PRACTICAL TOOLS FOR SCHOOLS




FUN ACTIVITIES





1. ABOUT THE FLIP CHART:

This flipchart is designed to be used by teachers & facilitators during relevant school and/or Eco-club classes.

The flipchart consists of 4 modules: 1. Weather, 2. Water, 3. Waste, and 4. Energy.
Each module has 2 pages. The first page contains background information which should be read out to students. The second page has activities relevant to that topic. There are suggested times allocated to each activity to help you plan the class.

- On the front of each page is the illustration with its TITLE, visible so the students can find a context for the discussion. The front of pages also contains diagrams for the activities.
- On the back of the pages is a BACKGROUND FOR TEACHERS, which provides you with information to support the class. You may want to use some of the facts in your discussion. Also on the back of pages are the DISCUSSION POINTS which you should read out to stimulate class discussion.

KEY

To make teaching easier each page has a key based on the following elements:

This refers to DISCUSSION POINTS that should be read out and discussed with students

This icon refers to information that needs to be recorded in the workbook

Refers to handouts that should be given to students

Observations that students can make continuously in and outside of school time

2. BEFORE YOU START

- Before the class, the teacher should read and familiarize themselves with the flipchart. Ensure you have the all the materials you need to conduct the lesson.
- Organise the students around the flipcchart, ideally seated in a semi circle . Ensure they all can see clearly.

3. DURING THE CLASS:

- Discuss the first picture, then share some of the relevant theory with the group.
- Make the activity as enjoyable and practical as possible – people remember more when they feel happy.
- Try to get everyone to participate. If they are observing in one activity ensure they are more actively involved in the next activity.

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CONTENTS:

THIS TOOLKIT CONTAINS:

WEATHER

- Weather monitoring station
  Thermometer
  Rainfall tube
  Wind vane (direction & strength measure)
- Compass (NSEW)
- Record book – for recording information daily)
- Weather monitoring wall charts – for putting up on the wall in the classroom
- Graph paper

WATER

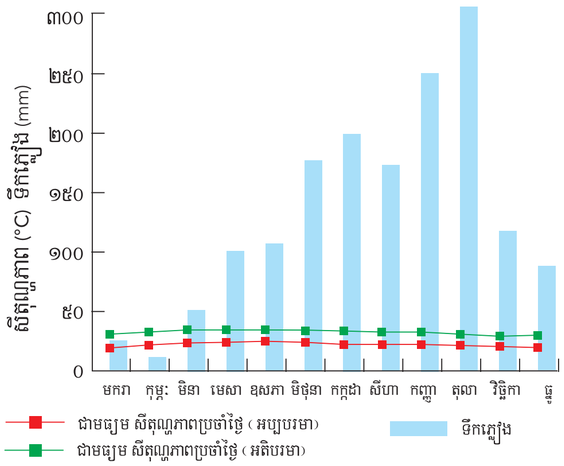
- 2 Measuring containers
- Plastic bags and string
- 10 Water test kits (H2S)
- 6 Ph test strips
- Ceramic water filter

WASTE

- 4 Rubbish baskets
- large white paper and coloured markers
- paper and pens
- Composting handout
- seeds
- scissors

ENERGY

- Balloons and string
- Magnets, foam and compass
- Magnet battery torch
- Gyro battery torch
- Solar panel kit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WEATHER

WEATHER THEORY

10-20 minutes

Weather is the general term given to the changing conditions of the earth's atmosphere. It is affected by many factors including temperature, rain, air pressure, humidity, hours of sunshine, types of clouds, and amount of cloud cover.

The main factor that allows the earth to have various weather conditions is the sun.

The heat of the sun affects the atmosphere to create weather; for instance, heat from the sun causes water to evaporate, which can produce rain.

The following activities will help you to better understand the weather by monitoring some of the key factors that affect the weather. It is important that the measurements are taken at about the same time each day so that they can be compared. As such timing is one of the first things to decide.

SEASONS

Cambodia has two distinct seasons – the wet and the dry.

Dry season runs from November to April. In this time rainfall is at its lowest and temperatures are at their highest during March - May and can reach 95° f (35 degrees Celsius), especially south and central, while winter lows seldom fall below 50° f (10 degreees Celsius). November to January are cooler while February to April are hot and dusty. November is the coolest month, April the hottest.

Wet season runs from May to October due to the southwest monsoon. Wet season brings some 75% of Cambodia's annual rainfall. July to September are the wettest months. There is often seasonal flooding in Phnom Penh and the rest of Cambodia in late-July and early-August.

Cambodia's weather revolves around monsoons, so rainfall is significant, with the heaviest amounts falling in the southeast, and mountainous coastal areas. Daytime humidity countrywide is near 60 percent, while in the evenings, 90 percent is quite common.

STORMS – THUNDER AND LIGHTNING

These two always go hand in hand. Lightning is a massive electrical discharge between one cloud and another, from a cloud into the air, or between a cloud and the ground. Only about one in five lightning strokes are from cloud to ground. The delay between when you see lightning and when you hear thunder occurs because sound travels much more slowly than light. Sound travels through air at about 330-350 metres per second (one kilometre per three seconds). This forms the basis for a rule that we can use to estimate our distance from the lightning (ground stroke).

Next time there is a storm, count the seconds between a flash of lightning and the thunder - every second indicates a distance of about 330 metres. Therefore a pause of three seconds means that the lightening hit about 1 km away.

Seek shelter immediately if a storm is approaching. But do not rest under a large trees as trees are sometimes hit by lightning as they are the highest point on the landscape.

HUMAN EFFECTS ON WEATHER

At present there is a global rise in temperatures. Many people believe that this temperature increase, or Global Warming, is caused from increasing carbon dioxide emissions from both industrialized and developing countries. Carbon dioxide emissions come from the burning of wood and fossil fuels. For example burning coal to make electricity and burning petrol in our car and motorbike engines. Forests help in the absorbtion of carbon dioxide and they produce oxygen. Some countries are planting extra trees to compensate for the increase in carbon emissions.

Scientists have identified that our health, agriculture, water resources, forests, wildlife and coastal areas are vulnerable to the changes that global warming may bring. But projecting what the exact impacts will be over the next century remains very difficult.

There is the possibility that a warmer world could lead to more frequent and intense storms, including hurricanes. Preliminary evidence suggests that, once hurricanes do form, they will be stronger if the oceans are warmer due to global warming.

IMPACT OF SEASONS ON FARMING:

The country's food production is also highly vulnerable to the effects of adverse weather conditions, such as drought and floods.

Weather, climate and water have a major impact on socio-economic development. Accurate observations and predictions about weather, climate and water, are of vital importance.

Cambodian people rely greatly on natural resources for their livelihood. According to UNDP, four out of five Cambodians make their living directly from the water, fish and forests of their country. Weather conditions play a very important role in farming. The success or failure of farm crops depends on the weather. E.g. too much rain can drown a crop, whilst too little, hampers growth. Farmers must firstly think about the weather and seasons and then plan what crops to plant at what time of the year.

1. PLANTING SEASON THE CROP:

From November to January, is a good time to grow vegetables, because there are not so many diseases or insects to destroy the crops. But we need to water our plants at this time.

From February to May, it too hot and not a good time to grow crops. During this time when it does rain, the rain can cause damage to the flowers and fruits. For example when the mango tree is flowering rains, can cause the flowers and small fruits to fall from the trees.

From June to October, many areas flood and it is difficult to grow crops.

2. WATER FESTIVAL SEASON:

Generally it happens every year in November. This is the season when most farmers have just transplanted their rice, so they can join the Water Festival

3. HARVESTING RICE SEASON:

This usually occurs in the dry season before Khmer New Year, because with no recent rain, the rice is easy to harvest. After harvest, famrers may have enough time and money to celebrate the Khmer New Year.

4. ROYAL PLOUGHING CEREMONY:

Usually occurs in May and is a ceremony to predict the next yield of crop production, the level of rain and diseases for the year.

