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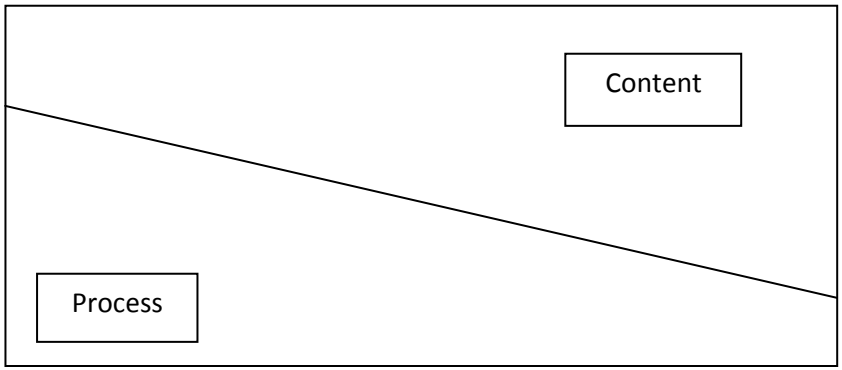
INTRODUCTION

Science and Technology are integral parts of everyday life. The purpose of Science is to answer questions about the nature of our world. Technology helps us to solve problems and meet the demands of work. It is important that science teaching offer opportunities to:

- develop knowledge and understanding of scientific and technological ideas, processes and skills, relating them to everyday experiences.
- learn how to find out, think about and communicate those ideas
- explore values and attitudes through science

During Cycle One, there is a stronger emphasis on the process skills than on content knowledge as opposed to Cycle Two where content plays a greater role.



Cycle One **Cycle Two**

The Cycle Two students progress from:

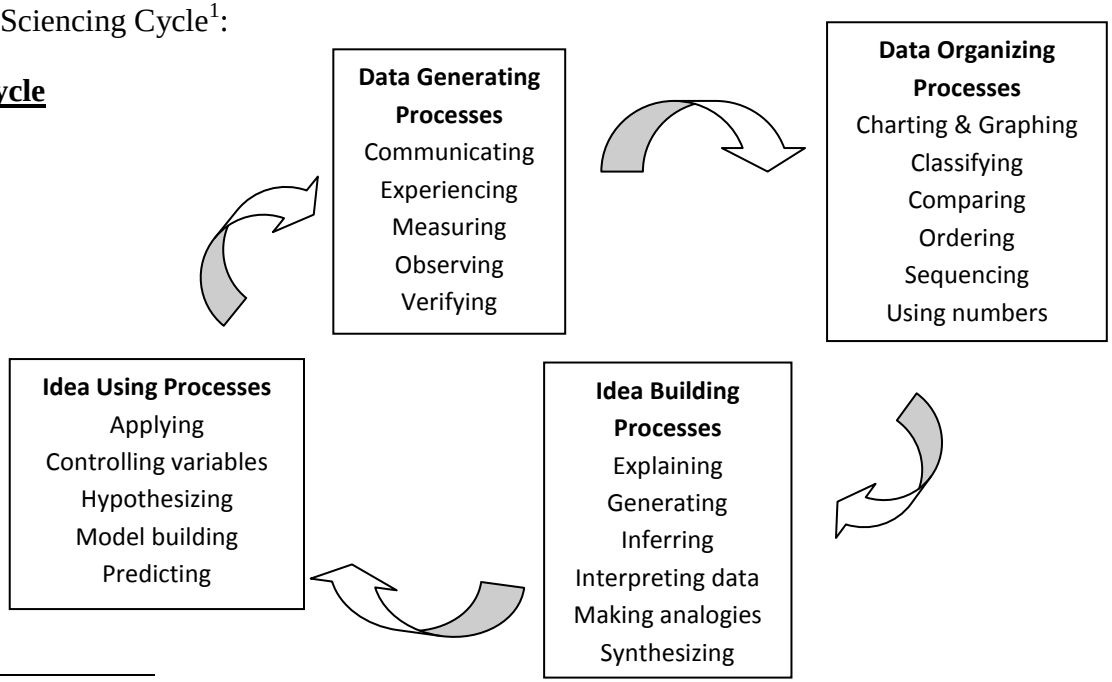
- using everyday language, to increasingly precise technical and scientific vocabulary, symbols and notation
- personal scientific knowledge in a few areas, to understanding in a wider range of areas and the links between them
- describing events and phenomena, to explaining them

- explaining phenomena in their own terms, to explaining them in terms of accepted vocabulary, ideas and models
- unstructured exploration, to the more systematic investigation of the scientific method
- using simple drawings, diagrams and charts, to using conventional diagrams and graphs to represent and communicate scientific information
- using technology for reinforcement, to using technology for research and communication of scientific ideas.

Although the students have to learn more content, the importance of 'hands-on' enquiry in teaching science cannot be undermined. The Biological Sciences Curriculum Study curriculum development team (1988) suggests that 'the five Es' (Engagement, Exploration, Explanation, Elaboration and Evaluation) of the Learning Cycle give students the freedom to discover through exploration, but they should be guided by the teacher to learn science concepts. There is a vast amount of content to be learnt and therefore teachers must decide when and how concepts will be taught.

In Foundation Based Education (F.B.E.) the science process skills are emphasized. Each lesson must address two to three process skills through the Sciencing Cycle[1]:

The Sciencing Cycle



[1] Adapted by Sargeant Training International USA for the Teachers' Retraining and Upgrading Program organized by D. E. R. P. I., St. Maarten

The Curriculum Team hopes that this Curriculum Guide enables teachers to develop lessons that help the students:

- realize that science is fun
- develop their scientific and technological knowledge
- enable them to learn skills that prepare them for life

SCIENCE AND TECHNOLOGY

EARTH AND SPACE SCIENCE

Standards

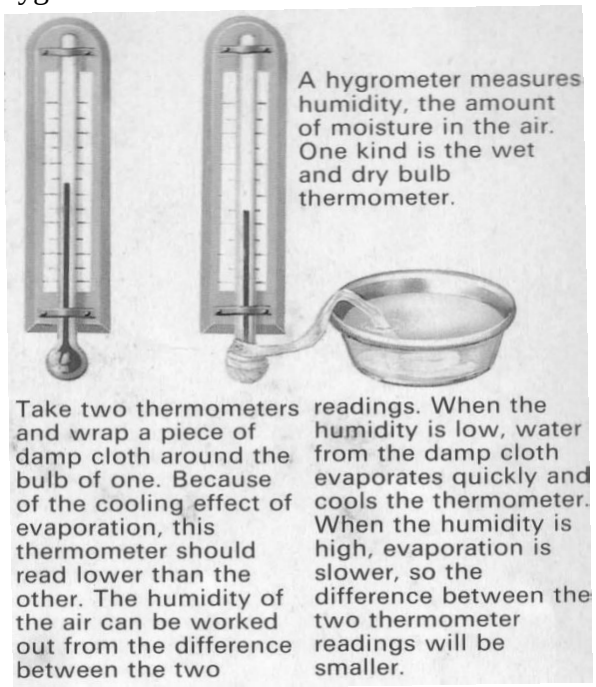
# 1 Earth and Space Science:	The student differentiates between atmospheric processes and the water cycle.
# 2 Earth and Space Science:	The student identifies Earth's composition and structure.
# 3 Earth and Space Science:	The student explains the composition and structure of the universe and Earth's place in it.
#13 Basic Science and Technology Skill:	The student can follow and execute steps in simple research skills.
#15 Basic Science and Technology Skill:	The student can apply simple research skills.

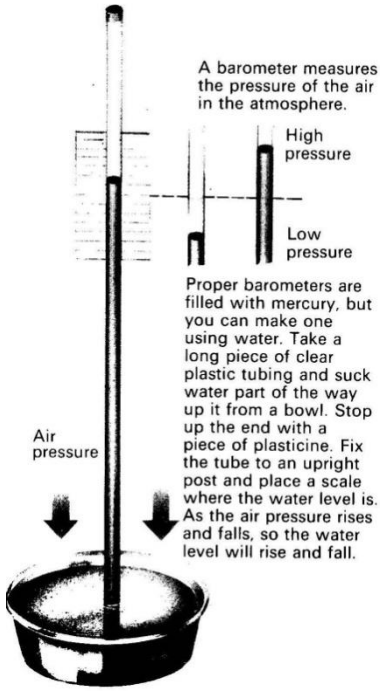
Essential Concepts

- Water has a major impact on the life and shaping of the earth.
- The water cycle is the continuous movement of water from the earth's surface to the atmosphere and back to the earth's surface.
- The earth's atmosphere is the mixture of gases that surrounds the planet
- Weather is the condition of the atmosphere at a certain time and place
- Climate is a long-term and widespread pattern of weather.
- The sun, planets, and their moons make up the solar system.
- The earth's crust contains minerals, rocks and soil.
- The surface of the earth is the result of changes on and within the earth.

TOPIC: WEATHER *(1.1)*

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
1.1(1) Define 'atmosphere' **1.1(2)** Observe and demonstrate the effects of temperature changes on the air pressure **1.1(3)** Describe and record the daily weather conditions **1.1(4)** Identify and use a variety of weather instruments **1.1(5)** Observe and describe how daily weather affects the activities of people and vice versa **1.1(6)** Define 'hurricane' • Categories • Preparedness • Effects **1.1(7)** Identify changes in the land caused by weather **1.1(8)** Investigate weather forecasting **1.1(9)** Describe the difference between weather and climate **1.1 (10)** Identify and describe the different climatic zones in the world	*Essential Concepts:* • The earth's atmosphere is the mixture of gases that surrounds it and is affected by pressure, temperature and moisture. • Weather is the condition of the atmosphere at a certain time and place. • Climate is a long-term and widespread pattern of weather. *Sub topics/themes:* • Weather Variables • Weather Systems • Erosion and landscape change • Weather Forecasting • Climate & Seasons • Humans and Weather (e.g. global warming) • Climatic Zones *Process Skills:* observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving	Atmosphere: air pressure, carbon dioxide, nitrogen, oxygen, water vapour, wind Climate: climatic zones – polar, tropical, temperate, equatorial, Weather; temperature, moisture, cloud (stratus, cumulus, cirrus), thunderstorm, lightning, electricity, weather vane, anemometer, hygrometer, barometer, rain gauge, thermometer, Celsius, Fahrenheit, degrees (°) Meteorology: forecast, hazards, earthquakes, Richter Scale, fronts, trade winds, tsunami, tropical depression/storm hurricanes, Saffir-Simpson and Beaufort Scales, hurricane watch/ warning /lamp / hunter, cyclones, precipitation, drizzle, global warming, ozone	Teacher observes or records when a student: • Defines 'atmosphere' in own words • Demonstrates by observation or experimentation the effects of temperature changes on air pressure • Uses a variety of instruments to measure and record weather conditions • Describes how weather affects daily life • Defines hurricane including hurricane preparation • Identifies changes in the land caused by weather conditions • Investigates weather forecasting and records findings • States the difference between weather and climate • Identifies and describes the different climatic zones in the world

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
1.1(2)A 1.1(9)A Discuss with the whole class their ideas about the atmosphere before researching the true definition. During the discussion, point out the definitions of *weather* and *climate* **1.1(3)A 1.1(4)A** The whole class can be divided into groups to create a weather station. Each small group can be responsible for measuring a particular aspect of weather and designing an instrument to do so. Real instruments, if available, can be used as controls.	***Skills: observing, using time relations, comparing, communicating, manipulating, measuring, investigating, predicting, inferring, interpreting data, hypothesizing, controlling variables and experimenting (older students)*** **1.1(2)A** *Temperature is one element that tells about the weather. The Sun's energy warms the Earth's* ***atmosphere (troposphere****). The* ***temperature*** *in different parts of the Earth differs causing differences in* ***air pressure*** *The teacher demonstrates how to use a thermometer accurately.* Investigations • Students can record the temperature at the same place at different times of the day over a week and discuss their findings. • Students can draw a plan of their classroom and choose 3 different areas. They record the temperature in these places at specific times during the day over a two-day period. Results can be compared and the students asked to give reasons for any differences. (Indoor and outdoor temperatures can be taken). *Mathematics Link* Students can collect daily temperature recordings from the newspaper and make a table or graph and interpret the results. They can also convert Fahrenheit to Celsius and vice versa. • Students can investigate the affect of colour on temperature. First predict how colour will be affected by temperature. Tape a piece of white paper loosely around a thermometer and leave it in a sunny place for 20 minutes and record the temperature. Repeat with a piece of black construction paper and then 2 other colours (one light and one dark). Discuss the results and relate to types of clothing worn on sunny days.(**13.1A**)	Homemade or commercial weather instruments: wind vanes/socks; compass, anemometers, rain gauge, barometer, hygrometer  Thermometers (Large teaching thermometer, small classroom thermometers) White paper and coloured construction paper ***Conversion formulas*** *Fahrenheit to Celsius: C = (F – 32)1.8* *Celsius to Fahrenheit: C x 1.8 + 32* Bright Ideas Macmillan Primary Science Books 3 & 5

1.1(5)A
Language and Communication Link
• A book of weather stories/ poems can be written based on the students' feelings about given weather conditions
• The students can observe and note the effects of weather and write about what they notice about the weather conditions e.g. rain - puddles, wet roads, and inability to go outside.
1.1(8)A
The class can visit the Meteorological
	• Using a flashlight and a globe, older students can design an experiment to test the relationship between the angle of the sun rays and the temperature of the earth's surface. (**15.1A**)
	• Older students can also explore the relationship between the temperature and air pressure, using a home-made water barometer. Warm, hot, cool and cold water can be added to the bowl. (See diagram[2]) The students can formulate a hypothesis and decide which variables to control. (**15.1A**)
	• Students can research the work of scientists who invented the barometer and thermometer.
	1.1(5)A
	• The students can investigate the effects of wind, temperature and rain on buildings, trees and plants in the school environment.
	  ○ Which are the warmest, coolest, most sheltered areas in the school?
	  ○ Which direction does the wind come from? Does it affect the plants and buildings?
	After collecting information through observation the students can develop their own theories about the effects of weather conditions. (**15.1A**)
	1.1(6)A Students can:
	• Learn and illustrate the Beaufort scale
	• Create a hurricane season kit.
	• With their individual families develop a hurricane plan of action to include pre, during and post activities
	• Track hurricanes during the hurricane season
	• Interview persons from the Hurricane Disaster Management Team
	• Create a timeline of previous hurricanes and how they affected St. Maarten.
		Flashlight and a globe (regular or inflated)
		 
		
		Copy of the Beaufort Scale
		Interesting websites
		www.enchantedlearning.com/subjects/weather/hurricane.html
		http://edheads.org/activities

[2] Taken from 'Science All Around' by Robin Kerrod published by Purnell

Office at the airport or invite a speaker from the office to come to the school.	• Create a hurricane in a bottle **1.1(7) A** Students can go outside and record observations of the effect of: • Rain water on the land (erosion) • Sun (heat & light) on the plants After direct observation the students can develop a hypothesis and create experiments. (**15.1A**) **1.1(8)A.** *Before asking the students to read, watch or listen to a weather forecast, the teacher should ensure that the students learn the necessary vocabulary* • The students are asked to listen to a television weather reporter or read a weather report in the local newspaper. They then use the information to create a chart. After creating the chart they are to present a weather report to the class.[3] • Older students can compare and contrast weather reports from different climatic regions over a period of one week. • The students can compare and contrast the different types of weather maps i.e. satellite, radar, precipitation, temperature, wind speed, front.	Baking trays, dirt, sand, water, plants, plastic bags, boxes Weather reports from the newspaper Examples of weather maps from http://school.discoveryeducation.com/lessonplans/programs/weather maps/ World maps or globes

[3] Activity adapted from Weather Reporter lesson plan from www.Edheads.org (June 2004)

GLOSSARY - WEATHER

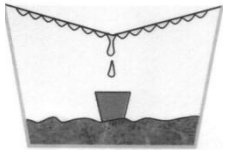
Air/atmospheric pressure	Pressure caused by the weight of air pressing down on the earth at a certain point
Air mass	A large body of air that has similar temperature, pressure and humidity throughout
Anemometer	An instrument that measures wind speed
Atmosphere	Layer of gases that surround the earth
Barometer	An instrument that measures air pressure
Beaufort Scale	A scale measuring wind speed
Carbon dioxide	A colourless, odourless gas which is present in small amounts in the atmosphere; used by plants to make food; traps heat from the sun; exhaled by living things during respiration
Celsius	A unit of measurement used in centigrade thermometers where water freezes at 0° and boils at 100°
Climate	The pattern of weather conditions in a certain place
Climatic zones	Areas of a particular climate; polar, tropical, temperate, equatorial,
Cloud	Masses of water droplets or ice crystals in the atmosphere; stratus, cumulus and cirrus are types of clouds
Cyclone	A closed rotating wind
Drizzle	Light rain falling in small mist-like drops
Degrees (°)	A unit for measuring temperature
Electricity	A form of energy created by a force between positive and negative charges

Earthquake	Shaking or sliding of the ground caused by the sudden movement of masses of rocks below the earth's surface
Fahrenheit	A unit of measurement used in thermometers where water freezes at 32° and boils at 212°
Front	An area between two different air masses with different temperature and humidity levels
Global warming	The increase in the average temperature of the Earth caused by greenhouse gases that trap heat in the Earth's atmosphere
Hazard	Dangerous situation
Humidity	The amount of water vapour in the air
Hurricane	A powerful rotating tropical storm with winds of at least 74 miles per hour
Hurricane watch	Means that a hurricane is possible within 36 hours
Hurricane warning	Means that a hurricane is expected within 24 hours or less
Hygrometer	An instrument that measures the amount of moisture in the air
Lightning	A flash of light in the sky caused by a discharge of electricity
Meteorology	The science dealing with the study of the atmosphere and weather
Moisture	Water or any liquid spread in tiny drops in the air or on a surface
Nitrogen	A colourless, odourless gas that is approximately four-fifths of the air
Oxygen	The second most abundant gas in the air which is necessary for life
Precipitation	Forms of water that fall from the clouds, e.g. rain, snow, hail, sleet
Rain gauge	An instrument that measures the amount of fallen rain

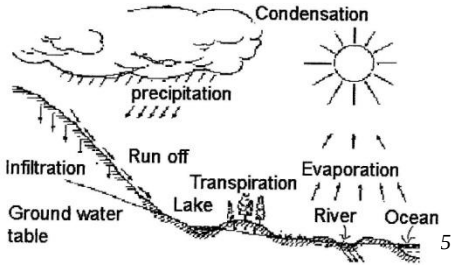
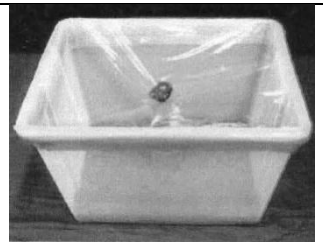
Richter Scale	A scale indicating the severity of earthquakes
Saffir-Simpson scale	A scale measuring hurricanes
Temperature	The measurement, in degrees, of hot or cold an object is
Thermometer	An instrument that measures temperature
Thunderstorm	A storm with thunder, lightning and usually heavy rain
Trade wind	A wind blowing toward the equator from latitudes 30° North or South of the equator
Tropical depression	The stage of hurricane development where the air pressure drops and the wind is up to 38 miles per hour
Tsunami	A huge sea wave caused by a submarine earthquake
Water vapour	Water in a gaseous state
Weather	The condition of the atmosphere at a particular time and place.
Weather forecast	A prediction of weather conditions based on the conditions of the atmosphere
Weather vane	An instrument that measures the direction of the wind
Wind	Moving air

