Science of Survival

TY Science Module

Teacher Handout

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Acknowledgements:

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We want your comments on this module in order to make it better. Please keep a note of mistakes, things that don't work, things that could be improved etc. and send this feedback back to us either by post or email.

Student's Safety Handout

- Personal protection must be worn at all times i.e. white coat, goggles and gloves.
- All long hair must be tied back.
- No eating or drinking is allowed in the laboratory.
- Report accidents (however small) and breakages immediately to teacher.
- Clean up spills immediately.
- Wash hands before leaving the laboratory.
- Follow all safety instructions carefully.

Please add any other laboratory safety rules in force in your school.

TY Science

Science of Survival

Introduction for teachers.

This science module aims to teach Science through the concept of surviving in the wild. The module has been designed to provide teachers with a series of science classes based on the concept of survival. Students will be familiar with this concept as there are many popular television shows that deal with the topic such as:

- *Lost* – http://abc.go.com/primetime/lost/ (Season 1 is currently available on DVD.)
- *Survivor* - http://www.cbs.com/primetime/survivor/
- *Rough Science*: http://www.pbs.org/weta/roughscience/
- *Scope* (RTE Two) has an episode on survival skills. http://www.rte.ie/tv/scope/SCOPE3_show05_survival_course.html

Clips of the science included in these shows could be shown in class as an introduction to the concept. **You will need to source these clips yourself.** You may also find suitable material on YouTube.

The aims of this module are to:

- Promote students interest in Science by teaching topics through an everyday context.
- Encourage students to use the knowledge they already have to solve problems.
- Give students an understanding of the relevance of science topics in everyday life.
- Develop practical scientific skills that can also be used in everyday life.
- Introduce students to new concepts in science.

- Bring in aspects of Biology, Chemistry and Physics.

Important

The module has eight units based on different aspect of survival. The units can be taught in sequence, or the module is flexible to allow the teacher to decide the sequence of the lessons depending on how many classes a week are allocated to TY science in the school, the students' ability and the resources available. This is a complete course but you must decide what you have time to teach. This is a resource to help you when teaching Transition Year science.

Each unit is designed for a single and a double lesson, however there are also extra single lessons for each topic and suggested activities that could be included, if time allows. The single and double lessons complement each other and build up a structured unit of study for the students. The extra lessons are extension work.

The eight units are as follows:

Unit 1. Survival in the wild.
Unit 2. Water Purification.
Unit 3. Fire.
Unit 4. Food.
Unit 5. Shelter and Protection.
Unit 6. Food Hygiene.
Unit 7: Personal Hygiene.
Unit 8. Preparedness.

In the final lesson students will devise a plan of action to use if they ever find themselves in a survival situation, based on everything learned in the previous 7 units.

Remember that for this TY Science Module to be successful it is important that you make yourself familiar with the materials before use and check if equipment and other resources are available etc. You will need to introduce the topics and provide extra information as needed. We hope you and your students find it useful.

Unit 1

Survival in the Wild

Unit 1. Survival in the Wild.

Lesson 1. What you need to Survive (single lesson)

Note: This lesson serves as an introductory to the topics of survival if time allow, but is not strictly necessary as each topic will be dealt with in more detail in the following lessons.

Introduction.

The aim of this lesson is to get students thinking about what they will need in a survival situation and how difficult this may prove to be.

Survival Scenario.

Water:

Water is the most important requirement to survive. A person can only survive for a few days without water. Water is lost from the body through excretion, heat, cold and stress. This fluid must be replaced for the body to function properly.

A person needs 2-3 L of water per day to survive.

To find a water source on a mountain:

- Walk downhill as water will travel this way.
- Water could be found in the form of a river, stream or lake.
- Rainwater could also be collected.
- Snow is another source of water but it must be melted before consuming, as it will reduce body temperature and lead to further dehydration.
- Never drink sea water as it will cause further dehydration.

The Solar Still – Explanation.

Water can be collected in sunny weather using a solar still. The water from the soil or leaves evaporates and condenses on the sheet of plastic. **There is a description of how to create a solar still outdoors in the student handout.**

To create a solar still in the lab

Materials Needed:

Large beaker or water bath
Soil
Water

Clear plastic or cling film
Sellotape
Stone
Plastic cup

Procedure:

1. Place the plastic cup in the centre of the large beaker/bath.
2. Pour soil into the large beaker/bath. The cup is now partially submerged in soil.
3. Sprinkle about 1 cup of water over the soil.
4. Seal the beaker/bath with cling film and tape.
5. Place the stone on the plastic, directly over the cup.
6. Place in a sunny location

Water should collect in the cup after a few hours.

Water can be purified by boiling or filtering through the earth.

Fire:

A fire will be needed to survive as it will provide:
1. heat,
2. act as a signal, and
3. cook food.

The fire should be built near a fuel source (such as dry wood). It should be kept away from trees or anything else that could catch fire causing it to go out of control. When camping it is a good idea to take fire-starters and matches to start a fire when needed. Always keep them dry, do not allow them to come in contact with any water.

Food:

Try to ration any food you have as it may take some time before being rescued.
Try to limit food which is being consumed to carbohydrates as proteins need more water to digest.
General advice about eating in the wild: **Avoid red and white berries, plants resembling beans, cucumber and melons as they are often poisonous.**

Shelter:

Trees and rocks can provide shelter. Branches and leaves could be used to make a shelter to keep dry. Leaves could be used on the floor of the shelter to insulate.

Question:

Students must devise a plan inorder to survive when lost in the mountains. They must realise what materials could be used to help them survive on the mountain, and how difficult it would be if they have no water, food, matches etc.

Suggested activities:

Students could be asked to research survivor's stories and analyse what actions were taken in order to survive. Students should think about what they could have done in that situation and if they would have been able to survive.

Helpful websites:

http://www.survivaliq.com/survival/introduction.htm

http://www.wilderness-survival.net/

http://www.equipped.com/primer.htm

Book:

Casserly, B. and Horgan, B. (1994) *Breakthrough Science*, Dublin: Gill and Macmillan.

Unit 1. Survival in the Wild.

Lesson 2. Testing Water (double lesson)

Introduction

The aim of this lesson is to get students to use their scientific knowledge to test water.

Explanation:

Water boils at 100° C.

Activity:

The activity allows students devise another method of distinguishing water from a selection of clear liquids.

To test if a colorless liquid is water.

Materials Needed:

Beaker
3 clear liquid samples (one of which is water)
Thermometer
Bunsen Burner or hot plate

Procedure:

1. Place the clear liquid sample on the hot plate.
2. Turn up the heat.
3. Observe until liquid starts to turn to steam.
4. using the thermometer measure the temperature at which liquid starts to turn to steam.

The liquid that boils at 100°C is the water.

Safety Note:

Care must be taken while working with hot substances. Do not use alcohols when using Bunsen.

Water pH.

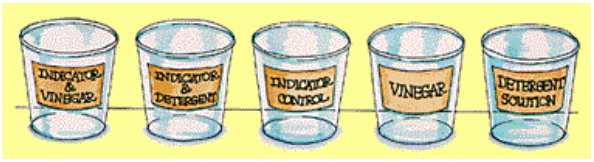
Water has a pH of 7. However, because water bonds easily with other substances (very good solvent), this is not usually the case.

Universal indicator, Litmus paper, Phenolphthalein indicator etc. can be used to test the pH of a substance. These could be demonstrated quickly by the teacher.

Students now discuss methods of pH testing in the wild.
An indicator is a substance used to tell by means of a colour change whether a solution is acidic or a basic.