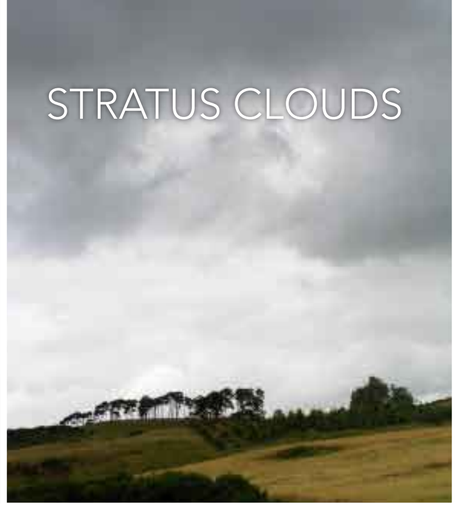
DISCUSSION POINTS

A. Why is weather important (temperature, wind, rain)?

B. What are the effects of bad weather?

C. What are your local seasons? Why is knowing about seasons important to us?

D. Can human activities affect weather? How?



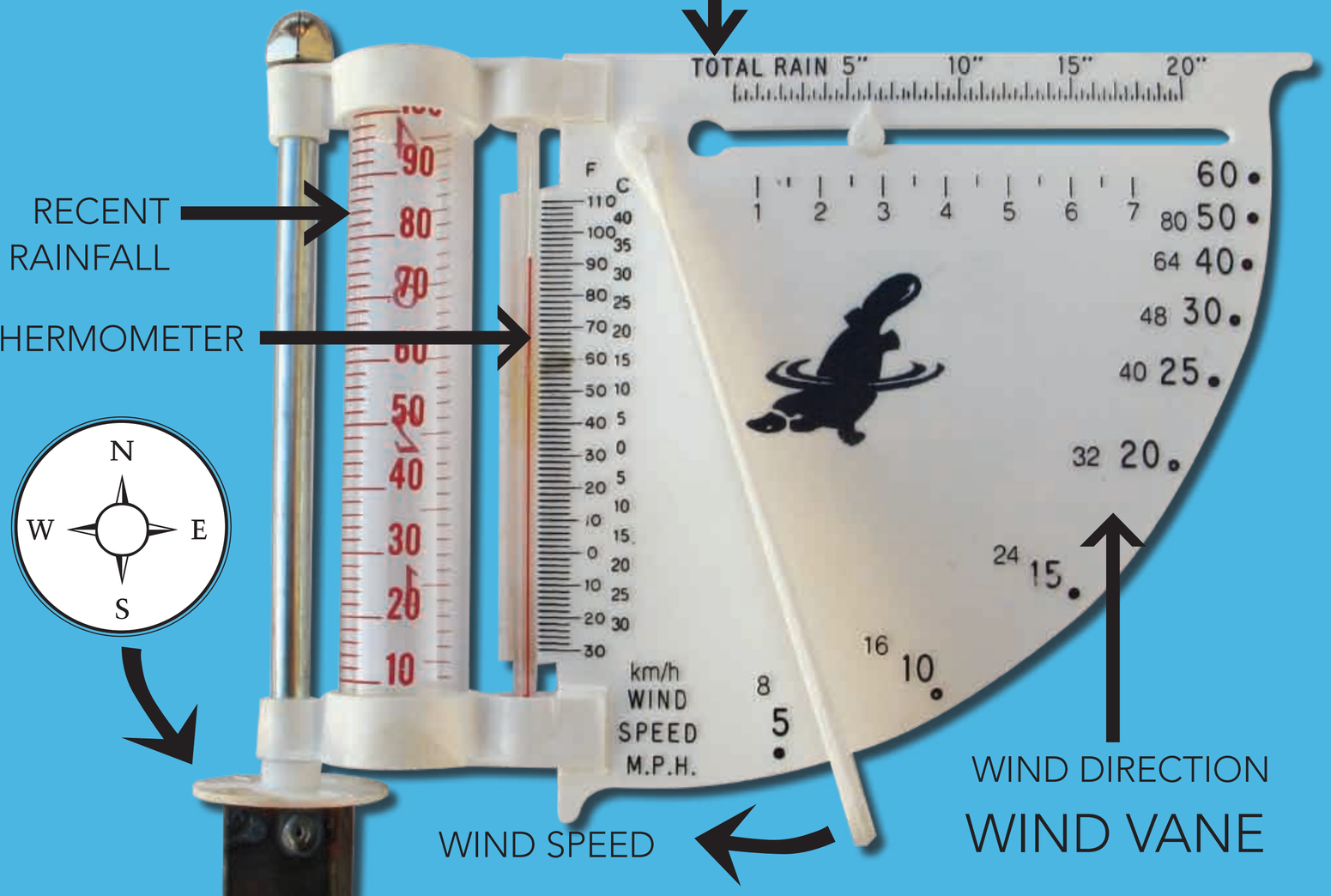
WEATHER MONITORING

RAIN GAUGE

TOTAL RAINFALL

RECENT RAINFALL

THERMOMETER



WIND DIRECTION

WIND VANE

WIND SPEED

Weather kit monitors:

- total rain
- recent rain
- wind speed
- temperature
- wind direction

INSTRUCTIONS:

- Attach wind-speed indicator flap to weather meter
- Use a compass to align the directions with north, south, east & west.
- Select site where wind can reach the meter but is safe from theft or adverse conditions
- Make sure meter swings freely and is within eye level
- Empty rainfall tube after each rain and record the amount of rain on sliding rain scale

WEATHER ACTIVITIES

SETTING UP THE WEATHER MONITORING STATION

When setting up your weather monitoring station it is very important to consider the following:

1. Place in an open location, so wind & rain can be accurately measured, 2. Align the directions north, south, east, west using a compass, 3. Place it in a secure place so it won't be stolen.

Note: For weather activities it is best to try to record the data on a daily basis but if this is not possible then as often as possible. It is also important to collect the information at the same time each day – if you collect temperature at 6am one day and then 11am the next you will definitely see a difference but it won't help you monitor the local weather over a period of time. It may be useful to have at least two volunteers for each daily reading.

The data obtained from the following activities should be recorded daily in the RECORD BOOK (provided). This book can be taken outside by students to write down the results. Daily, this data should then be transfered to larger WALL GRAPHS, so the whole class can see the daily results and become involved. This will help keep class interested. The activities on this page encourages the students to:
1. observe weather 2. measure weather 3. record weather 4. analyse data 5. make graphs to show longer term trends and 6. display in class

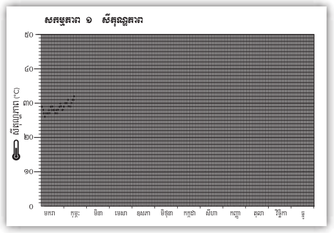
10 minutes then ongoing

ACTIVITY 1 TEMPERATURE

Material: Thermometer, record book (weather monitoring chart) and large charts to pin up on wall

Action: As a group get students to check the thermometer and write down the temperature at the same time each day/week. (The teacher should nominate 2 students to do this for the rest of the week, outside eco-class time). Enter this data in the RECORD BOOK – monitoring chart, also mark the appropriate weather box. Record the daily temperature on a graph (see sample below) and display this large graph on classroom wall. Are the days getting hotter or colder?

eg.

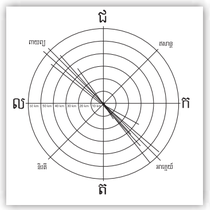


Theory: When the sun is closer it can heat up the earth more. Factors such as cloud cover or forest cover can influence the temperature. Large areas of water tend to moderate changes in temperature as water is slower to change temperature than air.

10 minutes then onging

ACTIVITY 2 WIND

eg.



Material: Wind vane, compass and RECORD BOOK - weather monitoring worksheet

Action: Write down the direction and strength of the wind at the same time each day. (nominate 2 students to do this for the rest of the week, when not eco-class day)

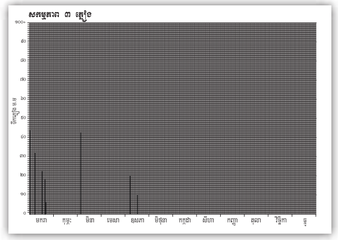
When the wind vane is pointing south it means that the wind is coming from the North. Each month graph the results. Is the wind coming from the same direction? Is it getting windy more or less often?

Theory: Heat from the sun warms the air, which rises and creates areas of low pressure. Wind is the movement of air from high-pressure areas to low-pressure areas in the atmosphere.

Note: It may be helpful to mark out the major compass bearings on the ground, below the weather station, to give the students a easily recognisable sense of direction. eg. N, S, E, W, SE, SW, NE, NW

5 minutes then ongoing

ACTIVITY 3 RAINFALL



Material: Rain gauge & RECORD BOOK – weather monitoring worksheet

Action: Use the rain gauge to measure the amount of rain each day. (The teacher should nominate a student to do this for the rest of the week)

After measuring empty the vessel. When the water is less than 10mm then you need to estimate. If the container is already full then note the amount and add a + sign. Record the information on a graph. Are you getting more or less rain?

Theory: Heat from the sun causes water to evaporate. Transpiration is the movement of water from the ground through the plant roots up into to the leaves and out to the air. The moisture in the air, from evaporation and transpiration, accumulates and can produce rain.

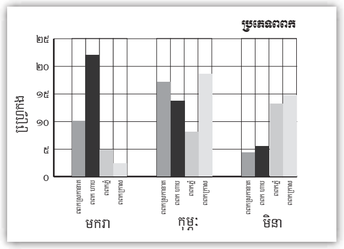
5–10 minutes then ongoing

ACTIVITY 4 OBSERVING CLOUD FORMATIONS

Material: RECORD BOOK – Weather monitoring worksheet

Action: Observe the sky. What kinds of clouds are present – what do they look like? How high are they in the sky? What shape are they? Record the type of clouds on the Weather Monitoring Worksheet. Do some clouds link to different weather such as rain or wind? At the end of the month, the data on cloud type can be graphed. (see sample below)

Theory: Clouds are produced when moist air is cooled. They are a visual indicator of moisture cooling in the air: literally clouds are made up of very small liquid droplets. There is a large variety of clouds groups, which are broken into three primary groups depending on where they are in the sky: high clouds, middle clouds and low clouds. The clouds are further defined by their appearances – cumulus clouds have a bubbly appearance, cirrus clouds have a wispy appearance, stratus is sheet-like and nimbus clouds are rain bearing.