TOPIC: THE WATER CYCLE *(1.2)*

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
1.2(1) Recognize and demonstrate the states of water **1.2(2)** Describe, diagram and interpret the water cycle in terms of the processes involved **1.2(3)** Classify water on Earth **1.2 (4)** Observe and collect data to show the importance of water to daily life **1.2(5)** Collect data to show human impact on the water cycle	*Essential Concepts:* • The earth is 70% water. • Water has a major impact on life and the shaping of the earth. • The water cycle is the continuous movement of water from the earth's surface to the atmosphere and back to the surface. • States of water • The Water Cycle • Sources of fresh / salt water • Importance of water • Human impact on water *Process Skills:* observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving	States: solid, liquid, gas, interaction, matter, energy Water Cycle: precipitation, collection, infiltration, water table, evaporation, vapour, transpiration, groundwater, runoff, surface water, aquifer, condensation fresh/salt water, desalination, Drinking, bathing, recreation, power, irrigation, waste disposal Pollution, conservation, depletion, drought	Teacher observes or records when a student: • Effectively demonstrates the different states of water • Describes diagrams and interprets the water cycle using the appropriate vocabulary to communicate the processes involved. • Describes the water cycle using appropriate terms • Classifies water • Uses inquiry process skills to show the importance of water in daily life • Investigates the human impact on the water cycle

	Suggested Experiences	
Whole Class	**Small Group / Centres**	**Resources**
1.2(1)A The teacher introduces the topic of the water Cycle (*This will be a review of the basic facts learned in Cycle I)The website http://kimballmedia.com/drippy/* has an interesting story that would appeal to Year I students. **1.2(2)A.** The students can set up experiments to study. (**13.1A)** *transpiration.*  1 = a jar, 2 = a plant, 3 = bottle cap of water, 4 = soil, 5 = sand and 6 = small rocks	***Skills: observing, using time relations, comparing, communicating, manipulating, measuring, investigating, predicting, inferring, interpreting data, <u>hypothesizing, controlling variables and experimenting</u> (older students)*** **1.2(1)**A After an introduction the students can experiment to demonstrate the three states of water. *Safety must be stressed at all times.* Ice cubes can be formed (liquid to solid) and water boiled to show the change from liquid to gas. • Students can place water in the sun to observe *evaporation*. Older students can extend this experiment to investigate using variables e.g. time, amounts of water, size and shape of container and place. They must form a *hypothesis before designing their experiment.* (**15.1A**) • *Condensation*[4] – Students can fill one of three glasses with ice water. Set one on a table, one in the refrigerator and one in the freezer. After 10 minutes observations are recorded and discussed. **1.2(2)A** The students can make a model of the Water Cycle called a Mini Solar Still. The still is placed in a sunny location where the wind does not cause the cling film to flap. The students can predict what will happen. The still or stills are left in the sun for 10 – 20 minutes. Students observe the formation of water drops on the inside of the cling film and infer where the water came from. **(13.1A)** 	'The Many Adventures of Drippy the Raindrop by Joel Kimball at http://kimballmedia.com/drippy/ Bright Ideas Macmillan Primary Science Books 4 & 6 Flat containers (saucers or similar shaped lids, water 4 identical drinking glasses, ice water, refrigerator/freezer Plastic tub, plastic cup, small rock or marble, 1 – 2 cups of water in a measuring cup/beaker, a roll of cling film paper, wide tape to seal the still, 2 – 4 litres of soil or sand.

[4] Retrieved from www.tomsynder.com (June 4th, 2009)

1.2(3)A The students can list sources of water and then categorize them into salt water or fresh water. They will realize that most of our water is salty. This can lead to a discussion on *water conservation.* **1.2(4)A** The students can conduct a survey to find out how water is used. Older students can perform a water audit by reading their water metres every day for a week. Readings can be taken at 6 a.m. and 6 p.m. and charted. Students can compare the results. Monthly readings can be taken from household water bills. **(13.1A)** **1.2(5)A** After the students have discovered the need to conserve water, a discussion can take place on how to *conserve* water, water *pollution* and *depletion.* Students can research areas in the world where *drought* occurs and other environmental issues.	After experimenting the students can draw the Water Cycle or label a diagram using the scientific terms, If the students log on to www.epa.gov they can follow an interactive description of the Water Cycle. *Language & Communication Link* *The students can imagine they are a minute droplet of water and write a story about their journey through the Water Cycle from the Caribbean Sea over St. Maarten* **1.2(2 - 4)A** • When the students realize that only 3% of the water in the world is fresh water, they should discuss where that water is found. A deeper study of the water cycle can be done in the Year 3 & 4 classes. Terms such as *saturation, watershed, aquifer* and *ground water* can be introduced.  [5] • Students can research the different methods of making water suitable for use by humans. A visit to the Water Plant or a visit from personnel working there can be a method of gaining information. *Desalination* should be discussed as this is the method that G.E.B.E. uses. Experiments can be set up to investigate each process. • Year 4 students can investigate the properties of water that make it important for life, e.g. density, as a solvent, surface tension and viscosity	 *The instructions for making the still are available at* ***ABC Science Online*** *Other websites give different models of the Water Cycle:* www.mos.org/oceans/planet/watercycle.html www.proteacher.org.html www.kidzonehjm Interesting web sites: www.msnucleus.org.html ABC Science online www.dnr.stste.wi.us/org www.epa.gov

[5] Retrieved from www.msnucleus.org (4th June,2009)

GLOSSARY – THE WATER CYCLE

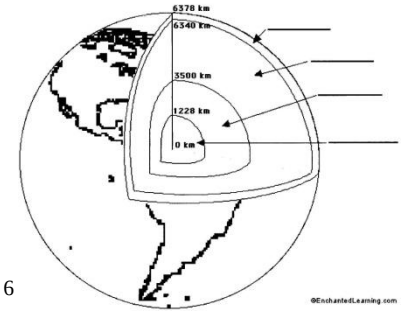
Aquifer	Underground areas where ground water is stored
Bacteria	Single-celled microorganisms
Condensation	The changing of a gas (vapour) to a liquid
Conservation	To keep something as it is, preventing it from being depleted, damaged or changed
Desalination	The removal of salt from sea (salty) water
Drought	A lack of rain for a long period
Depletion	To reduce supplies by using up resources
Energy	The ability to do work or cause change
Evaporation	The change of state from liquid to gas
Gas	A state of matter without a fixed shape or size where particles are widely spaced and move freely
Groundwater	Water found below the surface of the Earth
Infiltration	A process by which water seeps into the soil
Irrigation	To supply the land with water
Liquid	A state of matter where particles move freely so they pour and flow
Matter	Everything that has mass and takes up space
Pollution	Harmful waste or unwanted substance released into the environment
Precipitation	Forms of water that fall from the clouds, e.g. rain, snow, hail, sleet

Runoff	Water that flows on the surface or through the ground into streams, rivers, lakes and oceans
Solid	A state of matter with a fixed shape and size
Surface water	Water found on the surface of the ground
Transpiration	The evaporation of water from the leaves of plants
Vapour	A gas
Water Cycle	A process whereby water circulates from the Earth to the atmosphere and back to the Earth
Water table	The level below which the ground is saturated with water

TOPIC: THE STRUCTURE AND COMPOSITION OF EARTH (*2.1)*

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
2.1(1a) Recognize and demonstrate the composition of Earth. **2.1(1b)** Describe and demonstrates the layers of the Earth **2.1(2a)** Explain the slow and rapid processes that change Earth's surface **2.1(2b)** Describe how landforms are created by a combination of constructive and destructive forces **2.1(3a)** Demonstrate an understanding that smaller rocks come from breaking and weathering of larger rocks **2.1(3b)** Explain the rock cycle **2.1(4a)** Describe the composition of rock and soils **2.1(4b)** Compare and contrast the different types of rocks and soils **2.1 (5)** Describe how fossils are formed and explain how they relate to	*Essential Concepts:* • The Earth's crust contains minerals, rocks and soil. The topography of the crust has resulted from changes on and within the Earth. • The history of the earth is recorded in the rock strata and fossils. *Sub topics:* • Composition of Earth's surface • Earth's Layers • Processes of Change: weathering; erosion; transportation and deposition of sediment caused by waves, wind, water and ice; landslides; volcanic eruptions; earthquakes; drought • Constructive forces: crustal deformation, volcanic eruptions and deposition of sediment • Destructive forces: weathering, erosion • The Rock Cycle • Types and composition of rocks and soils	Earth's surface: topography, lithosphere, soil, living forms, rocks, dirt, water, gases Earth's layers: core, mantle, hydrosphere, atmosphere Change Processes: weathering, erosion, landslides, deposition, sediment, volcanic eruptions, earthquakes, drought, crustal deformation, landforms The Rock Cycle: weather, sediments, compacted, plate motion Rocks: hardness, composition, minerals, iron, copper, salt, diamond, sedimentary, shale, limestone, sandstone, igneous, magma, granite, larva, basalt, metamorphic, slate Soils; weathered rock,	Teacher observes or records when a student: • Describes the composition of Earth's surface • Describes the layers of the Earth • Explains processes that change the Earth's surface • Differentiates between constructive and destructive forces that create landforms • Demonstrates the effect of weathering on large rocks • Explains the Rock Cycle • Describes and differentiates between the different types of rocks • Describes and differentiates between the different types of soils • Explains how fossils provide evidence of history

history	• Evidence of the history of plants and animals provided by fossils *Process Skills:* observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving	living organisms, texture, water retention, fertility, Fossils	

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
2.1(1a)A / 2.1(1b)A The teacher can demonstrate the layers of the earth by referring to an apple, a peach or a boiled egg. Years 1 & 2 can be introduced to the terms *crust, mantle, core* (inner/outer) (*The eggshell is the crust, the white of the egg the mantle and the yolk the core*) Older students can also be introduced to the Earth's system i.e. *geosphere (crust, mantle and core); hydrosphere (water) and atmosphere (air)* **2.1(2a)A / 2.1(2b)A** The class can discuss and collect pictures of different landforms A question can be asked e.g. 'How did	**2.1(1a)A / 2.1(1b)A** Pairs of students can find information on the Internet and/or view information on interactive websites. Groups can research information from reference books. Students can create their own models to demonstrate understanding.  6 **2.1(2a)A / 2.1(2b)A** Small groups can research how different landforms are formed. They can also make models out of clay, paper of 'junk' material. [7]Experiments can be done to show *erosion* by *weathering.* • The students can build a mountain of dirt outside, measure its (height, width) and record the measurements. Each week they can measure and record their observations. It is also important to record the weather conditions as after rain there will be more signs of *weathering.* • Put equal amounts of limestone in each of two jars. Cover the stones with water in one jar and vinegar in the other. Screw lids on the jars and allow them to stand overnight. Record observations and discuss. Pour the liquid from each jar into bowls. Allow the liquid to evaporate and compare the amount of	Interactive web sites: www.allaboutspace.com/label/geology http://science.pppst.com (free power point presentations) Related library books: • 21st Century Science series (Inside the Earth) published by World Almanac Library, 2002 • The Starting with Science Series (The Earth) published by Kids Can Press 1997 Websites www.edu.pe.ca.htm www.kidsgei.com/geology-for-kids Book 'The Magic School Bus Goes Inside the Earth' Bright Ideas Macmillan Primary Science Books 3,4, & 6 2 screw-top jars, limestone, water, vinegar, bowls Screw-top glass jar, large 'Ziploc' bag 2 baking trays, soil/dirt, hose or

[6] Retrieved from www.enchantedlearning.com/subjects/astronomy/activities/label/labelearth.shtml 15th June, 2009
[7] Adapted from http://userpages.bright.net/~double/erode.htm 16th June, 2009

we get mountains?'The students are then required to find out the answer. **2.1(3a)A / 2.1(3b)A** The whole class can go on a field trip to observe the location of the three major types of rock on the island. They can also note weathering, the different landforms and rock structures. Collections of rocks, pebbles, stones and soils can be made. This field trip can be an introductory or final session of a project on rocks and soils. **2.1(5)A** *Language and Communication Link* The story 'A Pebble in My Pocket' by Meredith Hooper & Chris Coady – published by Frances Lincoln 1996 can be	solid left. Discuss. This experiment can lead to discussions on *acid rain/ groundwater.* • To demonstrate how ice weathers rock, fill a glass jar with water and cap it tightly. Place the jar in a 'Ziploc' plastic bag and put it in a freezer for one night. Remove it the morning and ask the students to predict how it relates to rocks and weather. • Place dirt in two baking trays. Place books under one end of the trays so that inclines of different heights are formed. Using a hose or watering-can, sprinkle water on the trays and observe soil erosion. Older students can use a hose head with different settings and compare the force of the water used as well as the steepness of the incline. **(13.1A)** Students can go on a field trip in the community to observe erosion in steep areas. • The students can experiment with *transportation and deposition of sediment by waves.* Take a dishpan and slope a large amount of sand against one end. Add water until the sand is half covered. Use the side of a ruler to create waves. The waves created must be steady and even. The students observe the action of the waves on the sand as sand is removed and deposited elsewhere. • The students can research information about volcanoes (location, benefits and disadvantages of volcanic activity) and then build an active volcano to observe how volcanic eruptions create landforms. **2.1(3a)A / 2.1 (3b)A** • The students can collect rocks from the local environment and classify them into groups according to texture, size, colour etc. Older students can name the types of rocks collected and group them (*sedimentary, igneous, and metamorphic)* A commercial rock collection can also be used. • The students can also rub rocks together to observe how soil is created. • The students can view interactive web sites to learn about the Rock Cycle	watering can, Hose head with 3 or 4 different settings Large dish pan, sand, 6 inch rulers, water Related library books Material to build a volcano Rocks from the environment, commercial rock collections Related library books and other reference material e.g. 'Rocks & Minerals and the Environment' Kathryn Whyman – Published by Stargazer books 2005 Web sites; www.learner.org/rockcycle/diagram.html www.soil-net.com Examples of soil from different locations Vinegar, lemon/lime juice or a mild acid White card Water

read to the class and discussed. This story tells the history of the earth through the eyes of a pebble. **2.1(5).A** The students can go to the beach and have a fossil hunt. The class can discuss and research how fossils are formed. They can also explain what can be learnt about Earth's history from fossils.	**2.1(4a)A / 2.1 (4b)A** Students can carry out many tests on rocks: • Hardness; Use your fingernail, a coin, a nail, a penknife, and a steel file to scratch different rocks. The hardness is determined by which tool scratches the rock. • Acid test: Pour vinegar or a mild acidic substance on rock and observe what happens • Mineral Content: Some minerals leave a coloured streak when rubbed on stiff card or a tile • Erosion Test: Rocks can be hit with a hammer or mallet to see how easily they break and how they break. Rocks can also be rubbed together to see how easily they erode. Students can be encouraged to design fair tests. • Permeability; Small quantities of water can be poured on rocks to see how long the water remains on the surface of the rock or it soaks into the rock • Soil can be collected from different areas e.g. the beach, a yard or field. It can be sifted with a sieve with large holes then medium and then small or fine holes. The students will observe the composition of the soil samples**. (13.1A)** • Students can grow their own crystals • To show how *sedimentary rocks* are formed: Mix sand, gravel, mud, silt and clay in a large screw top jar. Add water and cover the jar. Shake the jar vigorously. Let it stand for a period of time. The students observe and record what happens at the end of each day for a week. • Students can investigate the uses of rocks and minerals in everyday life	Sieves (These can be made by punching holes in a plastic tub.)

