Science.gc.ca Activity Book 5

Canada

Welcome to the FIFTH edition of the Science.gc.ca Activity Book!

Science is all around us and can be discovered, explored and used in so many ways!

This new Activity Book showcases the diversity of the world of science through activities in health, biology, environment, agriculture, meteorology, astronomy, engineering, the living world and much more!

Science.gc.ca is the official Government of Canada website for Science and Technology (S&T) information and resources. We have put together this Activity Book to stir your inner scientist. Whether you are in elementary, intermediate or secondary school there are activities for all ages and skill levels. These activities can be done individually or with friends in class, at camp, at home or with your Girl Guides of Canada or Scout Canada clubs.

If you would like to learn how to *make invisible ink*, *build a mechanically powered launcher* or even find out our *mystery phrase*, you'll find it all inside this Activity Book! For more activities, you can visit Science.gc.ca and download our previous Activity Books. While you are there, don't forget to check out *Videos*, *Games* and *Educational Resources* for more science and technology experiments, activities and facts. You can even submit a question to "Ask a Scientist".

Science.gc.ca challenges you to go out, explore and look for science everywhere you go.

We would like to thank our funding partners for their ongoing participation and support:

- Aboriginal Affairs and Northern Development Canada
- Agriculture and Agri-Food Canada
- Canadian Food Inspection Agency
- Canadian Space Agency
- Defence Research and Development Canada
- Environment Canada
- Fisheries and Oceans Canada
- Foreign Affairs and International Trade
- Health Canada
- National Research Council
- Natural Resources Canada
- Natural Sciences and Engineering Research Council
- Public Health Agency

Go ahead, get started; discover and explore the fascinating world of science!

Sincerely,
The Science.gc.ca Team

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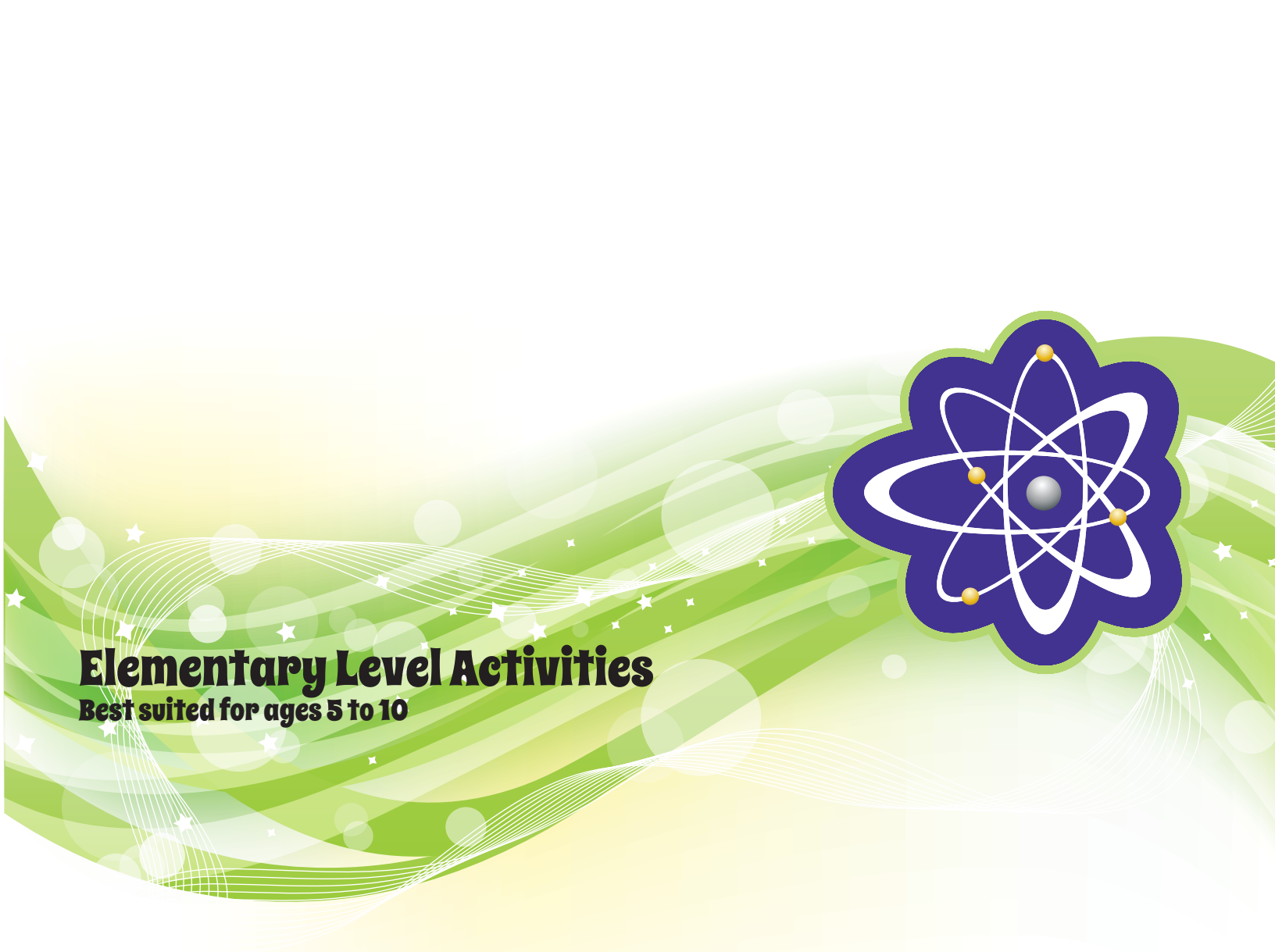


Elementary Level Activities

Best suited for ages 5 to 10

1 Find the hazards

Circle **10** safety hazards and write them down

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

2 Build a windmill

A fan uses electricity to produce wind, but a wind turbine uses the wind to produce electricity. As long as the wind continues to blow, wind energy can be produced.

Materials

- 20-centimetre square of paper
- Plasticine
- sharp pencils, rulers and scissors
- paper fasteners
- beads (with centre holes wide enough to slide onto the paper fastener)
- drinking straws

Generate your own wind power!

It's easy. Just follow these steps:

1. Fold your paper in half diagonally. Press along the crease. Unfold it. Fold it across the other diagonal and press along the crease. Flatten it out again.

2. From the centre where the creases meet, measure 4 centimetres (cm) along each crease line and make a dot with your pencil. Cut from the outside corner along the crease to the dot. Don't cut all the way to the middle.

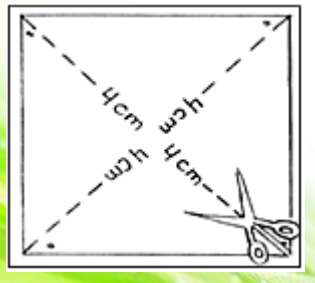
3. Roll some plasticine into a ball. Place it under the centre spot of your paper. Use a sharp pencil to make a small hole in the centre of your paper. Using the plasticine again, make a hole on the left side of each corner so you have five small holes.

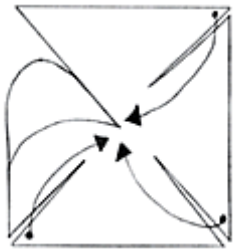
4. Fold each corner toward the centre so the holes line up with the hole in the middle. Push a paper fastener through all five holes.

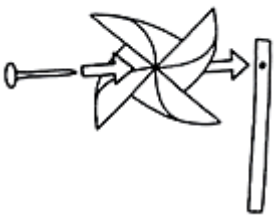
5. Thread a bead onto the back of the paper fastener. This will make it spin better.

6. Measure down 2 cm from the top of your straw. Make a small hole through both sides of the straw with a sharp pencil.

7. Push the paper fastener through the holes and fold the ends back to hold your windmill together.







3 Word Search

Find these **hidden words** related to indoor air pollutants! The words could be up, down, left or right so look carefully! Then use the leftover words to spell out the secret.

G	N	I	H	G	U	O	C	B	R	G		
	I	R	R	I	T	A	T	I	O	N		
	T	S	N	E	L	L	O	P	T	I	S	V	H
F	R	E	S	H	A	I	R	E	O	H	E	E	T
	O	T	T	E	M	O	H	T	B	T	U	N	L
	G	I	O	A	M	H	T	S	A	A	C	T	A
A	E	M	V	G	O	M	S	U	C	E	E	I	E
S	N	E	E	Z	I	N	G	D	C	R	B	L	H
E	D	I	X	O	N	O	M	N	O	B	R	A	C
T	I	N	D	O	O	R	A	I	R	H	A	T	E
	O	G	N	I	Z	E	E	H	W	E	B	I	
	X	N	O	I	T	U	L	L	O	P	A	O	
	I	S	C	O	M	B	U	S	T	I	O	N	
	D	L	U	O	M	E	K	O	M	S	Y		
	E												

Secret: _ _ _ _ _ _ _ _ _ _ _ _

ASTHMA
BARBECUES
BREATHING
CARBON MONOXIDE
COMBUSION
COUGHING
DUST
FRESH AIR
HEALTH
HOME
INDOOR AIR
IRRITATION
MITES
MOULD
NITROGEN DIOXIDE
POLLEN
POLLUTION
SMOG
SMOKE
SNEEZING
STOVE
TOBACCO
VENTILATION
WHEEZING

4 Mystery Phrase

Everywhere the sun shines, there is solar energy. We take advantage of this energy in simple ways – by opening the curtains in winter to help heat the air or by filling our pool before we want to swim so the water has a chance to warm up.

Scientists rely on all their creative powers to come up with ways to capture and use the sun's power.

Now it's your turn to solve a mystery! Use the following table – each symbol represents two letters. Use the following codes to find the mystery phrase.

_ _ _ _ _   _ _ _ _ _ _   _ _   _ _ _ _,
^ @ : ! %   % ! % % & :   ? ^   ^ % % %

_ _ _ _ _   _ _ _   _ _ _ _ _ _ _ _ _ !
: % ! !   ! ! $ % % ! %< ! @ : %

Legend

!	A	N
@	B	O
#	C	P
$	D	Q
%	E	R
^	F	S
&	G	T
0	H	U
?	I	V
<	J	W
>	K	X
:	L	Y
[	M	Z

5 A Certain Something in the Air

The atmosphere plays an important role in how our planet functions. It protects us from the sun's rays and regulates our climate, making our survival possible.

Go for a walk outside.

Describe the odours you can smell in the air:

■ Fruity? ■ Floral? ■ Diesel? ■ Other: _____

What direction is the wind blowing from? _____

What did you do to find out?

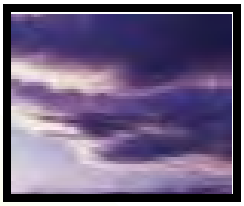
_____

_____

See any clouds in the sky? How are they shaped and what does their shape tell you?

_____

_____

	**Cirrus**	Located high in the sky, cirrus clouds sometimes indicate that rain is coming.
	**Cumulus**	Located low in the sky, these clouds often appear in good weather. In the hot, humid days of summer, they can transform into cumulonimbus clouds.
	**Stratus**	Usually sitting fairly low in the sky, stratus clouds often cause "grey" days and can herald storms or drizzle.
	**Cumulonimbus**	These are large grey clouds, taller than they are wide; in summer, they are a sign of stormy weather.

6 Make invisible ink

Invisible ink is used to write messages that are **undetectable** to the naked eye. Discover your inner “secret agent” by creating and revealing your own hidden messages in this fun and simple chemistry experiment.

Materials

- Baking soda
- Water
- Bowl
- Spoon
- Toothpick, cotton swab, paintbrush or other tool for writing
- White paper
- Purple grape juice

Instructions

1. Add equal parts baking soda and water to bowl; stir with spoon. Make sure the baking soda dissolves well so as not to be too powdery.
2. Dip toothpick, cotton swab or other writing tool into the “ink”; write a message on the paper.
3. Allow the ink to dry completely until it is invisible.
4. Paint over the paper with purple grape juice to reveal your message.

What just happened?

This is a classic example of an acid-base chemical reaction. The acid in the grape juice is neutralized by the baking soda (the base), producing a colour change on the paper to reveal your message.

7 Growing sugar crystals

Crystals form in different manners. Snow crystals grow directly from moist air — i.e. from water vapour. Growing other crystals from liquid solutions is easy to do with your children or students.

Materials

- 250 ml Distilled water (with no impurities)
- 375 – 500 ml White, granulated sugar
- 1 Paper clip
- 1 Popsicle stick
- String
- 1 Tall, thin glass jar
- Small saucepan
- Food colouring (optional)

Instructions

1. Pour the water into a saucepan and carefully bring to a boil. Remove it from the stove.
2. Gradually stir the sugar into the hot water, a spoonful at a time, stirring after each spoonful to dissolve. Keep adding sugar to hot water until no more will dissolve (you have made a “supersaturated” solution).
3. Pour your solution into the tall, thin jar.
4. Cut a piece of string that is about two mm shorter than the height of the jar. Tie one end to the centre of the Popsicle stick and attach a paper clip to the other end.
5. Rub a few grains of sugar along the string.
6. Slowly lower the string into the solution, making sure that the paper clip does not touch the bottom of the jar. Rest the popsicle stick across the rim of the jar.
7. Let the solution cool and allow it to rest for about five days.

What happens?

Sugar crystals should start to grow along the string after several days. The grains of sugar on the string act as the seeds on which crystals dissolved in the water are deposited. The longer the solution remains undisturbed, the larger the crystals grow. If you add food colouring when you prepare the solution, then the sugar crystals will be lightly coloured.

8 Wash your hands

Always wash your hands before eating, before helping to prepare food, or setting the table. Washing your hands gets rid of bacteria that could make you sick. Wash your hands with soap and warm water for 20 seconds (sing the Happy Birthday song twice).

"Recipe" for washing hands. Put these steps in the correct order.

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

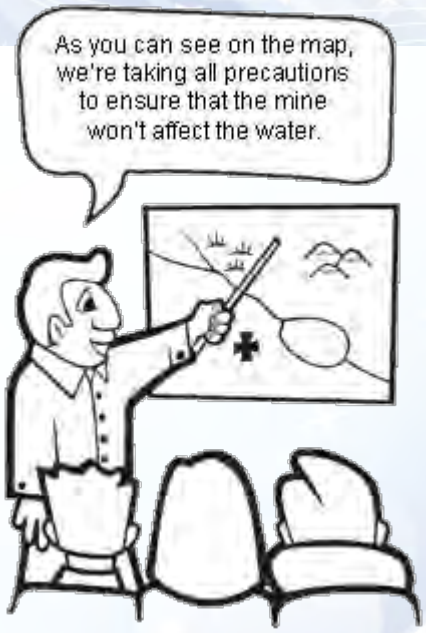
9 Environmental Review

The environment is how plants, animals and humans interact with the land, air, and water around us. How we act and what we do can affect the environment. Everything works together. The Mining Company is looking at opening a mine near Grandfather's summer camp. Join Johnny and Lisa as they follow Grandfather through the environmental review process.


This is a chance for us to get involved in the process. We can make sure that things are done to the land in a responsible and respectful way.