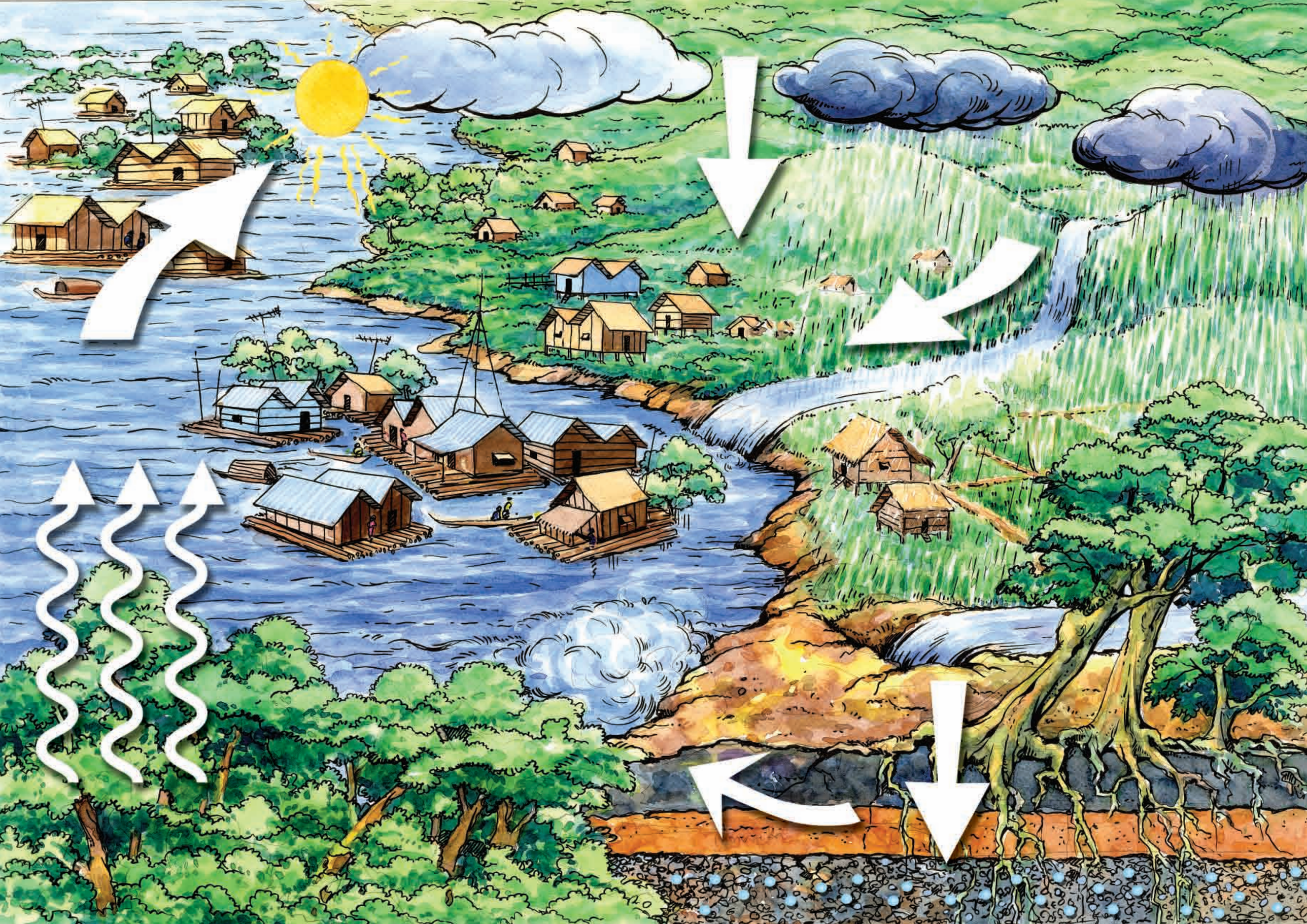
Monthly

ACTIVITY 5 SEASONS

Material: RECORD BOOK – Weather monitoring chart and graphs

Action: Compare the graphs from rainfall, sunshine, wind, and cloud cover over a few months. Observe patterns between the graphs. Observe seasonal patterns over time.

Theory: Clouds, temperature, wind and rainfall all relate to each other, each one affecting the other. By observing the patterns, weather can be predicted and climate defined. Seasons are defined by the weather patterns. Seasons vary based upon the location on the earth. All areas have seasons but areas that are further from the equator have greater changes in seasons.



WATER CYCLE THEORY

20 minutes

Water is one of the most basic of human needs. Without water, life could not exist. It is the most valuable resource on Earth.

The freshwater that we can use on earth is being constantly recycled through the water cycle. Rain water that soaks into the ground, runs off the land and flows into streams, rivers, lakes, ponds, sea and oceans is heated by the sun and rises up into the atmosphere to form clouds. When it rains again the process starts all over again.

As shown in the illustration the water cycle consists of the following:

1. TRANSPIRATION

Plants draw water in at the roots where it moves up to the leaves, and then evaporates. This process is called TRANSPIRATION and is responsible for much of the water that enters the atmosphere. If plants are removed, particularly trees, then this part of the water cycle is disrupted, there is less transpiration and therefore less rain.

2. EVAPORATION

Energy supplied by the sun helps water to rise up (evaporate) from trees and water surfaces such as lakes and oceans, into the atmosphere. (Note that rainwater is always fresh and not salty)

3. CONDENSATION AND RAIN

These drops of water in the atmosphere form into (condense) clouds. The sun also provides the energy which drives the weather systems to move the water vapor (clouds) inland (otherwise, it would only rain over the oceans). Once water condenses, it gets heavier, gravity takes over and the water is pulled to the ground as rain water.

4. RUNOFF AND INFILTRATION

Rain water runs off the land and flows into oceans, lakes and rivers. Rainwater can also soak into the soil, subsoil and rock to become groundwater. The water moves down into the ground because of gravity, passing between particles of soil, sand, gravel, or rock until it reaches impervious rock. This area becomes filled, or saturated with water. This ground water may be very near the ground's surface or it may be hundreds of feet below. Wells that are sunk in the ground tap into this groundwater, or sometimes groundwater makes its way to the surface and forms a spring – another source of drinking water for a village.

5. GROUNDWATER

Most groundwater is clean, but it can become polluted, or contaminated. It can become polluted from sewage, or when people apply too much fertilizer or pesticides to their fields. When pollutants leak, spill, or are carelessly dumped on the ground they can move through the soil to contaminate water.

Because groundwater is deep in the ground, groundwater pollution is generally difficult and expensive to clean up. Sometimes people have to find new places to dig a well because their own becomes contaminated.

6. STORAGE

Huge quantities of water are stored in rivers, oceans, lakes and glaciers.

WATER QUALITY & TREATMENT

It is important to check the quality of the water you are drinking regularly as even rainwater can become foul. Checking its smell and appearance are simple ways to determine the quality, but a H2S strip is another more accurate way to see if there is any bacterial contamination in the water.

There are several ways to purify water for drinking: eg. boiling constantly for 5 minutes or using a ceramic water filter. Other solutions are to protect water sources through management of human waste, livestock waste, rubbish and chemical waste. Ensuring there are trees around water sources is also important as trees act as a natural filter to protect the water source.

CERAMIC FILTERS

A ceramic filter is very easy to use and removes all germs and bacteria from water. It works with both rain water and surface water. This system is especially valuable in areas where electricity is not available as it relies on gravity. For about $10 US dollars an easy to use filtration system can be installed.

HOW DOES IT WORK?

1. A specially constructed clay/ceramic pot is placed inside the top of a large water storage container.
2. Contaminated water is poured into the ceramic pot.
3. As the water seeps through the porous pot, nearly all of the impurities are removed.
4. Pure drinkable water is collected in the large water container.

If the water is turbid or cloudy or has a lot of solids in it then it needs to be periodically cleaned with a soft bristle brush. Solids such as leaves or other biomass from a highly contaminated source should be cleaned more frequently.

WHAT ARE PH LEVELS? WHAT DOES IT MEAN?