GLOSSARY

THE STRUCTURE AND COMPOSITION OF THE EARTH

Atmosphere	Layer of gases that surround the earth
Compacted	The pressed together rocks, sediment or disintegrated material that form a hard mass or strata of rock
Core	The material at the centre of the Earth
Crust	The rocky covering around the Earth
Deformation	Any change in the original shape of the Earth's crust
Deposition	The act of laying down soil, rocks as sediment by natural causes e.g. a flood
Drought	A lack of rain for a long period
Earthquake	Shaking or sliding of the ground caused by the sudden movement of masses of rocks below the earth's surface
Erosion	The moving of pieces of rock or soil by wind, water, ice, plants, animals or gravity
Eruption	A burst of molten rock, dust and gas from a volcano
Fertile	Soil that is fertile has everything a plant needs to grow well
Fossil	Remains or evidence of a living thing
Hardness	The amount of scratch resistance on a rock's surface
Hydrosphere	The water on the surface of the earth
Igneous rock	Formed from melted rock, e.g. magma, granite

Landforms	The physical characteristics of land e.g. plains, plateaus, mountains
Lava	Melted magma from beneath the earth's crust which pours forth from a volcano
Landslide	Sliding down of a mass of soil or rock on a steep slope
Lithosphere	The solid portion of the Earth
Lustre	Whether something is shiny or dull
Magma	Molten rock beneath the Earth's crust
Mantle	The part of the earth between the crust and the core
Metamorphic rock	Rock which is changed by heat and pressure, e.g. slate
Mineral	Natural non-living crystal that makes up rocks
Plate	A rigid section of the Earth's crust that slowly moves over the mantle
Rock Cycle	Gradual and continuous change of rock in the Earth's crust from igneous, sedimentary or metamorphic rock
Sediment	Small pieces of rock, shells or plant/animal remains that have been carried along and deposited by water, wind or ice
Sedimentary rock	Crushed rock and organic material layered or compacted into new rock, e.g. shale, limestone
Soil	The loose weathered material on the Earth's surface where plants grow
Topography	The surface features of a place or region
Volcano	An opening in the Earth's crust that has released molten rock
Weathering	Different ways in which rock is worn away and becomes soil

TOPIC: THE SOLAR SYSTEM *(3.1)*

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
3.1(1) Describe the Solar System **3.1(2)** Identify the planets in the Solar System and their position in relationship to each other **3.1(3)** Differentiate between revolution, rotation and orbit **3.1(4)** Describe the role of gravity in the Solar System **3.1(5)** Compare and contrast the characteristics of the different parts of the Solar System **3.1(6)** Compare Earth with other planets **3.1(7)** Define the role of the sun and moon in Earth's seasons	*Essential Concepts:* • The sun, planets and their moons make up the solar system. • Our solar system is part of a galaxy called The Milky Way *Sub Topics:* • Planets and other celestial bodies of the Solar System • Relationship of planets to the sun and to each other (size, distance from sun and each other) • Movement of celestial bodies • Gravity • Characteristics of planets, asteroids, comets, moons, stars • Comparison of Earth to other planets • The Earth and the moon and the seasons *Process Skills:* observing, comparing,	Solar System; • Sun • Inner: Mercury, Venus, Earth, Mars • Outer: Jupiter, Saturn, Uranus, Neptune, Pluto (dwarf planet) • Asteroid belt • Moons, comets, minor planets Rocky planets, gas planets, small planets, giant planets, diameter, satellites, meteors/meteorites, comets, Halley's Comet, galaxy, universe Gravity, Isaac Newton mass, inertia, revolution, axes, rotation, tilt, moon phases, crescent, solar/lunar eclipse, spring/neap tides	Teacher observes or records when a student: • Describes the Solar System, naming all its parts • Identifies the planets in the Solar System and their position in relationship to each other • Differentiates between revolution, rotation and orbit • Describes the role of gravity in the Solar System. • Compares and contrasts the characteristics of the different parts of the Solar System • Compares Earth with other planets • Defines the role of the sun and moon in Earth's seasons

	measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving		

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
3.1(2)A After doing research, the whole class can create a 3-D model of the planets in the Solar System DiscoverySchool.com has instructions for one kind of model using balloons of different sizes and fishing lines. This can be created in the *Cultural & Artistic Development* lesson **3.1(5 -6)A** The students can complete a large class chart with information that they have learnt about	**3.1(1)A** Divide the class in groups. Allow each group to find out information about one of the nine planets, the sun, comets, asteroids, meteoroids and comets. Each group must produce a poster with images and information on their celestial body. **3.1(3)A** The students can make models that help them to understand the terms. • Revolution – The students can demonstrate this by forming a circle around one student in the centre. One student marks the spot where he/she stands. The students move around in the circle. When the student has returned to the marked spot, that is one revolution. • Earth's rotation – Use a sponge ball, a flashlight, a pencil and a paper clip to demonstrate Earth's rotation. • At www.classzone.com the students can view an interactive visual representation.	There are many interactive websites that are useful for finding information on the Solar System www.kidsnineplanets.org www.kidsastronomy.com/solar_systemhtm www.globio.org www.windows.ucar.edu http://solarsysyem.nasa.gov www.planetary.org www.spacelink.nasa.gov. Bright Ideas Macmillan Primary Science Books 3, 4, 5 & 6 DiscoverySchool.com Ball, string

planets. The following comparisons can be made: • *Number of days to orbit the Sun* • *Number of days for a rotation* • *Distance from Sun* • *Diameter* • *Gases in atmosphere* • *Average temperature* • *Surface* • *Number of moons*	• Orbit – The student can use a lamp and a ball or spinning globe to represent the Earth's orbit around the Sun. **3.1(4)** *Students should research the story of Isaac Newton and the apple* ***before discussing*** *how gravity keeps the planets in space.* To explain why the moon moves in a curved path around the earth, the students can tie a string on a ball and whirl it in the air above their heads (*should be done in an open space).* The student will feel the ball pulling away which is the *centrifugal force (This force is used in a spin dryer)* but their grip on the string is like the force of gravity that pulls the Moon to earth's centre. *The Sun's force of gravity holds all the planets in their orbits.* **3.1(7)A** The students can model how the moon orbits the earth and sun. The students can keep a record of the moon phases over a month. They can also view this on the websites listed. The students can model how the Sun and Earth's movements cause night and day using a strong lamp and a globe or any other model they choose.	www.woodlands-junior.kent.sch.uk www.harcourtschool.com.activity.moon_phases

GLOSSARY – THE SOLAR SYSTEM

Asteroid	Small objects that revolve around the sun with orbits mainly between Mars and Jupiter
Axis	A straight line around which an object turns (from the North to South Pole on Earth)
Comet	A ball of ice and dust that travels around the sun whose heat melts the ice and gives the comet a tail
Dwarf planet	A celestial body that orbits the sun and is not a satellite and is massive enough to have a spherical shape
Eclipse	A passing out of sight because light is cut off, e.g. lunar/solar eclipse
Galaxy	A group of billions of stars in space
Gravity	A force that pulls objects towards the earth
Inertia	The tendency to stay still or keep on moving in the same direction
Meteor	A lump of rock or metal burning up as it plunges through the atmosphere (shooting star)
Meteorite	A meteor that reaches the ground
Moon phase	The moon as it looks at a certain time, e.g. crescent, full, new
Newton (N)	A unit of force
Orbit	A pathway in which a planet or moon travels around another celestial body
Rotation	A turn
Planet	Heavenly bodies that move around a star (the sun)
Revolution	A movement around a celestial body

Satellite	A heavenly body that revolves around a planet; a man-made object launched by a rocket into orbit around a celestial body
Solar System	The sun together with planets and all other celestial bodies that orbit the sun
Spring/neap tides	The rise and fall of the sea that happens halfway between a full and a new moon
Star	A huge ball of burning gas in space
Tilt	To lean

CHECKLIST FOR EARTH & SPACE SCIENCE

Behaviours	Names of Children												
Write date when target behaviour is mastered													
Weather													
Define 'atmosphere'													
Observe and demonstrate the effects of temperature changes on the air pressure													
Describe and record the daily weather conditions													
Identify and use a variety of weather instruments													
Observe and describe how daily weather affects the activities of people and vice versa													
Define 'hurricane' • Categories • Preparedness • Effects													
Identify changes in the land caused by weather													
Investigate weather forecasting													
Describe the difference between weather and climate													

Identify and describe the different climatic zones in the world													
The Water Cycle													
Recognize and demonstrate the states of water													
Describe, diagram and interpret the water cycle in terms of the processes involved													
Classify water on Earth													
Observe and collect data to show the importance of water to daily life													
Collect data to show human impact on the water cycle													
The Structure & Composition of the Earth													
Recognize and demonstrate the composition of Earth.													
Describe and demonstrate the layers of the Earth													
Explain the slow and rapid processes that change Earth's surface													
Describe how landforms are created by a combination of constructive and destructive forces													
Demonstrate an understanding that smaller rocks come from breaking and weathering of larger rocks													

Explain the rock cycle													
Describe the composition of rock and soils													
Compare and contrast the different types of rocks and soils													
Describe how fossils are formed and explain how they relate to history													
The Solar System													
Describe the Solar System													
Identify the planets in the Solar System and their position in relationship to each other													
Differentiate between revolution, rotation and orbit													
Describe the role of gravity in the Solar System													
Compare and contrast the characteristics of the different parts of the Solar System													
Compare Earth with other planets													
Define the role of the sun and moon in Earth's seasons													

SUGGESTED SCOPE AND SEQUENCE

Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4	Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4
Weather						**The Structure & Composition of the Earth**					
Define 'atmosphere'				**I**[8]	**D**						
Identify and use a variety of weather instruments		**I**	**D**	**M**	**M**	Recognize and demonstrate the composition of Earth.				**I**	**D**
Observe and demonstrate the effects of temperature changes on the air pressure				**I**	**D**	Describe and demonstrates the layers of the Earth				**I**	**D**
						Explain the slow and rapid processes that change Earth's surface				**I**	**D**
Describe and record the daily weather conditions	**I**	**D**	**D**	**M**	**M**	Describe the composition of rock and soils		**I**	**D**	**M**	**M**
Observe and describe how daily weather affects the activities of people and vice versa	**I**	**D**	**D**	**M**	**M**	Describe how landforms are created by a combination of constructive and destructive forces				**I**	**D**
Define 'hurricane'	**I**	**D**	**D**	**M**	**M**	Demonstrate an understanding that smaller rocks come from breaking and weathering of larger rocks		**I**	**D**	**M**	**M**
Categories	**I**	**D**	**D**	**M**	**M**						
Preparedness	**I**	**D**	**D**	**M**	**M**						
Effects											

[8] I = Introduce the concept D = Develop the concept M = Mastery of concept

Identify changes in the land caused by weather			**I**	**D**	**M**	Explain the rock cycle			**I**	**D**	**M**
Investigate weather forecasting		**I**	**D**	**D**	**M**	Compare and contrast the different types of rocks and soils		**I**	**D**	**M**	**M**
Describe the difference between weather and climate			**I**	**D**	**M**	Describe how fossils are formed and explain how they relate to history				**I**	**D**
Identify and describe the different climatic zones in the world				**I**	**D**	**The Solar System**					
						Define the role of the sun and moon in Earth's seasons		**I**	**D**	**D**	**M**
The Water Cycle						Describe the Solar System		**I**	**D**	**M**	**M**
Describe, diagram and interpret the water cycle in terms of the processes involved			**I**	**D**	**M**	Identify the planets in the Solar System and their position in relationship to each other		**I**	**D**	**D**	**M**
Recognize and demonstrate the states of water	**I**	**D**	**D**	**M**	**M**	Describe the role of gravity in the Solar System			**I**	**D**	**M**
Observe and collect data to show the importance of water to daily life	**I**	**D**	**D**	**M**	**M**	Compare and contrast the characteristics of the different parts of the Solar System				**I**	**D**
Collect data to show human impact on the water cycle				**I**	**D**	Differentiate between revolution, rotation and orbit				**I**	**D**
Classify water on Earth		**I**	**D**	**M**	**M**	Compare Earth with other planets			**I**	**D**	**M**

SCIENCE AND TECHNOLOGY

LIFE SCIENCE

Standards

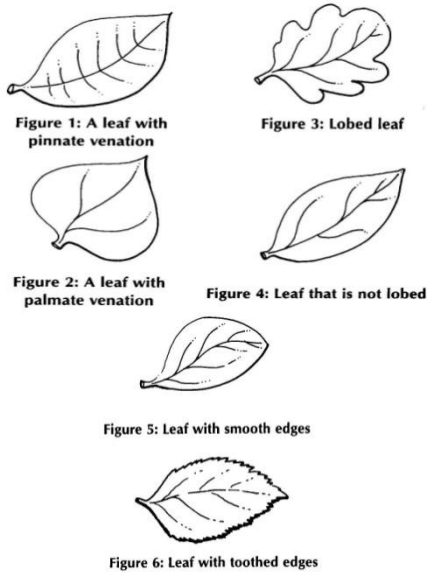
# 4 Life Science:	The student understands the structure and function of cells and organisms.
# 5 Life Science:	The student understands the relationships among organisms and their physical environment.
# 6 Life Science:	The student can explain biological evolution and the diversity of life.
#13 Basic Science and Technology Skill:	The student can follow and execute steps in simple research skills.
#15 Basic Science and Technology Skill:	The student can apply simple research skills.

Essential Concepts

- All living organisms are made of cells and are classified into groups based on their characteristics
- All living organisms can be classified into groups and are part of a system of interdependent and interrelated parts.
- An organism's patterns of behavior are related to the nature of that organism's environment.
- All living organisms progress through similar patterns of life.
- All living organisms need energy and matter to live and grow.
- Plants and animals have structures for respiration, digestion, waste disposal and transportation of matter.

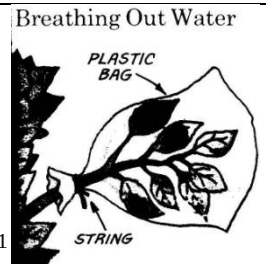
TOPIC: PLANTS (*4.1, 6.1*)

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
4.1(1) Identify the structures of a plant and their functions **4.1(2)** Explain the various processes that plants undertake **6.1(1)** Classify plants	*Essential Concepts:* • All plants have common characteristics. • Plants undertake many processes in order to grow. • There is a diversity of plant life. *Sub Topics:* • Plant structures and their functions • Plant life cycles (germination, reproduction {asexual, sexual}) • Plant processes (photosynthesis, respiration, transpiration) • Uses of plants (food provision, medicines, beautification, earth support, oxygen, animal habitats) • Plant Kingdom – Types of plants *Process Skills:* observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving	• Structures: Flowering plants – leaves (simple, compound, blade, vein, petiole (leaf stalk), flower (stamen, style, stigma, pistil, sepal, petal, ovary, pollen, seed, embryo, fruit), stem (woody trunk, branches, twigs, herbaceous, underground – bulbs, rhizomes, tubers), root (fibrous, tap, root cap, root hairs) • Functions: Leaves - photosynthesis Flower / seeds – reproduction (fertilization, pollination) Stem – support, asexual reproduction Root – absorption of water; anchoring of plant; asexual reproduction • Processes Reproduction - pollination, seed dispersal, fertilization, germination, seedling Photosynthesis - chlorophyll, chloroplasts, carbon dioxide, oxygen • Classification – flowering /non-flowering, vascular / non-vascular, trees (evergreens, conifers), shrubs, herbs, mosses, algae, ferns; perennials, biennials, annuals	Teacher observes or records when a student: • Identifies the structures of a plant and explain their functions • Explains and describes different plant processes such as photosynthesis, respiration and transpiration, osmosis • Demonstrates the life cycle of a plant • Identifies and demonstrate how plants adapt to their environment • Explains the importance of plants to life and provides examples • Classifies plants

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
4.1(1)A, 6.1(1)A The students can take a walk in the school community and observe the different types of plants, sketch them (trees) and collect samples. On return to the classroom they can discuss the different types of plants observed and classify them noting the different characteristics Each student can bring a flower to school. At school they can examine them with hand lenses and identify the different parts (sepals, petals, stamen, stigma, style, pollen, ovary)	**4.1(1)A** • Each student should collect and then make a detailed drawing of a plant. They should then label its major structures (leaves, flower, stem, roots, seeds) and then research and describe the function (absorb sunlight, absorb water and nutrients, support growth, transport water and nutrients, attract pollinators, hold seeds, reproduction) of each structure. *Sets of cards can be made; i.e. plant parts and functions. These can be put in a centre and the students can play a matching game with them.* • The students can collect different vegetables and label them according to the plant parts that they represent e.g. carrots – roots, celery - stem. • Leaf – The class is divided into small groups. Each group is given or collects five different leaves. The students then compare and contrast the leaves in terms of length, width, texture (both sides), shape, vein pattern, edge. They can chart their observations (*Visual Arts Link – Prints and rubbings can be made)* Older students can be introduced to terminology that describes patterns observed (See resources) o Students can discuss why shape and texture is important, e.g. waxy coating and thickness can help plants keep moisture in dry areas and waxy coatings repel moisture in rain forests. Students can design an experiment to see which leaf shapes shed or retain water. • Stems – Students can examine cut stems under a microscope. They can also examine the rings on a cut trunk and note how old the tree was when cut. o Students can observe how water moves through a stem by placing a celery stalk (with end cut off) in a jar of water with red food colouring added. The jar is placed in a warm light place for a day. The stalk is washed and then cut. Students observe that they see red dots where water has passed through the stem.	Related library books and textbooks Hand lenses (magnifying glasses), clipboards (or substitute), containers for samples (or Ziploc bags), pencils, paint, wax crayons Vegetables Leaf Types  Stems of different plants Celery stalks, a table knife, food colouring, water, a jar (*a white carnation can be used. The students will observe that the*

4.1(2)A The teacher will discuss the different processes that plants go through in order to survive, e.g. reproduction, germination, photosynthesis, transpiration, respiration **4.1(2)A** The teacher reviews the characteristics of living things and asks how plants reproduce. After discussion the students collect different flowers from the local environment, examine them, draw and label them. The teacher explains the function of each part and asks the students to choose	• Roots – Students can collect plants and then sort them according to their root structure (tap, fibrous, primary, and secondary). They can also observe what happens to the soil surrounding the plant when the plant is uprooted and infer that roots help stabilize the soil. **4.1(2)A** Photosynthesis – Review what the plants need for photosynthesis to take place (light, carbon dioxide, chlorophyll and water). • Let students collect green leaves and rub them between paper towels so they can observe the '*chlorophyll'* The teacher will help the students set up experiments that will show how the removal of light affects photosynthesis. Let students place plants in three different places (dark cupboard, classroom near a window and outside). Each plant must be given the same amount of water at the same time each day. Students record daily observations for three – five days. **(13.1A)** *(One plant can be used and one of the branches covered with brown paper bag, another with coloured cellophane).Students infer that light is necessary for photosynthesis.* • [9]Older students can put a 100 ml of 'bromthymol' solution in three different cylinders and blow bubbles into them. (*The blue turns colour when carbon dioxide is added)* A sprig of Elodea (a pond plant) is added to two of the jars. Each jar is covered with a screw top lid. One containing the plant is placed in the sun and the other in a dark place. After a day students record their observation. (*The bromthymol solution in the plant that was placed in the sun will turn blue indicating that the plant has used the carbon dioxide)* Transpiration – (*loss of water through the leaves*) Students place a clear plastic bag over a small branch of leaves on a bush or small tree. The bag is left for 2 days. *Students observe that drops of water form on the inside of the bag.* **(13.1A)** Older students can control variables using 2 potted plants and placing petroleum jelly (Vaseline) on the leaves so that the (*stomata-*	*petals will become red.)* Websites www.msnucleus.org www.biology4kids.com www.bbc.co.uk www.pbs.org www.squidoo.com (has videos) www.science-teachers.com www.teachervision.fen.com www.enchantedlearning.com 3 potted plants Light sources Brown paper bags, coloured cellophane paper Three 125ml jars with screw-top lids Straws Bromthymol blue 100ml graduated cylinder Elodea or other pond plant Potted plants, plastic bags Petroleum jelly (Vaseline)

[9] Retrieved from mbgnet.net/bioplants

one and research how reproduction takes place, which method of pollination and how the seeds are dispersed. Students can collect different seeds and examine them, classify them according to properties observed. Students will discuss and defend their method of classification. **4.1(2)A** The topic of asexual reproduction can be discussed by the class as a whole. Experiments with the different methods can be done in groups. Most of the students will have	*small holes are closed)* and use an artificial potted plant. The students give each plant the same amount of water. They can also measure the amount of water loss**.(15.1A)** (*The soil of the artificial plant will remain wet, the soil of the real plant with jelly on the leaves will be damp and the other plant will have soil that is dry.)* The results should be discussed and students asked to give reasons for their observations. Reproduction (sexual) this process has three major parts. Students should research *pollination* and *cross pollination, fertilization and dispersal of seeds.* Germination - Before germinating seeds students should examine soaked seeds. (*Lima or kidney beans are good choices. Do not soak for more than24 hours as the seeds will start to rot)* Each pair of students can examine two seeds, one of which will be cut in half so that the inside can be drawn and labeled. Older students can compare and contrast *monocotyledonous* and *dicotyledonous seeds. The terms embryo (baby plant); hilum (scar on the seed coat where the seed was attached); testa (seed coat); cotyledon (seed leaf) can be introduced.* *When germinating seeds students should be encouraged to develop experiments to investigate the conditions that affect germination of healthy seedlings e.g. light, warmth, water and soil.* (**15.1A**) *Mathematics Link* - The students can graph seedling growth. Students can also study tropisms. (*Phototropism – bending toward light; hydrotropism – bending toward moisture; geotropism - bending caused by gravity*) Germinating seeds can be inverted. Students will observe that the root always grows down (*geotropism).* Seeds or seedlings can be put to a box. On one side a hole will be cut out. During germination or growth it will be observed that the shoot grows	Breathing Out Water  11  Websites with information about pollination, fertilization and dispersal www.thekidsgarden.co.uk www.pollinationcanada.ca www.pollinator.com/kids/ www.neok12.com (has good videos) Information about germination can be found at www.mbgnet.net/bioplants www.msnucleus.org www.tutorvista.com/content/biology-iv/

[11] Taken from "*the Know How Book of Experiments"* by Heather Amery published by Osbourne

knowledge of the asexual reproduction of tubers (potato); bulbs (onion); roots (carrot); as well as cuttings at home. The question, 'Do all new plants grow from seeds?' can be discussed. The class can explore the school environment to see if they can observe methods of asexual reproduction in plants. A gardener can be invited to speak to the students on growing new plants without seeds.	toward the light (*phototropism).* To demonstrate *hydrotropism*, students can place a seedling (on one side) in a window box filled with soil. A porous pot is placed in the box on the left side. After two days the students will observe that the root bends towards the pot. Asexual reproduction – Students can place an onion or the top of a carrot in water and observe what happens. Potatoes (*tubers)* with 'eyes' can be planted to observe and discuss what happens. Spider plants can be observed to see reproduction by *runners.* Celery stalks can also be placed in water and observed. Older students can list the advantages of asexual reproduction. **6.1(1)A** *The plant kingdom classification is very complex. In Year 1 students can be introduced to plants with seeds and plants without seeds whereas in Year 2 the terms vascular and non-vascular can be introduced* [10]Students can develop their own method of classification for common fruits. Each group can explain their classification. After this has been completed the teacher can introduce the scientific classification, life cycle classification or classification by use. *Curricula Links* *Mathematics* – graphing based on experiments; measurement *Social Studies* –Study of history by tree rings *Technology* – use of the computer for reference and storage of data *Cultural & Artistic Development* – Visual Arts – Sketching and detailed observational drawing, comparison of famous artworks related to plants; Music - Use of plants to make instruments, Drama & Dance – Skits, plays, dances based on processes e.g. germination *Language & Communication* – vocabulary development, poetry,	www.msnucleus.org www.britannica.com and www.neok12.com have interesting videos on asexual reproduction.