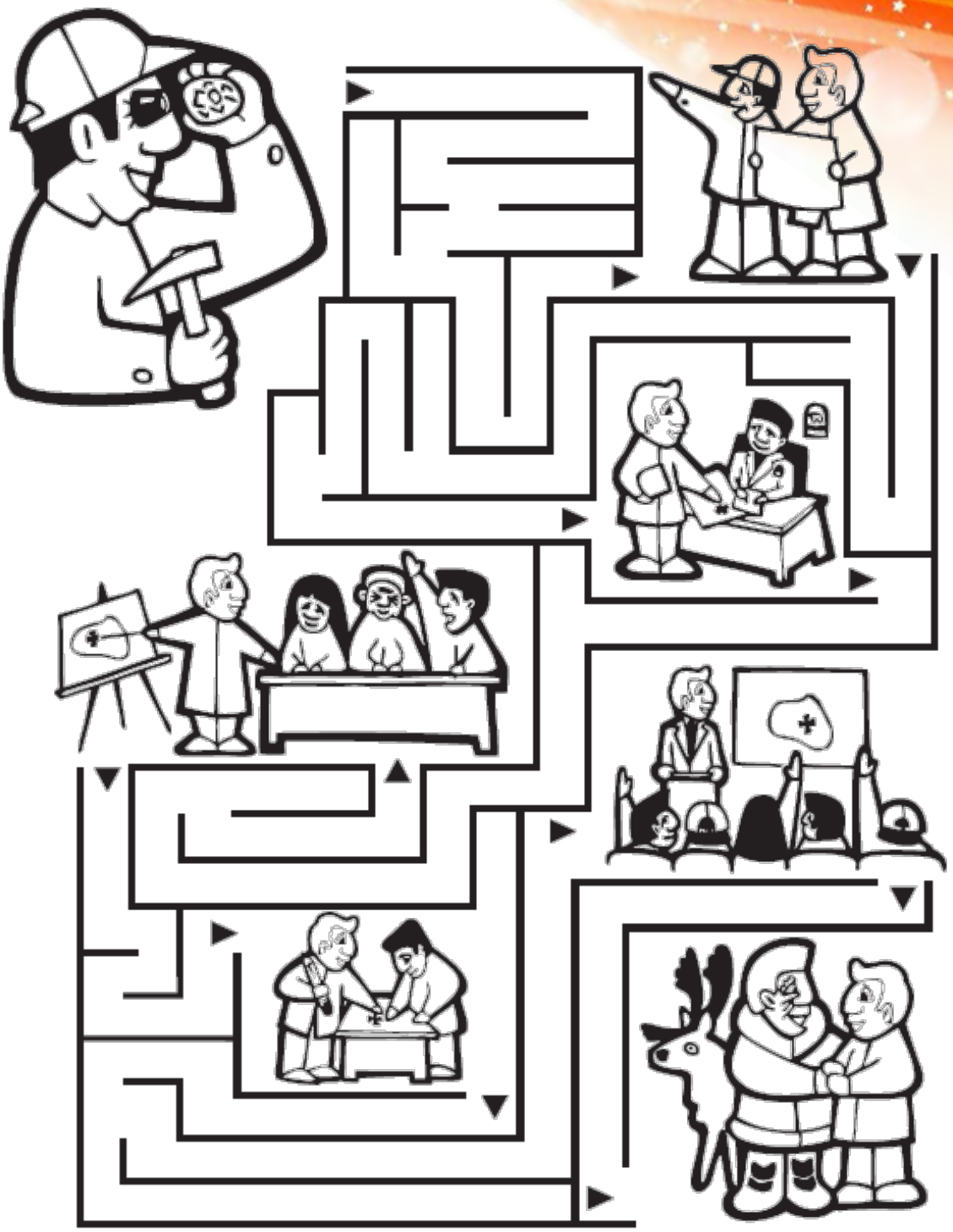

Grandfather, who are all those people?
Nunavummiut sit on an advisory board. It is their job to make sure that all our concerns are heard and that the land and people are respected.


The proposed site for the mine is near where we fish for char. How can we control the mine's impact on fish?


As you can see on the map, we're taking all precautions to ensure that the mine won't affect the water.


Now that the meeting is over, what happens next?
The board and The Mining Company will review all the concerns brought forward and send them to the Minister of Aboriginal Affairs and Northern Development. If all goes well, a mine could be opened in a few years.

Solve the maze.



Nunavut is a special place.
The environment here is what makes us who we are.
We must remember to treat the land with respect.
The land is ours to use wisely.

10 What's happening?

First Nations people were acutely aware that nature's life cycles must adjust to many variables. In this activity, students will have an opportunity to observe changes in nature by examining a portion of their playground. It will allow students to draw conclusions about the seasonal change in a habitat over a period of time.

The following **materials** will be needed:

- camera
- fencing/rope
- waterproof sign (laminated cardboard or wood and paint)
- rain gauge

Preparation:

Get permission from the school to fence off a small grassy or wooded area in the playground (approximately 10 square metres) for an entire school year. This may be done by the students. Assist the children in preparing a sign that says "PLEASE DO NOT DISTURB. SCIENTIFIC EXPERIMENT IN PROGRESS. DO NOT WATER, MOW OR FERTILIZE THIS AREA."

Method:

Designate a day and time each week to collect data. Depending on how sophisticated you wish to make the activity, students may record the following:

- a photograph of the plot, taken from the same place. Date each picture, so that changes can be seen over time.
- temperature and other weather conditions
- amount of water in the rain gauge. This may be done after every rain or snow instead of once a week
- number and kinds of plants and insects in the plot

You might also have the children draw a weekly journal entry. Each drawing should include observations on plant growth, colour changes, and insect and animal activity. At the end of the year, the children can make a display of their charts and photographs to share with other people.

11 Natural dyes

Colours are significant to many First Nations. For example, red, black, yellow and white are the colours of the Medicine Wheel, a vital teaching tool among many First Nations. Many First Nations decorate their clothing, hunting implements and other objects with natural colours through embroidery using dyed moose or caribou hair, beads made from coloured shells or dyed porcupine quills.

Purpose:

This activity will help students understand how some colours are extracted from nature to be used as dyes.

With the following materials, students can create natural dyes in the classroom:

- Spinach or moss – green
- Sunflowers or onion skins – yellow
- Beets and wild berries* – red, purple, blue

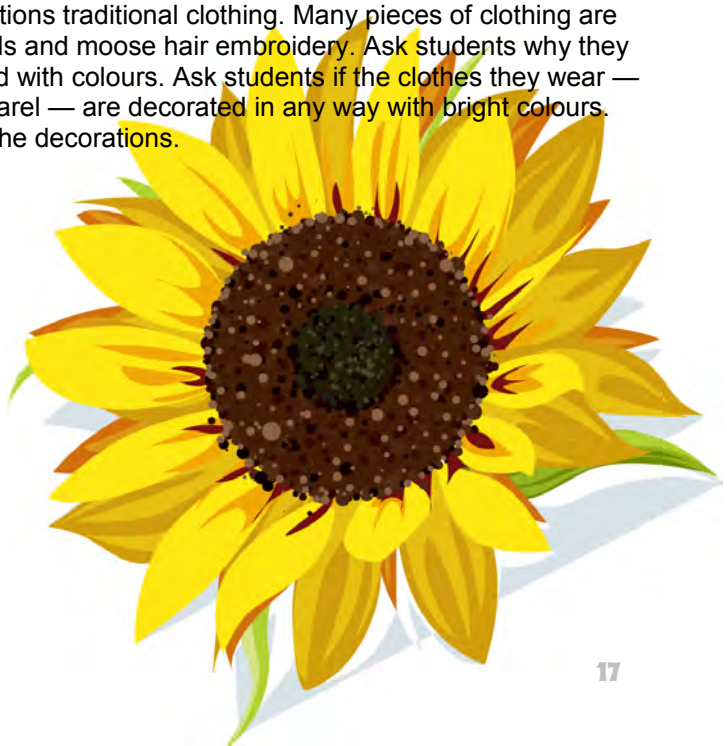
*Wild berries are a good source of colour. Ask the students to bring in a variety of berries such as strawberries, blueberries, cranberries, salmonberries, raspberries, gooseberries, blackberries, thimbleberries, huckleberries, and red and black currants. After pressing the berries, have the students compare the different reds, purples and blues extracted from the various berries.

Method:

Ask students to bring these items to class. Have them soak the items in water and then press them to produce coloured dyes to use in their artwork. Use the resulting dyes to paint on rocks or paper.

Extension:

Show students pictures or illustrations of First Nations traditional clothing. Many pieces of clothing are decorated extensively with brightly coloured beads and moose hair embroidery. Ask students why they think traditional First Nations clothing is decorated with colours. Ask students if the clothes they wear — running shoes, caps, sport jackets and other apparel — are decorated in any way with bright colours. Ask students the importance of these colours to the decorations.



12 Germs Away

Infectious diseases account for millions of lost school days each year. It's not surprising when you think about it because school is all about sharing: desks, books, pens, bathrooms, doorknobs, water fountains, computers and…germs. From colds…to the flu…to skin infections. Students share close contact with other students and teachers all day, every day. Students and staff can bring illnesses home with them and can unknowingly infect family members. **Clean hands are critical**. One of the most common ways people catch colds is by rubbing their nose or eyes after touching someone or something that is contaminated with the cold or rhinovirus virus.

Here are some great tips to keep the germs away!

Cover your mouth and nose with a tissue when you cough or sneeze.

Cough or sneeze into your upper sleeve, not your hands.

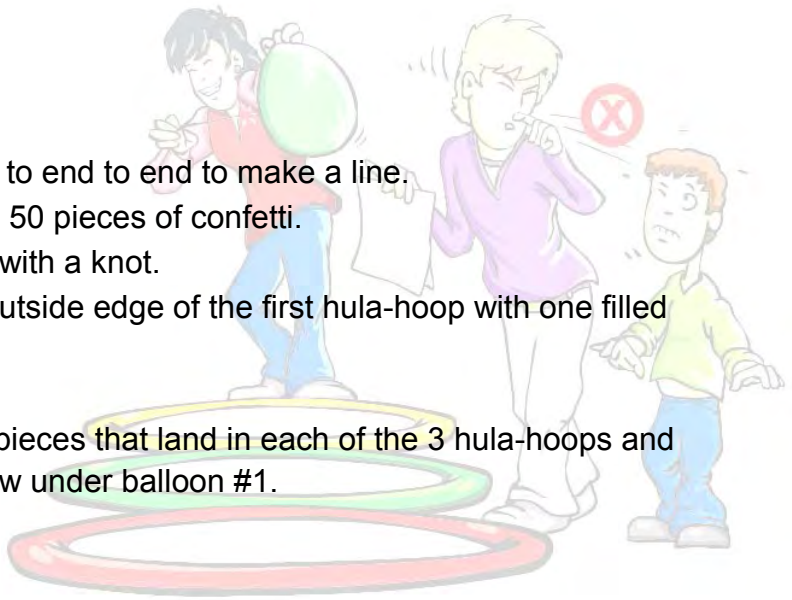
Put your used tissue into the wastebasket.

We've shown you **HOW** to cover a cough or sneeze. But should you cover your cough? Let's do an experiment to find out **WHY!**

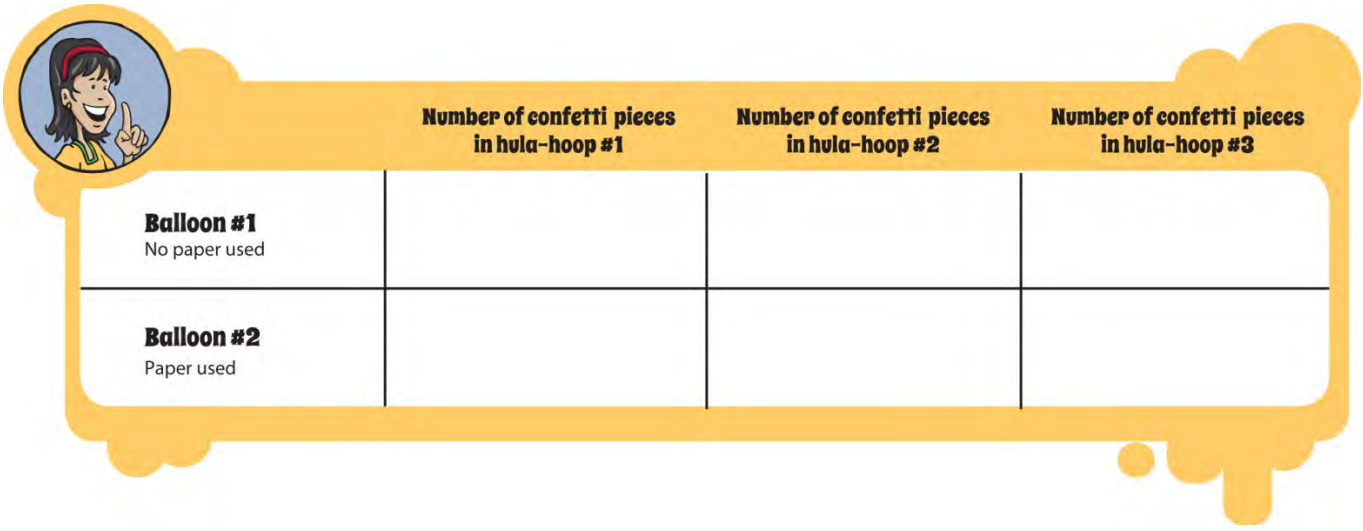
What you will need:

- Three hula-hoops
- Two round balloons
- 100 pieces of confetti split into two piles of 50 pieces (idea: use a hole puncher)
- One tack
- One piece of 8" X 11" paper
- One broom and dustpan

What to do:



1. Lay the three hula-hoops end to end to end to make a line.
2. Fill each deflated balloon with 50 pieces of confetti.
3. Blow up each balloon and tie with a knot.
4. Have someone stand at the outside edge of the first hula-hoop with one filled balloon in hand.
5. Pop the balloon with the tack.
6. Count the number of confetti pieces that land in each of the 3 hula-hoops and record them on the chart below under balloon #1.
7. Sweep up the confetti.
8. Repeat numbers 1 through 4.
9. Have someone hold the piece of paper in front of the second filled balloon so the paper is between the balloon and the hula hoops
10. Pop the balloon with the tack.
11. Count the number of confetti pieces that land in each of the 3 hula-hoops and mark it down in the chart below under balloon #2.
12. Sweep up the confetti.



	Number of confetti pieces in hula-hoop #1	Number of confetti pieces in hula-hoop #2	Number of confetti pieces in hula-hoop #3
Balloon #1 No paper used			
Balloon #2 Paper used			

What does it mean?

Imagine each piece of confetti is a germ. See how easily it spreads? Imagine the piece of paper is a tissue, or your sleeve. How did the “germs” spread differently?

What other ways can you reduce the spread of…**GERMS?**

Intermediate Level Activities

Best suited for ages 11 to 15

1 Climate Change errors

Read the following sentences about climate change. Circle the word that is misspelled in each sentence and write it correctly in the space provided.

1. When we produce energy from fossil fuels, we release greenhouse gases (GHGs) into the atmossfere.

_____

2. All over the world, GHGs are contributing to warming the planet and changing the climeat: rainfalls are heavier, hurricanes are stronger, and we experience more heat waves.

_____

3. Canada is so big that climate changes are different depanding on where we live.

_____

4. The northern see ice where polar bears live and hunt is shrinking because of climate change.

_____

5. When stuff - food, clothes and toys - travvels a long way to get to us, a lot of GHGs are created because of the fuel and emissions from transportation.

_____

6. When we use our own energy - like riding our bikes to school - we help the enviromnent.

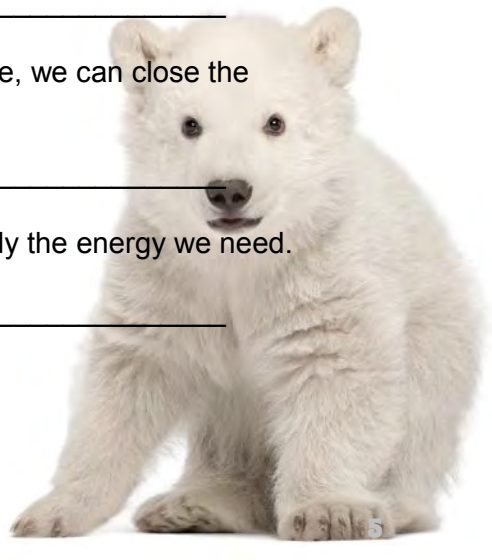
_____

7. We can use less energy in the summer too - for example, we can close the curtains instead of using the air condichener.

_____

8. We can all be climate change champeons - by using only the energy we need.

_____



2 Unscramble the words

1. CIACEMHLS

Clue: All household products are made of these

2. TOCXI

Clue: A term used to identify chemicals that are harmful to your health

3. CRORVOSIE

Clue: this means the contents of the container will burn skin or eyes

4. PSNOIO

Clue: This means not to swallow, touch or inhale

5. FEMLBAMAL

Clue: Keep this container away from heat

6. EVSPIXOEL

Clue: Do not heat or puncture container

7. HURADAOSZ MIAEATLRS

Clue: Are also known as “Dangerous Goods”

8. CNUTOIA

Clue: Temporary injury may occur

9. DEAGRN

Clue: Temporary or permanent injury may occur

10. ETMXREE DGNERA

Clue: Being exposed to even a little may cause injury. Be very careful.

3 Eggsposed to danger

Being a salmon egg is risky business. Some of the conditions that kill salmon eggs are:

1. Pollution
2. Movement
3. Silt clouding the water
4. Extreme temperatures
5. A change in the water level

Hidden in each of these groups of eggs is a situation that may cause one or more of these conditions. To find out what's happening to put these salmon eggs at risk, **decode the message** by crossing out eggs marked J, Q, X, or Z. Then circle the condition (s) (1, 2, 3, 4 and/ or 5) that might be caused by that situation.