PH is a scale that measures how acidic or alkaline a substance is. The scale ranges from 1 to 14 with 1 being very acid, 7 neutral and 14 very alkaline. A pH level that is too low, such as acid rain, may cause corrosion to metals and damage to plants. A pH level that is to high may cause the water to appear cloudy and contribute to the formation of scale in piping. The recommended pH level is between 6.5-8.5

DISCUSSION POINTS

A. Why is water important to the us and the planet?

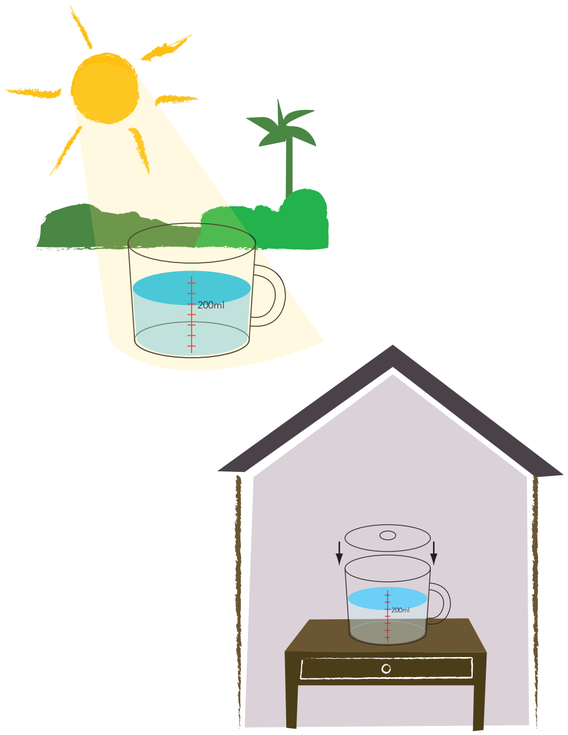
B. Where does your drinking water come from?

C. Can human activites affect water quality? How?

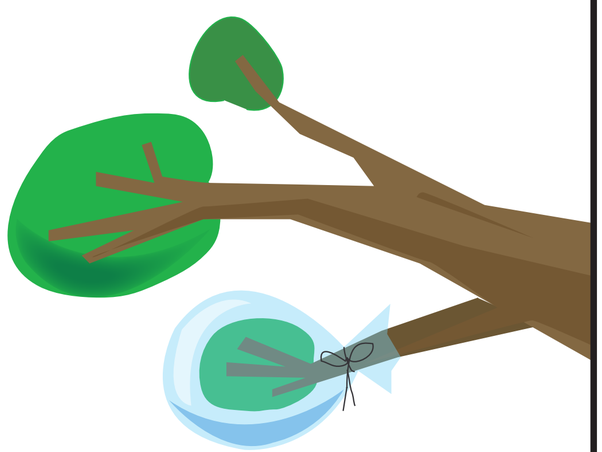
D. How can you treat water for drinking?

WATER CYCLE ACTIVITY

ACTIVITY 1
EVAPORATION



ACTIVITY 2
TRANSPIRATION



ACTIVITY 3
WATER TEST KIT

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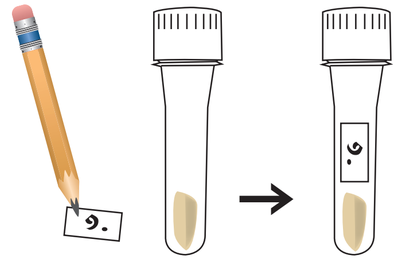

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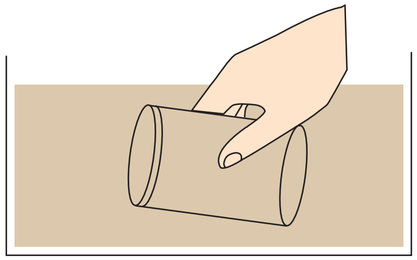

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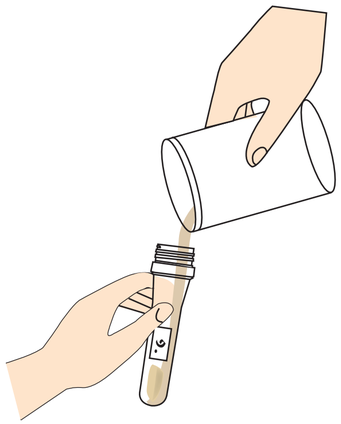

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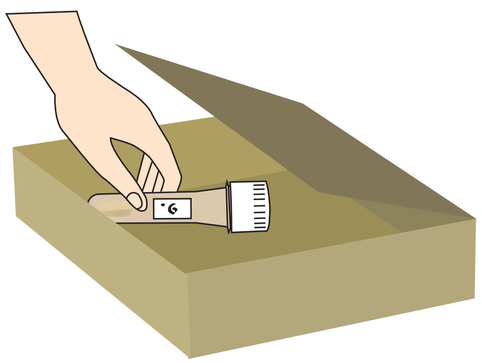

ACTIVITY 4
pH LEVEL TESTING

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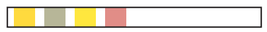

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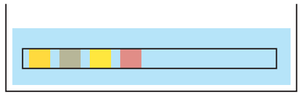

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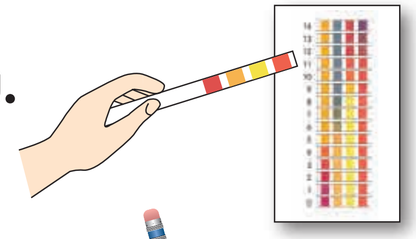

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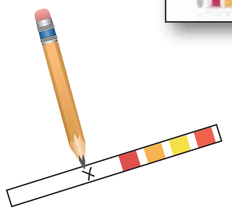
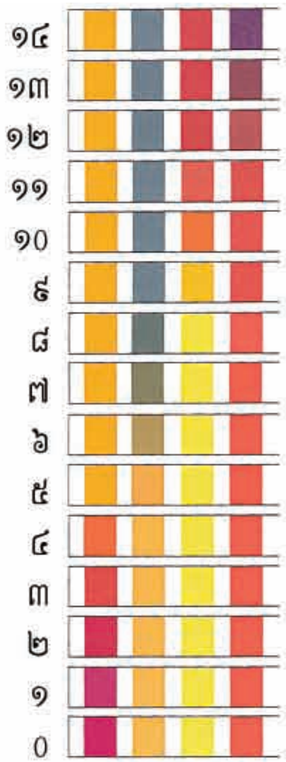




Bleach 12.5

Household ammonia 11.5

Hand soap 9.0

Sea water 8.0

Blood, pure water 7.5

Healthy human saliva, milk 6.5

Coffee and tea 5.0

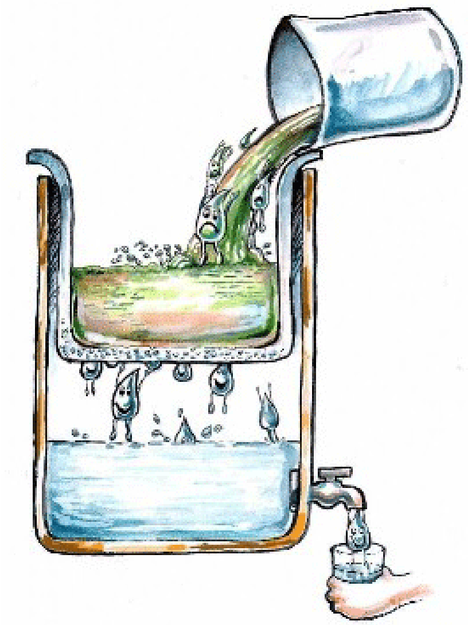
Acid Rain (<5)

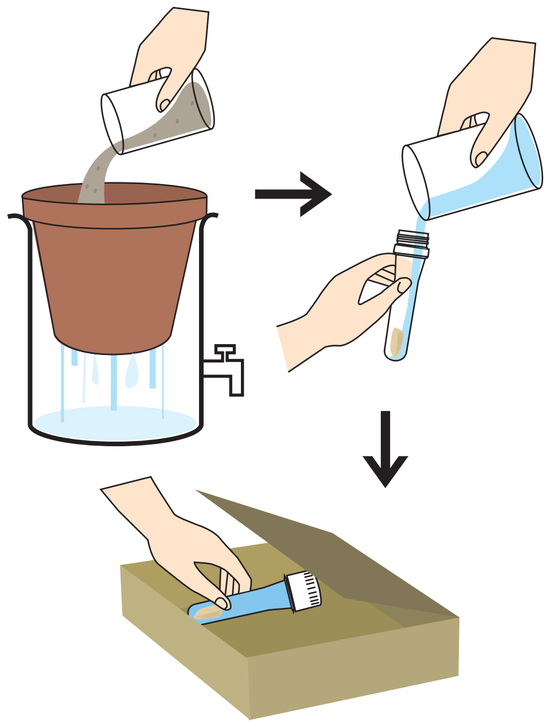
Orange or apple juice
Vinegar 3

Gastric acid 2, lemon juice 2.4

Battery acid 0.5

ACTIVITY 5
CERAMIC FILTERS – TREATMENT





WATER CYCLE ACTIVITY

Water is one of the most basic of human needs. Without water, life could not exist. It is the most valuable resource in the world. We must make every effort to keep this resource clean. Dirty water results in sick people. It is also vital in the environment as it supports our animal and plant life, which in turn supports our livelihood.

Water for human consumption can be collected from rivers, lakes, wells or from rain. It is important to check the quality of the water you are drinking regularly as even rainwater can become foul. Checking its smell and appearance are simple ways to check the quality. You should compare the taste to bottled drinking water. It is not always possible to determine the quality of drinking water therefore it is best to purify anyway.