[10] Adapted from information retrieved from www.kidsgardening.com/2005.kids.garden.news/dec/pg2.html

	expository & narrative reading, interviewing *Philosophy of Life* – caring for plants & nature *Social & Emotional Development* – social skills for group work, self-regulation in carrying out activities, critical thinking *Health* – diet and nutrition	

GLOSSARY - PLANTS

Algae Simple plants that contain chlorophyll but have no stems, leaves or roots

Bulb An underground stem covered with thick fleshy leaves e.g. an onion

Carbon dioxide A gas that is used by plants to produce food

Carpel/Pistil The female part of a flower

Chlorophyll The green pigment of a plant that facilitates **photosynthesis**

Chloroplasts The plant cell organelle that contains chlorophyll

Conifers Plants that produce cones

Embryo An animal or human in the early stages of development; an undeveloped plant within a seed

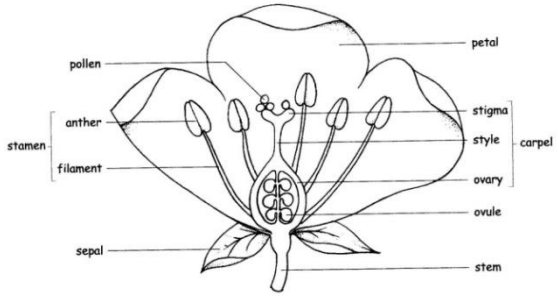
Evergreen A tree that has green leaves all year round

Ferns A group of plants that has roots, stems and leaves but not flowers or seeds

Fertilization The moment when a female and male cell combines

Fibrous roots Small roots that spread sideways through the soil e.g. the roots of grass

Flower The part of a flowering plant (**angiosperm**) that contains the reproductive organs



Fruit Part of the plant that contains seeds

Fungus Any organism that lives by breaking down and absorbing the organic material in which it grows

Germination The sprouting of an embryo within a seed

Herb A flowering plant whose stems live for one or more seasons: **annual** (yearly); **biennial** (every two years); **perennials** (having underground parts that live for more than two years/seasons)

Herbaceous Having stems that are not woody

Moss Very small green or brown plants that grow close together like a carpet on the ground, rocks or trees

Organelle A specialized part of a cell

Ovary The female organ that produces eggs and female hormones; part of the flowering plant that contains ovules

Petal The part of the flower that is often brightly coloured that attracts insects for cross pollination

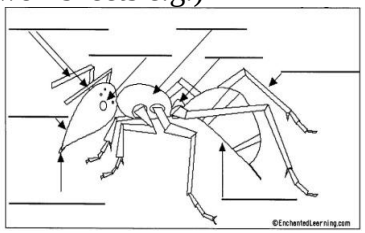
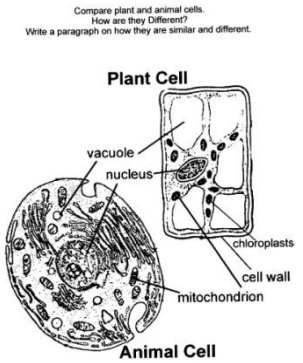
Petiole The part of a leaf that connects it to the stem

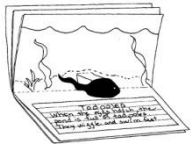
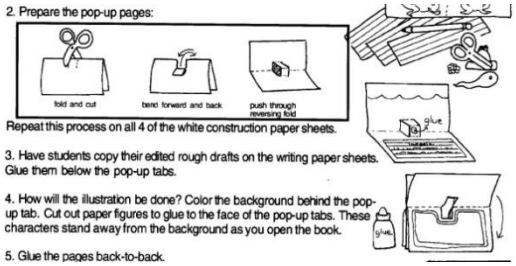
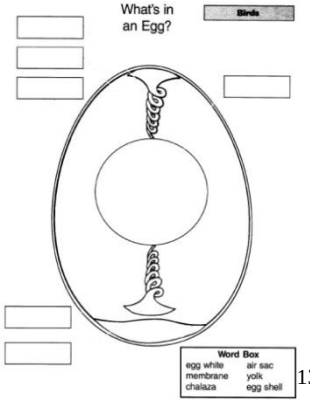
Pistil The female reproductive part of a flower

Photosynthesis	The conversion of light (sunlight) energy into chemical energy (food) by green plants
Pollen	Fine, yellowish powder formed in flowers containing the male sex cells
Pollination	The transfer of pollen from the **anther (stamen)** to the **stigma (carpel)**
Reproduction	The process by which a new organism if formed
Rhizome	A root like stem that lies on or under the ground e.g. ginger
Sepal	A leaf like structure that encloses the bud of a flower
Shrub	A woody plant smaller than a tree, usually divided into separate stems near to the ground
Stamen	The male part of the flower that contains the pollen
Stem	The part of a plant that supports the leaves and flowers that begins as a **shoot**
Stigma	The female part of the flower that receives the pollen
Style	The part of the flower where the pollen is passed to the ovules
Tap root	A strong primary root that grows deep into the soil
Trunk	The primary stem of a tree that is woody and covered in bark
Tuber	The solid thick parts of an underground stem e.g. potato
Twig	A slender shoot of a plant; a very small branch
Vein	The ‘ribs’ of a plant
Weed	An unwanted plant

TOPIC: ANIMALS (*4.2, 6.2*)

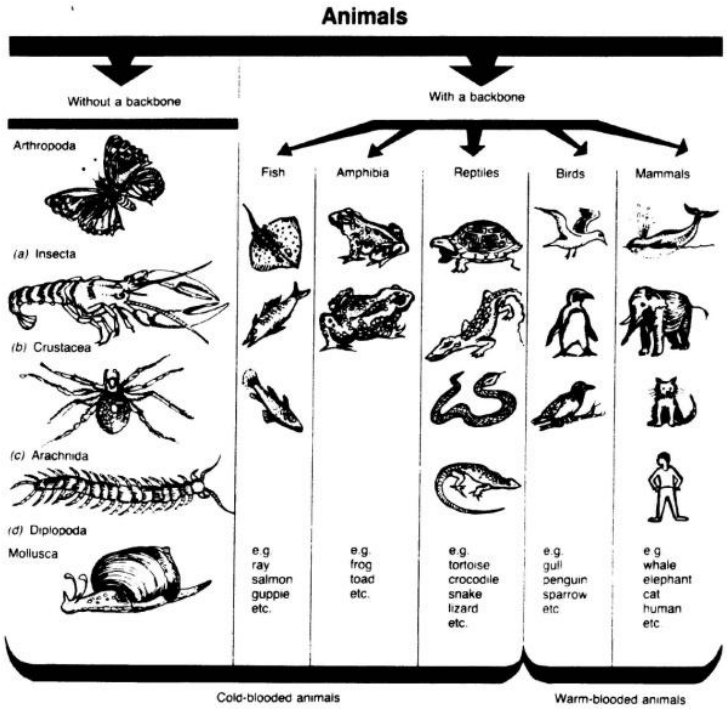
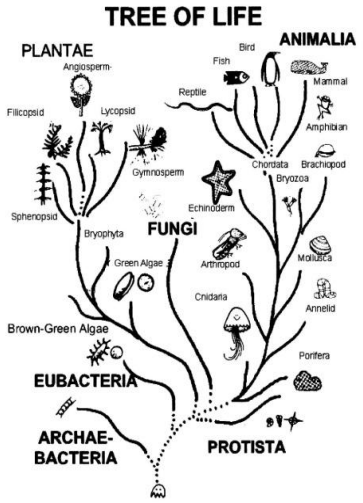
Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
4.2(1) Identify the structures of animals and their functions **4.2(2)** Compare and contrast the life cycles of different animals the environment **6.2(1)** Classify animals	*Essential Concepts* • All animals have common characteristics. • Animals have distinct structures and body systems that serve specific functions in growth, survival and reproduction • Animals need certain resources for energy and growth. • There is a diversity of animal life. *Sub Topics:* • Animal characteristics, structures and their functions • Animal life cycles • Animal processes • Animal Kingdom – Types of animals *Process Skills:* observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving	• Characteristics – multicellular, mobile, reproduce, grow, respond, react, environment • Structures – o Vertebrates (backbone, fur, skin, feathers, wings, beak, bill, scales, fins, paws, hooves, webbed feet, skeleton, heart, lungs, veins, gills, nerves, muscles, tissues, jaws, teeth, digestive organs {stomach, crop,}) o Invertebrates – shell, exoskeleton, antennae, tentacles • Life Cycle – reproduction : sexual - sperm, egg, fertilization, fetus, mating; asexual – budding, division; birth, hatching, growth, death, larva, pupa, cocoon, chrysalis, metamorphosis • Classification – tame/wild, warm/cold blooded, land/ water, animal kingdom, phylum, vertebrates – mammals (rodents, primates, marsupials), birds, amphibians, reptiles, fish; invertebrates – protozoa (single cell), arthropods (insects), crustacean, sponges, mollusks (snails, octopus), annelid (segmented worms), arachnids (spiders), echinoderms (jellyfish)	Teacher observes or records when a student: • Identifies characteristics common to all vertebrates and invertebrates • Identifies and compares the physical structures of animals in different groups • Compares and contrasts the life cycles of local animals in different groups • Outlines the major divisions of the animal kingdom • Compares and contrasts animals in the major divisions of the animal kingdom

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
4.2(1)A • The teacher and students can collect pictures of animals and sort them into groups. The teacher suggests two groups but does not tell the students what the groups are. Discussion can take place as to the reasons for the classification. At that point the teacher can review the differences between *vertebrates and invertebrates*. If the students did not classify the pictures that way, then they can do so. The differences and similarities can be recorded on a Venn diagram. • The students can then give examples of invertebrates (Year 1) and vertebrates (Year 2). • The students can explore the school community to find examples of animals. On return to the	***The students need to examine animals in their own environment to make learning more interesting!*** **4.2(1)A** • Divide the students into groups and let them research the physical characteristics of invertebrates. Each group can research one group e.g. *mollusks, annelids, insects* etc. *Arthropods* have many sub groups including *insects* and *arachnids.* *The teacher can choose or let the students choose the invertebrate to be researched.* Each group must list the special characteristics of their invertebrate and if possible collect samples. The cooperative learning strategies 'Jigsaw' or 'Corners' can be used to enhance reporting. A similar activity can be carried out with *vertebrates.* • Students can compare and contrast the structures of *vertebrates* and research how they help the vertebrate to function e.g. gills of fish. • Animals are *multicellular.* Year 4 students can study *microorganisms* which are *unicellular* and also the structure and function of cells. • Animals that have a particular function e.g. honeybees, can be studied on their own. • Students can compare and contrast one structure common to all animals e.g. teeth. • Students can study one structure and study the features that help the animal to function e.g. birds' feathers. • Students can compare and contrast two animals in one group e.g. butterflies / moths; sea/land turtles.	www.msnucleus.org www.enchantedlearning.com (has a variety of worksheets e.g.)  www.biology4kids.com  www.honey.com (this site provides links to other sites with information)

classroom they can classify them. **4.1(2)A** *Most students will study the life cycle of frogs and butterflies in Cycle I. However this can be repeated in years 1 & 2 at a higher level introducing scientific vocabulary. It is better to collect caterpillars or frogspawn and observe the life cycle. A field trip to or a visit from a person who breeds dogs can also be arranged. Ask a parent to videotape the birth of a kitten or puppy if the household pet is pregnant. (Years3/4)* The students can develop an experiment to find out how much a caterpillar eats each day. The students form a hypothesis and then test it. (www.education.com)	**4.1 (2)A** Students can make pop-up books to illustrate the life cycles that they are studying.   12 • The incubation of fertilized chicken eggs can be observed by older students. The incubation period is twenty-one days. Arrangements must be made for the weekends when the students are at home. *Curriculum Links* Language & Communication • Write your life cycle as if you are the organism studied • Write letters to animal organizations to find out about how endangered animals are breed in captivity • Write poems, create plays or skits about the life cycle of a particular animal Cultural & Artistic Development • Create posters, life cycle murals and new animals • Create a dance or movement sequence that represents the life cycle of an animal.	Web sites www.enchantedlearning.com has many printable worksheets of the life cycles of butterflies, birds and frogs. www.youth.net www.joelson.addr.com/learningabout**lifecycles**.htm http://kiddyhouse.com (life cycle of frogs) www.eduplace.com/**kids**/ (interactive games)  13

[12] Retrieved from www.teacherfilebox

[13] Retrieved from www.teacherfilebox.com

6.2(1)A The major divisions of the animal kingdom should be taught to the whole class throughout the Cycle. Year 1 can study invertebrates, particularly arthropods; Year 2 invertebrates and the characteristics of vertebrates; Year 5 comparison of the 5 kingdoms and Year 6 the lower kingdoms. Each year group builds on prior knowledge	**6.2(1)A** • In order for the students to understand the classification of animals, the teacher can give them buttons to sort. The students have to develop criteria for sorting them and placing them in hierarchical groups. • Students (Year 4) can be giving an animal (unknown to them) and asked to place them in the correct class) • Students can be given cloze tests to assess their knowledge of the characteristics of different groups. Ready-made cloze paragraphs can be found at www.enchantedlearning.com  	Examples of Classification charts www.msnucleus.org  www.apples4teacher.com (has interactive games and puzzles)

GLOSSARY - ANIMALS

Amphibian A vertebrate with smooth, moist skin and webbed feet that live in water when young and on land as adults

Annelid A soft-bodied worm

Antennae Long slender feelers on the head of an insect

Arachnid An organism with eight legs e.g. spiders, mites, ticks, and scorpions

Arthropod An invertebrate that is segmented or jointed e.g. insects, spiders, crustaceans

Asexual reproduction The process by which an organism makes an exact copy of itself

Bill The beak of a duck or bird

Birth The moment a new baby mammal comes from its mother

Budding Asexual reproduction by means of buds

Camouflage Colours or patterns that hide an animal against its background; method of defense

Carnivore An organism that eats only meat

Chrysalis The larva of a moth or butterfly living in a hard case or **cocoon**

Cold blooded Having blood that is the same temperature as the air or water around the animal e.g. snakes

Colony A group of animals or plants of the same kind living or growing together

Crop The baglike swelling of the esophagus of many birds where food is stored and prepared for digestion

Crustacean	an invertebrate with a hard skin and many legs that live in water or damp places e.g. crabs
Digestion	The breaking down of food for materials and energy
Echinoderm	An animal with a spiny, stony shell with a body with spokes e.g. starfish
Environment	The surroundings of an organism
Fetus	An embryo of a mammal that has the main body features of the species
Gills	The part of the body of a water animal by which it breathes
Gizzard	A bird's second stomach
Habitat	The place where an organism lives
Hatch	To bring forth young from an egg
Hibernate	To spend time sleeping during winter or periods of severe weather
Instinct	A natural knowledge that animals are born with that causes them to act in a certain way
Invertebrate	An organism without a backbone
Larva	The immature form of an animal that looks very different from the adult
Mammal	An animal that is warm-blooded, has a backbone, gives birth to its young and is covered with hair or fur
Mating	The act of coming together of a male and female
Metamorphosis	The stage of the life cycle of an insect in which the larva undergoes rapid transformation into an adult
Migration	The movement of animals from one region to another with the change of seasons (to warmer climates)

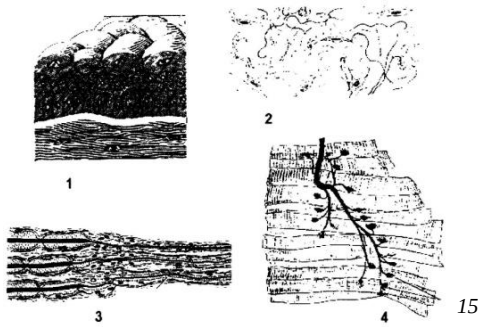
Mobile	Ability to move by oneself
Mollusk	An invertebrate with a soft body, some have shells for protection e.g. slugs, snails
Multi-cellular	Having more than one cell
Phylum	A group/class of organisms with the same characteristics
Predator	An organism that does the killing in a relationship where one animal kills another for food
Prey	An animal hunted and/or killed for food by a pedator
Protozoa	A single-celled organism that eats food
Pupa	The stage of growth of an insect between the larva and the adult
Reflex	An involuntary action in response to a stimulation of nerve cells e.g. sneezing
Reptile	A cold-blooded animal that has a body covered in scales or dry skin,
Skeleton	The bones of the body
Species	A class of organisms that are related, have the same characteristics and may breed with each other
Sperm	The male reproductive cell
Symbiotic	Two unlike organisms living together in a relationship that benefits each other e.g. cattle and tick bird
Tentacle	A long, slender, flexible growth from the head or mouth area of an animal used to touch, feed or hold
Terrestrial	Living or growing on land
Territory	An area inhabited by an animal which it protects from others of its kind
Tropical zone	Region near the equator that is warm, humid and diverse in plants and animals