Decoded message: _____

This can cause 1 2 3 4 5

Decoded message: _____

This can cause 1 2 3 4 5

Decoded message: _____

This can cause 1 2 3 4 5

Decoded message: _____

This can cause 1 2 3 4 5

Decoded message: _____

This can cause 1 2 3 4 5

4 Environment Quiz

1. **Insects help forest ecosystems by:**

   a) Removing old trees
   b) Recycling nutrients
   c) Providing new habitat and food for wildlife
   d) All of the above

1. **How many species of trees are found in Canada's boreal forest?**

   a) 20
   b) 100
   c) 5
   d) 500

3. **When lobster mushrooms are infected with a certain parasitic fungus, they become so delicious that they are sought after by restaurants.**

   a) True
   b) False

4. **Planting a tree is one of the best things you can do for your local environment and for the planet because:**

   a) They produce oxygen
   b) They remove carbon dioxide and contaminants from the air
   c) They provide habitat for birds and other wildlife
   d) All of the above

5. **To ensure trees are successfully planted:**

   a) Keep spacing between the trees inconsistent
   b) Ensure roots are horizontal
   c) Plant them straight and firmly heeled in

6. **Approximately one quarter of Canada's estimated 140 000 species of plants, animals and micro-organisms are found in the forest.**

   a) True
   b) False

7. **What Canadian service administers a network of protected areas, which protects an estimated 11.8 million hectares of wildlife habitat?**

   a) Migratory Birds Convention Service
   b) Environment Canada's Canadian Wildlife Service
   c) Canadian Service of Ecological Areas

8. **All trees in Canada can be distinguished as:**

   a) Conifer
   b) Deciduous
   c) Sycamore
   d) A and b

9. **Canada's forests are a source of:**

   a) Food
   b) Medicine
   c) Clean air
   d) Water
   e) All of the above

10. **What is the largest forest in Canada?**

    a) The Hudson Bay Lowlands
    b) Great Lakes-St. Lawrence Forest
    c) Boreal Forest
    d) The Deciduous Forest

5 Construct a Mechanically Powered Launcher

The very first reported mineral finds on the surface rocks of Mars were discovered in 2004 by the Mars rovers - Spirit (NASA) and Beagle 2 (ESA). Today, 2050, the first Mars colony has been established. As one of the scientists on the colony, you have discovered new minerals and urgently need to send them back to Earth for analysis. The colony has only limited building materials and recycled items. You must build a mechanically powered launcher (MPL) to send a capsule containing mineral samples into orbit, where an Orbiter will retrieve the capsule to bring it back to Earth.

The capsule must be launched at a precise angle to escape the gravity of Mars, and reach the proper altitude where the Orbiter awaits.

Design Specifications:

- The “capsule” *(standard ping pong ball)* must be launched by the MPL. Make sure you have a device to hold the “capsule” in place.
- Only the materials listed are allowed. Decorations are permitted and encouraged, as long as they do not interfere with the function of the MPL.
- The MPL must fit, completely assembled, into a standard photocopy paper box (432mm x 279mm x 225mm), with the lid on. An oversize MPL will be disqualified.
- All types of launchers are allowed (catapult, trebuchet, slingshot, etc.) but must only be built with the specified materials.
- No modifications are allowed to the payload (ping pong ball).

Materials allowed:

- Paper, cardboard, newspaper
- Popsicle sticks, tongue depressors, toothpicks, skewers, chopsticks, dowels
- String, yarn, rope, fabric
- Glue, play dough, tape
- Wooden pencils
- Plastics, Styrofoam, rubber
- CDs
- Spools (wooden, plastic)
- Bottle caps (plastic)
- Paint, decorations
- Straws, rubber bands
- Paper clips
- Sand and Play-Doh

EXCLUDE:
Glass, metal (except paper clips), mousetraps, lumber/wood (except Popsicle sticks, tongue depressors, toothpicks, skewers, chopsticks, pencils, spools, dowels), construction kits (Lego, Meccano, K’nex, etc.), batteries, and water.

Teams consist of 3 to 5 students with the following responsibilities:

- **Designer:** With input from the other team members, creates the design and obtains authorization from the teacher or volunteer engineer to proceed with construction. Sketches the team’s design drawing.

- **Materials Manager:** Collects and keeps a record of all materials used by the team during construction.
- **Constructor/Builder:** Leads construction of the prototype according to the design drawing plan and includes modifications suggested by team mates.
- **Communication Specialist:** Spokesperson for the team who presents project to others.

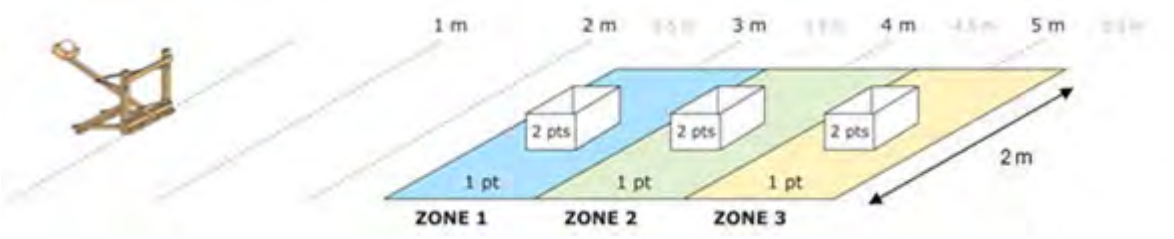
Challenge Construction Tips:

- Accuracy and repeat performance are key to the success of the mission. Find a way to launch your capsule so that you obtain the same results launch after launch.
- Consider the different angles required to hit each target and think of ways to calibrate your MPL so that you can successfully achieve various targets. (Hint: think about how you can use a protractor!) Also consider the ceiling height of your launch area.
- Make sure the MPL is sturdy enough to survive multiple rounds of testing.
- If there are delicate parts on your MPL, make some "spares" that can be easily fitted in case of damage during the competition.

MPL Testing Criteria:

Once construction is completed, teams gather together to test their MPLs against the other teams in the class and/or school. Test your team's MPL and see if you have successfully conquered the Engineering Challenge!

- Teams must attempt to successfully launch their payload and hit targets at 3 different distances – 3m, 4m and 5m. Use standard photocopy paper boxes for targets.
- Create a launch pad area on the floor, to ensure that all MPLs start the same distance from the target zone. No part of the MPL may cross over the launch line.
- Mark off a target zone on the floor with masking tape starting with a line at 2.5 m from the front edge of the launch pad. Add more lines at 3.5 m, 4.5m and 5.5m. This creates 3 "target zones" in which to place your target boxes. Target zone width should measure 2 m, with target box placed in the centre. (See illustration below.)
- Place the first target at 3m, with the centre of the box 3m away from the front edge of the launch pad. Place the second target 4m away and the third target 5m away.
- Each team will have 2 chances to launch their payload into each target. The payload must land directly in the target (no bounces allowed).
- Teams will be awarded 1 point for hitting the target zone, 2 points for landing their payload inside the target box and 0 points for landing outside of the target zone.
- Teams must launch their payload into the 3 successive targets in order, starting with the 3m target.



Judging Criteria:

MPLs will be judged on performance, as well as on the ingenuity of the design and construction.

Performance:

Performance will be determined by tallying total points accumulated during payload launch attempts.

Team Name	***Target 3m***		***Target 4m***		***Target 5m***		**Total points (max 12 pts)**
	Attempt 1	**Attempt 2**	**Attempt 1**	**Attempt 2**	**Attempt 1**	**Attempt 2**	
MPL1	*1pt*	*2pts*	*1pt*	*2pts*	*1pt*	*2pts*	*9*
MPL2	*x*	*2pts*	*1pt*	*2pts*	*1pt*	*1pt*	*7*
MPL3	*2pts*	*x*	*1pt*	*x*	*x*	*2pts*	*5*

Evaluation	**Points**
Innovation/ workmanship: ingenuity, imagination, attention to detail	/10
Presentation by Public Relations person and quality of poster	/5
Total Ingenuity Score	***/* 15**

6 Identify me

Here's a **"salmon speak"** code. Each letter has a matching number. Look for a pattern in the number/letter pairs provided, and complete the code.

Now, using the salmon-speak code, fill in the blanks. When you've finished, the details of my life will reveal which species of salmon I belong to.

a	b	c	d	e	f	g	h	i	j	k	l	m
2		4	3					10	9			
n	**o**	**p**	**q**	**r**	**s**	**t**	**u**	**v**	**w**	**x**	**y**	**z**
		15			20			21	24	23		

I will spend _ _ _ _ _ _ _ _ _ rearing in this _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _.
16 13 6 26 6 2 17 4 16 2 20 19 2 11 20 19 17 6 2 14

During that time I will have to _ _ _ _ for _ _ _ _ and be alert for _ _ _ _ _ _ _ _ _ _!
11 16 16 12 5 16 16 3 15 17 6 3 2 19 16 17 20

While I'm _ _ _ _ _ _ _ _, everything about the _ _ _ _ _ _ – the _ _ _ _ _, the
8 17 16 24 10 13 8 20 19 17 6 2 14 17 16 4 12 20

_ _ _ _ _, the _ _ _ _ _ _ _ _ _ _ _ _ _ _ – will be _ _ _ _ _ _ _ _ _ _ _ _ in my
17 16 16 19 20 16 19 7 6 17 2 13 10 14 2 11 20 10 14 15 17 10 13 19 6 3

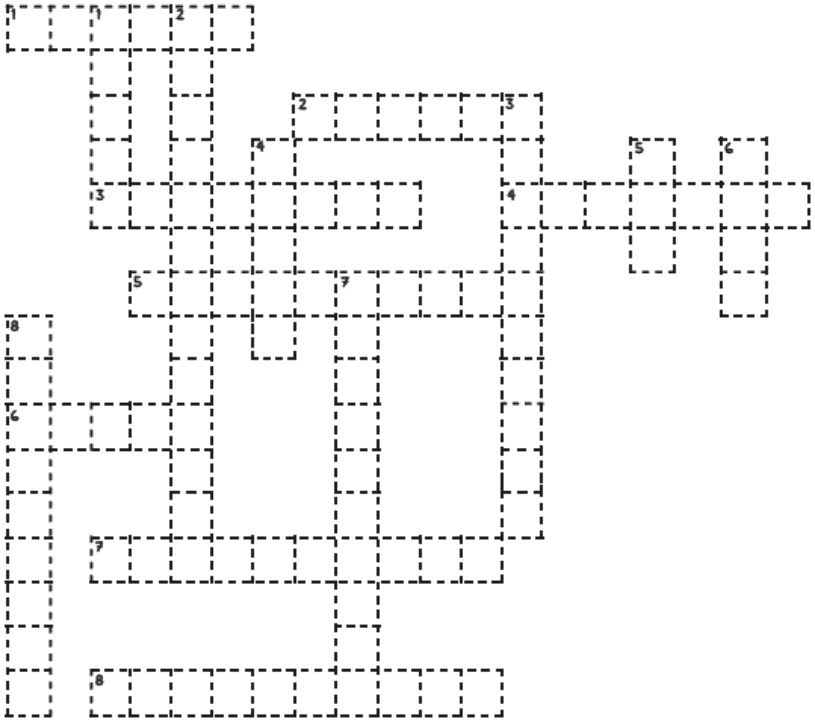
brain. After _ _ _ years of travelling in the _ _ _ _ _ I may weigh as much
19 24 16 16 4 6 2 13

as _ _ _ kg. Then, probably in late _ _ _ _ _ _ _ _, I will come back here to
20 10 23 13 16 21 6 14 1 6 17

_ _ _ _ _, guided by the smell of this good old _ _ _ _ _ _!
20 15 2 24 13 20 19 17 6 2 14

What species of salmon am I? _____

7 Conserving Energy Crossword

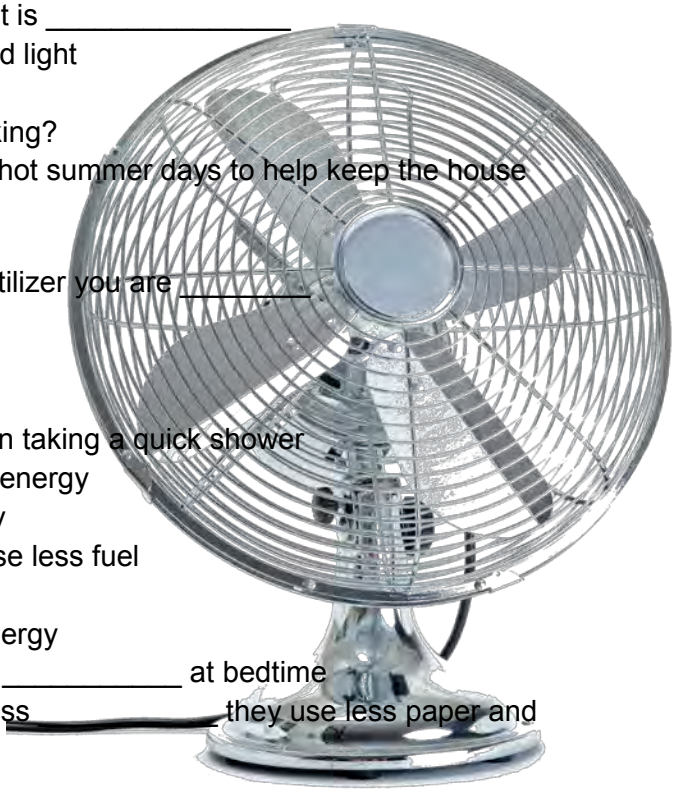


Across

1. _____ vehicles switch between two types of energy
2. When a car is running but not moving, it is _____
3. It is the natural source of all our heat and light
4. Liquid fuel made from plants
5. What is another name for a person walking?
6. _____ the blinds and curtains during hot summer days to help keep the house cool
7. Run this appliance only when it's full!
8. When you turn your food scraps into fertilizer you are _____

Down

1. Taking big _____ uses more water than taking a quick shower
2. These traditional light bulbs use a lot of energy
3. A "colourful" name for renewable energy
4. If these are properly inflated, vehicles use less fuel
5. A _____ is a cheap way to stay cool
6. Do laundry in _____ water to save energy
7. Use an extra blanket and turn down the _____ at bedtime
8. When shopping, try to buy things with less _____ they use less paper and wrappings of all kinds



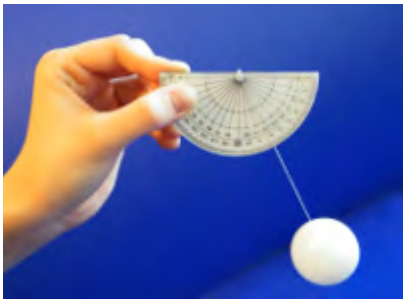
8 Build your own anemometer

Purpose

An anemometer measures the speed of the wind. You can make one easily with a ping pong ball and the protractor from your math set.

Materials

- Needle
- Thread
- Ping pong ball
- Protractor



Method

1. Cut a piece of thread about 20 centimetres long. Thread the needle and tie a large knot in the end of the thread.

2. Stick the needle into one side of the ping pong ball and out the opposite side. Draw the thread through until the knot at the other end stops the thread from moving.

3. Tie the thread to the centre of the straight base of the protractor so that the ball hangs below the arc of the protractor so that the ball hangs below the arc of the protractor which has the angles marked on it. If the protractor is held level, where there is no wind, then the ball will hold the thread over the 90° mark.

4. Take the protractor outside. Hold it level and parallel to the wind. The wind will blow the ball and when it does, note the position of the thread on the protractor. Record the angle that the ball has been blown and use the chart to convert the angle to a wind speed.

Anemometer angle to wind speed chart

Angle	Kilometres per hour
90°	0
85°	9
80°	13
75°	16
70°	19
65°	22
60°	24
55°	26
50°	29
45°	32
40°	34
35°	38
30°	42
25°	46
20°	52

9 The Salmon Spawner

Materials:

- Two 25-metre lengths of rope
- Four pylons or cones
- Four to six floor mats, tied into rolls
- One copy of “Handout: The Salmon Spawner” for each student
- Writing supplies or art supplies

Time required:

Approximately 30 minutes in the gym and 30 minutes in class

Preparation

- In a gym or open area, place two ropes on the floor, parallel to each other and about four metres apart. Mark the ends of each rope with pylons or cones. Explain that the ropes represent the banks of a straight-sided stream.
- Have the students find a place in the gym where they can sit without being close enough to touch anyone else. Ask them to find a comfortable position and close their eyes as you read “Handout: The Salmon Spawner” to them. This should help them to relax and focus on the instructions, while minimizing any potential “rough play”.