Water pollution has many causes and characteristics. The main cause of water pollution is sewage as a result of poor sanitation systems. Lakes and rivers become polluted with sewage and are often the only source of water in the local area. Rubbish and chemicals also contaminate water. Wastes that enter water sources can have potential health impacts and cause other environmental problems.

Drinking water needs to undergo a process of purification. eg. boiling constantly for 5 minutes or using a ceramic water filter. Other solutions are to protect water sources through management of human waste, livestock waste, rubbish and chemical waste. Ensuring there are trees around water sources is also important as trees act as a natural filter to protect the water source.

WHAT IS WATER?

Water is a simple molecule that consists of one oxygen atom and two hydrogen atoms. (An atom is the smallest component of an element having the chemical properties of the element.) Water molecules like to stick together, but don't like to be squeezed into tight spaces. At different temperatures water has different properties. It is most commonly a liquid but can turn solid when very cold (ice), and when very hot it can become a vapour.

one week

ACTIVITY 1
EVAPORATION

Materials: Two measuring containers

Action: Pour 100ml into each of the two measuring containers. Place one measuring container in direct sunlight and another measuring container inside in the shade and cover this one. After two hours – a day and a week – check the water level. How much water is left in the containers. Note down the differences. You can mark this on the container with a pen. Why do you think this has happened?

Theory: As the water heats up it becomes vapour and then moves into the air. The hotter the water becomes the more water will evaporate. This is partly how water is recycled in nature. For example, sunlight causes evaporation from seawater or freshwater. The water vapour rises and forms clouds in the sky. When the water vapour in clouds gets cooler, it condenses and forms rain.

20 minutes

ACTIVITY 2
TRANSPIRATION

Materials: Two plastic bags and some string

Action: Place a clear plastic bag around a horizontal branch of a tree. Tie the end of the bag around the branch, ensuring that there is air in the bag but that it is sealed so the air cannot get out. It might be interesting to do this activity with a couple of different trees. At the end of the session and again after a week, check the bags. Note down your observations. If there is anything in the bag measure it after a week.

Theory: The water that is collected in the bag has travelled through the tree, moving up from the roots through the trunk and stems and into the leaves. The movement of water through the leaves is called 'transpiration' – this is an important part of the water cycle. It is almost like the tree is sweating!

20 minutes

ACTIVITY 3
WATER TEST KIT

Materials: Ten water test kits – (H2S strip in small bottle)

Action: Split into two groups with 5 bottles each. Number the test bottles. Take the first bottle and carefully fill it with bottled drinking water – this is the control and should not go black in colour. Take the other test bottles and fill them with drinking water from other different sources, such as tank water, river, lake, and pond. Make sure you note down which number bottle corresponds with each sample. Check the samples to see if there is any instant colour changes and note this. The samples should then be stored in a dark place and final results obtained after one week.

Theory: The strip in the small bottle will make the water change colour to black if there is a specific bacteria (e. coli) in the water. The bacteria is associated with faeces and as such is an indicator that the water is polluted and not good for drinking.

30 minutes

ACTIVITY 4
PH LEVEL TESTING

Materials: Six strips of litmus paper, plus some substances to test: juice from lime, fish sauce, soapy water, sample of pond water, rainwater, sample of lake or river water

Action: Put the 4 substances as mentioned above in separate containers. Make a sixth mixture using your saliva. Test each solution one by one, by dropping in one piece of litmus paper. Record how the solution affects the litmus paper. Record your observations and check the pH level using the colour table provided.
NB: when checking pH of saliva do not stick the pH strip in your mouth!

Once the test is complete and result recorded, put a cross on the end of the paper, to indicate that is is used. Do not put the Litmus paper back in the container, it cannot be reused, it should be thrown in the rubbish bin.

Theory: PH is a scale that measures how acidic or alkaline a substance is. Litmus paper can be used to measure the pH of a substance. Litmus paper provides a ready and simple means of distinguishing between acids and alkalis. It turns red in acid substances (below pH5), turns blue in alkaline substances (above pH9) and green in Neutral substances. The pH of your drinking water reflects how acidic it is. pH stands for "potential hydrogen", referring to the amount of hydrogen mixed with the water. The normal range for pH in ground water lies between 6 and 8.5. By comparison, lemon measures about 2, while milk measures around 6.4 pH. Drinking water with a pH level above 8.5 could indicate that the water is hard. The recommended pH level is between 6.5-8.5

?? minutes

ACTIVITY 5
CERAMIC FILTERS – PURIFICATION

Note: This activity is linked to Activity 3.

Materials: Ceramic water purification tank and 2 H2S water test kits

Action: Take a sample of water from a source that has been identified in activity 3 as contaminated. Pour the water into the ceramic filter, collect the water after it has been filtered and re-test to see if it is still contaminated. (use the method as in activity 3)

Theory: Two processes are at work. Because the mixture of rice and clay has small micropores: parasites, amoebas, and large bacteria cannot flow through these micorpores. Simply put, water can fit through the pores, most disease causing organisms cannot. A coating of colloidal silver adds a chemical process to stop other bacteria. Together, this system eliminates 98% of the harmful diseases present in surface water. It does not eliminate some chemicals.


ធុងសំរាម


កាត់បន្ថយ
ប្រើប្រាស់ឡើងវិញ
កែច្នៃឡើងវិញ

WASTE THEORY

20+ minutes

Waste management is one of the biggest environmental challenges in the world. As populations grow so do waste problems. Many modern wastes are non-organic and societies are not acting to effectively reduce, reuse and recycle these wastes. Effective waste management requires communities to take ownership of waste issues, starting from the household level.

Waste can be divided into 2 major groupings: organic and non-organic.

Organic materials are often the bulk of our waste materials. Organic materials are those that break down easily in the environment such as paper, food and plant material. These organic materials can be composted.

Non-organic waste may break down, but the process can take a very long time, sometmes thousands of years. When some of these eventually do break down, they breakdown into smaller component parts. Sometimes these components can also cause pollution.

Waste can be a solid (for example bottles or cans) a liquid (eg. sewerage) or a gas (eg. fumes from a car).

There are 3 main sources of waste:

1. Domestic Waste - produced in the home, includes food scraps, unwanted plastic bags and bottles. Hazardous waste is produced as a result of using chemical fertilizers and pesticides.
2. Commercial waste - waste from markets, shops, hotels and health clinics. Commerical waste includes unwanted packing materials, wood, glass, plastic and food scraps.
3. Industrial Waste- produced in factories, including unwanted chemicals and other by-products generated in the manufacturing of products.

The following techniques can be used to protect people from environmental pollution.

REDUCE, REUSE AND RECYCLE

REDUCE – Using less of things, for example, don't throw away paper unless you have used both sides. Reduce the use of plastics by using a longer life bag or a woven basket. For example when we buy something from a shop which is already packaged in a box, or wrapped in paper or plastic, we do not need to put it into another plastic bag.It is even better to bring your own cloth bag and avoid plastic altogether.

Cambodia has a population of about 12 million people, if everyone used 4 disposable plastic bags each day, it would calculate to 48 million plastic bags would be thrown away everyday of the year. This a lot of plastic!

REUSE – There are many things that we can use again instead of throwing away, for example, use a plastic bottle again for storing honey or growing seedlings.

RECYCLE - This is the process where recyclable materials (eg paper, plastic, glass, metal, aluminum, steel etc.) are converted into new products.

Never throw waste into a street or river or anywhere else in the environment.

POLLUTION

Pollution is contamination of the environment with waste people produce. If waste is thrown into the environment it causes pollution. If people do not dispose of their waste correctly if can have serious impacts on the environment and the health of people. If people throw their waste into the river, the water will become polluted. If people drink water or eat the fish from a polluted river they will become sick. If people throw waste into the street, rats will scavenge in the waste and this will spread disease.

WHY MAKE COMPOST?

Don't throw away materials when you can use them to improve your soil and garden! Compost is one of nature's best mulches and soil amendments, and you can use it instead of commercial fertilisers. Best of all, compost is free. Using compost improves soil structure, texture, and aeration and increases the soil's water-holding capacity. Compost loosens clay soils and helps sandy soils retain water. Adding compost improves soil fertility and stimulates healthy root development in plants. The organic matter provided in compost provides food for microorganisms, which keeps the soil in a healthy, balanced condition. Nitrogen, potassium, and phosphorus will be produced naturally by the feeding of microorganisms.

HOW DOES COMPOST DECOMPOSE/BREAKDOWN?

Compost is the end product of a complex feeding pattern involving hundreds of different organisms, including bacteria, fungi, worms, and insects. What remains after these organisms break down organic materials is a rich, earthy substance. Composting replicates nature's natural system of breaking down materials on the forest floor. In every forest, grassland, jungle, and garden, plants die, fall to the ground, and decay. These are slowly dismantled by the small organisms living in the soil. Eventually these plant parts disappear into the brown crumbly forest floor.

By providing the right environment for the organisms in the compost pile, it is possible to produce excellent compost. We usually want to organize and hasten Mother Nature's process. By knowing the optimum conditions of heat, moisture, air, and materials, we can speed up the composting process. Besides producing more good soil faster, making the compost faster creates heat which will destroy plant diseases and weed seeds in the pile.