Tissue	Masses of cells that form part of an animal or plant
Veins	Blood vessels that carry blood to the heart
Vertebrate	An animal with a backbone
Warm blooded	Having blood that stays at the same temperature

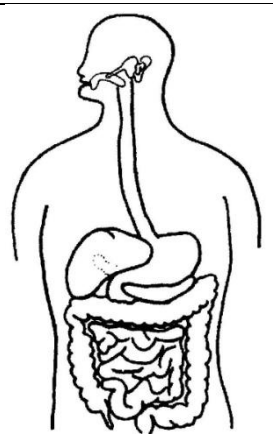
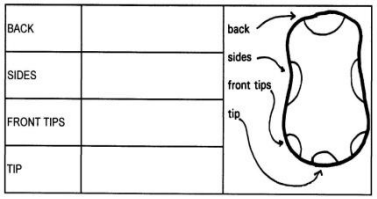
TOPIC: HUMANS (*4.3, 5.3, 6.3*)

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
4.3(1) Identify cells as the smallest unit of the body **4.3(2)** Identify and describe the structure and function of cells and cell parts **4.3(3)** Describe how the human body is organized into cells, tissues, organs and organ systems **4.3(4)** Identify changes that take place as a human being develops and grows	C ells • Main parts • Types • Functions Tissues • Types • Functions Organs • Types • Functions • Interaction Systems • Skeletal • Muscular • Digestive • Respiratory • Circulatory • Excretory • Nervous	Cells - nucleus, cell membrane (semi-permeable), organelles, mitochondria protein, diffusion, osmosis, concentration Types - animal, plant, blood, nervous system, etc. Tissues – connective, muscle, nervous, epithelial Organs – sensory, brain, heart, lungs, kidneys etc. Systems - respiratory, breathing / respiration (nose, trachea, lungs, bronchi); digestive, digestion, (intestines, stomach, liver); skeletal, stabilize, (skull, ribs, spine, vertebra); circulatory, transportation of oxygen and carbon dioxide, (blood, oxygen, heart, veins, arteries); muscular (smooth, cardiac, voluntary); excretory,	Teacher observes or records when a student: • Demonstrates an understanding that the cell is the smallest unit of the body • Identifies different cells and describes them • Describes the functions of cells • Describes how the human body is organized (from cell – systems) • Identifies the different human body systems • Describes the major body systems (the organs and function of each system) • Describes how different systems interact

5.3(1) Identify the major parts and functions of the systems of the human body **5.3(2)** Describe ways in which the systems of the human body interact **6.3(1)** Demonstrate an understanding that many characteristics are inherited from parents and others are learnt	• Endocrine • Reproductive • Functions • Interdependence Growth and development of humans (baby – adult) Characteristics • Inherited • Learned/ acquired through interaction with the environment *Process Skills:* observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving	elimination of waste products, (kidneys); endocrine, control, (glands, hormones); nervous (brain, spinal cord, nerves); reproductive, reproduction, fertilization, (genitals, female (ovaries, vagina, uterus, egg cells, pregnancy, fetus), male (testes, penis, sperm cell) Growth – baby, child, youth, adult, teenager, puberty, growth spurt Characteristics – inherited, gene, chromosomes, DNA, genetic diseases, sickle –cell anemia, pigments, eye colour, body shape, acquired, flexibility, habits	• Identifies and describes changes that take place during growth • Compares and contrasts characteristics that are inherited and learnt

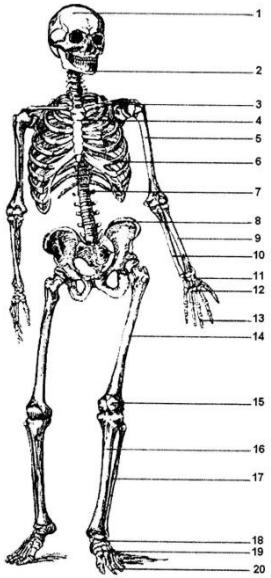
Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
4.3(1)A / 4.3(2)A Students (Year 4) can be given pictures of different cells from secondary sources (books, internet) to view. They can note similarities and differences. Through the discussion the teacher can point out the main parts of a cell i.e. *organelles, vacuoles, nucleus, cell membrane, cytoplasm* and their functions. **4.3(3)A** The teacher writes *cell, tissue, organ* on the chalkboard and asks the students to look at a number of slides or pictures and identify whether they are cells, organs or tissue. *The teacher guides the students to discover that cells form tissues and tissues form organs which are part of a system.* **5.3(1)A** *The whole class should be introduced to the particular system being studied so that all students become familiar with the*	**4.3(1)A /4.3(2)A** Groups of students can look at unicellular animals and plants, and single cells from the human body under a microscope. If these are not available they can go to www.cellsalive.com. They can compare the shapes of the cells and relate them to their function. **15.1(1)A** The students can investigate how the cell gets food, (i.e. through *osmosis*) and set up experiments to demonstrate osmosis. **4.3(3)A** • Students can compare and contrast different types of tissue and tell where they are found in the human body.  *15* *The skin is the largest organ of the body*. Students can examine their skin with hand lenses and discuss what they discovered. They can also research the parts and functions of the skin at www.discovery.com and www.cyh.com/HealthTopicsDetailsKids as well as the websites listed on the right. Skincare can also be researched (www.kidshealth.org) Other sensory organs can be discussed (review of Cycle One) • Students can use a model of the human body torso which contains parts that can be removed and replaced. Students have the task of replacing the organs in the correct position. Alternatively 'Accu-cut' organs can be placed on an outline of the human body. • **5.3(1)A** *The systems of the human body will be studied at different times during Cycle II. The reproductive and endocrine systems*	Related library books Models of the human body Posters of the various systems Cut-outs of organs (Accu-cut) Measuring instruments (tape measures etc.) Cardboard, scissors, markers, rubber bands, stopwatch, thermometer, timer Skeleton Interactive web sites www.kidsbiology.com/human_biology www.anatomyarcade.com www.msnucleus.org (good slideshows) www.buginvestigators.co.uk www.gamequarium.com/humanbody.html www.lessontutor.com www.biology4kids.com

[15] Retrieved from www.adprima.com/sci-respsystem.htm - 9/2/2009

organs involved in the system and their functions and vocabulary that will be used. <u>Human Body Book</u> A book cover with two flaps is made out of one large sheet of construction paper. Each group of students is given a transparency with the outline of a human body. They draw all the organs of one system in the outline (with one colour Sharpie for each organ). They also make matching definition cards about each organ. Each group of students will have a different system to draw. The transparencies can be placed in the book so that they overlap and all the organs can be seen. **5.3(1)A** The Skeletal System Distribute the names of major bones of the skeletal system to the students and allow them to label a large diagram or model of a	*should be studied in Year 5/6. Curricular links – Social & Emotional Development; Health and HIV curricula.* *Here are some activities that can be done with the different systems.* The Digestive System • Experiments with the tongue and taste - Solutions are placed in small paper cups i.e. sugar + water; vinegar; salt + water; baking soda + water. Each child dips a cotton swab into the solution and records the area of the tongue where the taste was sensed. Ensure that students rinse their mouth and drink a sip of water after each 'taste'. The students record the final results on a chart using the words salt, sour, sweet, bitter. [16]**(13.1A)** • Students can demonstrate how the teeth, saliva and gastric juices work together to break down food. Each pair of students is given two jars with water. To one jar potato chunks are added, to the other grated potato. The lids are placed on the jars and then the jars are shaken for 5-10 minutes. The students discuss what happened to the potato.[17] **(13.1A)** • Give each student a zip loc bag and a piece of bread. The bag represents the 'stomach'. Pour a little orange juice into the bag. The juice represents 'digestive juices'. The students observe what happens to the bread, they squeeze the bag for two minutes, (as the large intestine squeezes food). The food is now ready to be absorbed into the small intestine and go into the bloodstream. The Respiratory System (www.lung.ca/children/index_**kids**.html *)* • The students can be grouped in pairs and record their normal breathing rates (e.g. in 30 seconds). The rates should be taken three times, then averaged and calculated per minute. Students can compare their breathing rates. They also take their breathing rates after running in place for 30 seconds. Both sets of breathing rates	 Diagram of the Digestive System Table for recording results of taste experiment 

[16] Retrieved from http://www.msnucleus.org.membership/html/k-6/ - 28/8/2009
[17] Retrieved from www.bb.co.uk/science/humanbody/body - 11/9/2009

skeleton.
Groups of students can be given templates of different parts of the skeleton and asked to assemble the skeleton.



[14]

4.3(4) A

- The students can make a timeline to show what was done at certain ages, e.g. walking, talking and starting elementary school …. dying.

can be compared. The students must discuss the reason behind the results. **(13.1A)**

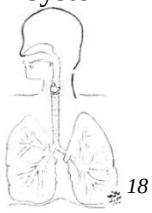
- Models can be made to demonstrate how the lungs work. (*See diagram on the right.*) The bottom (black part) of the 2-litre coke bottle is cut off. A plastic bag is attached with a rubber band to the cut end. The cotton balls must plug all the spaces around the straws at the neck of the bottle. The balloons must be taped securely to the straws. The students pull down and push up the plastic bag and observe what happens. They are asked to explain the results in terms of the actions of the diaphragm. **(13.1A)**
- The students can breathe into limestone - water (*made by placing limestone powder from chalk in water and leaving to stand overnight)* and see that carbon dioxide is exhaled. (*The water turns milky.)* (***Try all experiments before doing them with students)***

5.3(1)A The Skeletal System
Students can look at different poultry bones in order to investigate bone structure. Old X-rays can also be viewed.

5.3(2)A

- Students can investigate how the skeletal and muscular systems work together to facilitate movement by observing and identifying their joints. They can find out the types of joints we have.
- Students can make a model of a hinge joint.
- They can investigate reflex times by setting up a fair test. **15.1(1)A**
- Students can also investigate the interaction of the:
    - Circulatory and respiratory systems – Compare pulse and breathing rates before and after exercise and discuss the results.
    - Endocrine and reproductive systems – *The glands that produce testosterone, progesterone and estrogen which are*

Diagram of the respiratory system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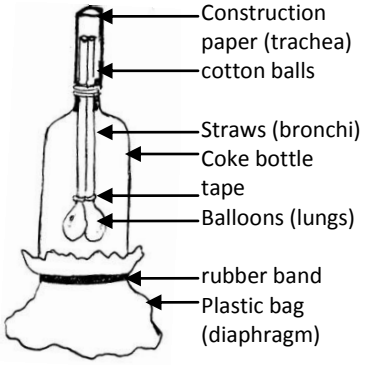


[19]

[14] Retrieved from www.lessontutor.com/jm-skeleton.html - 25/8/2009
[18] Retrieved from www.lessontotor.com/jm.respsystem.htm - 25/8/2009
[19] Retrieved from www.adprima.com/sci_respsystem.htm - 9/2/2009

• After discussing the reproductive system, students can map the changes that take place with the *fetus* after *fertilization.* • Puberty – *This will be discussed in the Health and HIV curriculum. The focus in Science is the physical changes and what causes them. The teacher needs to be open and willing to answer questions. Health care workers can be invited to talk to the students.* **6.3(1)A** Students can research the most common inherited traits and list them. The students can then work in pairs, triads and small groups to investigate the frequency of inherited traits. *Mathematics Link – frequency charts, line graphs or tallies can be made of the results.*	*related to the development of reproductive organs are part of the endocrine system.* ○ Digestive and excretory systems **4.3(4) A** • Students can draw the body changes that happen as a person matures, e.g. A new-born baby has a very large head, towards the end of childhood the body is less 'chubby'. Family photographs can be used with parental permission. • They can also develop a time-line for the human fetus describing what happens monthly. **6.3(1)A** • The students can also research which illnesses are inherited and find out if they are at risk for diabetes, allergies, sickle cell and other inherited illnesses that run in families. • Students can also research habits that they have inherited e.g. eating certain types of food, caring for pets, etc. A chart can be made comparing learned habits and inherited traits. *Curriculum Links* *Mathematics* – Handling data *Health* – Care of the Body; Disease & Disease Prevention; Coping with Body Changes during Growth; Health Workers; Diet and Nutrition; Addictions; Health products *Physical Education* – Sports safety *Social Studies* – Caring for the Environment; Pollution	Web sites for information on inherited traits www.learn.genetics.utah.edu www.biologyjunction.com/genetic_traits_activity.htm

GLOSSARY – HUMANS

Arteries	Blood vessels that carry blood away from the heart through the body
Brain	the organ located in the head that controls all human actions e.g. coordination, thinking, emotions etc
Bronchi	The lower branches of the trachea in the lungs
Characteristic	A trait or habit
Cardiac muscle	Heart muscle
Cell	The basic unit of living matter of which plants, animals and humans are made
Cell membrane	The outside cell boundary that controls which substances can enter or leave the cell
Chromosome	Part of the cell nucleus made of DNA which is responsible for the characteristics of a person
Circulatory System	The group of organs (heart, arteries) responsible for the transportation of blood and oxygen through the body
Digestive System	The organs and body parts (intestines, stomach, liver) that break down food for use by the body
Diffusion	The movement of a substance from an area of high concentration to low concentration
Disease	A sickness or condition caused by viruses or bacteria which causes the body to malfunction
DNA	A substance in the nucleus of cells that contains genetic information (deoxyribonucleic acid)
Endocrine System	Those organs (glands) which are responsible for the production of hormones
Epithelial tissue	The tissue that lines the body organs and the covering of the body surface
Excretory System	Organs which are responsible for the removal of waste from the body
Fetus	A developing human from the ninth week of development to birth

Genes	Codes for specific traits
Genetic diseases	Diseases that are inherited e.g. sickle cell
Genitals	External sex organs e.g. penis, vagina
Germs	Microscopic living things that cause disease
Gland	A body part that produces a hormone to help regulate a body function e.g. pituitary gland which regulates sexual development
Growth spurt	The rapid increase in height and weight that takes place during puberty
Heart	The organ that pumps blood throughout the body
Hormone	A chemical in the body that controls a specific body function
Inherited traits	Traits /characteristic that are received from both father and/or mother at fertilization
Intestines	The part of the digestive system between the stomach and the anus
Kidney	An excretory organ that filters the blood and eliminates waste or excess substances from the body
Liver	The largest organ in the body that produces and stores important chemicals and processes waste products
Lung	A respiratory organ that takes in oxygen and excretes carbon dioxide
Mitochondria	Parts of the cell that produce energy
Nervous System	The body's main control system composed of nerves, the spinal cord and the brain
Nucleus	The part of the cell that stores the genes and controls cell activity
Organ	A group of similar body tissues that perform certain functions e.g. heart, liver

Organelles The functioning parts of the cell

Osmosis The diffusion of water molecules through a semi-permeable membrane e.g. absorption of food in the body

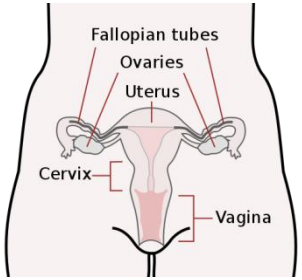
Pregnancy The time when the mother carries the developing baby in the womb

Protein A food nutrient that the body needs for growth and repair

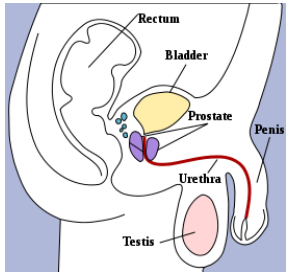
Puberty The stage where changes take place in the body that allow for reproduction

Reproductive System Those organs and body parts (genitals, ovaries, vagina, uterus, penis, testes, sperm, egg(ova) cells) which are responsible for the creation of babies

Female



Male



Respiratory System Organs (nose, trachea, lungs, bronchi) that work together for the exchange of oxygen and carbon dioxide between the cells and their surroundings

Sensory organs Organs such as the eyes, ears and skin that help us to be aware of our surroundings

Skeletal system The hard framework of bones and cartilage that support and protect the body's organs

Stomach A digestive organ that takes in food and begins to break it down using stomach acids and enzymes

Tissue Masses of cells that form part of the body and work together to perform a specific function e.g. muscle tissue

Trachea The windpipe through which air goes to the lungs

Veins Blood vessels that carry blood to the heart

Voluntary muscle Those muscles that are under conscious control e.g. biceps, triceps

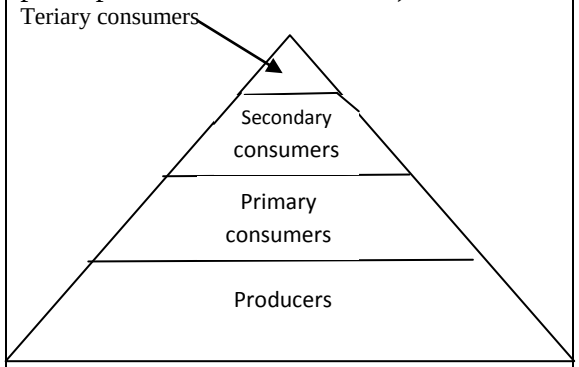
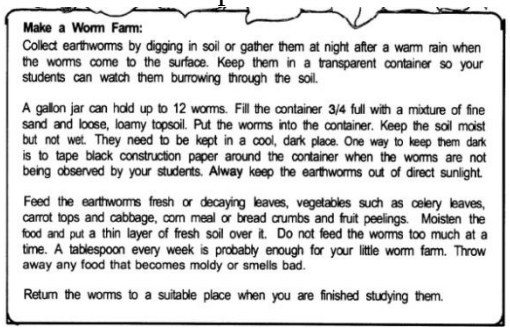
TOPIC: THE ENVIRONMENT (*5.4*)

