.

WHAT *just* happened?

You should have noticed that the pieces of foil moved apart and formed a "V" shape. This is because of the presence of static electricity! Brushing the comb through your hair caused negative charges to build up on the comb. When the comb was close to the spiral coil, the negative charges on the comb repelled and pushed the negative charges on the spiral coil down to the pieces of foil. Once they took the negative charges, they repelled each other and formed a "V".

The "V" formation in the electroscope is an indication of the presence of static electricity on the tested object!



Fun to know

Antistatic Gloves

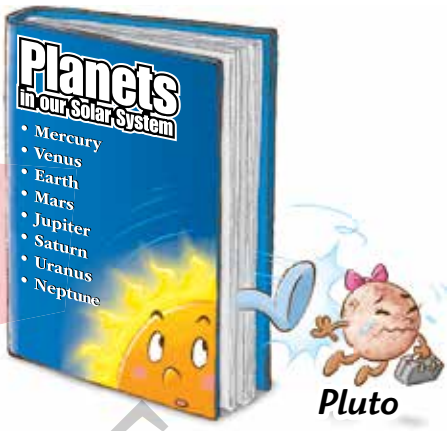
Other than being an unpleasant surprise, static electricity does not bother us very much. However, protection against static electricity is important when handling sensitive and fragile electronics. Antistatic gloves, wrist straps, shoes, bags, and coatings all help prevent static electricity from damaging electronics when being handled.

The Astronaut

Are you curious about what it is like to work and live in space? You would have the chance to travel to space and experience working and living in space if you become an astronaut.

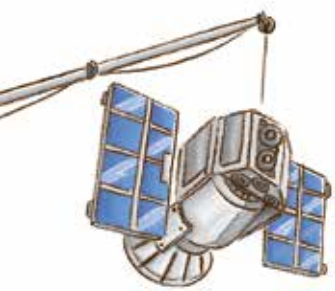
Astronauts are specially trained to explore space. They can be scientists, teachers, doctors, or pilots. Before they can fly in space, astronauts have to undergo hundreds of hours of training. They learn about space technology and science, and basic medical skills. They also learn about the special tasks they have to perform in their missions. They have to be familiar with the state of weightlessness, too.

Roberta Bondar, a medical doctor by profession, is the first Canadian woman astronaut. In 1992, she flew on a space mission aboard the Space Shuttle Discovery and performed experiments in life and material sciences in space. Bob Thirsk, another Canadian astronaut, lived and worked on the International Space Station for six months with five other astronauts. He was the crew's medical officer and robotics specialist. In his mission, he performed scientific experiments and maintained and repaired the station.



1 Why is Pluto no longer considered a planet in our solar system?

2 A footprint that you make on a beach may last for a while. Astronauts made footprints on the moon too. How long did theirs last?

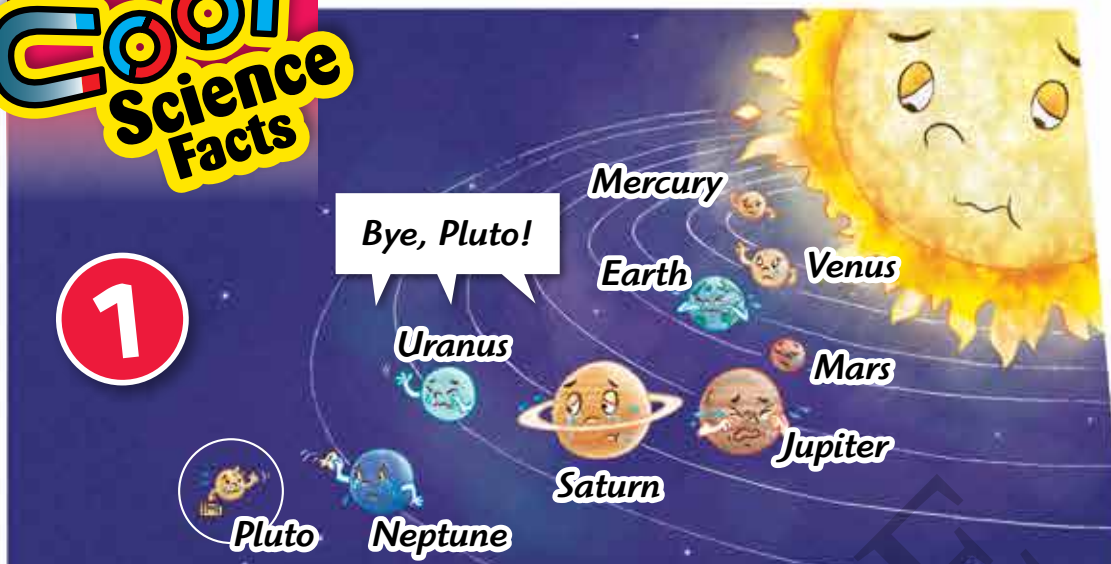


3 Why is it better to have tortillas instead of bread for a meal in space?

4 All satellites in the Earth's orbit fall toward the Earth continuously, but they never hit the Earth. Why?

5 Why can't we fly into space on an airplane? Why do we need rockets to get to space?

Find the answers on the following pages.