Activity: To make your own indicator

Diagram:



Materials Needed:

Red cabbage
Beaker
Liquid samples (acidic, basic and distilled water)
Knife
Strainer
Liquifier or pestle and mortar

Procedure:

1. Peel off about 6 big cabbage leaves.
2. Liquify the cabbage leaves by chopping and adding water. (use a mortal and pestle or liquifier)
3. Pour this through a strainer to seperate the large pieces of leaves and water and collect the liquid part in a beaker.
4. Place the liquid samples to be tested in different beakers. Label as 1, 2 and 3.
5. Add some of the cabbage juice indicator to each.
6. Record results.

Another method:

1. Chop up some red cabbage.
2. Bring to the boil using bunsen burner or hot-plate.
3. Allow to stand for a few minutes.
4. Filter the mixture.

Note:
Acid turns red or deep purple.
Base turns green or yellow.

Limestone or seashells could be used in the wild to neutralize acidic water.

Suggested activities:

- Try making pH indicators from other common plants.
- Students could research using other plants as pH indicators.
- Get students to recall that limestone 'fizzes' when in contact with an acid. This could be demonstrated in class.
- $CaCO_3 + 2HCl \rightarrow CO_2 + CaCl_2 + H_2O$
- Students could also do an experiment to neutralise an acid using a base.
- $HCl + NaOH \rightarrow NaCl + H_2O$

Helpful websites:

http://www.madsci.org/experiments/

http://www3.iptv.org/exploremore/water/in_depth/what.cfm

Book:

Casserly, B. and Horgan, B. (1994) Breakthrough Science, Dublin: Gill and Macmillan.

Unit 1. Survival in the Wild.

Lesson 3. Finding a Water Source (single lesson)

Introduction

The aim of this lesson is to get students to use their previous knowledge to be able to ensure that they get enough water and that students understand why the body needs water to survive.
In the first part of the lesson students answer questions on why water is needed to survive and how much a human body needs per day to survive. The students will then realise the need for a water supply. The lesson then moves on to the various methods that could be used to ensure there is water in the diet.

Explanation:

Water is the most urgent requirement of survival. More that ¾ of your body is made up of fluids.

- The human body needs 2-3 liters per day to survive. A person can only go a few days without water.
- The human body needs water for the cells to work. Water is required to replace the body's fluid.
- Fluid can be lost through heat, cold, stress and exertion. Fluid is also required in digestion (excretion, urine and sweat).

***Dehydration**:* If a person is to survive in the wilderness he/she must remain calm and think logically in order to create a plan of action to help them to survive. Lack of water can hamper this.
Dehydration can cause: irritability, nausea, weakness, dizziness, headache tingling in the limbs, inability to walk, deafness and even death.
Therefore it is extremely important that a water supply is found as soon as possible.
Note: Although uncommon, a person can drink too much water which can overwhelm the kidney's ability to get rid of excess water.

Activity:

- An easy way to test if the body is getting enough water.

- Other ways to test if the body is getting enough water is to examine the color of urine. If you are well hydrated, it will be transparent. If dehydrated it will be very strong in colour and will smell strongly.

Conclusion

Discussion

1. *How would you find a water source?*

- If up a mountain walk downhill.
- If near a lake, dig a hole about 50 feet from the lake. This will filter the water (Earth is a natural filter!) as stagnant water can be unsafe.
- Catch rain using tarps or plastic.
- Watch animals or birds as they will visit their water supply regularly.
- Observe where plants are growing as they will have a water supply.
- Do not eat snow as this will help to dehydrate. Instead melt the snow and then drink the water.

To test for presence of water

Materials needed:

Blue Cobalt chloride paper
Liquid samples.
Test tubes and racks
Droppers

Procedure:

1. Place some of sample A in a test tube. Label this test tube A. Do this for each of the different samples.
2. Place some water in a test tube. Label this test tube "Control".
3. Using a different strip of blue cobalt chloride paper for each, test each clear liquid.

After this task is completed, discuss student's results and conclusions.
Note: Cobalt Chloride paper turns from blue to pink on contact with water.
To test if it is pure water: boil the water. If it boils at 100°C then it is water.

Discussion:

2. *If you cannot find a water source, suggest other ways you can include water in your diet.*

Fruit and vegetables contain lots of water e.g. oranges are around 85 per cent water. Milk and fruit juices are also good sources of water. Food provides around 20 per cent of total water intake.

Suggested activities:
Students could be given the following assignment to research:

- Imagine you are stranded either a.) up a mountain or b.) on a desert island. Outline a list of 5-6 guidelines how to obtain water and why this is so important to find a water source for survival.

Helpful websites:

http://www.wilderness-survival.net/

Unit 2

Water Purification

Unit 2. Water Purification

Lesson 1. Filtering Water (single lesson)

Introduction.

The aim of this lesson is to get students to realise the reasons why some water sources may be dangerous. Students will then find ways to make the water drinkable.
Students are asked to discuss various methods that could be used to purify water. The chemistry behind each suggestion should be discussed and students can predict if their suggestion would work and why.

Note: Set up the activity as soon as possible to allow time for water to filter through. While this is happening, students should write up experiment in student handout provided.

Activity:

The activity in this class will allow students to see that the Earth acts as a natural filter to 'clean' water.

To use sand/gravel model to filter water.

Materials Needed:

Muddy water
Sand
Gravel
Pebbles; large and small gravel
Beaker
Funnel (a large plastic coke bottle could be used)

Procedure:

1. Set up apparatus as shown.
2. Pour muddy water into funnel.
3. Collect water that comes out through funnel.
4. Examine water (noting colour).

Conclusion.

After the experiment students should discuss what materials they could use to filter water if lost in the wilderness.
Students should discuss the benefits of boiling water and why this may be necessary.

Helpful websites:

http://pbskids.org/zoom/activities/sci/waterfilter.html
This web-site has instructions of how to make a home-made water filter.

http://www.wilderness-survival.net/water-3.php
This web-site tells what can happen if water is not cleaned before use. It also mentions some chemicals and products available to take with you on a camping trip which can be used to make water safe to drink.

Book:

Cullen, J. Discovering Science. 2003. Dublin: Mentor Books.

Unit 2. Water Purification

Lesson 2. Purifying Seawater (double lesson)

Introduction:
In this lesson students will learn how to separate salt from saltwater and collect the fresh water.

To purify salt water.

Activity 1:
Students will carry out the experiment and collect the products.
The salt will remain in the evaporating dish and the now salt-less water will be collected using a cold object such as glass.

Safety: Be careful of spitting

Development:
Students discuss the reasons why they should not drink seawater and devise other methods to obtain pure water from saltwater.

Activity 2:
Students will carry out the experiment and learn how to collect the fresh water by condensation using a Leibig condenser.

Students can safely test the product to see if it contains salt by using the egg test. *In salt water a raw egg will float. In fresh water a raw egg will sink.*

There is also another method to remove salt using everyday objects This should get students thinking about materials they could use in a survival situation.

Conclusion

Discussion:

Other methods to use in a survival situation:
- Use the first method to evaporate off the water. Use a cloth to collect the steam. Wring out the cloth to collect the de-salted water.

- Build a fire. Place some rocks in the fire. Dig a hole in the sand, allowing it to fill with seawater. Throw the hot rocks into the water. Collect the steam using a cloth. Wring out the cloth the collect the de-salted water.

Suggested activities:

Students could research what kinds of chemicals and products are on the market to purify water and explain how each works and the cost of each.

Helpful websites:

http://www.survivaliq.com/survival/water-procurement.htm

http://www.wilderness-survival.net/chp6.php

http://www.schoolscience.co.uk/content/3/chemistry/materials/match3pg1.html

http://www.swfwmd.state.fl.us/education/splash/desal_worldii.html
The experiment was found on this web-site.

http://science.howstuffworks.com/question29.htm
This web-site explains reverse osmosis which is another method for separating salt from salt-water.