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities

5.4(1) Define and differentiate between different types of environments
5.4(2) Identify the relationship between living and non-living elements of local and other environments
5.4(3) Demonstrate how organisms react and adapt to changes their environment
5.4(4) Identify ways in which human activities have changed their environment and/or affected other organisms
5.4(5) Show
	Definition and description of environments, world biomes, local ecosystems, habitats
	Essential Concepts
	• An ecosystem requires certain components in order to be maintained
	• Organisms adapt to their environment (over a period of time) in order to survive.
	• Organisms are interdependent.
	Sub topics
	• Animal habitats
	• Relationship of animals to other organisms
	• Adaptation to the environment
	• Changes Human Beings Make to the Environment
	  • Beneficial (e.g. shelter, food)
	  • Detrimental (e.g. pollution, deforestation,
		Environment - natural, constructed, urban, food, water, shelter,
		Habitats, aquatic, oceans, terrestrial, mountains, grasslands, temperate / tropical forests, deserts, polar regions
		Biomes – tundra, desert, tropical rain forest, prairie, savanna
		Ecosystem – community, plants, animals, habitat, population, organisms, interact, survival, sunlight, climate, producers, consumers, inorganic/organic materials
		Relationships – interdependence conservation, endangered, food /chain /web, producers (autotrophs), herbivores, carnivores, omnivores, heterotrophs, trophic level, pets, symbiotic, predators, decomposers, bacteria, organic, soil fertility
		Adaptations – tropisms, ecosystems, nutrients, weeds, camouflage, defenses, 'playing dead', territories, colonies, hibernation, seasonal migration, instinct
		Changes - beneficial, detrimental, pollution, disease, deforestation, loss of habitat, global warming, hurricanes, Ice Cap, melt, flooding, drought
			Teacher observes or records when a student:
			• Defines and differentiates between different types of environments
			• Defines the relationship between:
			  ○ different animals
			  ○ animals and plants
			  ○ animals and humans
			• Investigates how local organisms react to and cause changes to their environment in order to survive
			• Identifies ways in which human beings have changed their environment and/or affected other

appreciation for the need to conserve resources in the environment	global warming, etc.	Conservation; bulbs, alternative fuels, solar heating, wind power, reduce, reuse, recycle, domestic waste disposal, plastic, compost, biodegradable, melted, processed, sustainable development	organisms • Identifies ways of conserving electricity • Researches ways of conserving sources of renewable energy

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
5.4(1)A The teacher can discuss with the class terms such as e*nvironment, habitat, aquatic, oceans, terrestrial, mountains, grasslands, temperate / tropical forests, deserts, polar regions, biomes, tundra, desert, tropical rain forest, prairie, savanna, ecosystem, community, population* **5.4(3)A** All living things have to adapt to changes in their habitats. When examining the local area the students should investigate a plot of land about 1 square metre, take photographs and / or	**5.4(1)A** • Students can collect pictures of different habitats e.g. deserts, tropical rain forest and the plants that live in them. They can discuss the features of the plants that help them to survive in the particular habitat. The pictures can be placed on card so that a matching game can be played in a centre. • Pictures of places in the local environment can be shown to different groups. The students are asked to predict what kinds of organisms would be found there. They then have to visit that places to check their predictions and note /draw organisms found and the living conditions of the area e.g. light, water, soil, shade, temperature. • Students can compare the different types of marine environments found locally e.g. beach, sea, fresh pond, salt pond, mangroves, coral reef, etc. **5.4(1)A – 5.4(3)A** Year 4 students can build an *ecosystem* in an aquarium tank. Place a layer of gravel 3cm deep in the tank and sprinkle activated charcoal on it. Then mix potting soil and sand	Related library books Bright Ideas – Caribbean Primary Science Books 3 – 6 Pictures of different habitats Pictures of local flora and fauna **Chart for School Yard Ecosystem Observation** DESCRIPTION OF AREA ANIMALS PRESENT DESCRIPTION OF TOPSOIL VEGETATION PRESENT Aquarium tanks, activated charcoal, grass seed, soil, gravel, water, insects (spiders, worms, ants etc.), hand lenses

collect samples of plant life. On return to the classroom they can discuss how the plant is adapted to suit the habitat e.g. If there are many flying insects then the plants will be bright and colourful. This will enhance chances of pollination. **5.4(2)A** • The class as a whole can brainstorm uses and importance of plants. After the responses are placed on the chalk or white board they can be grouped, e.g. animals need plants for food, shelter; however plants need animals for seed dispersal, and provision of fertilizer containing needed nutrients. • The teacher will introduce the terms that refer to food chains underlining the fact that plants are *producers.*	(3:1) and spread in the tank, 7cm. deep. Sprinkle grass seed over the soil and water it to keep the soil moist. When the grass grows add insects. Different groups can add different insects and observes what happens over time. The terrarium s can be placed in different areas, shady, exposed to much/little sunlight etc. The students can report on any adaptations / interactions that take place. **5.4(2)A** • Students can give examples of food chains/webs from their local environment as well as the region and other world areas. Older students can discuss different tropic levels within food webs. • *Food is an important aspect of survival.* The students should choose a local animal and investigate its feeding habits from secondary sources. The students then go and find that animal in its environment and find out whether that animal is a *decomposer, herbivore, carnivore or omnivore.* They also observe the animal's position in a food chain and any physical adaptations needed to obtain food. • Students can also choose a local habitat and identify the structure of a food chain in that habitat. • Students can research and discuss the effect on animals of changing conditions in a given habitat e.g. coral reefs, mangroves and how animals react. • Students can explore relationships such as symbiosis in the local environment e.g. cattle and the tick bird. • The study of pets and their relationship with their owners can also help students internalize the term *interdependence.*	Pictures of different flora and fauna Blank Food Web Triangle[22], (students place pictures in correct level).  Worms are decomposers. A worm farm can be made so that the students can observe how they work and infer the physical adaptations they have to function as decomposers.  **Make a Worm Farm:** Collect earthworms by digging in soil or gather them at night after a warm rain when the worms come to the surface. Keep them in a transparent container so your students can watch them burrowing through the soil. A gallon jar can hold up to 12 worms. Fill the container 3/4 full with a mixture of fine sand and loose, loamy topsoil. Put the worms into the container. Keep the soil moist but not wet. They need to be kept in a cool, dark place. One way to keep them dark is to tape black construction paper around the container when the worms are not being observed by your students. Alway keep the earthworms out of direct sunlight. Feed the earthworms fresh or decaying leaves, vegetables such as celery leaves, carrot tops and cabbage, corn meal or bread crumbs and fruit peelings. Moisten the food and put a thin layer of fresh soil over it. Do not feed the worms too much at a time. A tablespoon every week is probably enough for your little worm farm. Throw away any food that becomes moldy or smells bad. Return the worms to a suitable place when you are finished studying them. Retrieved from www.teacherfilebox.com

[22] Adapted from http://msnucleus.org/membership/html/k-6/1c/ntenvn/5_4a.html 8th January, 2010

5.4(3)A *In order for animals to survive they must adapt to changes in their environment.* • Game - Animal Survival[20] The students choose an animal to role play. All students become that animal e.g. pelican. To survive each student must collect enough fish. Some of the students will be blindfolded; others will have one hand or leg tied to represent a broken wing or leg. Other disabilities can be used. At the start of the game all students stand in one corner of the room (pond). The teacher places cut-out fish throughout the area. On signal the students crawl around the room to try and get as many 'fish' as possible in a given time. The teacher will write on the board how many fish are needed to survive for certain amounts of time. During discussion the	**5.4(3)A** • [21]Students can observe what happens when there is limited space for seeds to grow. Place beans in four containers in which soil has been placed. In carton #1 the beans are 8 cm apart; in #2, 5 cm apart; in #3, 3 cm apart and in # 4, 1cm apart. The cartons will be placed on a tray in a sunny place and watered regularly. **(13.1A)** Students record their observations in a science journal. Questions to be considered o Did the seeds sprout at the same time? Why / why not? o Did they grow at the same rate in the same way? o Why do gardeners thin out seedlings and weed? • Students can grow selected vegetables in differently fertilized soils and compare results. • Students can study animal adaptations for various habitats e.g. deserts, grasslands etc. • *Colour is used by many animals to ensure survival during the mating season and for protection* ***(camouflage)***. The students can research the use of colour for camouflage. (*Students should first find examples in the local environment e.g. stick insects, lizards, iguanas)* • Students can compare and contrast the colouring of female and male animals and discuss why they are different in their body colouring. • Students can also study defense mechanisms that help animals survive e.g. *migration, hibernation, living in colonies*	Containers (milk cartons cut in half), soil, scissors dried beans, rulers Websites www.kidsgardening.com http://the seedsite.co.uk/class.html (teacher resource) Vegetable seeds Examples of fertilizers Examples of different types of soil Match Animal Adaption card Game instructions are available at www.education.com/print/Match-adaptation_fifth/ www.youtube.com (has videos about adaptations)

[20] Retrieved from http://www.youth.net/cecsci/cecsci.123.txt 8/20/2009
[21] Author : Jillian Duffield, Intermediate School 70 – Grade level: 6th grade Life Sciences

teacher should help the students to understand why some animals survive and others don't. (*Safety is important during this activity!)* • Discuss how humans adapt to changing conditions e.g. weather patterns **5.4(5)A** • A discussion can be facilitated by the teacher on the topic: 'Conservation of Energy' • Students can discuss the effect on plants and animals in a particular habitat when humans change the living conditions, e.g. draining the pond, removal of sand from the beach, removal of trees (shade) and ground cover from road sides or building sites. • Invite members of local environmental groups to speak to the students	**5.4(4)A** • *Humans change their environment to provide food, shelter, clothing etc.* Students need to investigate, list the advantages and disadvantages of industries related to these basic needs on a local, regional and global basis. They can also research the effects on other living things e.g. loss of habitat, depletion/extinction of species. • They can discuss how man helps/ hinders plants from growing by use of different chemical fertilizers. Natural fertilizers can also be discussed. Different types of soil can be compared and contrasted. • Students can discuss local environmental problems related to plants, e.g. the mangroves, over development, indiscriminate use of chemical fertilizers **5.4(5)A** • Students can form groups. Each group chooses one nonrenewable source of energy, e.g. oil, coal, natural gas, uranium, and researches methods of conservation, e.g. biomass insead of oil, wind electricity, solar heating. • Older students can research appliances that are energy efficient. *Curriculum Links* *Social Studies* – Geography – comparisons of habitats, ecosysstems and biomes; taking part in environmental /community clean-ups; pollution; transportation; communication; industries including tourism *Technology* – use of the computer for research, publication and storage of information *Language and Communication* – debating environmental issues; writing letters about projects that are detrimental to the environment *Mathematics* – handling data / ststistics	Newspaper articles

GLOSSARY – THE ENVIRONMENT

Adaptation	Changes that take place in an organism that helps it to survive in a given environment
Alternative fuels	Fuels that can be used instead of fossil fuels that are non renewable
Aquatic	Living or growing in or by water
Autotroph	An organism that makes its own food
Beneficial	Useful, good
Biodegradable	Material that will break down in time and become part of the earth without harming it
Biome	A large geographical region or community of animals and plants identified by climate and vegetation
Camouflage	Colours or patterns that hide an animal against its background; method of defense
Carnivore	An organism that eats only meat
Colony	A group of animals or plants of the same kind living or growing together
Conservation	The action of taking care of something so that it cannot be harmed, damaged, depleted or changed
Community	A group of interdependent organisms inhabiting the same region and interacting with each other
Compost	A pile of rotting material used to add to the garden soil to enrich it
Consumer	An organism that eats another organism
Deforestation	The harmful destruction of trees
Desert	A barren region with little or no rain

Detrimental	Harmful
Disease	A sickness or condition caused by viruses or bacteria which causes the body to malfunction
Domestic waste	Solid waste, composed of garbage and rubbish, originating in a private home
Drought	A lack of rain for a long period
Ecosystem	A system made up of a group of living organisms, their physical environment and their relationships e.g. a pond, an ocean
Endangered	A species in danger of extinction
Environment	The surroundings of an organism
Food chain	The transfer of food energy from one living thing to another by feeding e.g. corn → chicken → man
Food web	Complex food chains existing in an ecosystem
Fossil fuels	Fuels created by the action of pressure and heat on the buried remains of living things, e.g. oil, coal
Global warming	The rise in temperature of the whole earth
Habitat	The place where an organism lives
Herbivore	An organism that eats only plants
Heterotroph	An organism that cannot make its own food
Hibernation	Sleep or inactivity during winter
Ice Cap	A thick cover of ice over an area, sloping in all directions from the center

Industry	A branch of business, trade or manufacture
Inorganic	Not having the structure or organization characteristic of living things
Instinct	Inborn pattern of behavior
Interdependent	A relationship in which things depend on one another for survival
Migration	The movement of organisms from one country to another
Omnivore	An organism that eats plants and animals
Organic	Related to or derived from living organisms
Organism	Any living thing
Polar Region	Region near the North or South Pole
Pollution	Harmful waste or unwanted substances released into the environment
Prairie	A treeless grassy plain
Population	A group of organisms of the same species inhabiting a given area
Producers	An organism usually a plant that makes food for itself
Rain forest	A forest with heavy annual rainfall
Recycling	Separating waste articles and using them as new products
Renewable	Something that can be replaced; e.g. solar energy
Savanna	A flat grassland in tropical or subtropical regions
Soil fertility	The ability of a soil to supply plant nutrients for healthy growth

Solar energy/heat	Energy or heat from the sun
Survival	A natural process resulting in the evolution of organisms best adapted to the environment
Sustainable	Can be used again without destroying the environment
Symbiotic	A relationship between two organisms which is mutually beneficial
Temperate zone	A region of earth between the polar and tropical circles
Terrestrial	Living or growing on land
Territory	An area inhabited by an animal which it protects from others of its kind
Tropical zone	Region near the equator that is warm, humid and diverse in plants and animals
Trophic level	The same position in a food chain occupied by any class of organisms
Tropism	The movement of a plant in response to light (**phototropism**); water (**hydrotropism**); gravity (**geotropism**)
Tundra	A large, treeless biome where the ground is frozen all year

CHECKLIST FOR LIFE SCIENCE

Behaviours	Names of Children												
Write date when target behaviour is mastered													
Plants													
Identify the structures of a plant and their functions													
Explain the various processes that plants undertake													
Classify plants													
Animals													
Identify the structures of animals and their functions													
Compare and contrast the life cycles of different animals													
Classify animals													
Humans													
Identify cells as the smallest unit of the body													
Identify and describe the structure and function of cells and cell parts													
Describe how the human body is organized into cells, tissues, organs and organ systems													
Identify changes that take place as a human being													

develops and grows													
Identify the major parts and functions of the systems of the human body													
Describe ways in which the systems of the human body interact													
Demonstrate an understanding that many characteristics are inherited from parents and others are learnt													
The Environment													
Define and differentiate between different types of environments													
Identify the relationship between living and non-living elements of local and other environments													
Demonstrate how organisms react and adapt to changes their environment													
Identify ways in which human activities have changed their environment and/or affected other organisms													
Show appreciation for the need to conserve resources in the environment													

SUGGESTED SCOPE AND SEQUENCE

Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4	Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4
Plants						**Animals**					
Identify the structures of a plant and their functions	**I**	**D**	**D**	**D**	**M**	Identify the structures of animals and their functions	**I**	**D**	**D**	**D**	**M**
Explain the various processes that plants undertake	**I**	**D**	**D**	**D**	**M**	Compare and contrast the life cycles of different animals	**I**	**D**	**D**	**M**	**M**
Classify plants	**I**	**D**	**D**	**M**	**M**	Classify animals	**I**	**D**	**D**	**M**	**M**
Humans											
Identify cells as the smallest unit of the body			**I**	**D**	**M**	Identify changes that take place as a human being develops and grows		**I**	**D**	**D**	**M**
Identify and describe the structure and function of cells and cell parts			**I**	**D**	**M**	Identify the major parts and functions of the systems of the human body	**I**	**D**	**D**	**M**	**M**
Describe how the human body is organized into cells, tissues, organs and organ systems	**I**	**D**	**D**	**D**	**M**	Demonstrate an understanding that many characteristics are inherited from parents and others are learnt	**I**	**D**	**D**	**M**	**M**
Describe ways in which the systems of the human body interact		**I**	**D**	**D**	**M**						

The Environment											
Define and differentiate between different types of environments	**I**	**D**	**D**	**D**	**M**	Demonstrate how organisms react and adapt to changes their environment		**I**	**D**	**D**	**M**
Demonstrate how organisms react and adapt to changes their environment	**I**	**D**	**D**	**M**	**M**	Show appreciation for the need to conserve resources in the environment		**I**	**D**	**D**	**M**
Show appreciation for the need to conserve resources in the environment	**I**	**D**	**D**	**M**	**M**						

SCIENCE AND TECHNOLOGY

PHYSICAL SCIENCE

Standards

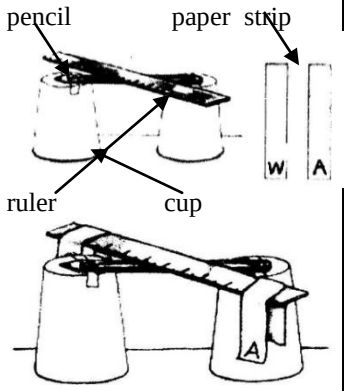
# 7 Physical Science:	The student understands the structure and properties of matter.
# 8 Physical Science:	The student names the sources and properties of energy.
# 9 Physical Science:	The student recognizes forces and motions.
#13 Basic Science and Technology Skill:	The student can follow and execute steps in simple research skills.
#15 Basic Science and Technology Skill:	The student can apply simple research skills.