COMPOST MATERIALS:

Almost any organic material is suitable for a compost pile. The pile needs a proper ratio of carbon-rich materials, or "browns," and nitrogen-rich materials, or "greens." Among the brown materials are dried leaves, straw, and wood chips. Nitrogen materials are fresh or green, such as grass clippings and food scraps and manure .

Food Scraps: includes carrot peelings, apple cores, banana peels - You can successfully compost all forms of food waste. However, meat, meat products, dairy products, can present problems. Meat scraps and the rest will decompose eventually, but will smell bad and attract pests. All additions to the compost pile will decompose more quickly if they are chopped up before adding.

Wood Ashes from a wood burning stove or fireplace can be added to the compost pile. They are especially high in potassium. Don't use coal ashes, as they usually contain large amounts of sulfur and iron that can injure your plants.

Manure is one of the finest materials you can add to any compost pile. It contains large amounts of both nitrogen and beneficial microbes. Manure for composting can come from bats, sheep, ducks, pigs, goats, cows, pigeons, and any other vegetarian animal. As a rule of thumb, you should avoid manure from carnivores, as it can contain dangerous pathogens. Most manures are considered "hot" when fresh, meaning it is so rich in nutrients that it can burn the tender roots of young plants or overheat a compost pile, killing off earthworms and friendly bacteria. If left to age a little, however, these materials are fine to use.

COMPOST SITE SELECTION

Any pile of organic matter will eventually rot, but a well-chosen site can speed up the process. Look for a level, well-drained area, shelter the pile in a shadier spot so it doesn't dry out too quickly.

Build the pile over soil or lawn rather than concrete or asphalt, to take advantage of the earthworms, beneficial microbes, and other decomposers, which will migrate up and down as the seasons change.

DISCUSSION POINTS

A. What is the difference between organic and non organic waste?

B. What happens if we throw non organic waste in waterways and on the ground?

C. What breaks down the quickest, an apple core, a plastic bag, or some paper?

D. Can waste affect human health?

ACTIVITY 1- SCHOOL AUDIT

ACTIVITY 3 – COMPOST

ACTIVITY 2- WASTE DECOMPOSTITION

ACTIVITY 4 – REUSE

WASTE ACTIVITY

30 minutes

ACTIVITY 1
SCHOOL AUDIT

Material: Large white paper and coloured markers. Question sheets and four rubbish baskets

Action: As a group draw a large map of the school. Mark in special feature such as buildings, gates, fences, etc. Then walk around your school ground in groups of 4 and record and collect the kinds of litter in your school yard. (dont forget to pick it up and dispose of it properly!)

Answer the following questions on the handout:

1. List the kinds of litter you collect
2. Record the numbers of each kind of rubbish. What is the most common?
3. Where does this waste come from? How did it get here?
4. What are the consqeuences of rubbish in the schoolyard?
5. Can any of it be reduced, reused or recycled? Write the names of the rubbish in each column.
6. Who should be responsible for keeping the school clean?
7. What actions can you and your school take to ensure the school is kept clean?
8. Go back into the class and look again at the map you drew. Each group should mark on the map the locations where most rubbish was found. Discuss

Theory: It is necessary to first understand what waste is being produced so that you can develop a suitable waste management plan. If you don't know what waste there is how will you know how to manage it? Do they have management problems? What about recycling programs already?
This excercise can also be used in other parts of the community.

15 minutes
check weekly

ACTIVITY 2
WASTE DECOMPOSITION

Material: 4 plastic containers, (can use water drinking bottles cut in half) 4 different waste materials (plastic, paper, fruit waste, peel, skins, vegetables, leaves, etc.)

Action: Take a few different waste materials and place one in each container. Leave them in the containers and check them each week. Are some things changing? Which are changing and which are not?

Theory: Different materials break down at different rates – some organics (matter derived from living things) can break down very quickly while things like plastic may not break down. With organic materials some have high nitrogen and break down quickly while others have higher carbon and break down slowly.

ESTIMATES TIME IT TAKES FOR RUBBISH TO BREAKDOWN?
(depending on weather conditions)

- Vegetables - days
- Leaves - weeks
- Fish - weeks
- Stems - months
- Orange and banana peel up to 2 years
- Cigarette butts 1-5 years
- Plastic-coated paper 5 years
- Plastic bags can take between 20 and 1000 years
- Tin cans 50 years
- Aluminium cans 80-100 years
- Glass bottles 1 million years
- Plastic bottles indefinitely

40 minutes
then onging

ACTIVITY 3
COMPOST

Materials: Composting Handout. Ask the students to bring in some organic materials. eg. paper, cardboard, fruit and vegetable scraps, leaves, grass etc. The teacher will also need a small knife to chop up large matter, and some water to make the compost heap wet.

The compost heap needs to be watered once a day. Every 2-3 weeks you will need to take off the outside grass layer and mix the compost that remains. After mixing put the grass cover back on and water.

Action: Discuss the concept of compost with the students. Get them to list down the organic materials that are considered waste. Layout the materials that been collected for the heap and ensure that there are also sufficient leaves or dry yard wastes. Examine the material and determine which should and should not be placed in the heap.

Now follow the instuctions on the composting handout

Theory: Compost not only reduces what is considered waste it is also a very useful way to reuse this organic material and can help in making more fertile soil without the need for any chemicals. Compost is natures way of breaking down organic material into usable pieces for plants and animals. It is an important part of the cycle of life.

20 minutes

ACTIVITY 4
REUSE

Material: Plastic containers, soil, seeds

Action: Cut the tops off the plastic containers and put small holes in the bottom of plastic containers for drainage. Place a piece of paper in the bottom of the container and then fill it with soil. The container is now suitable for planting the seed (note bigger plants need bigger containers). Make sure you keep the soil moist but give it some but not too much sunlight. Take care of the seed and it should grow.

Theory: It is better to reuse old plastic containers than buy special new containers to grow plants. By reusing the plastic container, you are effectively reducing the amount of waste that needs to be disposed of. By growing a plant you are also having a positive impact on the environment.





ENERGY


SUNLIGHT ENERGY
OXYGEN
CHLOROPHYLL IN GREEN LEAVES
CONVERTS THE ENERGY OF
LIGHT INTO GLUCOSE
CARBON DIOXIDE
CHLOROPHYLL
GLUCOSE
WATER


ENERGY THEORY

30 minutes

What is Energy and why is it important? It's simple – energy is the ability to do work.

The Sun is the most significant energy source on earth. Energy from the sun gives us light during the day. It helps plants grow, and then other animals (including us) eat plants and grow and so on.

Why do humans need energy? When we eat, our bodies transform the energy stored in the food into energy to do work. When we run or walk, we "burn" food energy in our bodies. When we think or read or write, we are also doing work. Many times it's really hard work!

Why do plants and animals need energy? Energy stored in plants is eaten by animals, giving them energy. And predator animals eat their prey, which gives the predator animal energy.

Everything we do is connected to energy in one form or another, but most of the time we think of harnessed energy – the energy we use to do things. Energy lights our cities, powers our vehicles, trains, planes and boats. Energy can cool our homes, cook our food, play our music, and gives us pictures on television. Energy powers machinery in factories and tractors on a farm. A lot of energy is used so humans can do less.

SOURCES OF ENERGY

There are many different energy sources. Some are Renewable, that is can be easily made or "renewed." Others that cannot are called Nonrenewable.

We can never use up renewable fuels. Examples of renewable energy are: Solar, Wind, Geothermal (energy contained within the Earth), Biomass (energy from plant and animal matter), Hydro and Ocean – whilst others are Non-Renewable – like Oil (Petroleum), Natural Gas, Coal and Uranium (Nuclear).

Nonrenewable - Fuels that cannot be easily made or "renewed." We can use up nonrenewable fuels. Oil, natural gas, and coal are nonrenewable fuels. These are the most commonly used fuels at the moment, but unfortunately there are some problems such as pollution so more and more research is being done to encourage the use of renewable fuels.

SUN – PLANT POWER (PHOTOSYNTHESIS)

Most plants don't have to graze, hunt, or shop for food. No, they just sit around. They create meals out of sunlight and water. The big thing that connects plants is photosynthesis. Photosynthesis is the process that allows plants to take energy from the Sun and create sugars. Not all plants go through the process of photosynthesis.

Plants are able to turn sunlight into energy but not directly. Plants are actually able to store energy in some chemical bonds that can be used later. There are two processes on Earth: Photosynthesis and respiration. Photosynthesis stores the energy and respiration releases that energy. It all starts with the Sun. Sunlight is actually energy, electromagnetic energy to be exact. When that energy gets to a green plant, all sorts of reactions can take place to store energy in the form of sugar molecules.

SOLAR POWER – ENERGY FROM THE SUN

The sun has produced energy for billions of years. Solar energy is the solar radiation that reaches the earth. When we hang clothes outside to dry in the sun, we are using the sun's heat to do work -- drying our clothes.