Books

Cullen, J. *Discovering Science*. 2003. Dublin: Mentor Books.
Healy, R. and Quirke, M. *Science Today*. 2003. Dublin: C. J. Fallon.

Unit 2. Water Purification

Lesson 3. Other ways of purifying water (Single lesson)

This is an extension lesson and gets the pupils to research and desribe the science behind other methods of purifiying water, and compare the different methods e.g. cost.

Several methods are available for turning contaminated water or sea water into water suitable for drinking. Some of these are:

- Distillation
- Ion exchange
- Reverse Osmosis
- Freezing
- Water filters
- UV treatment

Divide the class up into small groups and give them one of these methods to research and then write a short description of how it works, where it is used, and if possible how much the water costs i.e. its economics. They should write this into their workbook. You then get someone from each group to explain briefly to the class how their method works and what scientific principle it uses.

They should be aware at the end that purifying water costs money and in Ireland we are lucky to have an abundance of fresh water that requires minimal purification. Making fresh water from sea water or brackish water is very expensive mainly because of the energy costs involved.

Most of the methods described are too expensive for developing countries. However, simple filtration systems using sand or charcoal, and UV purification using plastic (PET) bottles and sunlight offer cheap soltions.

Resources:
http://en.wikipedia.org/wiki/Water_purification
Useful information with links.
How stuff works website is a useful resource.
www.howstuffworks.com
http://www.howitworks.net/how-water-filters-work.html

Unit 3

Fire

Unit 3. Fire

Lesson 1. How to build a fire (single lesson)

Note: It may be better to do the activity as a demonstration for safety reasons.

Introduction.

The aim of this lesson is to get students to realise the need for a fire when surviving in the wild and how to build it.

Explanations:

Site selection:

The fire should be built near your shelter, on a dry sandy or rocky area. It should be close to water and far enough away from trees to avoid forest fires. However, it should be within walking distance of a fuel source.

Materials:

Tinder	Kindling	Fuel
• Fine wood shavings • Straw • Sawdust • Dead grass • Dead evergreen needles • Dead palm leaves • Cotton	• Small twigs • Small strips of wood • Wood that has been doused with highly flammable materials	• Dry Peat • Dry dead branches

Activity:

Students can practice building a fire. The fire is built in a teepee shape so that the fire has enough oxygen to consume.
Note: this could be done as a demonstration by the teacher.

Safety note:

- Care should be taken when working with fire.
- Keep anything flammable away from the fire.
- Tie back hair.
- Have a fire extinguisher nearby in case of an accident.

Other methods of lighting a fire.

- Magnifying glass and sun pointed towards tinder.
- Flint and steel.

The next part of the lesson explains how matches work. Students should understand the chemical reactions that must occur so that the match will light.

Suggested activities.

Students could research the history of matches.
Students could also be asked to find out what part the Irish physicist Robert Boyle played in the history of matches.

Helpful Web-sites:

http://www.pa.msu.edu/~sciencet/ask_st/092596.html
This web-site has explains how matches work.

http://inventors.about.com/library/inventors/blmatch.htm
This web-site has information on the history of matches.

Unit 3. Fire

Lesson 2. Fire-starters (double lesson)

Introduction.
The first part of the lesson shows how matches can be made waterproof.

Development:
The next part of the lesson explains how to create fire-starters. Fire-starters are taken on camping trips as it may not always be easy to find dry materials to start a fire in the outdoors e.g. in rain

The teacher should demonstrate various homemade fire starters. Students should use a stopwatch to time the difficulty/ease in which the fire-starter works. They will fill in the table for each fire-starter and then choose which would be the best fire-starter to take with them when going on a camping trip.

Safety note:

- Care should be taken when working with fire.
- Keep anything flammable away from the fire.
- Tie back hair.
- Have a fire extinguisher nearby in case of an accident.

Suggested Activities:
Students could be asked to research the types of fire-starters available to buy, how they work and how much they cost. These could then be compared to the homemade fire-starters and their cost.

Helpful web sites:
http://www.equipped.com/devices28.htm
This web-site discusses fire-starters.

http://www.lovetheoutdoors.com/camping/Tips/firestarters.htm
This web-site gives tips on things to use to create homemade fire-starters.

Unit 3. Fire

Lesson 3. History of fire-making (single lesson)

In this unit the pupils have thought about how to start a fire, but how have people solved this problem down the centuries? In this lesson the pupils will research the history of making fire and produce a poster or time-line showing the major developments.

The aim is to find out people made fires before there were matches and lighters. We take instant fire for granted but it wasn't always as easy. In groups the pupils will research the topic in an encyclopedia or on the internet and collect you information together. They should try to find out the scientific principles involved in starting a fire in each case.

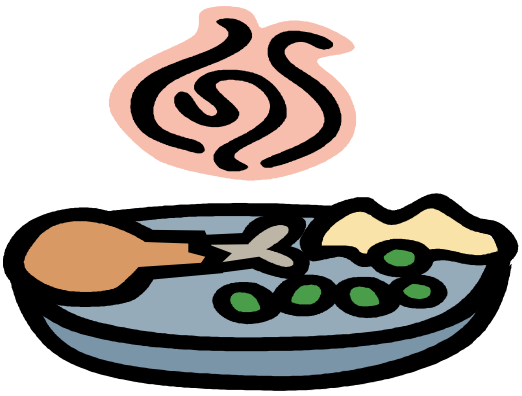
From their findings the pupils will devise a poster or a time-line, with pictures, and a description of the science involved in making fire at different periods in history. Try and answer the question: how did people start a fire 2,000, 1,500, 1,000, 500 and 100 years ago, compared to today.

They might try to find out, for example, when matches were invented; what a tinder box was; and how a burning glass works.

Sources:
A good encylopedia e.g. Britannica, will have a lot of information on this topic.
http://www.ul.ie/~childsp/CinA/Issue61/TOC25_Phosporous.html
http://en.wikipedia.org/wiki/Making_fire
You might it more efficient to assign each small group or pair of students a topic e.g. matches, tinder box, burning glass etc. and get them to research that one aspect, produce a poster and put them all together in a timeline.
They should learn that mankind has developed over the centuries many ways to light a fire and a number of these methods could be adapted for sue in a survival situation in the wild.

Unit 4

Food



Unit 4. Food.

Lesson 1. Preparing and Preserving food (single lesson)

Introduction:
The aim of this lesson is to introduce students to the need of preparing and preserving food.
Students will discuss the preparation of meat so that they realise that a lot of time and effort goes into preparing the food for consumption.
Students find out how they can preserve their food so that it lasts longer.
In the activity students can see the benefits of preserving their food.

Explanation.

Preparing food for cooking:
Bird: After killing the bird, remove its feathers by either plucking or skinning (skinning removes some of the food value). Open up the body cavity and remove its entrails, saving the crop (in seed-eating birds), heart, and liver then cut off the feet.
Cook the bird by boiling or roasting over a spit. Scavenger birds should be boiled for about 20 minutes before cooking to kill parasites.

Be careful birds are carriers of many diseases. Ensure to cook thoroughly.

Animals:
Bleed the animal by cutting its throat. Remove the hide. Remove the entrails of the body. Remove the lower intestine. Remove the bladder. Save the heart and liver.
Cut off the head and feet. Cut larger game into manageable pieces. You can stew or boil smaller pieces, as soup or broth.