Essential Concepts

- Physical Science is the study of non-living systems.
- Everything on Earth is a form of matter.
- Matter is made up of particles too small to be seen without magnification.
- Matter has observable, measurable properties.
- Matter can be classified dependent on the physical and chemical properties.
- Physical and chemical changes occur in matter.
- The physical properties of matter can be changed by exposure to heat, light, pressure and chemicals.
- Interactions between matter and energy produce changes in the system without affecting the total quantities.
- Energy exists in many forms; heat, light, electrical, mechanical, motion and sound.
- Energy can be transferred from one type to another in many ways.
- Energy cannot be created or destroyed but only changed, (from one form to another).
- There are different types of force that affect motion.
- Friction is a force that opposes motion

TOPIC: MATTER (*7.1*)

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
7.1(1) Define matter **7.1(2)** Identify the structure and properties of different materials **7.1(3)** Classify materials as the different states of matter, elements, compounds, solutions and mixtures **7.1(4)** Investigate and analyze ways in which matter changes	*Essential Concepts* • All matter, regardless of its size, shape, or color, is made of particles (atoms and molecules) that are too small to be seen by the naked eye. • Matter can exist as a solid, a liquid, or a gas. • Matter can be classified as elements, compounds, and mixtures. • Matter has physical properties that are observable. • When matter undergoes a physical change the properties remain the same. • When matter undergoes a chemical change a new substance is formed. Definition of matter Structure of matter in different states Chemical and physical properties of matter in different states Definition and differences between elements, compounds, mixtures and solution Methods of changing matter Scientific investigation and experimentation *Process Skills:* observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving	Atom, mass, particles, molecules Materials - Glass, plastic, wood, synthetic, rubber, paper States of matter – solid, liquid, gas, flow, shape, volume Physical properties – hard, soft, flexible, absorbent, transparent, density, texture, size Chemical properties - acidity, basicity, combustibility, and reactivity States - solids, liquids, gases, compounds, solutions, solute, solvent, mixtures, alloys, emulsion, amalgam elements, metals Change – reversible, irreversible, dissolve, evaporate, condense, melt, solidify, freeze, heat, cool, temperature, separate, mix, compress Chemical Change – reaction, substance, interact, pressure, temperature, concentration, photosynthesis	Teacher observes or records when a student: • Defines matter • Observes and categorizes different materials in terms of their physical properties • Identifies and demonstrates the differences between a solid, liquid and gas • Demonstrates an understanding of elements, compounds and mixtures • Differentiates between physical and chemical change • Identifies and demonstrates ways in which matter can be changed

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
7.1(1)A Students and teacher discuss matter and create a definition (*This will allow the teacher to assess the students' knowledge)* **7.1(3)A** • The teacher shows the students objects or pictures of objects and lets them describe them in terms of the states of matter. The teacher and students discuss factors that influence *evaporation* and *condensation*, e.g. heat, wind. • The teacher should introduce the terms *atom, element, molecules and compounds* to the class as a whole (Year 4) **7.1(4)A** • Building on work done with solutions, the teacher can help the students to differentiate between changes to matter that are '*reversible*' or *'irreversible*'.	**7.1(2)A** • Groups of students are given several objects to classify. Their task is to develop criteria which will allow them to name the material (*wood, plastic, glass, metal)* from which the object is made and state one or two characteristics (properties), (*The teacher will decide which properties [hardness, flexibility, softness, absorbency strength, transparency, etc] are to be described and choose objects accordingly.)* • Older students can be given the opportunity to test several objects with the same property and compare the levels e.g. absorbency – The students can test several types of paper to see which is most/least absorbent. They form a hypothesis and then design an experiment. (**15.1A**) **7.1(3)A** • Students are given solids and liquids to classify e.g. shampoo, wood, syrup, oil, rice, sand, etc. The teacher can ask questions to prompt critical thinking; '*Do solids flow?' 'What happens to liquids if you change the containers they are in?' 'Is the volume the same?'* • Students investigate how solids can be changed to liquids. (*Review the three states of water.)* • Students investigate how liquids turn to gas by evaporation using water, nail polish, perfume, correction fluid or alcohol. Make a balance (*see picture on the right)* out of two paper cups, a ruler and a pencil. Cut two 4 x 20cm. strips of paper. Mark one with 'W' for water and one with 'A' for alcohol. Soak each strip in a tablespoon of the respective liquids. Drape the strips at the end of the ruler and note what happens and give scientific explanations. • Older students can experiment with the rate of evaporation of different substances. (**15.1A)** • *The students need to experiment with gases, liquids and solids in order to discover their properties and differences.*	Common objects Measuring beakers, cups cylinders A collection of solids, liquids and powders in transparent containers Web sites www.chem4kids.com www.msnucleus.org www.bbc.co.uk Related library books Evaporation experiment from www.acs.org/kids 

• Let the students discuss how salt can be recovered from salt water (evaporation); flour from rice (filtering). Drop an "Alka-Seltzer" tablet into a glass of water. Let the students use scientific terms to describe what happens (*a gas is formed*). Add water to cement (*a solid is formed*); vinegar to baking soda (*a gas is formed*). These are '*irreversible*' changes. • Let the students discuss what happens when a substance is burned. Let them say whether the change is '*reversible*' or '*irreversible*'. Help the students to realize that '*burning*' is a '*chemical*' or 'irreversible' change.	• Students can be introduced to the terms '*solvent*'; '*solute*' and '*solution*' by adding sugar (*solute*) to water (*solvent*) to form sugar water (*solution*). When the students are familiar with the term they can observe what happens when a range of solids are added to water, e.g. salt, coffee, flour, powder paint, marbles, sand, tissue paper and 'Glutofix'. The students can observe the difference between mixtures and solutions and the changes that take place. *The teacher can point out that soda is a solution with a liquid and a gas.* • Groups of students can investigate the '*solubility*' of different '*solvents*' **(15.1)A** **7.1(4)A** • Students can experiment with heat to see how it affects *solubility*, by adding 1ml of any solute to 100ml of cold water and then to hot water. Students record their observations and conclusions. **(13.1)A** • Students can investigate whether substances that do not dissolve in water will dissolve in other liquids using e.g. margarine, water and a soap powder solution. (*Some students may be allergic to soap powder.)* • Groups of students can investigate whether salt or sugar dissolves faster in different liquids after forming a hypothesis as to which will dissolve faster. The students will choose 5 liquids, e.g. white vinegar, club soda, ginger ale, glass cleaner, rubbing alcohol, apple juice, lemonade/limeade or tea. The students add ½ teaspoon of salt to each of 6 cups labeled 'salt' and ½ teaspoon of sugar to 6 cups labeled 'sugar. First the students add 240ml of water to a cup containing sugar and a cup containing salt and record the time it takes for the sugar and salt to dissolve completely. This is repeated two more times. The whole process will be repeated for each of the chosen five liquids. An average time is calculated for each liquid. After the experiment the results are discussed in terms of the hypothesis. The following questions can help students to think critically. '*Did you see patterns emerging*?'; '*Was it obvious which solute dissolved faster?*'; '*Do you think the nature of the solutes and solvents affected the results ?*'	Adapted from www.teachervision.fen.com/chemistry/lesson-plans/63850.html Materials 12 clear plastic10oz plastic cups, permanent marker, 1 5ml & 1 2.5ml teaspoons, 1 measuring cup, 8 tsp, salt, 8 tsp. sugar,1440 ml water, 720 ml each of 5 different liquids,1 stopwatch, 1 clear plastic cup containing 240 ml of water.

GLOSSARY – MATTER

Absorbent	Able to take in moisture, light or heat
Acid	A chemical that tastes sour and turns litmus paper red
Acidity	The degree of acid in a substance
Alloy	A metal made by mixing and fusing two or more metals; a combination of a metal and other substances
Amalgam	An alloy of mercury with some other metal or metals
Atom	The smallest particle of a chemical element that can take part in a chemical reaction without being permanently changed.
Base	A chemical substance that turns red litmus paper blue
Chemical change	A change in which one substance is changed into one or more substances with different properties
Combustible	Easy to burn
Compound	A substance formed by the chemical combination of two or more elements
Compress	To squeeze together; to make smaller by applying pressure
Concentration	The strength of a solution
Condense	The change of state from gas to liquid
Dissolve	To become part of a solution; sugar dissolves in water
Element	One of the simple substances e.g. gold, iron, carbon that cannot be separated into simpler substances
Emulsion	A mixture of liquids that do not dissolve into each other e.g. oil and water

Evaporate	The change of state from a liquid to a gas at a temperature below boiling point
Flexible	Easily bent in all directions without breakage
Flow	To move like water
Gas	The state of matter in which the molecules are widely spaced and move freely
Liquid	A state of matter in which molecules are closely spaced but free to move over each other. Liquids can flow and pour
Mass	The amount of matter in an object
Particles	Pieces of matter
Property	A characteristic
Melt	To change state from solid to liquid
Metal	Anyone of the group of chemical elements e.g. gold
Mixture	The product of two or more substances mixed together
Molecule	One of the basic units of matter
Photosynthesis	The conversion of light (sunlight) energy into chemical energy (food) by green plants (a chemical change)
Pressure	The continued action of a weight on a surface or area
Reaction	A change resulting from a chemical action of two substances on each other
Reactivity	The power of being reactive
Reversible	That which can be reversed

Solid	A state of matter with a fixed shape and size in which the molecules are arranged in a fixed pattern
Solidify	To make a liquid into a solid by freezing e.g. water to ice
Solute	A solid, liquid or gas, which is dissolved in a liquid to make a solution e.g. salt in seawater
Solution	A mixture in which the particles of a solid are spread out, dissolving into a liquid
Solvent	A substance, usually a liquid, that can dissolve other substances (solute + solvent = solution)
States of matter	The different forms that matter takes e.g. solid, liquid, gas
Synthetic	Made artificially
Temperature	The measurement of how hot or cold an object is
Texture	How the surface of an object feels e.g. rough, smooth
Transparent	An object with the ability to let light pass through it
Volume	The amount of space taken up by an object

TOPIC: ENERGY (*8.1*)

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
8.1(1) Recognize that energy can be used to do work **8.1(2)** Identify the types/forms of energy **8.1(3)** Identify the sources of energy **8.1(4)** Compare and contrast kinetic and potential energy **8.1(5)** Explain how energy is transferred from one form/type to another **8.1(6)** Compare and contrast methods of heat transfer **8.1(7)** Describe how humans utilize energy	*Essential Concepts* • Energy exists in many forms. • Energy can be transferred from one type to another. • Energy cannot be created or destroyed. Definition of energy Sources of energy Types of energy Differences between potential and kinetic energy How energy is transferred Uses of energy Investigation and experimentation of movement of energy; interaction of energy and matter; electrical circuits; creation of sound and the role of heat and light in the transfer of energy *Process Skills:* observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting *Critical Thinking Skills:* analyzing, synthesizing, evaluating, applying, problem solving	Vigorous action, ability to work Types/forms: heat (thermal); light (radiant); mechanical; electrical; chemical, sound Sources: • Renewable – solar (sun); wind; geothermal (heat from Earth); biomass (plants); hydrothermal (water) • Nonrenewable – fossil fuels (oil, natural gas, coal); nuclear energy (uranium) Potential (stored energy): chemical, atoms, molecules, plants, petroleum, natural gas, coal, mechanical, tension, nuclear, nucleus, gravitational, hydropower, electrical, battery, lightning Kinetic (motion, moving energy): waves, radiant energy, light, sun, thermal, heat, electricity / electrical, mechanical / motion energy, wind, sound, vibrate/vibration, Transfer of energy: energy carriers, electricity, fuel, heat, mechanical – heat; mechanical – electrical; chemical – heat; circuits (parallel/ series),battery, bulbs, wires, switch, closed, open, heat, burning, friction, Heat transfer: radiation, convection, conduction, solar heat Uses: electricity - heating, lighting, cooking, appliances; industry, transportation	Teacher observes or records when a student: • Recognizes that energy can be used to do work • Defines and identifies the different types/forms of energy • Names sources of energy comparing renewable and nonrenewable sources • Compares and contrasts potential and kinetic energy • Demonstrates ways in which heat is transferred. • Explains how energy is transferred from one form/type to another • Describes how energy is used

<table>
<tr><th colspan="3">Suggested Experiences</th></tr>
<tr><th>Whole Class</th><th>Small Group / Centres</th><th>Resources</th></tr>
<tr>
<td>8.1(1)A The teacher poses the question, ‘What is energy?’. Students discuss in groups and a spokesperson reports to the whole class what was said. Ideas are recorded. The teacher then gives the definition. During the discussion ideas can be webbed as the students will probably give examples. A common student misconception is that energy is a fuel or energy resource.
8.1(3)A Take the class outside on a sunny day and ask them what they feel (heat from the sun). Let the students collect pictures of items that use</td>
<td>8.1(2)A
• After the whole class discussion on energy the children can give examples of the types or forms of energy. The students can be given copies of printed matter pertaining to the topic or use the Internet to find information.
• The students can become ‘Energy Detectives’.[23] Each group is given a Detective Data sheet to record evidence and energy source. Three clues are given i.e. ‘Energy can make things change.’; ‘Heat comes from energy.’; ‘Movement comes from energy.’ to help them in their energy hunt. The sources are then discussed. Vocabulary such as solar, thermal, radiant, electrical, motion, kinetic, sound), chemical, nuclear and mechanical (potential and kinetic) can be introduced.
8.1(3)A
• Give each group of students a different renewable source of energy to research. They must find out the scientific name for the source e.g. biomass; where it comes from, e.g. plants(crops and wood), animal and human waste (rotten food products), land fill garbage and the effects on the environment when it is converted to other forms of energy, (less air pollution but less food is available for eating).
• The students can construct an anemometer (see Weather unit) to demonstrate wind energy.</td>
<td>Websites
www.msnucleus.org
www.nrel.gov.

<table>
<tr><td>We know that energy was here because….</td><td>Energy Source (sun/ wind? electricity? other?</td></tr>
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www.tonto.eia.doc.gov/kids/energy
www.energyquest.ca.gov</td>
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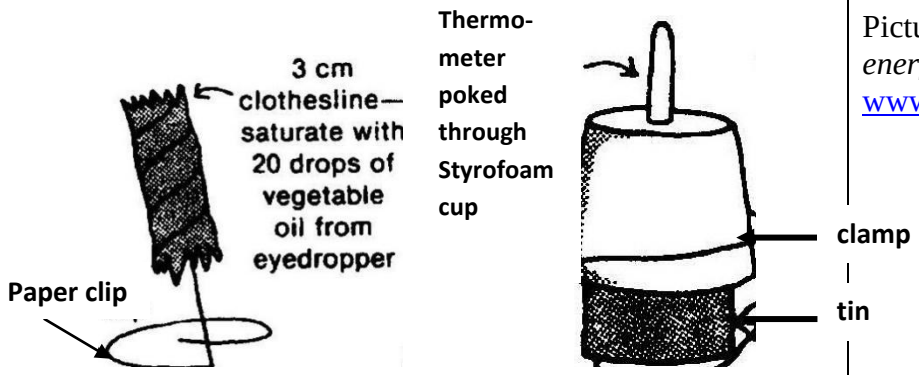
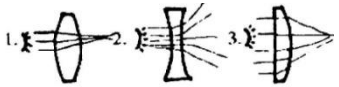
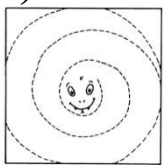
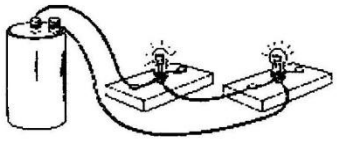
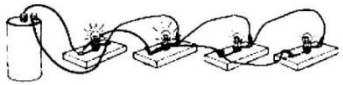
[23] Retrieved from www.nrel.gov – 17th September, 2009

solar (sun) energy. Ask the students why they think that *solar energy* is considered to be a *renewable energy source.* Let the students give other renewable energy sources, (*wind, geothermal, biomass, water , (hydrothermal).* **8.1(4)A** The teacher gives one example of *potential energy* e.g. a rock lying on top of a cliff, a car at the top of a ramp. The teacher then explains how the examples *potential energy* become *kinetic energy* e.g. the rock topples over the cliff, the car travels down the ramp. The students are given different pictures and asked to say whether they show *potential* or *kinetic energy* .Ask the students to define *potential* and *kinetic energy* and then give their own examples. **8.1(5)A** *Energy is*	• The power of *hydro energy* can be shown by placing a ping pong ball at the head of a hose. The pressure of the water coming from the hose keeps the ball in the air. • Let the students brainstorm lists of nonrenewable sources energy (*fossil fuels[coal, oil, gas], nuclear energy).*They can repeat the research done for *renewable source.* • Set up an experiment to see which oil produces more heat. Prepare a 'water heater' as shown below. Use a clamp to hold a can of cold water over the 'water heater'. Saturate the homemade 'water heater' with vegetable oil, automobile oil, olive oil etc. Use a Styrofoam cup to hold a thermometer in the tin can to measure the temperature of the water after burning. *Safety rules must be observed at all times.*  **8.1(5)A** • Let the students bring toys, (that move, make noise, use batteries or produce light), to school. Each group of students analyzes three toys and decides on the potential energy present in the toy and how the energy is transformed as the toy moves. E.g. a battery operated fire truck that has lights and a siren would show chemical energy (in the battery) that is transformed into light energy (lights), sound energy (siren) and kinetic energy (movement).	2 pieces of cotton clothesline (3cm each), dropper, thermometer, tin can, clamp, Styrofoam cup Pictures showing *potential* or *kinetic energy* www.bbc.co.uk (very interactive).

constantly changing from one form to another. The students can be given situations and asked to discuss how the energy is transformed. Examples: • Photosynthesis (light (from the sun) – chemical energy (food • Solar panels light energy – electrical energy • Using a projector the teacher can project light onto different surfaces on the screen e.g, aluminium foil, a prism, clear glass, wax paper, black card. The students observe and record what happens. *The teacher explains that energy travels in waves. The waves in the ocean and sound are* ***physical****. Light travels in* ***electromagnetic*** *waves.*	• The Sun provides us with heat and light energy. Students can investigate how light energy reacts with matter. (*Light travels in straight lines but when it strikes different materials many things happen. It can be reflected or refracted.* ○ Refraction – Fill a clear glass with water and place a pencil in it. Let a student look at it from the side. The light is being *refracted* by the water. ○ Reflection – Shine a light on a mirror. The light bounces off, it is *reflected.* Students can collect and compare mirrors. • The students can investigate how light reacts when it hits the surface of different lenses (link with eyesight). Some students may want to investigate what happens to light shone through a homemade kaleidoscope. • Students can investigate how sound travels. Ask the students to blow across the top of a bottle to make sound. Put water in the bottle to see how the sound changes. Place a ruler over the edge of the desk and flick the free end so that the ruler vibrates. A sound will be heard. Change the length hanging over the desk to see how the sound changes. (*Sound is produced by vibrating objects. It also travels through solids and liquids*) Students can develop experiments that prove this fact. They can also make musical instruments and demonstrate how to change the pitch. **5.1(1)A** (Link with hearing.) **8.1(6)A** Let the students experiment with *radiation, conduction* and *convection* and observe the differences between how heat travels. *They must observe that heat travels from the object with the higher temperature to the object with the lower temperature, e.g. from the sun to our bodies.* • Radiation (*requires no contact between the source and the*	www.msnucleus.org/membership/html/k-6/as/physics Lenses[24]  biconvex biconcave planar convex *Convex lenses bring together light rays, convex spread light rays out.* Homemade or commercial instruments Tuning forks Rulers, rubber bands, boxes, wide-necked bottles, drum skin, rice grains Ticking clocks www.uen.org/lessonplan (has many activities about heat)

[24] Retrieved from http://msnucleus.org/membership/html/k-6/as/physics/5/asp_6_6d.html - 9/23/2009

All waves can ***reflect, refract or defract.*** **8.1(6)A** *When energy is transformed, heat is usually produced.* Let the students rub their hands together. The *potential energy* in their hands is transformed into *heat energy* through *friction*. The students can discuss what other actions cause heat to be produced. **8.1(7)A** • Discuss electricity with the students. Let them brainstorm how electricity is utilized in the home. Review sources of electricity and work done on circuits in Cycle I. Show the students drawings of circuits and ask them to state whether they will work or not and why. Review relevant vocabulary; *battery, bulb, buzzer, motor, break, switch,*	*receiver)* Cut squares of coloured card (7cm x 7cm) and place them in the sun. On each place an ice-cube and time how fast each ice-cube melts. The students will observe how colour affects the absorbency rate of radiant heat. • Let the students use a magnifying glass to dry a small piece of wet paper by allowing the radiant heat (sunlight) to travel through the magnifying glass and heat the paper. • Conduction – Let the students compare the temperature of a metal and a wooden spoon that are placed in boiling (hot) water. Question the students as to which spoon is hotter and why? Explain that metal is a *good conductor* of heat. Give the students a wide range of common items and let them sort them into sets of good conductors and bad conductors of heat. • Convection – Draw and cut out a spinning serpent. Tie a string by the 'x' with a knot. Hold it over a flame, (about 6") and observe what happens. (*Heat travels through liquids and gases by convection.)*  • Place a glass pot full of water on a stove and let the water boil. As it is boiling add two or three drops of food colouring. Let the students observe what happens. (*Hot air rises and cool air sinks causing convection currents.)* • Let the students give examples of radiation, conduction and convection in everyday life. **8.1(7)A** • Students make circuits and test materials to see if they are good or bad *conductors of electricity.*They can also make	Squares of coloured paper Ice -cubes Magnifying glasses Squares of wet paper Metal and plastic spoon Jars: one with cold water the other with very hot water Common classroom items Spinning serpent cut out Candle String  Clear glass pot/beaker Stove Food colouring Matches, dropper Electricity web sites www.42explore.com/light.htm

conductor, insulator, wire, switch. If the students have not made circuits then let them do so. • An electrician can be invited to the class to show diagrams of electrical circuits from house plans and explain the symbols. • A visit to GEBE can be planned. • Safety and electricity can be discussed. • Discuss ways in which solar power is used.	circuits with switches; increase the number of batteries; use batteries with different voltages; change the number and types of bulbs. By using different variables the students carry out different investigations. Older students can investigate whether the thickness or length of the wire used affects the brightness of the bulbs. They can also compare and contrast series and parallel circuits. **5.4(5)A** • The students can collect pictures from magazines and create a poster/collage depicting the use of electrical and/or solar energy. (*Visual Arts Link)* • Students can make a timeline to show the development of transportation using various sources of fuel. *Curriculum Links* *Mathematics* – Reading scales, problem solving, operations *Language and Communication* – Reading skill, oral linguistic skills,writing skills, viewing skills *Social Studies* – Conservation, pollution, transportation, communication, time-lines, inventions *Health* –Safety (home / weather), care of the body (ears / eyes), energy from food *Visual Arts* – drawing and sketching	www.physics4kids.com www.touchstoneenergykids.com Circuits Series  Parallel[25]  www.eia.doe.gov/kids/energyfacts

[25] Retrieved from http://msnucleus.org/membership/html/k-6/as/technology/3/ast3_2d.html - 9/23/2009

GLOSSARY – ENERGY

Alternative fuels Fuels that can be used instead of fossil fuels that are non renewable

Appliance An object that is used to do household chores e.g. washing machine, can opener

Atom The smallest particle of a chemical element that can take part in a chemical reaction without being permanently changed.