Simulation

- Have about six students move slowly between the ropes, as if they were spawners swimming upstream. Have another six students link arms and move rapidly (but carefully) side-by-side between the ropes in the opposite direction to the spawners. Explain that they represent a wave of water moving downstream. Have the rest of the class observe how the rapidly moving water pushes the spawners along.
- Lay some rolled-up mats across the ropes so they are partly in and partly out of the “stream”. Explain that the mats represent logs, boulders and other obstructions in the stream. Have another group of spawners move upstream, while another wave moves downstream. Have the class observe how spawners can hide behind the logs to rest and to avoid the wave.
- Explain that gravel can accumulate in slow-moving waters and change the shape of the stream bank. Move the ropes so that they curve around the logs and obstructions. Have another group of spawners move upstream, while another wave moves downstream. Have the rest of the class observe how the wave becomes slower as it moves around the curves, and how it can move the stream bank, itself.

Discussion

Have students describe the difficulties in working along the stream under the different conditions. If necessary, prompt them with questions, such as:

- In which stream did spawners have the most trouble? In which was it easiest to make it to the end?
- What made one part harder than another?
- In what ways is the stream similar to the streams a salmon must travel on its trip upstream? How is it different?
  A salmon also has to jump and slide past a variety of obstacles. It may be easier for a salmon to swim through a wave of water, but its trip is much longer, and the salmon has no hands or feet to help it.
- What kinds of obstacles does a salmon have to pass on its migration upstream?
  Rapids and waterfalls, logs, dams, dried out sections of streams, fishing nets, polluted water, predators, etc.
- What natural features help a salmon in its migration upstream?
  Salmon can find pools behind rocks and logs to rest, and slower water along the edges of a river. Also, their skin becomes very tough, they can jump very high, and use their strong muscles to push their way along.

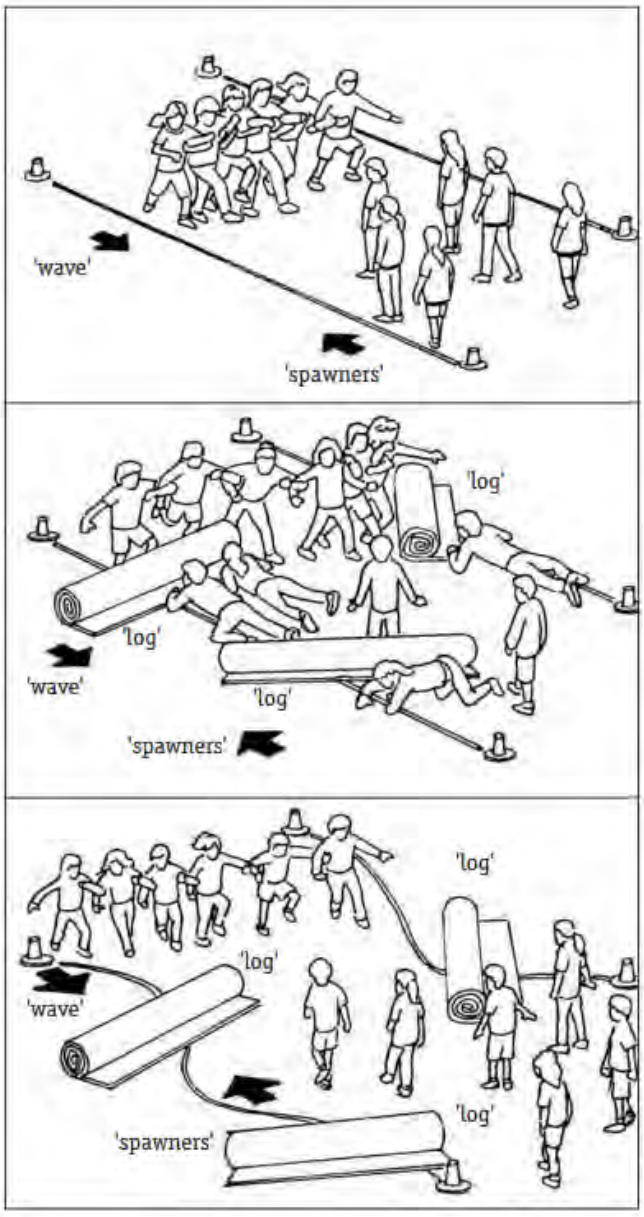


Illustration: Donald Gunn

Summation

Have students, in groups, review "Handout: The Salmon Spawner" and list at least five changes that salmon face in the last stage of their life. Have students, as individuals, draw or describe in writing

Handout: The Salmon Spawner

In the final stage of their life cycle, salmon re-enter their home river and swim back to the stream or lakeshore from which they emerged as fry. Some travel many hundreds or even thousands of kilometres, swimming from 30 to 50 km a day against the current. They follow the scent of the water to their home stream. Fishers and predators such as bears, otters, racoons and eagles catch many salmon on their trip upstream.

When they enter fresh water, salmon usually stop eating and live only on stored body fat. To save energy, they lose the slimy coating that helps protect them, their skin becomes thick and leathery, and they start to absorb their scales. Some internal organs may fail on the journey.

The salmon's appearance changes dramatically, with males and females developing distinct differences. They lose their silvery colour and take on deep red, green, purple, brown and grey colours. Their teeth become long, and they develop a hooked jaw, which is particularly pronounced in males. Their body shape can change, with some species developing a distinct hump on their back. Eggs develop in the ovaries of females, while males develop sperm.

When she reaches her home stream or lake, the female uses her fins and tail to find a spot with the right gravel size and water conditions. With her tail, she rearranges the stones in the gravel bed to form a redd, the nest-like depression in the stream- or lakebed where she will lay her eggs.

The female deposits her eggs in the redd, then the male deposits his sperm to fertilize them. Some species deposit up to 6,000 eggs, but the average is about 2,500. The female covers the eggs with gravel to protect them, often moving on to build a second or third redd which may be fertilized by other males.

Both males and females die within a few days of spawning. (Steelhead and cutthroat may survive to spawn more than once, although once is most common. If they survive, they go back out to sea as kelts, spawned-out salmon, then return to the spawning area in another year or two. Altogether, they may spawn three or four times.) The salmons' bodies decompose, releasing valuable nutrients, including minerals from the sea. The nutrients from the salmon carcasses form a rich food source for other wildlife, as well as fertilizing the stream and lake along the shore. When salmon carcasses are carried onto the riverbank, they also fertilize the forest and bushes. The ocean compounds in the salmons' bodies can be very scarce in the upstream environment. If few adult salmon return to spawn, the lack of nutrients can make the forest and the water a poor environment, with few nutrients for growing salmon fry and other species.

10 Circle of life

First Nations people recognized a simple, but frequently ignored, fact of life: that everything in nature is connected. This concept is often described as the "circle of life." In this modern technological age, it can be difficult for many of us to grasp the complexity and interrelatedness of all living things. This activity is designed to illustrate nature's connections to the students and how the circle of life can be broken by the actions of humans. Plants, animals and the environment within which they live create an ecosystem. Each element and being maintains the ecosystem by transferring energy through a food-chain.

Examples of a food-chain include:

- herring to salmon to sea lion to orca whale
- beetle to shrew to snake to fox
- algae to tadpole to bass to otter
- bacteria to fungus to tree to squirrel.

Purpose:

This activity is designed to illustrate how the absence of any component of a food-chain can affect the ecosystem as a whole.

Method:

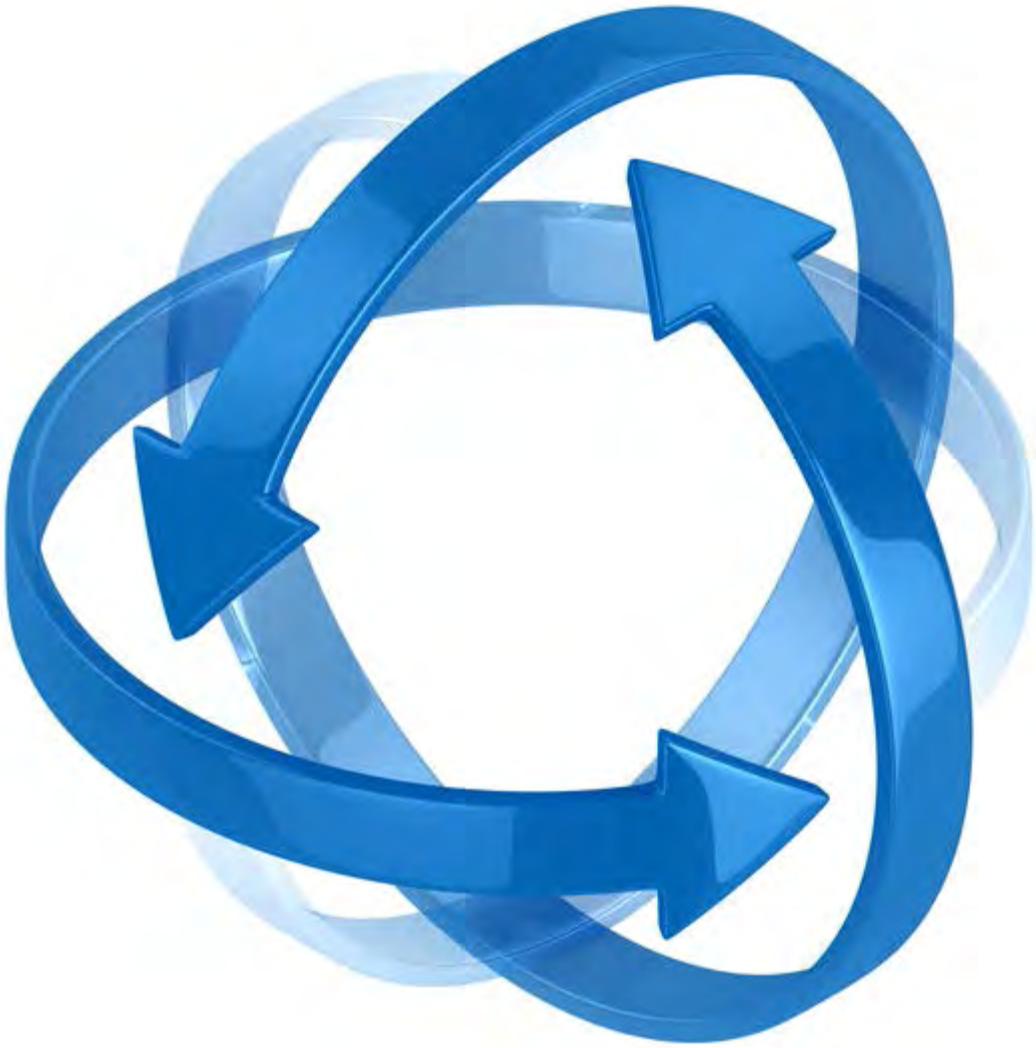
- Give students the opportunity to identify a familiar food-chain. If they are unable to do this, use the following example: trees are an important energy source in a food-chain. Aphids feed on the nutrients in the leaves of the trees; the aphids are eaten by sparrows and other birds, which are then eaten by hawks and eagles. Ultimately, the circle is completed when carnivores die, decompose and become part of the earth.
- Clear a large space in the classroom or, better; go outside to a grassy area. Give each student a number from one to four and put all the "ones" together in one group, etc. Assign each group a component of the food-chain. In the example here, "ones" are trees and "fours" are hawks, etc.

- Now form the circle of life. One student from each of the four groups should stand in the cleared area. The four students should stand shoulder-to-shoulder, facing the centre of the circle. Keep adding to the circle in sets of four until all the students are in it.
- Instruct students to turn to their right and take one step toward the centre. Everyone should place their hands on the shoulders of the person in front of them. Tell them that at the count of three, they must slowly sit down, on the knees of the person behind them, keeping their own knees together to support the person in front of them.

- When they are all supporting each other, tell them that this represents the circle of life. Tell them that once they have mastered the routine, they will understand how the transfer of energy affects an ecosystem. It may take several attempts before the entire group is able to maintain its composure and posture. Repeat the routine until they have succeeded.

- When the group has mastered the routine and a strong lap-sit circle is formed, identify a student who represents an aphid. Tell students that pesticide sprayed on the fields has spread to the surrounding trees. Then remove the "aphid" from the circle. If the circle does not collapse completely, the students will be struggling to maintain it. Students can

be removed from the circle based on a variety of conditions: logging, toxic waste, urban expansion, soil erosion, acid rain, poachers, oil spills and over-fishing. At a certain point in this activity, the removal of too many students will destroy the effect. Teachers will need to plan this activity with some care and forethought to ensure that students gain as much from it as possible. When the activity is complete, it should be clear to students that a human action that affects any of these crucial components of habitat will have an impact upon the rest of the circle. Ask students what this activity means to them and what they have learned.



11 Weather and climate

For this exercise, you will need to use a computer with Internet access, or your teacher may choose to collect the information for the class. You may use data for the capital city of your province or territory, or select another location from the city list on the Environment Canada Web site at www.weatheroffice.ec.gc.ca. Set up this exercise at the end of one month so that you can track the temperatures for the entire following calendar month.

1. Use the Past Weather link on the side menu to find the Climate Normals for the city you've chosen. Check to be sure that that location also reports daily highs and lows on their weather forecast Web page.

2. Find the normal daily maximum and minimum temperatures for that city for next month, and draw lines on the graph on the next page to represent these temperatures. Use a different colour for each, but don't use red or blue. For example, if the normal daily maximum is 16.2 C, you could draw a straight line in green at that point running from the first day of the month to the end of the month.

3. The Past Weather section of this Web site gives you Climate Data Online as well. You can use this link once a week for the following month to retrieve the actual daily high and low temperatures for that same city. Plot the daily temperatures using red for the maximum and blue for the minimum. Make a line graph by connecting the dots that represent the temperature values.

4. At the end of the month, compare the lines representing the actual temperatures with the lines representing the normal or average temperatures.
   a. Did the actual temperatures match the normal ones?
   b. Which lines would be considered weather and which would be climate?
   c. In your own words, explain why they are different.

Secondary Level Activities

Best suited for ages 16+

1 Reading the Phases of the Moon in a Tide Table

Objectives:

To learn how to read a tide table and investigate the position of the moon in relation to the tides.

Activity:

Read a tide table to find out when to visit a given location. Make predictions about the position of the moon by studying the high and low tides on a tide table.

Background:

Tides are caused by the gravitational pull of the sun and moon on the waters of the Earth. Because the moon is so much closer to the Earth than the sun, its influence is much greater.

The moon takes 24 hours and 52 minutes to travel around the Earth. For most of Atlantic Canada this produces two high and two low tides each day. These are called semi-diurnal tides. Each tide is 6 hours and 13 minutes apart. The tides change by an hour each day, due to the extra 13 minutes in each one.

When the sun and moon and Earth are in a straight line, during the times of a full moon and new moon, the gravitational pull on the Earth is the greatest. It creates high tides that are very high and low tides that are very low. These are called spring tides.

When the sun and moon are at right angles to each other they pull in opposition to one another and the difference between high and low tides is not very great. These tides are called neap tides.

However, in places like the Bay of Fundy, where the mouth of the bay is wide and deep and the head of the bay is narrow and shallow, when the neap tide advances, a large volume of water has to fit into a smaller space. As a result, even during neap tides the water rises higher and falls lower along the Fundy shore than other places in Atlantic Canada.

Tide tables give you information on the time and height of the tide. It's important to remember there are differences that can increase the effects of the tides, depending on your location, the size of the ocean basin, configurations along the shore, and storms.

Tide tables can be purchased from your local Fisheries and Oceans office, your provincial Geographic Information Centre, or a bookstore. They can also be purchased from the Canadian Hydrographic Service in Dartmouth, Nova Scotia.

Procedures:

- Pick a day on your tide table and investigate when the highest tide and the lowest tide will be. When is the best time to walk along the shore?
- By studying the tide table can you determine when a full or new moon will occur?
- Can you also determine when the sun and moon are at right angles to one another, during the 1st and 3rd quarter of the phases of the moon?
- Become a moon/tide detective and keep a tidal diary. Over a period of 28 days follow the position of the moon and the changes of the tide. Draw on the tide table the different phases of the moon. Do you see a pattern? Graph the tidal ranges over time.
- Remember to take into account that the shape of the coast can delay the spring tides.