To preserve food:

Bottling or canning food is a way to preserve it.
Fruit can be dried out in the sun: cut and pitt the fruit, allow to sit in the sun for a few days. Stack fruit in the shade. Add sugar or salt to reduce any moisture still left. Pack in container if possible.
Root vegetables can be preserved by piling into a pyramidal heap. Cover with straw and pack earth tightly around heap. Allow straw to stick out at

bottom to let air in. Allow small stacks of straw to stick out at the top to let air out.
Adding sugar or salt to food reduces the water content of food. It dries out the food so that micro-organisms cannot survive, thus reducing the possibility of the food being spoilt.

Development.

Activity 1:
Students can see the difference between the fruit and its rate of rotting which shows the benefits of preserving food.
Note: For best results a strong sugar solution should be used.

Activity 2:
Students can also see what adding sugar and salt does to plant cells by viewing under a microscope.

Other activities:
Students could try various methods of preserving food and decide on which is the best method.
To preserve meat by drying, cut it into 6-millimeter strips with the grain. Hang the meat strips in a sunny location with good air flow. Allow the meat to dry thoroughly before eating.

Conclusion~Discussion:

1. Guidelines on what plants to eat:
In general:
Avoid:
Plants with hairs, white sap, umbrella shaped flowers and white or green berries. (Some red berries can be poisonous!)
Mushrooms
Plants with bulb roots
Fruit from plants with shiny leaves.
Note: Plants should never be eaten if they are not recognised as being edible.

Safe:
Black or blue berries are usually safe.
Berries shaped like raspberries are always safe.
Single fruits on a stem are usually safe.

2. Edibility test.

To test any plant you are unsure of, test only a small part of the plant. Rub a tiny piece of the plant on a sensitive part of the body such as the inside of the wrist. Wait for a few minutes and observe to see if there are any adverse effects. If not, then proceed to taste a tiny amount of the plant. Do not swallow. Chew it for a few minutes to see if there are any adverse effects. If not, then swallow the small piece of plant. Wait 8 hours. If there are no adverse effects, eat some more. Wait another 8 hours and if there are no ill effects, continue to eat.
Note: This should only be done in an extreme survival situation, as it can be dangerous to consume poisonous plants.

Suggested activities:

Students could find pictures (from books or internet) of some edible plants that could be used in a survival situation.

Helpful web-sites:

http://home.howstuffworks.com/food-preservation.htm
This site has information on the different methods of preserving food.

http://www.survivaliq.com/survival/food-procurement_s5.htm
This site has tips on how to find and prepare food in the wild.

Unit 4. Food

Lesson 2. Finding Food. (double lesson)

The aim of this lesson is to create an awareness in students that their own previous knowledge can help them to survive. Students must identify the various nutrients needed by the body and must come up with ways of ensuring they find these nutrients to survive.

Explanation:

You should not eat food if you have little or no water as your body uses fluids to digest foods. You should be able to replace these lost fluids to stay healthy.
A person can survive for a few weeks without food (although psychologically this is very difficult).

Development.

The activity encourages students to use everyday materials to collect insects to use as food. Students learn the benefits of insects and also which insects to avoid.

Note: For the pooter to work the lid must be completely sealed so that suction is possible. It would be a good idea to make a pooter that you know will not work (using a plastic cup, cloth used as a lid and straws) to show students what happens when there is not enough pressure to suck in the insect.

Conclusion.

The next part of the lesson looks at the various foods and what type of diet is best to remain healthy. Students use their previous knowledge to decide what foods they will need to eat and why.

Helpful web-sites:

http://www.equipped.com/primer.htm
http://www.blackrock-edu.ie/environment/make_and_do/md_5.htm
This site has a method to make a pooter for collecting insects.

Unit 4. Food

Lesson 3. Cooking (single lesson)

Introduction
This lesson shows students the importance of cooking food.

Development
Students should be aware of what is happening to the food when cooked.

Explanations:

- Refrigeration and freezing slow down the growth of bacteria.
- The conditions needed for the growth of bacteria and fungi are: food, oxygen, moisture, pH and heat.

Bacteria: The most serious type of food poisoning is caused by bacteria. Some bacteria are pathogenic (disease causing).
Enzymes: Cause the breakdown of fruit. Cooking inactivates the enzyme.
Mold and Yeast: Mold can form a network of microscopic strands which can extend into the food causing illness or allergic reaction.

Food undergoes physical and chemical changes when cooked.
Physical changes:
Texture changes: fruit and vegetables become softer and more digestible. Meat softens as collagen is converted to gelatine and it becomes more digestible.
Colour changes: meat turns from red to brown which makes it more appealing to the eye.
Bacteria is destroyed: food needs to be at a minimum core temperature of 72°C for at least 2 minutes to destroy all pathogens that may be present. Food lasts longer when bacteria is destroyed.
Nutrients may be lost: water soluble vitamins and some minerals may leach out into the water. The higher the temperature, the higher the loss.
Extractives released: this releases flavour.

Chemical changes:
Enzymatic browning: When some foods are cut/damaged the cells release an enzyme. The enzyme reacts with oxygen in the air which causes food to change colour. This can be prevented by steeping in water, as water prevents the oxygen from getting at the food. Lemon juice can also be

used as it has an anti-oxidant which combines with oxygen to prevent food reacting with oxygen.
Non-enzymatic browning: this is also known as the 'Maillard Reaction'. I happens when proteins and carbohydrates are heated to high temperatures. Some amino acids react with glucose to form long-chained molecules. This is what gives the brown surface to food.
Loss of nutrients: especially vitamin C and B-group vitamins.

To prevent:

- Avoid steeping.
- Use a sharp knife for minimal cell damage.
- Use minimal amount of cooking water.
- Cook for the least amount of time possible.
- Always place food in boiling water.

Principles underlying cooking methods.

Conduction

Movement of heat through a substance without any movement of the substance. When food on a frying pan is placed on a hot ring, the heat from the ring is transferred to the molecules of the pan and through out the pan to the food.

Convection

Heat is carried through liquids and gases by the movement of particles. e.g. boiling = water current, oven = air current.

Radiation

Heat travels in invisible rays without needing a substance to travel through. The food then absorbs the heat. e.g. grilling.

A combination of these principles is usually used e.g. boiling: saucepan is heated by conduction of heat through the metal while the liquid heats up by convection.

Cooking

- Cooking makes food easier to chew, more digestible, slower to go off, easier to store and less likely to cause illness.

- The "Maillard Reaction" which is the browning of food provides much of the aroma and colour of cooked food.

Sugar:

The caramelisation of sugar is a browning reaction. "Maillard reactions" occur between amino acids and sugar molecules. Plain crystalline sugar has no odour. When heated to 160°C it will melt and at 168°C it begins to colour and to develop a rich aroma. Several hundred molecules have now been formed, as the carbon, hydrogen and oxygen atoms interact with each other and with oxygen in the air at high temperatures. The products formed include acids, aldehydes, alcohols and esters.

Meat.

When sugar molecules and amino acids are heated together they produce, lots of highly flavoured molecules that are responsible for the brown colour and the taste of cooked meat. When meat is cooked, the outside reaches a higher temperature than the inside. The Maillard reaction takes place and creates the strongest flavours on the surface This takes place at a temperature of about 154°C, which is why most foods brown on the outside when dry heated.

Vegetables:

Foods that have been boiled do not reach temperatures above 100°C as water boils at this temperature. For this reason, boiled foods do not undergo the "Maillard Reaction" which turns food brown at temperatures of around 154°C.

When heated the plant cellulose becomes soft and the plant wilts in the water.

Vegetables contain starch granules which swell when placed in water. Pasta and rice contain a lot of plant starch therefore these swell when boiled.