Solar energy can be converted directly or indirectly into other forms of energy, such as heat and electricity. The major drawbacks (problems, or issues to overcome) of solar energy are: (1) the intermittent and variable manner in which it arrives at the earth's surface and, (2) the large area required to collect it at a useful rate.

Solar energy is used for heating water for domestic use, space heating of buildings, drying agricultural products, and generating electrical energy.

HUMAN ENERGY – NUTRITION

FOOD GROUPS

There are 3 major food groups, each of which provides nutrients needed for good health.

1. Energy (carbohydrates)
   Food that provides energy - rice, rice mill, noodles, potato, sweet potato, taro, corn, nuts, bread, coconut flesh, cooking oil, animal fat and honey
2. Building (protein)
   Food to help build the body and provide strength- eggs, fish, chicken, red meat, beef, pork, tofu, soya bean, lentils, milk, crab, frog, fish, prawns, squid, eel, mussels. Two to three servings per day are recommended
3. Protection (vitamins and minerals)
   This is what you should eat the most of. Vitamins are found in most fruits and vegetables, they protect the body from harmful virus and illness. Three to five servings of vegetables are recommended and two to four servings of fruits per day.

   Minerals also protect you from organic diseases and maintain body fluids (electrolyte). They are found mostly in fruits and vegetables, meat and salt

   To maintain health and avoid disease eat a mixture of foods across a range of food types, such as vegetables, fruit, grains, meat and fish. A plate with a variety of colours on it is a simple visual indication of a balanced diet. Variety also means a range of food within the types eg. Vegetables can be tomatoes, corn, carrot, cucumber, wax gourd, pumpkin and eggplant. Ideally 20 -30 different types of foods should be eaten within a week. Diversity is the key to a healthy person and a healthy environment,

ENERGY EFFICIENT COOKING STOVE

Many people in Cambodia use wood to cook with. Unfortunately the demand on wood for cooking and buiilding has seen a reduction in Cambodias forests. If we can use wood more efficiently for cooking, we may be able to save money, time and even some valuable forest.

The reasons for using the Efficient Cooking Stove

- It is economical if we compare with traditional stove, for example: time, fuel or coal and money efficiency
- It burns well and stores the heat longer
- It is well insulated and so heat does not escape to make cooking hot and unpleasant
- It can burn other debris
- It is less smoke and carbon dioxide (CO_2)
- It helps to conserve the forest

DISCUSSION POINTS

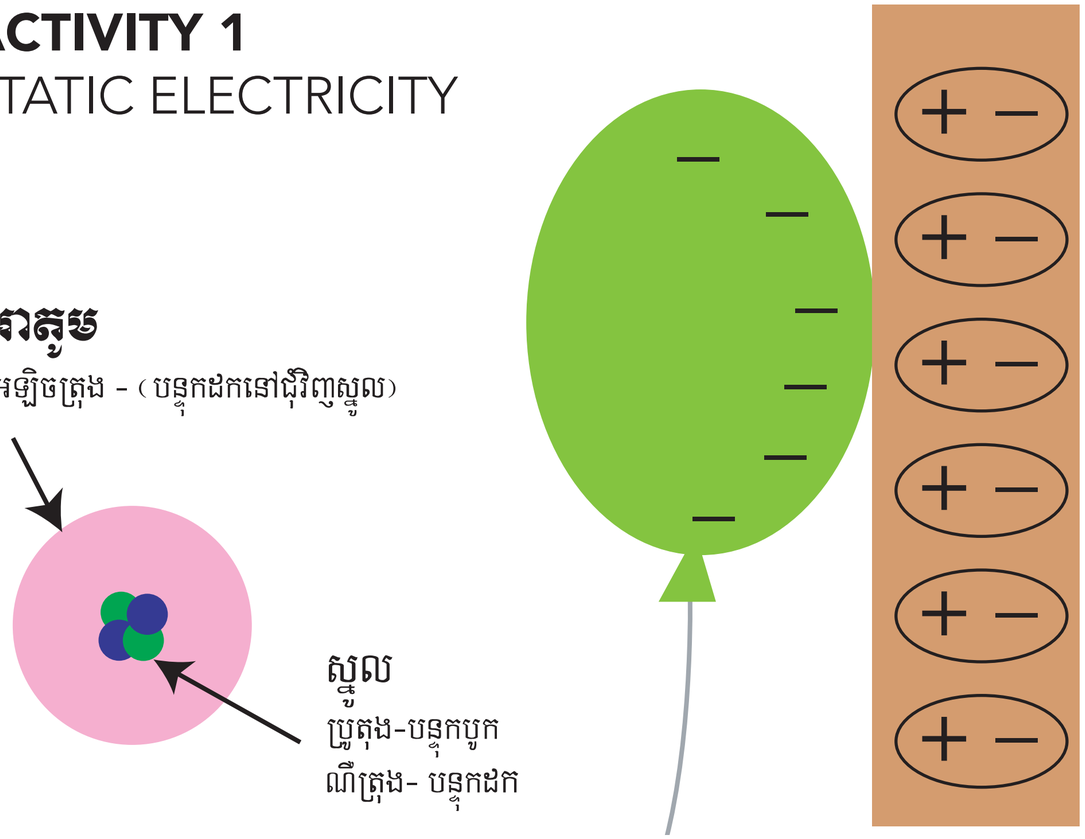
A. How do people get energy for their daily activities?

B. How do plants make energy to grow?

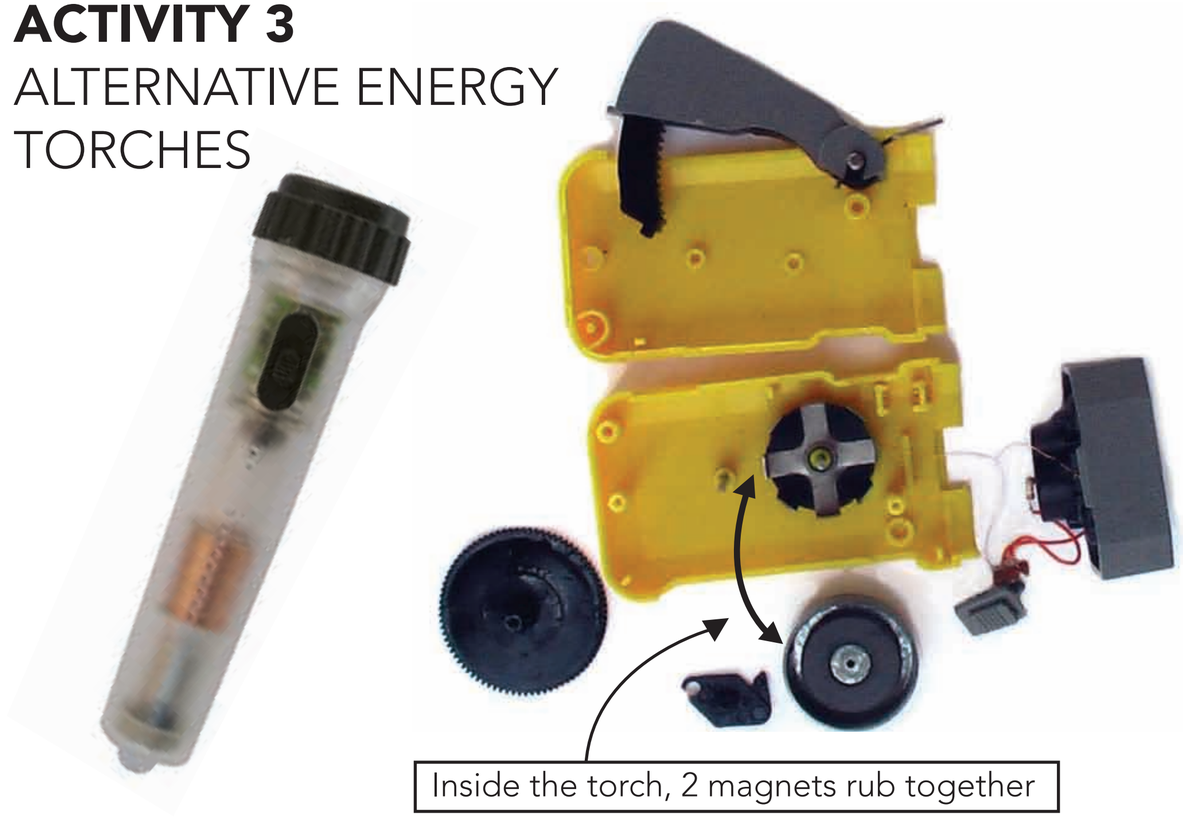
C. What energy do you use at home?