Extensions:

- Study the historical uses of tidal power and the potential of tidal power as an energy source.
- Visit a tidal bore. The most dramatic tidal bores are located in Moncton, New Brunswick, and Truro, Nova Scotia.
- Study some tidal legends such as Glooscap and The Whale in the Bay of Fundy.
- Using a tide table, compare the high tide times at different locations along the coast. Is it the same? Why not?
- Have students represent the sun, moon, and earth. Put a string around the earth to indicate the tidal bulges and attach elastics to the string between the earth, and the sun and moon. This represents the gravitational pull. Have other students represent the opposing bulges caused by the centrifugal force. Then let the students move to show neap and spring tides.

2 Food Safety and Food Quality Quiz

1. How long can leftovers stay on the counter?

a) 20 minutes
b) 2 hours
c) 5 hours

2. What should we use to wash fresh fruit and vegetables before eating them?

a) Detergent
b) Bleach
c) Water

3. What is the premium, or best grade, for processed fruit and vegetables?

a) Canada Fancy
b) Canada Choice
c) Canada Quality

4. On average, how many eggs does a hen lay in a year?

a) 52
b) 300
c) 365

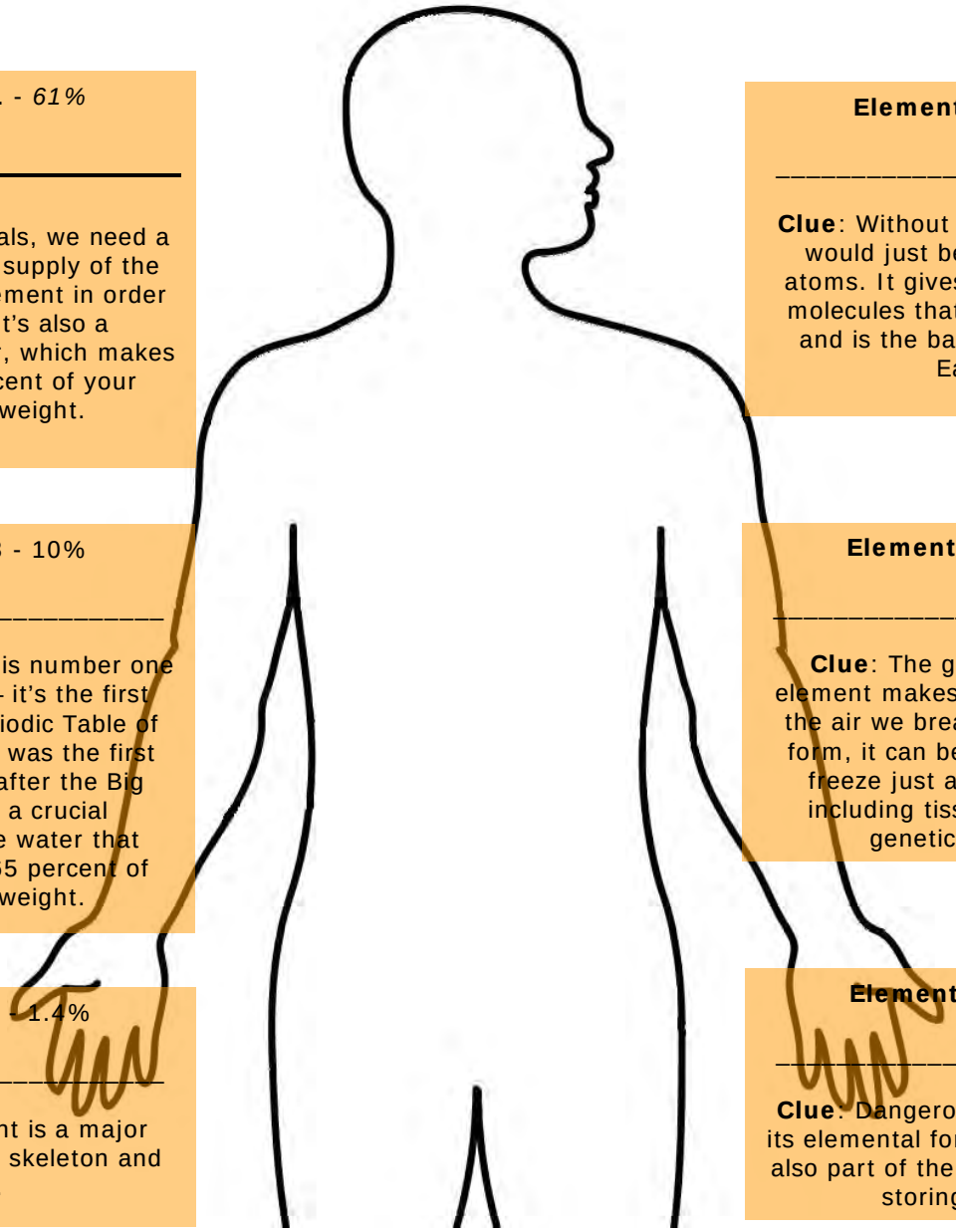
5. How many litres of milk does the average Canadian drink per year?

a) 22 litres
b) 67 litres
c) 92 litres

3 What elements are you made of?

Every element that exists on Earth is also part of you. But just six elements make up 99 percent of your body's mass. What are they, and why do you need them? Use the clues to choose the elements from the list below.

Potassium Oxygen Sodium Nitrogen Chlorine
Hydrogen Magnesium Carbon Iron
Calcium Phosphorus Fluorine



Element #1 - *61%*

_____

Clue: Like all animals, we need a minute-by-minute supply of the gas form of this element in order to stay alive. It's also a component of water, which makes up about 65 percent of your body's total weight.

Element #2 - 23%

_____

Clue: Without this element, you would just be a pile of loose atoms. It gives structure to the molecules that you're made of, and is the basis for all life on Earth.

Element #3 - 10%

_____

Clue: This element is number one in several ways — it's the first element of the Periodic Table of the Elements, and was the first element created after the Big Bang. It's also a crucial component of the water that makes up about 65 percent of your body's weight.

Element #4 - 2.6%

_____

Clue: The gas form of this element makes up 78 percent of the air we breathe. In its liquid form, it can be used to quickly freeze just about anything, including tissue samples or genetic material.

Element #5 - 1.4%

_____

Clue: This element is a major component of your skeleton and teeth.

Element #6 - 1.1%

_____

Clue: Dangerously flammable in its elemental form, this element is also part of the body's system for storing energy.

4 Canadian astronauts and astronomers

Objectives:

Through research and presentation, the students will be able to answer questions regarding Canadian astronauts.

Lesson Overview:

In this lesson, the students will work in groups to research a Canadian astronaut, developing a profile of their astronaut for presentation in a learning center. They will then visit the other groups' centers to learn about more astronauts before participating in a team quiz game on the subject matter.

Developing the Lesson:

Divide students into small groups and assign each group one of the following Canadian astronauts or astronomers to research:

Astronauts	Astronomers
• Chris Hadfield • Steve MacLean • Julie Payette • Bob Thirsk • Bjarni Tryggvason • Dave Williams	• Jaymie Matthews • Paul Hickson • Jayanne English • Sun Kwok • David Levy • Terence Dickinson • Tyler Foster

Instruct groups to develop a profile of their astronaut, including a picture, to be read by their classmates in a later class period. Profiles should be in note form and easily read, and must be completed in one period.

Next period, students should lay out their profiles at different points in the room and begin circulating between them, taking notes about each of Canada's current astronauts, and asking questions when necessary. Students should be encouraged to study these notes for the following period.

Closure:

Collect profiles from which to develop factual questions for a team quiz game the next day. The winning team may be rewarded in an appropriate manner.

5 The difference between comets, meteors and asteroids

Through this activity, students will become more familiar with both the unique characteristics and the similarities of comets, meteors and asteroids. Students will also learn how to group and sort information with the use of Venn diagrams. This activity involves having students analyze and order a list of characteristics pertaining to comets, meteors, and asteroids.

Materials and Resources:

- Student worksheet (next page)
- Teacher worksheet key (in answer guide)

Begin with focus questions:

Do you know the difference between comets and meteors?
Did you know that comets travel across the sky very slowly?
Do you know where comets come from?

1. The teacher should then provide students with brief overview to comets, meteors, and asteroids.
2. The teacher will then distribute and explain the worksheets to the students.
3. Students are to use the list of characteristics at the bottom of the worksheet to fill in the Venn diagram.
4. Students should work in groups of two to decide how they will fill in the diagram.
5. Student will need to identify the similarities and differences between the comets, meteors and asteroids.
6. Students must be able to justify and explain why they placed the characteristics in the different parts of the diagram.
7. Once all students have had the opportunity to complete the diagram, begin the closure activity.

Closure:

As a closure activity, the teacher will review the diagram with the students. The teacher should make an overhead image of the diagram to fill in eliciting feedback from the students. Once completed the teacher should summarize the characteristics displayed in the diagram.

Evaluation:

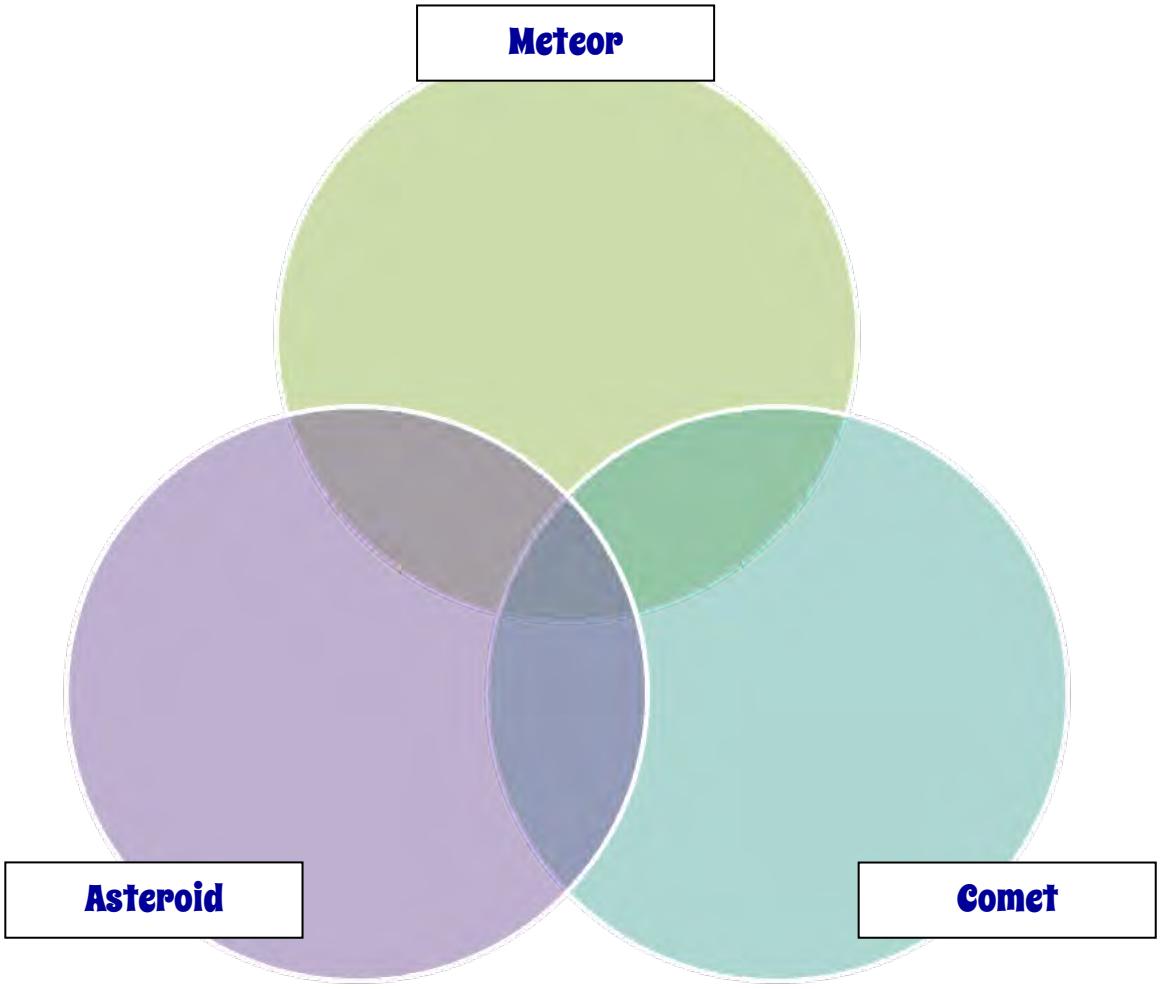
Once the entire activity has been completed, the teacher should take in the students' worksheets for grading. Students should also be evaluated on their ability to work in small groups.

Student name: _____

Student worksheet: Difference between comets, meteors and asteroids

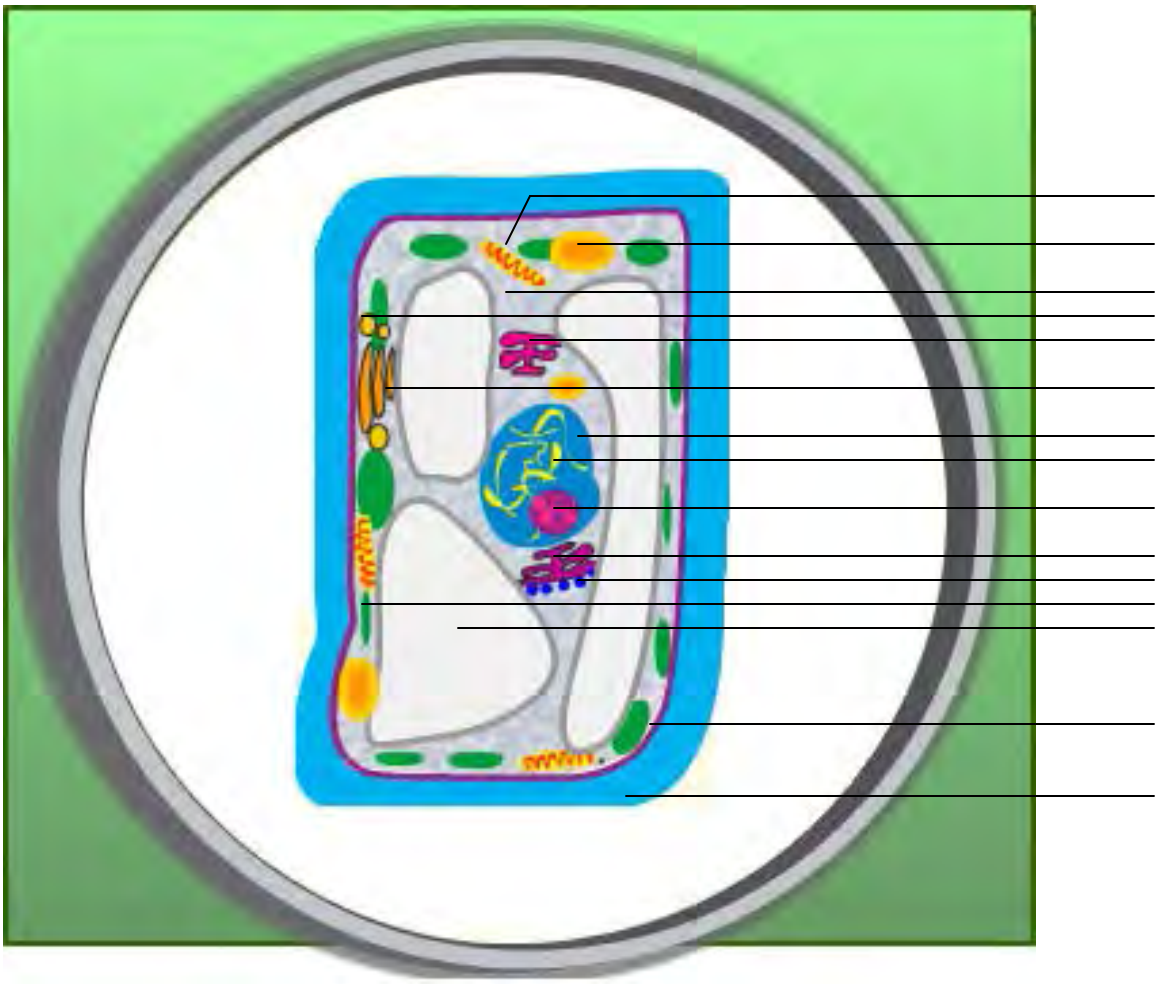
Add the characteristics listed below on the appropriate location on the Venn diagram.