Methods of cooking:

Cooking with hot rocks:

Place rocks at the bottom of the fire. Allow them to heat for about an hour. Take out the piping hot rocks. Cook food directly on the hot rocks (use the rocks as you would use a frying pan). This would work for fish, thin meat slices and eggs.

Cooking in Mud:

Wrap the meat tightly in grass, completely covering the meat. Tie at the ends. Cover it completely with mud. Place on a bed of embers and build the fire above. A big fish will take about an hour using this method. Game such as rabbit will take about 4 hours.

Cooking Fish:
Fish can be impaled on a stick and cooked over a fire. Boiling fish in the shin is recommended as the skin contains much of the nutrition. The broth should be consumed as this will contain nutrients. Fish can be packed into a ball of clay and can buried in the coals of the fire until the clay hardens. Fish has finished cooking when the meat flakes off.

Conclusion:
The end of the lesson should allow students to think about how difficult it would be to actually cook in the wild. Students should think about the materials they would need to be able to cook outdoors.

Suggested activity:
Students could research products available to make cooking easier in the outdoors.

Helpful Web-sites:
http://www.wilderness-survival-skills.com/campfire-cooking.html
This site gives more information on how to cook in the wild.

http://homepages.westminster.org.uk/hooke/issue10/chemcook.htm
This site explains the Maillard Reaction in more detail.

http://www.foodlink.org.uk/factfile_c.asp?file=1&chapter=10
This site has information on cooking and food poisoning.

http://www.survivaliq.com/survival/food-procurement_s5.htm

Unit 5

Shelter and Protection

Unit 5. Shelter and Protection

Lesson 1. Shelter (single lesson)

Introduction:
This lesson is to show the importance of shelter in a survival situation.

Explanations:
Shelter can protect from the sun, wind, rain, insects, snow and extreme temperatures. In some situations shelter can be the most important thing needed to survive e.g. in prolonged exposure to cold.

- The shelter should only be big enough to hold your body. It should not be much bigger as it will be difficult to stay warm in a large area.
- Shelter could be found in the surrounding are e.g. a cave or under trees.
- A shelter can be built using materials found in the environment such as wood and leaves.
- The shelter site should be close to water and food sources. It should be kept away from dead trees as one could fall in a storm.

Some methods of creating shelters.
Wood could be used to make a lean-to shelter. Lean the poles against a tree. The shelter could have leaves around it to protect and insulate. Students should be encouraged to come up with other methods to create shelters.

The uses of a garbage bag.
By cutting a hole in one of the corners of the bag a waterproof coat is made.
It can be used to carry wood for the fire.
If brightly coloured it can attract attention.

Snow:
Never eat snow as your body will dehydrate (as your body must use fluid to digest it).

Suggested activity:

To measure the insulating ability of some natural materials

Materials Needed:

Leaves
Soil
Paper
Cloth
Thermometer
Polystyrene cup with lid
Stop-watch

Procedure:

1. Pour hot water into the cup. Place the thermometer through a hole in the lid of the cup.
2. Cover the cup completely with insulating material.
3.Measure the starting temperature of the water.
4. Every minute, take note of the temperature of water.

The material that causes the slowest drop in heat is the best insulator.

Helpful web-sites.

http://www.theozarks.com/Survival.htm
Has some good survival tips.

Unit 5. Shelter and Protection

Lesson 2. Insulation (double lesson)

Introduction.
The aim of this lesson is to make students aware of what they will have to do to stay warm when outdoors.

Sleeping outdoors.
The head and neck should always be covered as 40% of heat lost from the body is from this area.
A hot water bottle can be made by heating some water over the fire, placing in a bottle and putting the lid on tightly. The bottle can then be placed in the sleeping bag.

Clothes.
In this part of the lesson students learn what materials are used to make clothes and the importance of clothes when trying to survive outdoors.

Explanations.
When clothes are dirty, the matted dirt prevents insulation.
When clothes are wet, insulation is prevented.
This is because they will only insulate when there is air spaces in the fabric. Grime and water clog up the air spaces.

Activity
The activity allows students to test the insulation ability of different materials. Students can then decide which materials are best to use when surviving outdoors.

Other Method:

Materials Needed:
Leaves
Soil
Paper
Cloth

Thermometer
Polystyrene cup with lid
Stop-watch

Procedure:

1. Pour hot water into the cup. Place the thermometer through a hole in the lid of the cup.
2. Cover the cup completely with insulating material.
3.Measure the starting temperature of the water.
4. Every minute, take note of the temperature of water.

The material that causes the slowest drop in heat is the best insulator.

Conclusion:

Discuss which material tested could be used to insulate the shelter.

Helpful web-sites:

http://www.discoveralberta.com/FeaturesReviews/TheBackcountry/8-35.html
This site has information on different types of clothing.

Unit 5. Shelter and Protection

Lesson 3. Fabrics (single lesson)

Introduction.
In this lesson students will look at the properties of different fabrics.

Activity: To compare water repellency of fabrics.
The sample with the least increase in mass has the greatest water repellence.

Activity: To compare the absorbency of different fabrics.
The increase in mass is the mass of water absorbed by the material. The one with the biggest increase in mass is the most absorbent.

Conclusion.
Discuss how this information could be used when outdoors.

Unit 6

Food Hygiene

Unit 6. Food Hygiene

Lesson 1. The importance of hygiene (single lesson)

Introduction.
In this lesson students will realise the importance of hygiene and the consequences, if high standards of hygiene are not maintained.

Hygiene tips.

- Wash regularly to remove sweat and grime. Washing helps prevent skin rashes that can develop into more serious problems.
- Wash hands regularly especially after going to the bathroom and before and after cooking or preparing food.
- Cook all foods until piping hot.
- Keep flies away from food by covering.
- Wash all dishes etc. used for preparing food and allow to air dry.
- Wash all food in purified water.
- Boil water before use.
- Boil food to remove parasites and cook food to kill bacteria.
- Cover all cuts and burns.

Why hygiene is important.
Some germs can stay alive on our hands and can spread to everything we touch.
Cross contamination of raw food with cooked food can cause illness.
Eating unwashed raw food can cause illness.
Consuming unsafe water can cause illness such as typhoid, cholera and dysentery.

Environmental factors which influence micro-organisms:
Temperature.
Micro-organisms grow at temperature between 5°C and 70°C.
Food.
Micro-organisms need nutrients for growth and energy. Nitrogen is needed for growth so microbes grow on proteins. They also grow on carbohydrates as sugar is needed.
Oxygen.

Some micro-organisms require oxygen to grow, however there are others that do not require oxygen.
pH.
Each micro-organism has an optimum max. and min. pH for growth. Bacteria prefer pH 7. Yeasts and molds prefer an acidic environment.
Moisture.
They need a water supply.

Fungi, Moulds and Yeasts.
They secrete enzymes onto food, breaking down nutrients and absorb these simpler substances through the cell wall.

Beneficial Fungi:	**Harmful Fungi:**
Used in baking and brewing (yeast). Used as food (mushrooms). Produce antibodies.	Spoil foods. Cause disease in humans and plants. Can be poisonous.

Moulds:
Penicillin has antibiotic properties.
Mucor: affects bread and starchy foods. Hyphae are white with greenish sporangia.
Rhizopus: causes soft rot on fruit and vegetables. Black in colour.
Penicillium: Effects cheese, citrus fruit and bread, causes soft rot on apples and mould on jam, bread and cakes. Forms blue green colonies.
Aspergillus: causes black rot on fruit and vegetables and also grows on grain. It appears as either a green or black mould.

"Facultative" means: they can grow with or without oxygen.

They do not produce toxins, and can grow in foods with high sugar content.