1

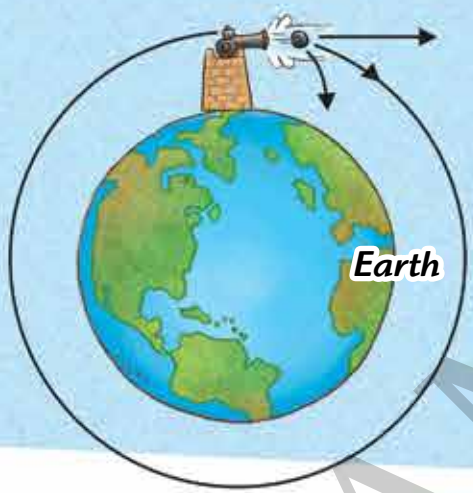
Pluto had been considered a planet in our solar system for more than 75 years before it was declared not a planet in 2006 by the International Astronomical Union. It was reclassified as a dwarf planet because of its small size, its irregular orbit around the sun, and the fact that there were other small celestial bodies near it.

2

Since there is no wind on the moon, the footprints left by astronauts may last millions of years.

3

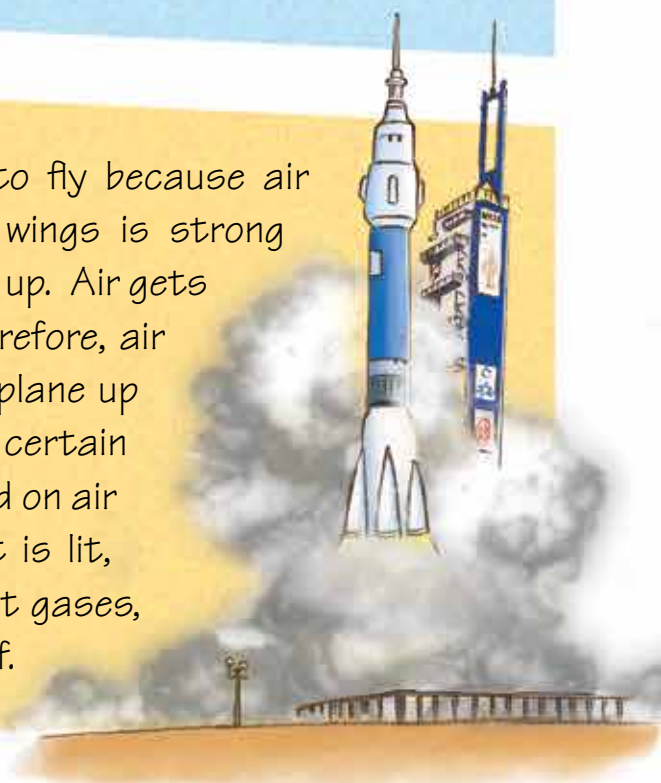
Certain foods work better in a weightless environment than others. Tortillas are better than bread because they take up less space for the same amount of food value and will not crumble. Crumbs floating around may get into electronic equipment or astronauts' eyes.



4 The gravitational force attracts us toward the centre of the Earth, so no matter where we stand on Earth, we do not fall into space.

Imagine there is a cannon firing a cannonball like in the diagram. If the speed of the cannonball is too low, it will crash into the Earth due to the strong gravitational pull. If the speed is too high, the cannonball will escape the gravitational attraction of the Earth. With the right speed, the cannonball will continuously fall toward the Earth, but never hit it. All satellites stay in the Earth's orbit in the same way.

5 Airplanes are able to fly because air moving under their wings is strong enough to hold them up. Air gets thinner at high altitudes. Therefore, air is no longer able to hold an airplane up when the plane goes beyond a certain altitude. Rockets do not depend on air to lift them up. When a rocket is lit, it produces large amounts of hot gases, which force the rocket to blast off.



Turtles have been on the Earth for more than 200 million years. They evolved before mammals, birds, crocodiles, snakes, and even lizards. Several species of turtles, including the American Box Turtle, can live to be over a hundred years of age.

Reptiles

There are four kinds of reptiles: snakes and lizards, the crocodile family, tortoises and turtles, and the tuatara.

- cold-blooded
- have scales
- have dry skin
- usually lay eggs, sometimes give birth to live young

Fun and Useful Facts

CLASSIFICATION OF VERTEBRATES

Animals belong to the animal kingdom. Scientists divide animals into two groups – vertebrates and invertebrates. Vertebrates are animals with backbones. They are grouped into five classes based on their skin covering, how they maintain body temperature, and the characteristics of their limbs.

Mammals

- warm-blooded
- give birth to live young
- have hair or fur
- mothers nurse their young with milk

There are about 4500 different kinds of mammals. Most have babies that grow inside a mother's body. Bats are the only flying mammals.

Giant Pandas are on the vulnerable species list. The Chinese government has taken steps to protect these cute and adorable animals.

Birds

- warm-blooded
- lay eggs
- have feathers and wings

There are more than 9000 kinds of birds. The largest groups are the passerines, or perching or song birds, like the robin. Hummingbirds are the only birds that are able to fly backward.

Fish

- cold-blooded
- covered with scales
- have fins
- lay many eggs
- breathe underwater using gills

There are more than 20 000 kinds of fish in the world. The earliest fossils of fish date back over 400 million years.

Many shark species are endangered. Fortunately, the Shark Foundation actively protects and researches endangered shark species and preserves their natural habitats.

Amphibians

- cold-blooded
- have moist, smooth skin
- have webbed feet
- live on land and in water
- lay eggs

There are three types of amphibians: frogs and toads, newts and salamanders, and caecilians. There are more than 4000 kinds of amphibians. Most amphibians change their appearance completely as they grow. This is called metamorphosis.