Characteristics		
1. Progress across the sky very slowly **2.** Remnants of the formation of the solar system **3.** Reflect sunlight **4.** rocky composition **5.** Orbits the Sun in highly elliptical orbits **6.** Measure a few kilometres in diameter	**7.** Most found in the asteroid belt **8.** Most are less than a kilometre in diameter **9.** Most have slightly elliptical orbits **10.** Most are less than 100 m in diameter **11.** Also known as shooting stars **12.** Most burn up as they enter the Earth's atmosphere	**13.** Streak across the sky very fast **14.** Most are fragments of large asteroids **15.** Icy objects **16.** Meteor showers are caused by the Earth passing through the debris path of a comet **17.** Tail always points away from the sun



6 Biology Basics Part I

Looking through a microscope, you discover there is an organic sample in a Petri dish. Identify its structures and components to discover what the sample is.



What is the organic sample in the Petri dish? _____

How did you determine your answer?

_____

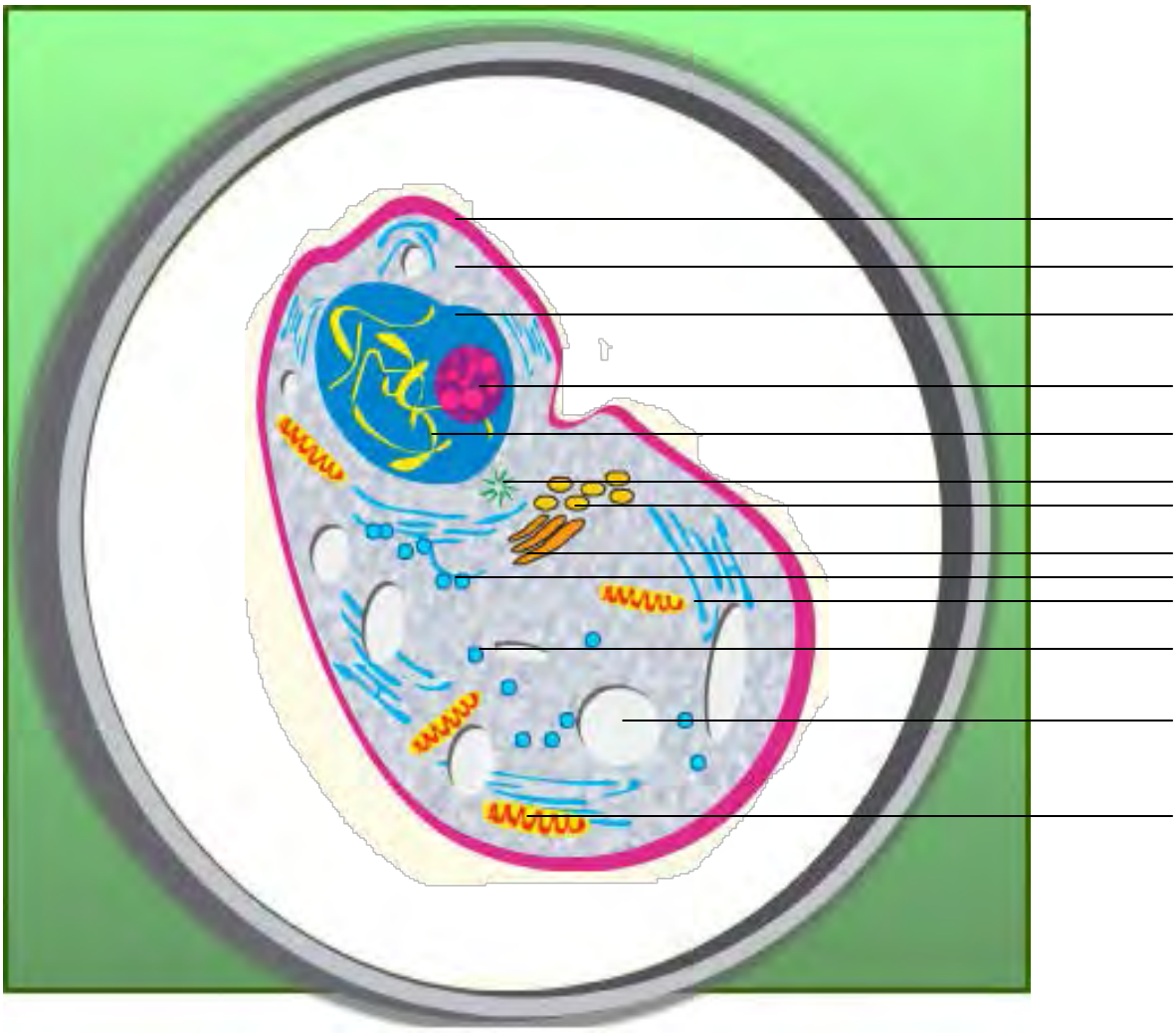
_____

_____

_____

7 Biology Basics Part II

Looking through a microscope, you discover there is an organic sample in a Petri dish. Identify its structures and components to discover what the sample is.



What is the organic sample in the Petri dish? _____

How did you determine your answer?

_____

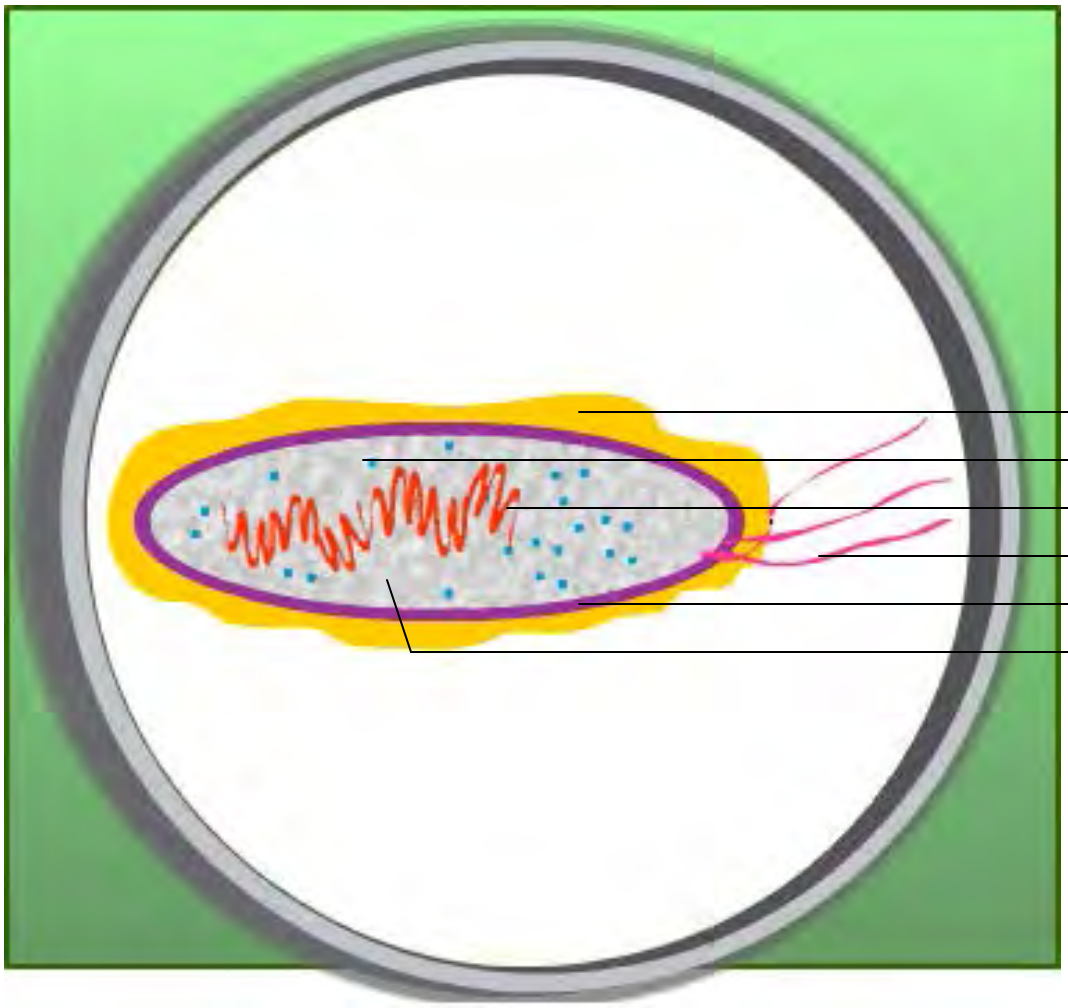
_____

_____

_____

8 Biology Basics Part III

Looking through a microscope, you discover there is an organic sample in a Petri dish. Identify its structures and components to discover what the sample is.



What is the organic sample in the Petri dish? _____

How did you determine your answer?

_____

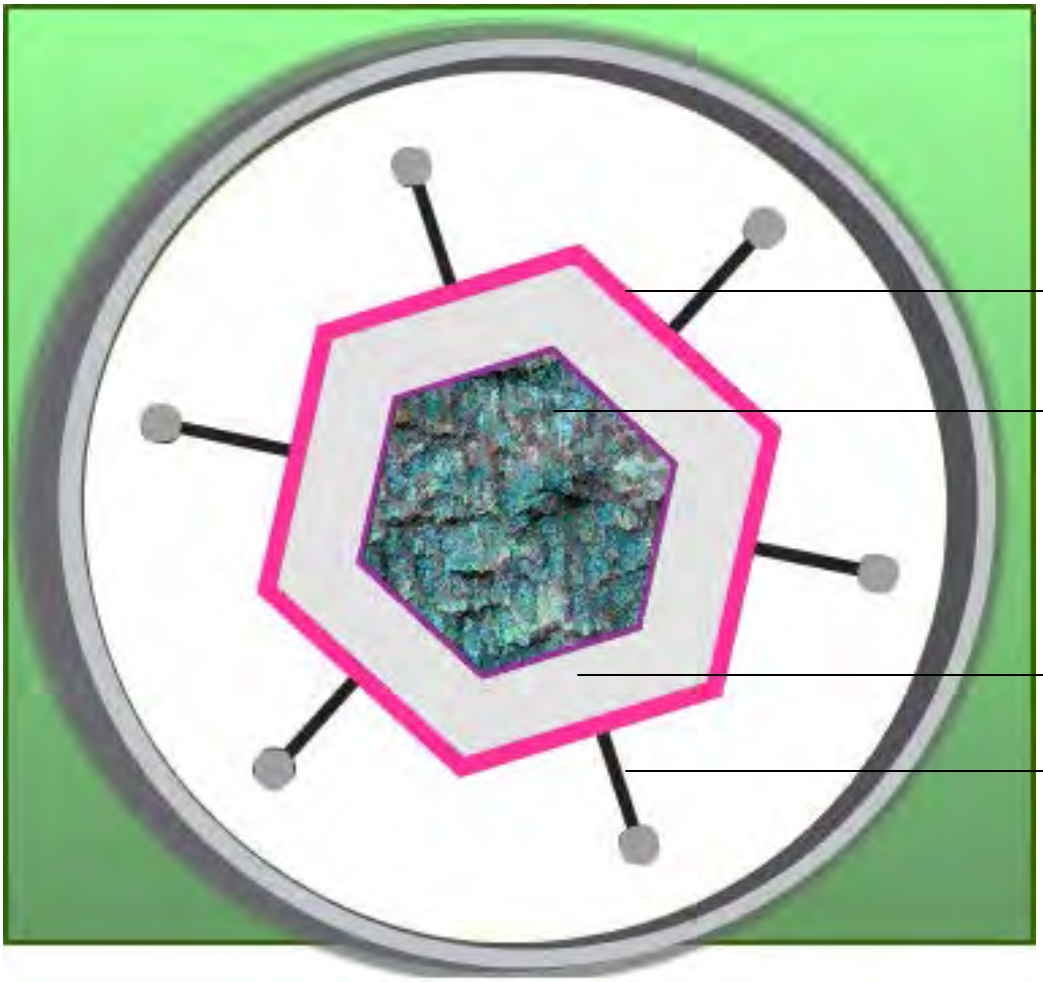
_____

_____

_____

9 Biology Basics Part IV

Looking through a microscope, you discover there is an organic sample in a Petri dish. Identify its structures and components to discover what the sample is.



What is the organic sample in the Petri dish? _____

How did you determine your answer?

_____

_____

_____

_____

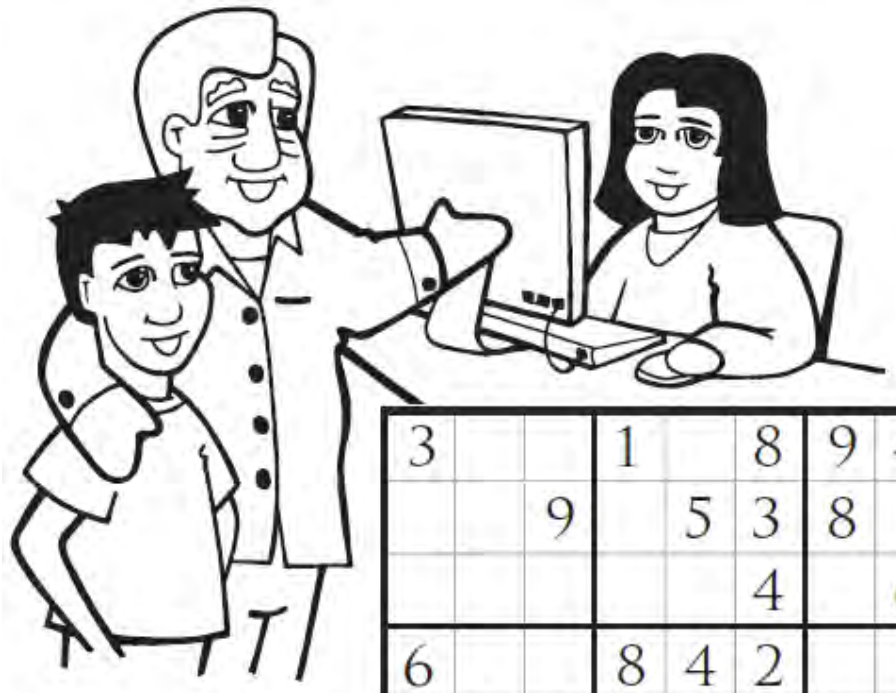
10 Sudoku

Johnny and Lisa have finished high school and are looking for summer jobs before they go to university in the fall. They've decided to visit Grandfather who works at Aboriginal Affairs and Northern Development Canada (AANDC), the federal government department responsible for northern development. AANDC offers many rewarding careers. Let's find out more about the kind of careers you can have at AANDC.

Johnny: I like science and numbers. Is there anything like that for me?

Grandfather: Let's take a walk and look around. This is Melissa. She is a Finance Officer. Melissa helps us budget our programs wisely. Finance Officers work with everyone in the department to ensure we have money for all the projects we need to develop each year.

Help Johnny complete the Sudoku as he practices his logic skills.



3			1		8	9	4	5
		9		5	3	8		1
					4		6	
6			8	4	2			
8	9	1				5	2	4
			5	1	9			3
	8		2		5			
7		2		9	6	1		
9	4	3			1			6

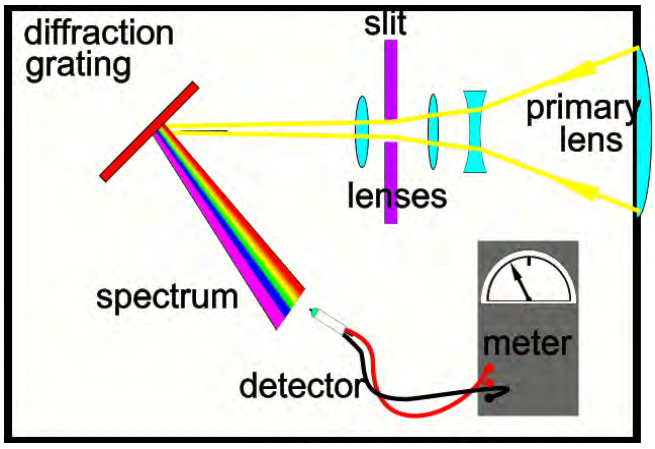
Instructions:

The numbers 1 to 9 must appear only one time in all the vertical columns, horizontal rows and 3 x 3 sections.