Fermentation: break down of sugar to produce carbon dioxide and alcohol.
The carbon dioxide can be used in bread-making as it causes bread to rise. When a gas is heated it expands and rises upwards. The alcohol evaporates during baking.

If carbon dioxide is driven off, still wine or beer can be made. If it is retained, fizzy drinks e.g. sparkling wine can be made.

Bacteria

Beneficial Bacteria.
Cause dead matter to decay.
Provide nitrogen in the soil.
Help make yogurt and vinegar.
Produce antibiotics.

Harmful Bacteria.
Spoil food.
Cause illness/disease.
Cause tooth decay.

Bacteria can die from lack of nutrient supply, when their toxins pollute their environment and through overcrowding.

Enzymes.

Organic catalysts which speed up or slow down the rate of chemical reaction without being changed themselves.
They are proteins which are naturally found in plants and animals.
Some enzymes cause food spoilage by turning the food brown, causing an off flavour or decaying.
In the human body enzymes control chemical reactions e.g. digestion.
Enzymes require specific temperature and pH in order to function properly.

When food is cut or bruised, enzymes are released from the cells. They react with oxygen which gives the brown colour to food.
Spoilage can be controlled by adding acids to foods as the acid will destroy the enzyme.
Food can be blanched in steam or water before freezing. This deactivates the enzyme.

Food preservation.

Canning, freezing, cooking, pasteurization, dehydration, chemicals, vacuum packing, packaging etc.

Conclusion:

Students will discuss how to ensure fungi and bacteria don't affect their health.

Book:

Conway, E. and Freeborn, I. *Get Living*. (2002). Dublin: Gill and Macmillan.

Unit 6. Food Hygiene

Lesson 2. The effects of micro-organisms (double lesson.)

Introduction

In this lesson students will discover the effects of micro-organisms on food.

Activity:

Note: the experiment should be observed over a few days.
In the activity students will get to see the effects of micro-organisms on food.

Development:

Students will then discuss some common pathogenic bacteria and their effects.

Explanations:

The conditions needed for the growth of bacteria and fungi are: food, oxygen, moisture, pH and heat.

Toxic Food Poisoning: caused by ingesting food that is contaminated by a toxin produced by the bacteria cell.
Infectious food poisoning: caused by the consumption of food that contains a large number of pathogenic bacteria.

Most common types of pathogenic bacteria.
E. coli.
Found in intestines of animals and humans.
Beef and dairy food usually effected.
It causes infectious food poisoning.

Clostridium botulinium.
Optimum temperature is 30-37°C.
Minimum pH for growth: 4.6-4.8.
Growth is limited by salt.
Foods at risk: tinned foods and yogurt.
Produces a toxin that has a very low lethal dose.

In 1989 a person in England died after eating contaminated hazelnut yogurt!

Salmonella.
Optimum temperature: 37°C.
Optimum pH: 6.5-7.5.
Inhibited by salt.
Survives well during freezing.
Destroyed by heat when cooked properly.
Mainly effects meat.

Discussion.

How can you control microbial food spoilage?

By removing any one of the factors that micro-organisms need to survive.
Store foods at proper temperatures.
Make sure food is covered at all times.
Avoid cross-contamination.

Suggested Activity:

Students could research the numbers of food poisoning cases in Ireland. Statistics available from Department of Health and Children and Food Safety Authority of Ireland.

Book:

Conway, E. and Freeborn, *l. Get Living.* (2002). Dublin: Gill and Macmillan.

Unit 6. Food Hygiene

Lesson 3. The history of micro-organisms (single lesson.)

In this lesson the pupils will look at the history of the germ theory and the discovery of micro-organisms. Do you know who first discovered 'germs' and thus laid the foundation for modern health care as well as for those industries that use micro-organisms?
Can you name one person who is important in the history of germs?
Louis Pasteur is the best known and the person who laid the foundations of this field of study.
Can you name two important industries in Ireland that depend on micro-organisms?
Brewing, whisky production, dairy industry (cheese, yoghurt), biopharmaceuticals are examples of important Irish industries that use micro-organisms.

In general this area of industry is now known as biotechonology.

Using an encyclopedia or the internet, the pupils should research the history of germs and their uses. Ask them to make notes of what they find out.

Ask them to use these notes to write a short (500 words) newspaper article to explain the how people found out about germs and why this knowledge is important in everyday life. They should use illustrations and diagrams in your article and choose a catchy headline. They could do this in pairs and access to a computer is important so they can produce a professional job.

Alternatively, or as homework, the pupils could be asked devise a catchy poster to remind people why knowing about germs and keeping clean are important in everyday life.

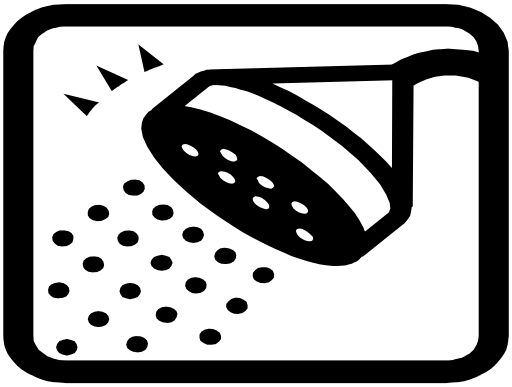
Resources:
Any good encyclopedia e.g. Britannica.

There are many internet resources on the history of microbiology e.g.
http://users.stlcc.edu/kkiser/History.page.html
http://www.slic2.wsu.edu:82/hurlbert/micro101/pages/Chap1.html

Biographies of Louis Pasteur:
http://en.wikipedia.org/wiki/Louis_Pasteur
http://www.zephyrus.co.uk/louispasteur.html
http://www.accessexcellence.org/RC/AB/BC/Louis_Pasteur.html

Unit 7

Personal Hygiene



Unit 7. Personal Hygiene

Lesson 1. Personal Hygiene (single lesson)

Introduction.
This lesson highlights the importance of personal hygiene.

Hair care.
Hair can be a breeding ground for bacteria. Always tie back and cover hair when preparing food.
Hand care:
Hands should be washed regularly as germs can spread by contact. Always wash hands:

- Before handling any food or equipment.
- After handling raw food especially meat and chicken. Immediately after going to the toilet, blowing the nose, coughing, sneezing, smoking, eating, combing or touching hair, handling waste food or rubbish and handling cleaning equipment.

Cuts and sores.
Wounds must be completely covered.

Nose, mouth and ears.
Around 40% of adults carry Staphylococci bacteria in their nose or mouth. Coughing and sneezing can carry the bacteria in droplets. Teeth should be cleaned regularly to prevent growth of bacteria.

Clothes:
If clothes are left dirty, germs will build up. So they must be cleaned regularly.

If personal hygiene is not maintained, germs will spread to food and water. When ingested, they will cause illness or even death.

Food borne illness.
This is passed on through the contamination of food e.g. *salmonella*, *Campylobacter* or *E. coli*.
Campylobacter can be found in raw poultry and meat. *Campylobacter* is the most common identified cause of food poisoning. Thorough cooking will destroy it.

Symptoms: include fever, headache, a feeling of being unwell, followed by severe abdominal pain. Symptoms usually take 2-5 days to appear but it can be as long as 10 days and can return over a number of weeks.

Salmonella can be found in raw meat, poultry and eggs, and raw unwashed vegetables. It is found in the gut and faeces of animals and humans. *Salmonella* can survive when refrigerated although it is unable to multiply through cooking.
Symptoms: These may include fever, diarrhea, vomiting and abdominal pain. Infection may be very severe, and in some cases may even be fatal. It normally takes 12 to 48 hours for symptoms to develop.

E. coli.
Found in intestines of animals and humans.
Beef and dairy food usually effected.
It causes infectious food poisoning.