D. Could you reduce your energy use at home? (efficiency)

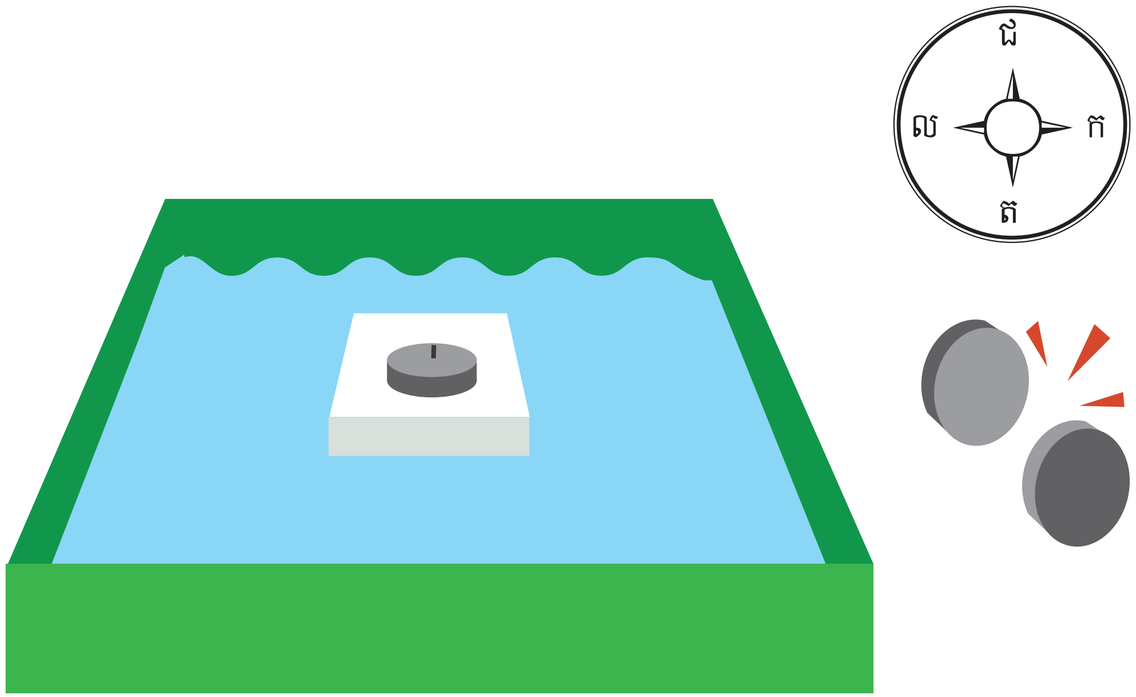
ACTIVITY 1
STATIC ELECTRICITY



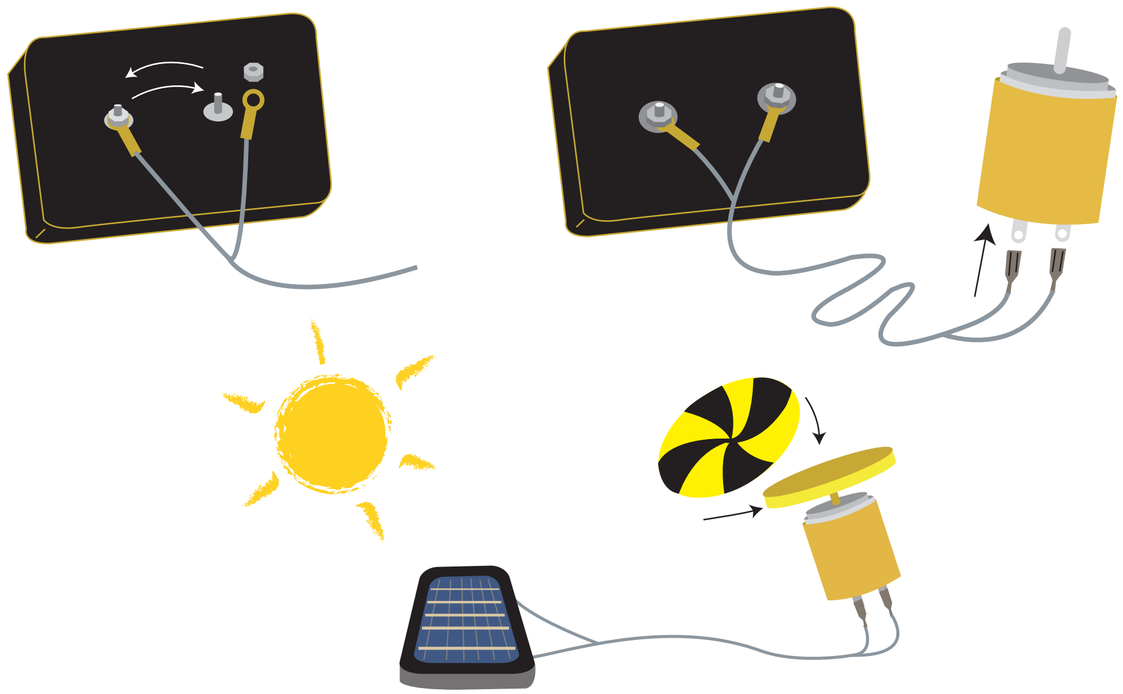
ACTIVITY 3
ALTERNATIVE ENERGY TORCHES



ACTIVITY 2
MAGNETS



ACTIVITY 4
SOLAR ENERGY



ENERGY ACTIVITY

10 minutes

ACTIVITY 1
STATIC ELECTRICITY

Material: Balloons and string

Action: Get each group to inflate a balloon and tie it so it stays inflated. Tie a string to each inflated balloon. Rub a balloon on your hair for about 15 seconds. Be sure to rub around the whole balloon. What happens to your hair? What happens when you bring the balloon back close to your hair? Rub the balloon on your hair again and have a friend do the same with the other balloon.

In groups of 2, get students to hold their balloons by the string, letting the balloons hang freely, but without letting them touch anything. Slowly move the 2 'charged' balloons toward each other, but don't let them touch.

What do you see? Do the balloons push away from each other, or do they pull toward each other? Place your hand between the two hanging balloons. What happens?

Rub the balloon again on your hair, (this removes some of the electrons from your hair and gives the balloon a slight negative charge), then put the balloon against a wall. It will stick (if the weather is dry) since the negative charges in the balloon will re-orient the atoms of the wall, and a weak electrical force will hold the balloon in place on the wall.

Theory: All materials contain millions of tiny particles, called protons and electrons, that have electric charges. There are two kinds of electrical conditions called plus and minus .Protons have positive charges, and electrons negative ones. Usually, they balance each other, but sometimes when two surfaces rub together, some of the electrons rub off one surface onto the other and we can have static electricity. Materials with like charges (all positive or all negative) move away from each other; those with opposite charges attract each other.

20 minutes

ACTIVITY 2
MAGNETS

Material: 2 Magnets & a compass

Action: Ask the students to try to get the magnet to stick to different materials – what will the magnets stick to? Place the magnets near each other – will they stick together in any direction? Place one magnet on a small piece of foam that floats freely in a container of water – does one end of the magnet point in one direction? What happens if you try to make it point in the other direction?

Theory: A magnet attracts iron, nickel, cobalt and combinations of those metals. All magnets have North-seeking (N) and South-seeking (S) poles. When magnets are placed near each other, opposite poles attract and similar poles repel each other. Magnets are found in many of our electrical appliances

30 minutes

ACTIVITY 3
ALTERNATIVE ENERGY TORCHES

Material: 2 Magnet torches and 2 Gyro torches;

Action: Ask the students to describe how a torch works. Ask them what powers the torch? If they say batteries ask what powers the batteries? Then get the students to break into two groups. Give each group a magnetic torch and a gyro torch. Ask them to explain how these work if they do not use/need normal batteries.

Theory: Everything is made of atoms. Every atom consists of a nucleus, which is surrounded by small moving, negatively charged particles, called electrons. An electrical field surrounds every particle that has an electrical charge. By convention, the lines of the electric field are said to radiate from a (+) particle and move towards a (-) particle. It is not certain if there is any direction of radiation, and there is no real good explanation of what the electric field is made of. It's just there. In this case the magnet moves past the field to make electrons. The electrons which, move in a current (through the wire) make electricity. The electricity then powers the torch.

20 minutes

ACTIVITY 4
SOLAR ENERGY

Material: Solar panel kit.

Action: Connect the solar cell and wire with screws and nuts. Connect the solar cell and Assemble the solar kit. Use the solar panel to power the fan. Do this outside in the sunlight and inside in a darker room. Note the difference between outdoors and indoors. When do things spin the fastest?

Theory: Energy is the power to do something. There are many forms of energy. Energy is neither created nor destroyed - it is simply transferred from one form to another. In this instance, light energy (from the sun) is taken in through the panel and transferred into energy to run the small motor.

NOTE: Do not subject the solar cell module to an excessive heat location, as it will warp the plastic lens. Remember, it is not heat that makes your model function, it is light. A little experimentation will tell you what setting makes your model work best! Please handle all models with care.

20 minutes

ACTIVITY 5
SHOPPING

Material: Paper and coloured pencils

Action: Split into group. In groups discuss what you would buy from the market if you had 4000 rial and wanted to make a nutritious meal. Present this to the rest of the group with pictures, prices and reasons for your choices.

Theory: Cambodia has some of the highest malnutrition rates in Asia, with 44% of children under five years of age stunted and 15% wasted. In the extreme this can be life threatening. A good diet is one that balances the 3 food groups ie fruit and vegetables, carbohydrates and protein.