11 Understanding Spectrometers

There are two spectrometers onboard SCISAT-1, the first belongs to the **M**easurements of **A**erosol **E**xtinction in the **S**tratosphere and **T**roposphere **R**etrieved by **O**ccultation (**MAESTRO**) experiment. The task of the MAESTRO spectrometer is to record the spectrum of the sun before and after sunlight has passed through the Earth's atmosphere.

Analysis of the spectra will give the MAESTRO scientific team information about various processes involved in the chemical and physical dynamics of the Earth's atmosphere, especially about the opacity of aerosols in the atmosphere and how they affect the atmosphere's energy balance.



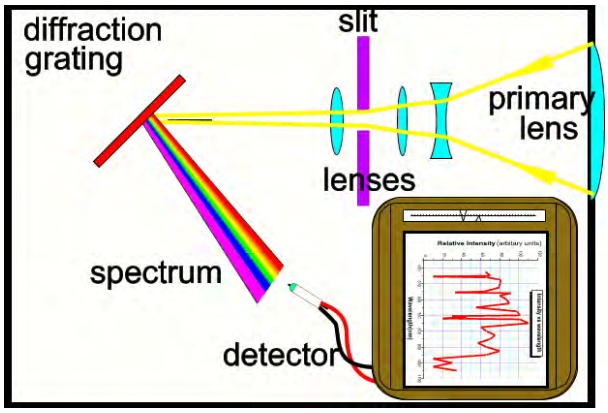
A spectrometer is really a very simple device which has extraordinarily powerful applications.

Basically it consists of three parts

1. A small telescope which collects light from a luminous source. The light is focused into a thin beam using a narrow slit and a set of specially designed lenses.

2. A diffraction grating (which acts like like a prism) to produce a spectrum from the incident beam of light.

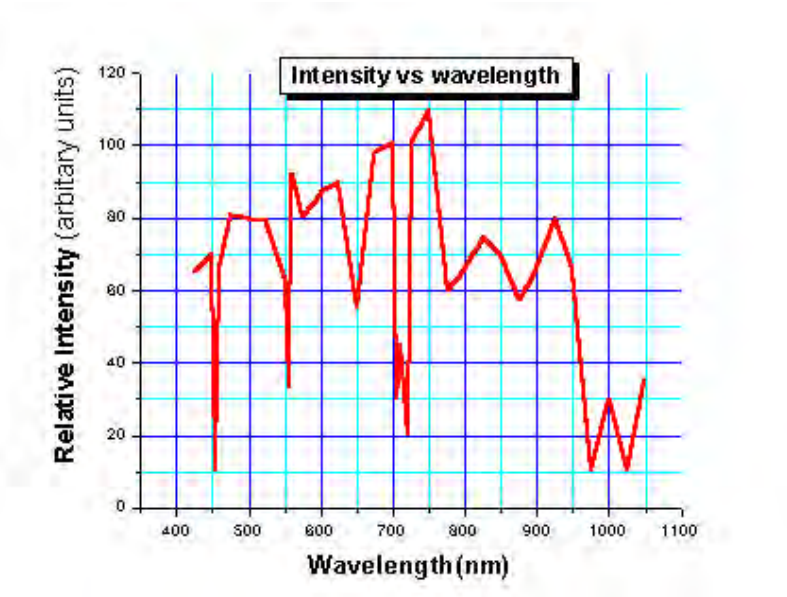
3. A detector, such as a photocell, to measure the intensity of the light in various regions of the spectrum. A simple voltmeter and a photocell can be used as a detector system.



To record the spectrum the voltmeter can be replaced by a chart recorder. As the detector "scans" across the spectrum, the intensity of the light at each point can be recorded.

The detector can also be attached to a computer interface. This allows the computer to record the light intensity, this data can be stored, transmitted and printed as a graph for analysis.

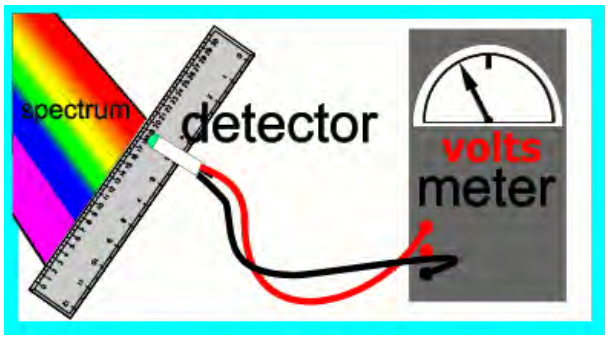
The spectrum can be scanned by either moving the detector or, more commonly, by rotating the grating.



The scanned result usually looks similar to the chart shown above.

Every source of light has a unique spectrum. From analysis of the spectrum one can determine such things as the temperature, chemical composition and motion of the source.

The x-axis plots the wavelength and the y-axis plots the intensity of the light at each wavelength in the spectrum.



Students have been given a photocell attached to a voltmeter which measures the voltage output of the photocell. A spectrum is projected onto a ruler as shown and at various positions along the ruler the intensity of the light from the spectrum is measured with the photocell. The voltage output is proportional to the intensity of the light that illuminates it. By moving the detector across the spectrum the voltage produced by the photocell is recorded at each position along the spectrum, as illustrated above.

Assignment:

Using the data collected in the chart below, plot the intensity (voltage) against the recorded position (on the ruler) to build a spectrogram (chart) of the observed spectrum.

Recorded Data

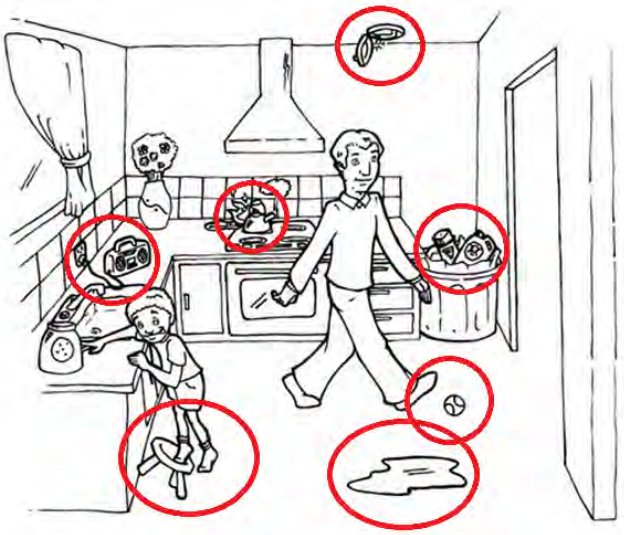
Detector position (mm)	Recorded voltage	Detector position (mm)	Recorded voltage
300	0.0	470	15.0
320	3.0	500	6.0
350	7.0	520	9.0
360	5.0	530	5.0
370	7.0	550	8.0
380	9.5	590	3.0
390	9.0	595	4.0
395	10.5	600	2.0
410	2.0	610	3.5
420	8.0	620	1.0
425	7.0	625	2.5
440	11.5	650	1.0
450	10.0	660	0.5
		665	0.0

Activity answer key

All levels

Elementary Level Answers

1 Find the hazards



4 Mystery Phrase

Solar energy is free, clean and renewable!

8 Wash your hands

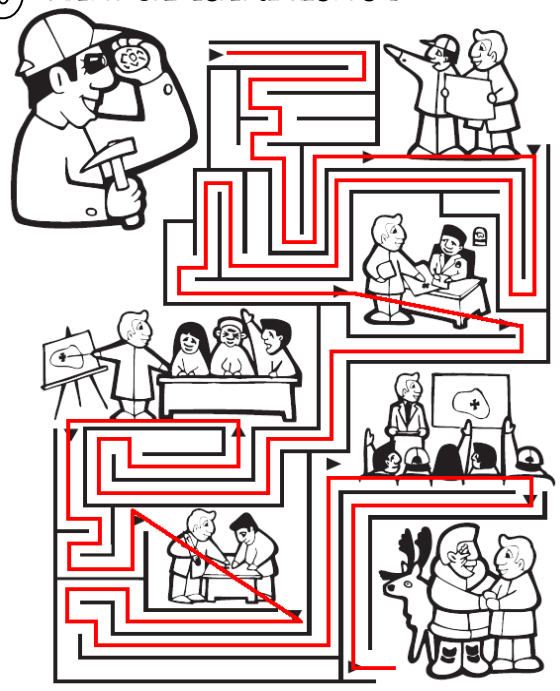
1. F
2. A
3. C
4. D
5. G
6. B
7. E

3 Word Search

Secret: BREATHE EASY

G	N	I	H	G	U	O	C	B	R	G			
	I	R	R	I	T	A	T	I	O	N			
	T	S	N	E	L	L	O	P	T	I	S	V	H
F	R	E	S	H	A	I	R	E	O	H	E	E	T
	O	T	T	E	M	O	H	T	B	T	U	N	L
	G	I	O	A	M	H	T	S	A	A	C	T	A
A	E	M	V	G	O	M	S	U	C	E	E	I	E
S	N	E	E	Z	I	N	G	D	C	R	B	L	H
E	D	I	X	O	N	O	M	N	O	B	R	A	C
T	I	N	D	O	O	R	A	I	R	H	A	T	E
	O	G	N	I	Z	E	E	H	W	E	B	I	
	X	N	O	I	T	U	L	L	O	P	A	O	
	I	S	C	O	M	B	U	S	T	I	O	N	
	D	L	U	O	M	E	K	O	M	S	Y		
	E												

9 Environmental Review



Intermediate Level Answers

1 Climate Change errors

1. Atmosphere
2. Climate
3. Depending
4. Sea
5. Travels
6. Environment
7. Conditioner
8. Champions

2 Unscramble the words

1. Chemicals
2. Toxic
3. Corrosive
4. Poison
5. Flammable
6. Explosive
7. Hazardous Materials
8. Caution
9. Danger
10. Extreme Danger

3 Eggsposed to danger

1. Heavy rain causes flood
   This can cause 3
2. Winter snow comes early
   This can cause 4
3. Other salmon builds redd in same spot
   This can cause 2
4. Untreated sewage flows from factory
   This can cause 1
5. Bridge is built upstream
   This can cause 5

4 Environment Quiz

1. D
2. A
3. A
4. D
5. C
6. B
7. B
8. D
9. E
10. C

6 Identify Me

I will spend **ONE YEAR** rearing in this **COSTAL STREAM**. During that time, I will have to **LOOK** for **FOOD** and be alert for **PREDATORS**! While I'm **GROWING**, everything about the **STREAM**- the **ROCKS**, the **ROOTS**, the **OTHER ANIMALS**- will be **IMPRINTED** in my brain. After **TWO** years of travelling in the **OCEAN** I may weigh as much as **SIX** kg. Then, probably late **NOVEMBER**, I will come back here to **SPAWN**, guided by the smell of this good old

7 Conserve energy crossword puzzle

Across

1. hybrid
2. idling
3. sunlight
4. ethanol
5. pedestrian
6. close
7. dishwasher
8. composting

Down

1. baths
2. incandescents
3. greenpower
4. tires
5. fan
6. cold
7. thermostat
8. packaging

Secondary Level Answers

2 Food Safety and Food Quality Quiz

1. B
2. C
3. A
4. B
5. C

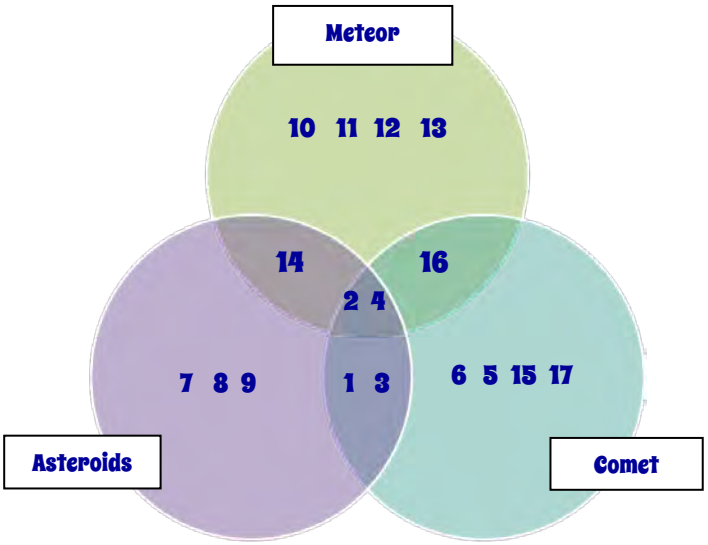
3 What elements are you made of?

	Description	Facts
Element #1 – 61% **Answer: Oxygen**	Oxygen makes up 61 percent of your body's mass. Oxygen is essential to life as it's a component of DNA and most important compounds in the body. Oxygen is present in your body mostly as water (H_2O), so the actual amount may vary. When you inhale, oxygen is absorbed through your lungs and picked up by the iron in your red blood cells. From there, it is carried to wherever it's needed throughout the body.	**Health fact:** Although water is essential to life, giving too much water to someone who is badly dehydrated can upset the balance of sodium and potassium ions in the heart muscle, leading to a heart attack.
Element 2 – 23% **Answer: Carbon**	We are carbon-based life forms. This is because carbon is a very sociable element — it forms strong chemical bonds not only to itself but also to other atoms. Carbon's stability makes possible the long chains and rings of atoms that form everything from your DNA to the steroids and proteins in your body. About 23 percent of your body mass is made of carbon.	**Health fact:** Although carbon on its own is harmless, some compounds of carbon are highly toxic. Carbon monoxide (CO) is an odourless, colourless gas found in combustion fumes such as car exhaust. Red blood cells pick up CO faster than oxygen, so if the air contains high amounts of CO, the body may not get enough oxygen. This can lead to illness or death.

Element 3 – 10% **Answer: Hydrogen**	Although hydrogen is the most abundant element in the universe, it makes up only about 10 percent of your body mass. Its most important role is as a component of water (H_2O). Water carries nutrients to your cells and removes toxins from the environment. Almost all reactions in the body take place in water. We need about 2.5 litres of water every day to keep healthy. About half of this comes from the liquids we drink, and half from food. Without hydrogen, you couldn't digest food. The acid in your stomach is a compound of hydrogen and chlorine (hydrochloric acid).	**Health fact:** Magnetic resonance imaging (MRI), a technology for scanning the body non-invasively, depends on the distribution of water throughout the body. Without water and the hydrogen it contains, MRI scans would not be possible.
Element 4 – 2.6% **Answer: Nitrogen**	Nitrogen makes up 2.6 percent of your body's weight. It's a component of DNA and of important molecules such as haem (part of the haemoglobin that carries oxygen in your blood). It's also a component of the amino acids that form enzymes and other proteins. Nitrogen is important for growth, especially during pregnancy. Although the air we breathe contains plenty of nitrogen, we don't absorb it in this form. Instead, we get most of our nitrogen from the foods we eat. Many foods contain nitrogen, especially protein sources such as meat and dairy products.	**Health fact:** During World War I, doctors found that workers who were packing ammunition shells with the explosive nitroglycerine (made of carbon, nitrogen, hydrogen and oxygen) had very low blood pressure. This led to the use of nitroglycerine to dilate blood vessels. It's often used to treat angina — chest pain caused by reduced blood flow to the heart.
Element 5 – 1.4% **Answer: Calcium**	Calcium accounts for about 1.4 percent of your body weight. Calcium is a metal, and the most abundant metal in the body. It's mostly found in bone but it also has other important functions, such as controlling cell division, aiding in the conduction of nerve impulses and contraction of muscles, and keeping blood pH stable. It's also important for blood clotting.	**Health fact:** Bone is constantly being created and broken down in the body, which helps to keep the level of calcium in the blood steady. When the body runs low on calcium, it makes up the deficiency from bone and replaces it later when there is excess calcium in the blood. As people get older, the calcium isn't replaced as easily, which can lead to osteoporosis.
Element 6 – 1.1% **Answer: Phosphorus**	Phosphorus makes up about 1.1 percent of your body weight. In the form called white phosphorus, it is highly flammable and poisonous. Luckily, in the natural world phosphorus is found only in the form of phosphate, which is a phosphorus atom bonded to four oxygen atoms. Although it's a small component of DNA, phosphorus is found in the body mostly as calcium phosphate in bone. Phosphorus also makes it possible for your body to move. When the energy molecule, adenosine	**Health fact:** A new family of drugs called bisphosphonates, which contain phosphorus, is being used to treat osteoporosis. These drugs bind to the calcium in bone and slow down the action of bone-eroding cells, so that bone-building cells can work more effectively.

	triphosphate (ATP), releases a phosphate molecule, this creates the energy needed for contracting muscles. The body creates, uses and recycles about one kilogram of ATP every hour.	