Infectious disease:

Can be spread by:

Direct contact:

Person to person: by the transfer of germs from an infected person to an uninfected person.
Animal to person: animals carry germs, their faeces can also be contaminated.
Mother to unborn child: Germs can pass through the placenta.

Indirect contact:

Many germs can remain on surfaces until you come in contact with them.

Droplet transmission:

When you cough or sneeze these droplets contain the germ that caused your illness.

Particle transmission:

Some disease-causing germs travel through the air in particles. Tuberculosis and SARS are two infectious diseases usually spread through the air, in both particle and droplet forms.

Bites, stings and contaminated food can also transfer disease.

To demonstrate the spread of infectious disease

Materials Needed:

Beakers
Baking soda or another chemical to mix with water to produce a solution with a basic pH
Phenolphthalein indicator

Procedure:

1. Make up "infected" solution by adding a basic solution to water.
2. Give one person the clear infected solution by filling a quarter of the beaker. (don't let students know who has the infected solution)
3. Everybody else gets a clear solution of water.(the clear solutions represent bodily fluids). Fill quarter of a beaker with this solution.
4. Explain that after students receive their solutions each of them should first interact with one other student. To do this, one students fills the other students beaker with their liquid.
5. The students then divide the mixture in half, taking half in their own beaker.
6. Students should now do this with another person.
7. Predict the number of infections.
8. Test each beaker with phenolphthalein indicator.

Result:

If they have exchanged solutions with the original infected person in the class or someone who came into contact with the infected person, they are now infected and their solution will turn red.

Conclusions:

Students should discuss how disease is transmitted and how to avoid infection.

Helpful web-sites:

http://history1900s.about.com/od/1900s/a/typhoidmary.htm
This site tells the story of Typhoid Mary.

Unit 7. Personal Hygiene

Lesson 2. Soap and detergents (double lesson)

Introduction.
In this lesson students will make soap, will discover how it works, and the differences between soap and detergents.

Activity.
Students can make their own soap. The method can be found in "Chemistry Now".

To make Soap in a lab
Soaps can be formed by boiling a fat (ester) in potassium hydroxide. Ethanol is used as a solvent to dissolve the fat.
Note: Potassium Hydroxide is used instead of sodium hydroxide as it is more soluble in ethanol.

Safety Note: Safety goggles should be worn as Potassium Hydroxide and Sodium Hydroxide can harm eyes. Wear gloves. Do not allow chemicals to touch skin.

Materials Needed:
Quick-fit distillation apparatus
Heating mantle (or Bunsen Burner)
Thermometer
Filter funnel
Filter paper
Glass rod
Lard or castor oil
Potassium hydroxide
Ethanol
Saturated sodium chloride solution
Deionised water

Procedure.
1. Set up the apparatus for reflux.
2. Place 4g of the fat, 4g of the potassium hydroxide pellets and approx. 50cm^3 of ethanol in the round bottomed flask.

3. Boil under reflux for 30 mins.
4. Rearrange the apparatus for distillation. Distill the ethanol off until temp. of distilling vapour is greater than 80 c.
5. Add the contents of the flask to the saturated sodium chloride solution. (this is to dissolve the excess alkali and precipitate the soap.
6. Filter with saturated sodium chloride solution. Then with deionised water.

To test the soap:

- By forming a lather (wash hands after to remove any alkali that may still be present.
- Making a soap solution with hot water.

The activity allows students to make their own soap.
Note: Do not use the soap you have made as it is still very crude and contains sodium hydroxide. This is just a basic method that you could use in a survival situation substituting the sodium hydroxide with lye water.

Other methods:

Materials Needed:
125 cm^3 of vegetable oil
100 cm^3 of water
20 g of sodium hydroxide
Safety goggles
Beaker
Glass rod
Salt

Procedure.
1. Weigh out sodium hydroxide onto a folded piece of paper. DO NOT TOUCH IT.
2. Pour the oil and water into a big beaker and stir with a glass rod until you make an emulsion.
3. Carefully add the sodium hydroxide, slowly and stirring all the time. DON'T TOUCH IT ! Keep stirring until a thick paste forms. (This could take half an hour.)
5. If you still don't have a paste after half an hour, stir in 4 spatulas of salt.
Place in a small plastic container such as those used to weigh out powders in the lab.
Allow to set for a few days.

Note: Do not use the soap you have made as it is still very crude and contains sodium hydroxide. This is just a basic method that you could use in a survival situation substituting the sodium hydroxide with lye water.

Soap can also be made using lye water. Lye water is made by pouring water on ashes. The brown liquid is the lye water.

Detergents.

- Enzymes are used to degrade protein-based stains. Bleaches and other oxidizers are used to de-color stains.
- Detergents have hydrophobic and hydrophilic components.
- The hydrophobic hydrocarbons are repelled by water, but are attracted to oil and grease.
- The hydrophilic end of the molecule means that one end of the molecule will be attracted to water, while the other end will bind to oil.
- Agitation allows the soap or detergent to pull the grime away from clothes or dishes.
- Rinsing washes the detergent and grime away.

Suggested activities:

Students could research the history of soap and detergents.

Helpful web-sites:

http://teachers.net/lessons/posts/35.html
This site has instructions on how to make soap using sodium hydroxide.

http://www.madsci.org/experiments/archive/854443814.Ch.html
http://www.i4at.org/surv/soapmake.htm
These sites have other methods of how to make soap.

http://chemistry.allinfoabout.com/features/detergentfaq.html
This site has information on detergents and how they work.

Book:

Kennedy D. *Chemistry Live*. 2000. Dublin: Folens.
McCarthy, J. and White, T. 2004. Dublin: Education Company of Ireland.
Mullally, S. *Chemistry Now*. 2000.Gill and Macmillan. Dublin.

Unit 7. Personal Hygiene

Lesson 3. What's in a cleaner (single lesson)

Soap is a very simple cleaning agent and has been made since Roman times. Today we use many different types of cleaning agents for different purposes. Most of them are complex mixtures of chemicals designed to do a particular job. The range and variety of cleaning agents in shops is far greater today than it was even 20 years ago. The idea of this lesson is make pupils aware of how many different cleaning agents we use day by day and that each is a complex mixture of chemicals.

They should be asked to do a survey at home of how many different types of cleaning agents are in use for different purposes and bring in labels from some of them, showing their chemical composition.

In the lesson they will draw a list of all the different cleaning agents and their uses. They should fill in the table in their handout and should try to find products with 10 different uses? Two different brands of soap count as one use!

Product and brand name	Purpose
1	
2	
3	
…	

They should collect the labels from two products from their home and write down their chemical compositions or stick the labels in their book. Ask them to see if there any chemicals in common between the two products and which is the major chemical in each product. How many cleaning products contain surfactants (another name for detergents)? Discuss in class how you think these products are made.
They should write the composition or stick the labels side by side as below.

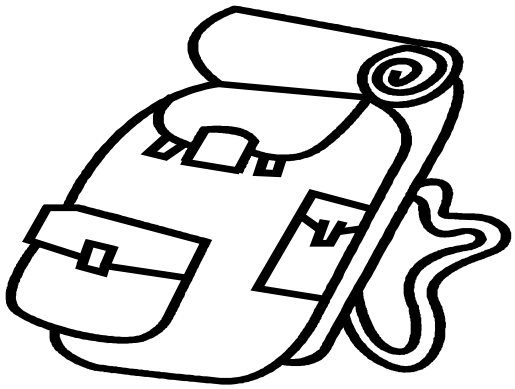
Product 1: **Product 2:**

A number of companies in Ireland make household cleaning agents. Check and see if there are any in your town or nearby. The products are complex mixtures, whether solid (washing powder) or liquid (hair shampoo), and will usually be made by blending or mixing the pure ingredients, in the correct proportions, often on a large scale.

The resources below give some information on how soaps and detergents are made on an industrial scale.
See: **http://www.nzic.org.nz/ChemProcesses/detergents/11A.pdf**
http://www.cleaning101.com/cleaning/manufact/

Unit 8

Preparedness



Unit 8. Preparedness

Lesson 1. Survival Aids (single lesson)

Introduction

This lesson introduces students to some of the health problems that may be encountered when living outdoors.

Explanations.

When surviving in the outdoors, one may face many problems with regards to health.
Lack of water is one of the most common causes of illness. Your body loses fluid through normal body processes. Your body loses 2-3 litres of water a day through normal exertions and so 2-3 litres must then be replaced.
If this does not happen, a person will become dehydrated.

The symptoms of dehydration.

Dark urine with a strong odor.
Low urine output.
Fatigue, dizziness, headache nausea.
Emotional instability.
Loss of skin elasticity.
Dark, sunken eyes.

2-3 litres of water is needed everyday in temperatures of around 20 c. This amount can be more if there is heat, cold, stress or exertion. Where food intake is low this amount should be increased to about 6 litres per day.
Small amounts of water should be drank every hour as it is difficult to drink 2-3 litres at one time.

To prevent dehydration.

Always drink water when eating because water is used as part of the digestive process.
Conserve sweat, not water – exercise should be kept to a minimum to prevent the body sweating and therefore losing water.

To prevent illness due to cold.

Keep warm and dry as wet clothes lose their insulation properties.
Don't wear clothes that are too tight.
Wear clothes in layers and make sure that there is room for air between layers for insulation.
Exercise limbs to encourage circulation.
Stay hydrated and eat plenty of food.

First Aid Kit.

The kit must be waterproof, small and have a tight fitting lid.
All medications should be stored in separate air-tight containers so as not to mix up.
Medicines:
Aspirin: exoskeletal anti-inflammatory. It will decrease fever and inflammation.
Antihistamine: blocks the release of histamine which is a chemical released during allergic reactions.
Antibiotic ointment: To treat bacterial skin infections.

Other things to include in the kit:

Bandages: for cuts and wounds.
First aid manual: to be sure you are aware of first aid procedures.
Small thermometer.
Small scissors.
Sterile blade.

To create a survival kit.

The following could be included:
Water bottle.
Mirror: to signal.
Matches (waterproofed).
Fire Starter: should start a fire even in the rain.
Poncho: waterproof.
Toilet paper.
Candle (wrapped in aluminum foil).
Fishing net: for food procurement.
Rope: to make a shelter.
Knife: multi-purpose.
Compass: To find a way home.
Whistle: to attract attention.

Garbage Bags: can act as a shelter and if brightly coloured can attract attention.
Coffee filter: to filter water.
Iodine tablets: for water purification.
Kerosene

Suggested Activities:

Allow students to bring in their own materials to make their own kit.
Investigate the cost of a home-made kit and compare it to those available on the market.

Helpful web-site:

http://www.wilderness-survival.net/chp3.php
This site has tips on what to put in a survival kit.

Unit 8. Preparedness

Lesson 2. Showing the Light (double lesson)

Introduction

In this lesson students will discover the uses of light and how to create a homemade lantern. They will also discover how candles work.

Explanations:

Light is a form of energy. Light travels in straight lines. This can be shown using a lamp and a straw. Look at the light through the straw. You can see the light. Now bend the straw and you can no longer see the light.

Reflection: happens when light waves bounce off of an obstacle. Uses: mirror to signal for help.
Refraction: Light bends when it goes from one transparent substance to another. This can be shown using a beaker, water and a coin. Place the coin in the empty beaker. Move back until you cannot see the coin over the top of the beaker anymore. Now fill the beaker with water until you can see the coin again. A pencil can also be used. When the pencil is places in the beaker of water it looks like it is bent.
Remember this when fishing as the pool may be deeper than it looks!

How does a candle work?

The fuel is made of wax.
The wick is made of absorbent twine.

The wick must either be very absorbent or have good capillary action e.g. glass fibre wicks in oil lamps. The wick must be absorbent to absorb the wax and carry it upwards when lighting. When you light a candle, you melt the wax in and near the wick. The wick absorbs the liquid wax and pulls it upward. The heat of the flame vaporizes the wax, and it is the **wax vapor** that burns.

To show that it is the wax vapour that burns

Materials Needed:

Candle
Matches.

Procedure:

1. Light a candle. Allow it to burn for a few minutes.
Blow out the candle. You should observe a white stream of smoke. This stream is paraffin vapor that has condensed into a visible form. This continues to form as long as the wick is hot enough to vaporize paraffin.
2. Touch a lit match to the stream. The stream ignites and the flame runs down to the wick and re-lights it.

To make your own lantern.

Note: this should be done as a demonstration by teacher as it contains flammable materials. Students should write up the experiment as it is being demonstrated.

Materials Needed:

Kerosene, charcoal or Zippo lighter fluid. (use only these types as the others are very flammable)
Empty coke can
Scissors or knife.
Small plastic or glass bottle e.g miniature whisky bottle.
Cotton cloth

Procedure:

1. Take the coke can and with a pair of scissors or a knife, cut around the top and bottom of the can. Then cut in a straight line so that you have a rectangle of aluminum about the same size and length as the bottle.
2. Roll up the piece of aluminum so that it fits tightly into the bottle.
3. Take a long strip of cotton and place it in the aluminum tube. This will act as the wick.
4. Half fill the bottle with the kerosene, charcoal or zippo lighter fluid.
5. Wait a while for the wick to become completely saturated. (takes about 20 mins.)
6. To use: extend the wick and rolled up piece of aluminum well above the rim of the bottle for safety. Light the wick.

Conclusion:
Students should discuss what materials they could use to create a light source.
Students could research light sources available, how they work and what their cost would be.

Helpful web-sites:
http://www.therangerdigest.com/
This site has tips on how to make homemade lanterns.

Signalling:

By fire:
During the day wet wood will burn with dark smoke which can be seen from far away. Green leaves, moss and a little water will create white smoke. The international distress signal is three columns of smoke. During darkness a fire is an excellent beacon. Build 3 fires in a triangle as this is the international distress signal. They can be difficult to maintain when you are on your own, so in that case, just build one.

Attracting the attention of airplanes:
Find a clear area such as a grassy hill. Use coloured objects or any materials that you have at your disposal. Make some kind of symbol or message such as creating the letters SOS or HELP. Make sure your signal is big enough to be seen from far away and that it looks man-made.

Mirrors or Shiny objects:
On a sunny day a mirror can work very well. Mirror flashes can be seen from many miles away.

Whistle:
A whistle can be heard from far away. Repeat 3 whistles as this is the universal distress signal. A whistle can carry for up to 2 miles.

Lights:
An SOS message can be spelt out using light. SOS = 3 dots, 3 dashes, 3 dots.

Using flags:
When using flags, hold flags on the left side for dashes and on the right side for dots.

Unit 8. Preparedness

Lesson 2. Surviving in the wild (single lesson)

In this lesson the aim is for the students to put all their information together! They should use diagrams and explanations to explain what they would do in this situation:
"You were in a plane crash. You have woken up on a desert island. There is nobody else around, but there is a lot of debris from the plane. Outline your plan of action that will help you to survive."

They should work in groups and first discuss the situation and then formulate answers to each of the questions. This should help them revise and synthesise all the ideas they have covered, and remind them how important a knowledge of science can be in an emergency - a matter of life or death in fact.