5 The difference between comets, meteors and asteroids

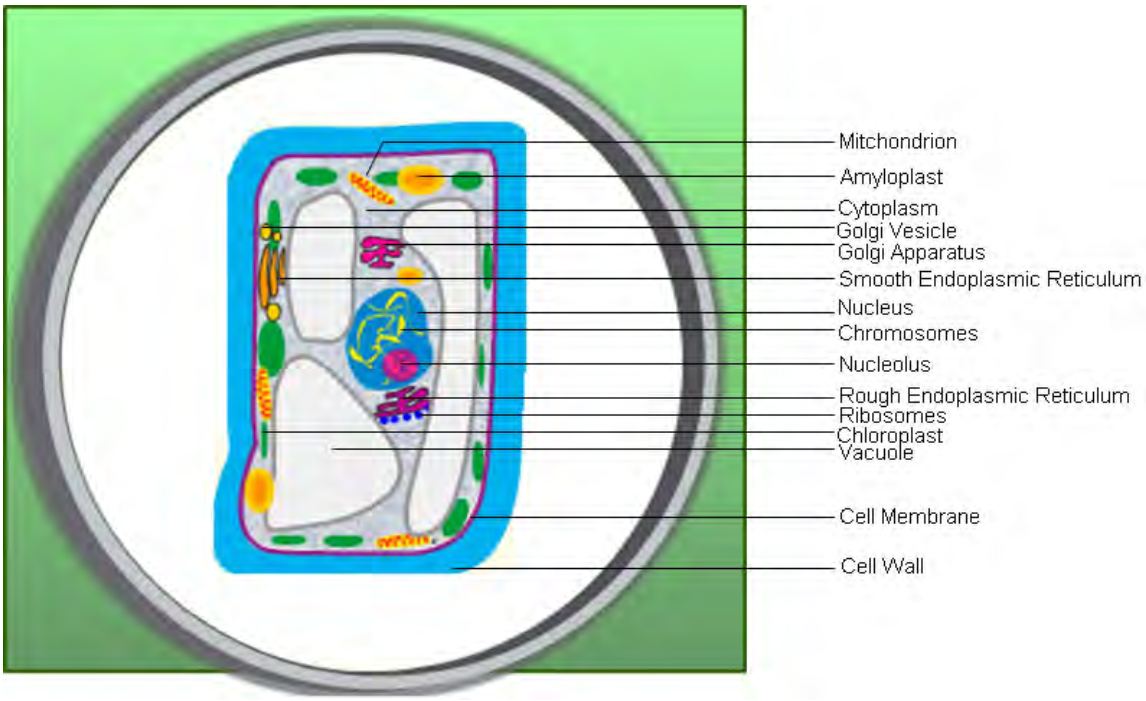


Characteristics

1. Progress across the sky very slowly
2. Remnants of the formation of the solar system
3. Reflect sunlight
4. Rocky composition
5. Orbits the Sun in highly elliptical orbits
6. Measure a few kilometres in diameter
7. Most found in the asteroid belt
8. Most are less than a kilometre in diameter
9. Most have slightly elliptical orbit
10. Most are less than 100 m in diameter
11. Also known as shooting stars
12. Most burn up as they enter the Earth's atmosphere
13. Streak across the sky very fast
14. Most are fragments of large asteroids
15. Icy objects
16. Meteor showers are caused by the Earth passing through the debris path of a comet
17. Tail always points away from the sun

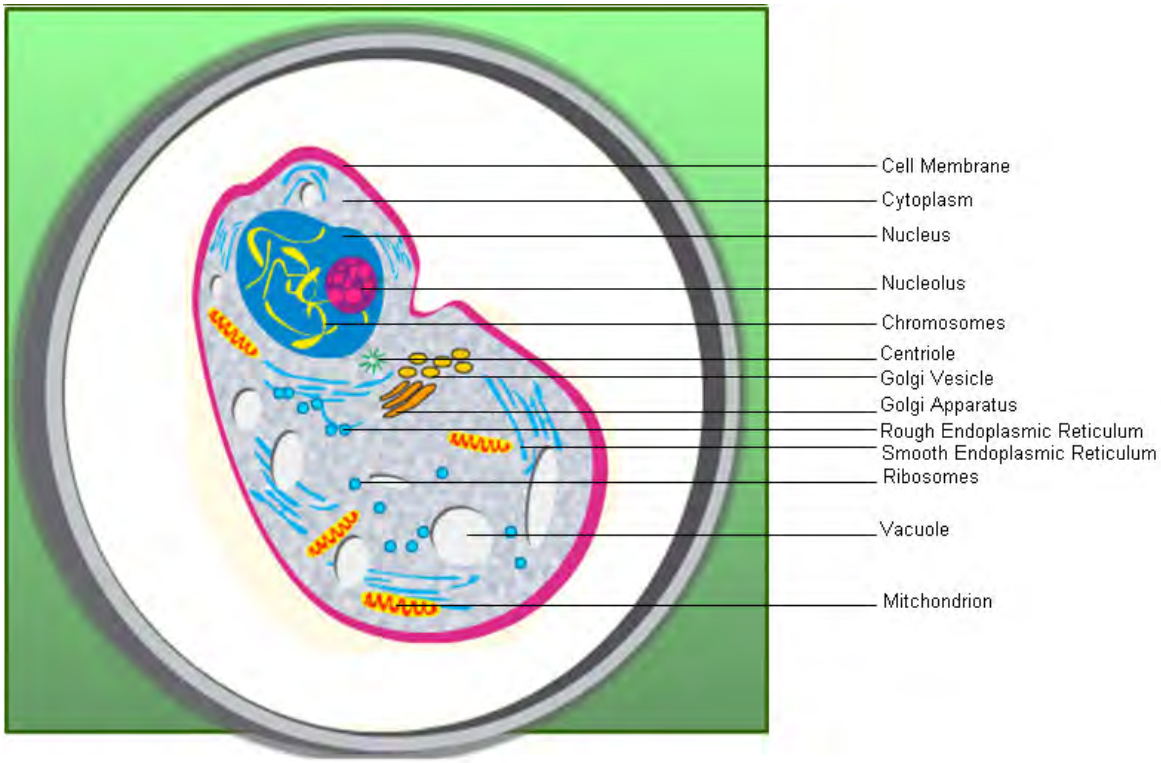
6 Biology Basics Part I

Plant Cell



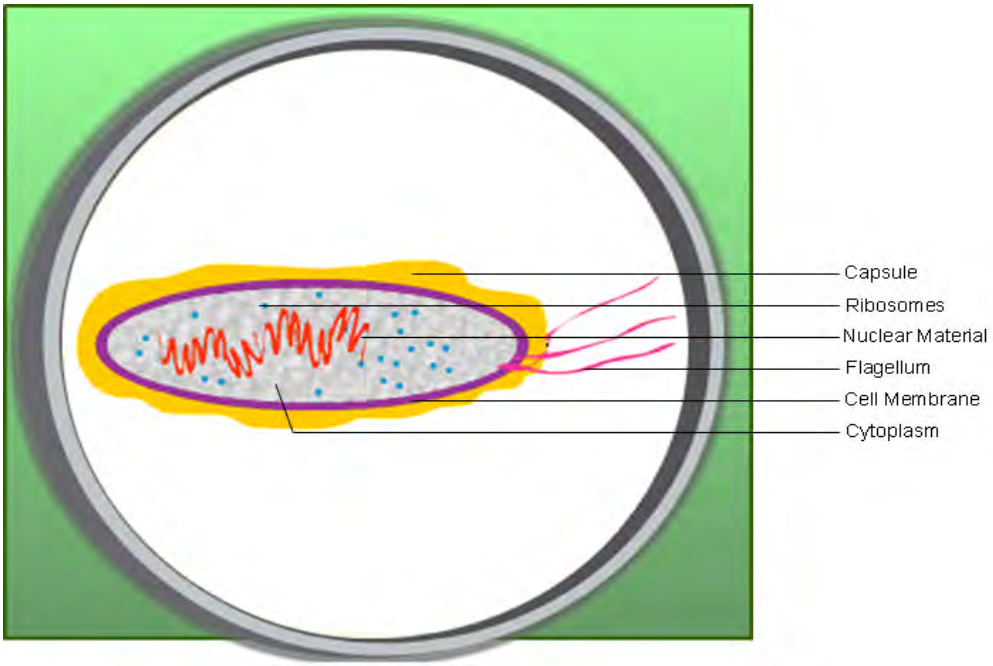
7 Biology Basics Part II

Animal cell



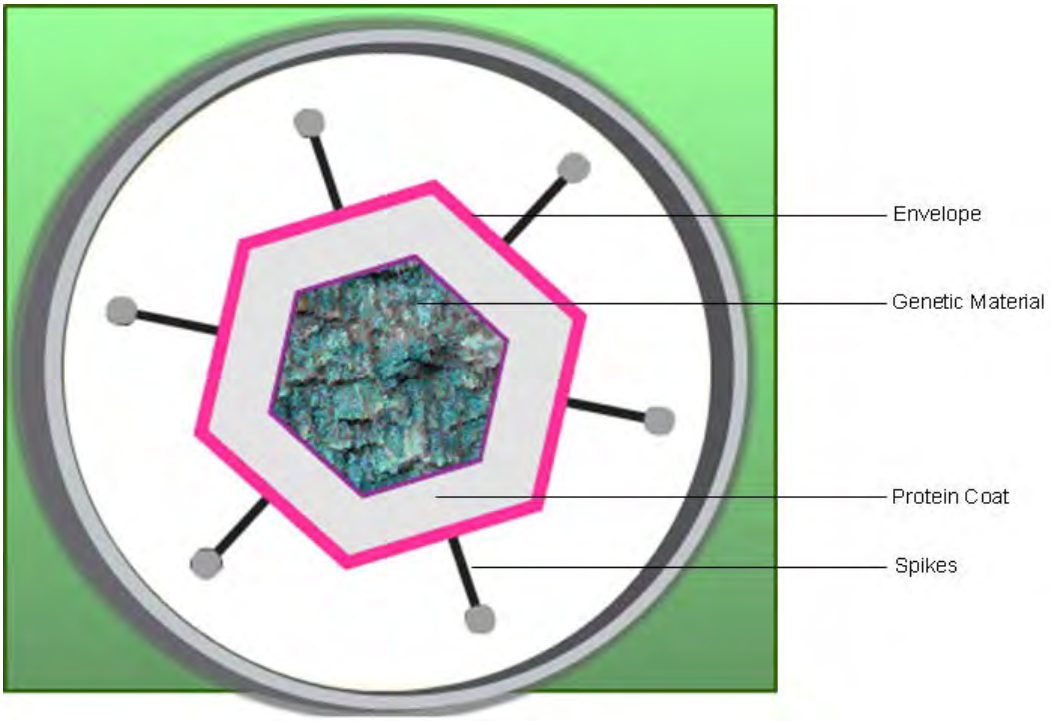
8 Biology Basics Part III

Bacteria



9 Biology Basics Part IV

Virus



10 Sudoku

3	6	7	1	2	8	9	4	5
4	2	9	6	5	3	8	7	1
5	1	8	9	7	4	3	6	2
6	3	5	8	4	2	7	1	9
8	9	1	3	6	7	5	2	4
2	7	4	5	1	9	6	8	3
1	8	6	2	3	5	4	9	7
7	5	2	4	9	6	1	3	8
9	4	3	7	8	1	2	5	6

11 Understanding spectrometers

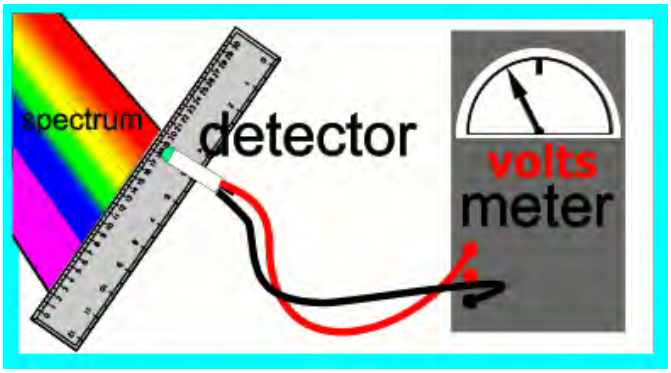
Students have been given a photocell attached to a voltmeter which measures the voltage output of the photocell.

The voltage output is proportional to the intensity of the light that illuminates it.

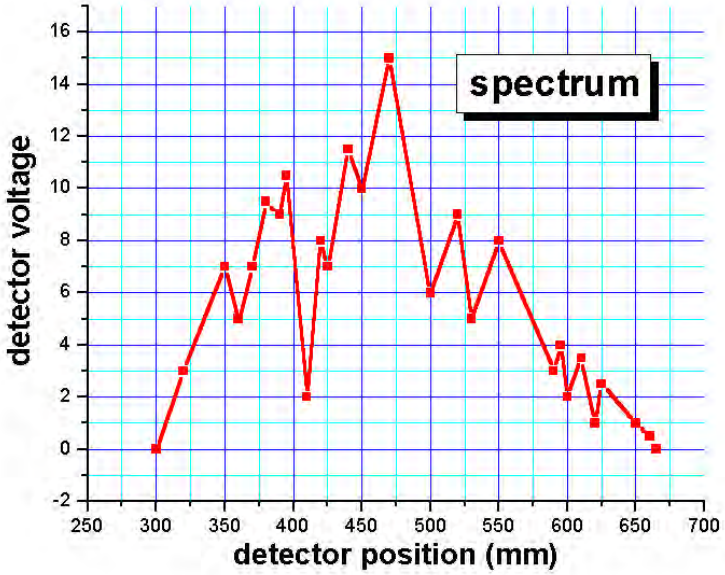
By moving the detector across the spectrum the voltage that is output is recorded at each position along the spectrum, as illustrated above.

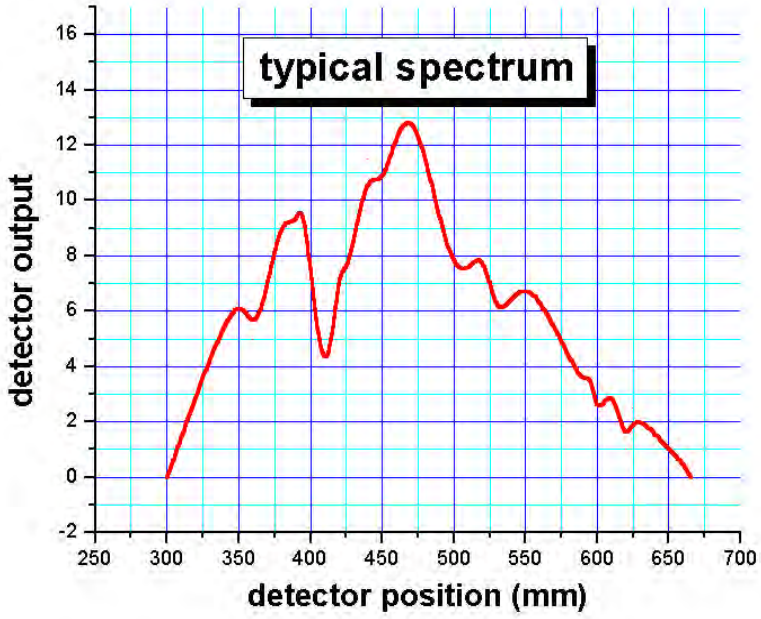
Assignment:

Using the data collected in the chart below, plot the intensity (voltage) against the recorded position to built a spectrogram (chart) of the observed spectrum.



Recorded Data





Teacher's notes: Item 1

Spectra seldom have "sharp" changes in slope, rather they appear smoothed because the detector integrates one spectral region into the next.

The first figure shows the graph as plotted by the students. The second one shows the same spectrum, scanned with the same detector, but instead of sampling discrete points in the spectrum as the students have, the detector is smoothly "swept" across the spectrum and its output is electronically recorded.

Teacher's notes: Item 2

In this assignment we have assumed no wavelength dependence on the detector's sensitivity. Real detectors have a very strong wavelength dependence. To determine the "true" intensity of each region of the spectrum, the sensitivity "curve" of the detector must be known.

For example, if the detector is only one-half as sensitive to red light as it is to blue light, then all red light measurements must be multiplied by a factor of two to make reliable comparisons of the light intensity in each of these regions.