Battery Two or more chemical cells that transform chemical energy into electrical energy

Biomass The total mass of living material in a given area

Bulb The glass container surrounding a filament

Burn To ignite; causing fire

Chemical energy Energy stored by fuels or food; chemical energy becomes heat energy if something is burned

Circuit A complete path over which electricity flows

Coal A solid, hard, black mineral that burns and gives off heat; it is formed by pressure and heat on decayed vegetable matter in the earth

Conduction A method of transferring heat through an object or electricity through wires

Convection A method of heat transfer through a liquid or gas

Electricity	A form of energy created by a force between positive and negative charges; a flow of electric current
Energy	The ability to work or cause change
Fossil fuels	Fuels created by the action of pressure and heat on the buried remains of living things, e.g. oil, coal,
Friction	Resistance to motion of surfaces that touch
Geothermal energy	Energy that comes from the inside of the earth
Gravity	The force that pulls objects down towards the centre of the Earth
Heat	Energy that makes things hot
Hydrothermal energy	Energy from heated water
Kinetic energy	Movement energy
Lightning	A flash of light in the sky caused by a discharge of electricity between clouds and the Earth's surface
Mechanical energy	Energy transmitted by a machine or machinery
Molecule	One of the basic units of matter
Nonrenewable	That which cannot be replaced
Nuclear energy	Atomic energy
Petroleum	An oily, dark, flammable liquid found in the earth
Potential energy	Stored energy that results from the position or shape of an object, e.g. stretched rubber band
Radiant energy	Waves of light, heat or electricity and/or sound sent out through space; energy in the form of waves
Radiation	A method of heat travel whereby the heat travels through a space

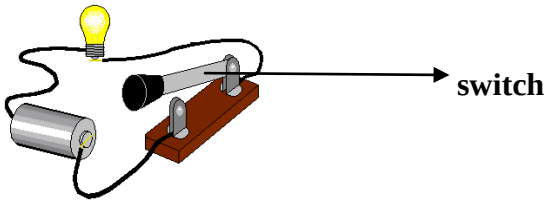
Renewable Something that can be replaced; e.g. solar energy

Solar energy/heat Energy or heat from the sun

Sound A form of energy in which vibrations create sound waves that travel

Source Where something comes from; a pond is a source of water

Switch Part of a circuit that turns the circuit on and off by opening and closing a break in the circuit



Tension A stretched condition; stress caused by the action of a pulling force

Thermal Having to do with heat

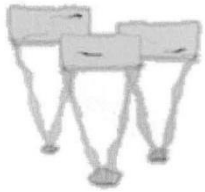
Uranium A source of atomic/nuclear energy

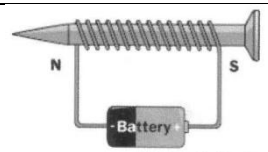
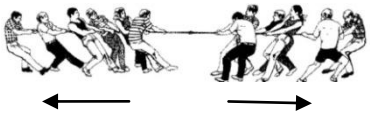
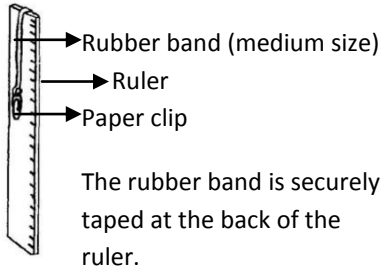
Vibrate To move to and fro quickly

Wire A fine thread of metal used in the transmission of electricity

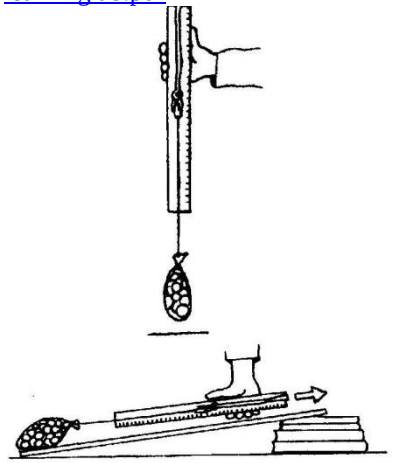
TOPIC: FORCE AND MOTION (*9.1*)

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
9.1(1) Define force and motion **9.1(2)** Identify, describe and demonstrate different types of force **9.1(3)** Investigate the effects of force on the movement of objects **9.1(4)** Investigate simple machines and their uses **9.1(5)** Describe and demonstrate the effects of friction on motion	Definitions of force and motion Types of Motion • Linear (translation) • Rotary (rotation) • Oscillation Types of force • Gravitational / weight • Magnetic • Electrical Effects of force on motion • Direction of motion • Speed (velocity) Simple Machines and their uses • Lever • Pulley • Wedge • Wheel and axle • Inclined plane • Gears • Screw Friction • Sliding (surface) • Air resistance • Rolling friction • Fluid friction • Static friction	Force – push, pull, direction, motion, Newtons (N), Motion – movement, position, place , linear, translation, sliding, rotary, rotation, oscillation Types of Force: • Gravity, gravitational, pull, Earth, downwards, toward, mass, weight, weightlessness, centre, Newton, constant velocity (speed), inertia, reaction, vacuum • Magnetic – magnets, poles, north, south, attract, repel, positive, negative, nickel, cobalt, iron, iron filings, magnetic field, magnetic, non-magnetic • Electrical - electromagnetic, batteries, wire, coils Effects – direction, speed, velocity, unbalanced force Simple machines – lever, pivot, load, fulcrum, effort, pulley, wheel, groove, raise, wedge, split, wheel and axle, rotation, inclined plane, flat, slanted, ramp, gears, clockwise, anti-clockwise, screw, cylinder, coil Friction - sliding, surface, rough, smooth, reduce, opposite, skid, lubricant, heat, water resistance, springs, force-meter, rolling, energy loss, ball bearings, fluid friction , oil	Teacher observes or records when a student: • Defines force and motion • Identifies, describes and demonstrates different types of force • Investigates the effects of force on the movement of objects • Investigates simple machines and their uses • Describes and demonstrates the effects of friction on motion

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
9.1(1)A • Use the Concept Attainment strategy to review what was learnt about force and motion in Cycle1. • Present the students with a range of activities e.g. hanging an object on a rubber band and placing it on the hook of a spring balance; putting two like or unlike poles of a magnet together; dropping a toy parachute from on high. Question the students until they discern that the activities represent force. Let them define *force* and then *motion.* • Introduce the terms *'linear', 'translation'* or	**9.1(2)A** • Make 3 parachutes out of small plastic bags. Cut 12 lengths of string (each 20 inches long). Punch 4 holes in each bag by the opening and tie the strings by the holes. Secure the string ends to a small rock with masking tape. (Each stone will be a different size.). Test the parachutes. Throw each parachute up into the air and time how long it takes to reach the ground. *Explain that gravity is a universal force that pulls everything to the centre of the Earth. However there is a resisting force of air molecules. The stones with larger surface areas will fall at different rates than heavier stones with smaller surface areas.* Let the students repeat the experiment with different size bags and observe what happens.  • Let the students compare how long it takes a crushed sheet of paper and a folded piece of paper to reach the ground from the same height. Discuss the results and ask the students for a scientific explanation. • Discuss why astronauts experience weightlessness in space. • Give the students opportunities to investigate magnetic force, including variables that influence the force of attraction (*whether the objects attracted are made of iron, poles of two magnets, distance between object and magnet or two magnets).* • Let the students create an electromagnet and find ways of making it stronger. • Have the students research the uses of electromagnets in the home.	Websites www.bbc.co.uk (interactive – Friction / Magnets and Springs) www.engineeringinteract.org www.edheads.org (interactive) www.fossweb.com www.pbskids.org www.kids-science-experiments.com http://www.collaborativelearning.org/friction.pdf http://sciencepppst.com www.tryscience,org Related library books

'sliding' to describe motion in a straight line; *'rotary'*, motion that is circular e.g. a roundabout and *'oscillation'* e.g. a swing. Let the students give further examples. **9.1(3)A** • *Explain that force is measured in newtons (N). Force cannot be seen but forces affect how objects move. If two forces are balanced no motion takes place. Forces push or pull.* • Discuss with students the work of Isaac Newton and his laws of motion. **9.1(4)** • Assess knowledge of simple machines by letting the students classify	• Ask the students if they can tip a bucket of water without spilling it. The teacher can demonstrate (outside) by swinging a small plastic bucket rapidly round in a circle overhead. (*This is an example of centrifugal force.)*The students can make a 'water whirler' out of cardboard and string. A cup of water placed on it will not fall off when whirled fast because of '*centripetal'* force. **9.1(3)A** • Give the students pictures of force in action e.g. a man pushing a box up a ramp, a paper clip attached to a magnet or an object suspended from a spring. Let them use a 'vector' (a line with an arrow beginning with a dot) to show the direction of the force/s. They can also show whether the force is causing a change in shape, speed, direction or both speed and direction. • Let the students investigate the effects of force in action during Physical Education classes by kicking, throwing and catching balls. They can observe what happens when you throw upwards, horizontally and sideward. • Let the students design a '*force-meter'* using a spring balance or a rubber band scale (see right). They can use it to weigh a set of objects suspended in the air, then weigh those (*Do not use items that will float)* suspended in water. The results are discussed. **15.1(1)A** **9.1(4)A** • Give each group of students a room from the house and ask them to list '*simple machines'* that are found there. Each group can share their information with the other groups. • Students can investigate each type of simple machine. ○ Lever – The students can investigate the effect of changing the position of the '*fulcrum*' / '*pivot*' '*force*' and '*load*'. ○ Inclined Slope – The students can experiment to show that using an inclined plane is better than raising a load. 35 marbles	 A simple electromagnet [26]  A 'water whirler'[27]  Balanced forces – No motion Rubber Band Scale(force-meter)  The rubber band is securely taped at the back of the ruler. The paper clip is at the 9cm mark.

[26] Retrieved from http://science.howstuffworks.com/electromagnet4.htm - 9/29/2009
[27] Retrieved from http://www.tryscience.org/experiments/experiments_begin.html?upandover – Retrieved 9/28/2009

pictures of simple machines. • Let the students note the simple machines they find in the school environment. **9.1(5)A** • The teacher explains what friction is by giving the students examples to observe, e.g. cars being pushed on different surfaces. Students must define friction and give attributes. • The students can make ball bearings. Reference – www.tryscience.org/experiments/experiments_letitroll_athome.html	are put into a sandwich bag and tied to make a load. The load is tied with a 30cm string. The other end of the string is attached to the paper clip of a rubber band scale. A stack of books is placed on the end on a table. The load is placed on the table next to the books and the ruler is slowly raised lifting the load to the height of the books. The students observe how far the rubber band stretches and record by the tip of the paper clip. A ramp (smooth piece of board) is made by resting the board on the stack of books. The load is placed at the bottom of the ramp and moved up the ramp by pulling the scale up the ramp and letting the rubber band stretch down the length of the ruler. The students record how far the rubber band stretches. The number beside the tip of the paper clip is recorded and compared with the first number. ○ Wedge - Students can compare the hammering of two nails into a board. One nail has a point (*the wedge)*, the other does not. ○ Pulley – The students can create their own pulleys. ○ Screws – The students can compare different screws by counting the number of turns it takes to drive the screws into a piece of board. ○ Students can observe how *wheels and axles* and *gears* work by observing items in the classrooms, e.g. desk top pencil sharpener, teaching clock with gears, watches. ○ The students can examine compound machines found in the classroom and say which simple machines are part of the machine, e.g. stapler (*lever and wedge);* hand drill *(wheel & axle, screw, lever, gears).* **9.1(5)A** • Collect pictures showing examples of friction. The students must work together to sort them into whether the friction is useful or not. • Let students set up experiments to examine the relationship between friction and different surfaces on a ramp, air resistance, water resistance, friction and tyres.	Retrieved from www.professorbeaker.com/sample-learninglab.pdf 

	C*urriculum Links* *Mathematics* – Measuring energy using a spring balance or home-made '*force meter';* measurement; handling data *Language & Communication* – Writing reports, viewing skill, research, reading about related scientists and their inventions *Visual Arts* – Drawing, sketching, building cars for experiments *Health* – Safety aspects of electricity; Household safety – mopping spills, non-slip mats *Social & Emotional Development* – Working in groups (Social skills), critical thinking *Social Studies* – History of transportation, communication, machines	Pictures are available at www.collaborativelearning.org/friction.pdf

GLOSSARY – FORCE AND MOTION

Attract To pull towards

Ball bearings A mechanical device for lessening the friction of axle bearings by means of small loose metal balls

Battery Two or more chemical cells that transform chemical energy into electrical energy

Effort The force used to do something

Electromagnet A piece of iron which has an electric current passing through coils which surround it

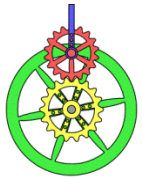
Force A push or pull

Friction Resistance to motion of surfaces that touch

Fluid friction Friction between a solid object as it moves through a liquid or a gas

Fulcrum The point or support on which a lever pivots

Gears A toothed wheel that meshes with another toothed wheel to transmit motion or to change speed or direction



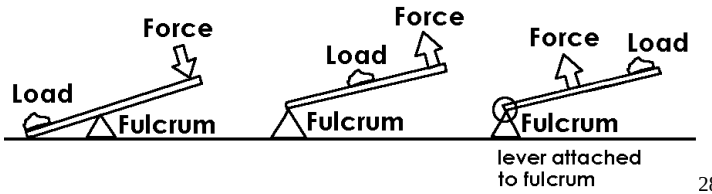
Gravity The force that pulls objects down towards the centre of the Earth

Inertia The tendency of objects to remain still or move in the same direction unless acted upon by a force

Inclined plane A simple machine or ramp

Iron filings Tiny pieces of iron

Lever A lever is a stiff bar that rests on a support called a fulcrum which lifts or moves loads



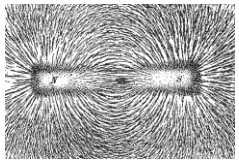
[28]

Linear Pertaining to lines; moving in a straight line

Lubricant Oil or grease that is put on machines to help reduce friction

Magnet Material that attracts objects made of iron or steel

Magnetic field The space around a magnet where its power of magnetism is exerted



[28] Retrieved from www.professorbeaker.com 2/11/09

Mass The amount of matter in an object

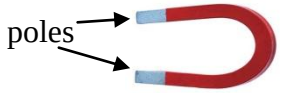
Motion Movement

Newton (N) A measurement of force

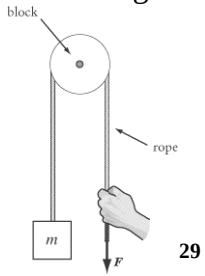
Oscillation To and fro movements that are repeated e.g. like a pendulum

Pivot To balance on

Poles The ends of a magnet that attract or repel



Pulley A simple machine consisting of a wheel with a grooved rim for a rope



29

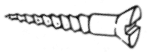
Repel To push away

Resistance An opposing force that prevents movement e.g. air, water

Rotation Turning in a circle; turning motion

[29] Retrieved from www.img.sparknotes.com 2/11/09

Screw A simple machine that is a threaded cylinder with a sharp point



Simple machines Tools that make work easier e.g. lever

Spring A device that returns to its own shape, and regulates movement e.g. in beds

Translation An onward movement that does not rotate

Unbalanced forces Forces that cause a change in motion, speed or direction because one is stronger than the other

Vacuum An empty space without air in it

Velocity Speed; rate of motion in a particular direction

Wedge An object with a slated surface that cuts things apart e.g. an axe head

Weight The force of gravity that pulls something down; how heavy one is

Weightlessness Being free from the pull of gravity; having no weight

Wheel and axle A wheel with a rod through its centre (axle)

Wire A fine thread of metal used in the transmission of electricity

CHECKLIST FOR PHYSICAL SCIENCE

Behaviours	Names of Children												
Write date when target behaviour is mastered													
Matter													
Define matter													
Identify the structure and properties of different materials													
Classify materials as the different states of matter, elements, compounds, solutions and mixtures													
Investigate and analyze ways in which matter changes													
Energy													
Recognize that energy can be used to do work													
Identify the types/forms of energy													
Identify the sources of energy													
Compare and contrast kinetic and potential energy													
Explain how energy is transferred from one form/type to another													

Compare and contrast methods of heat transfer													
Describe how humans utilize energy													
Identify ways that sources of energy can be conserved													
Force and Motion													
Define force and motion													
Identify, describe and demonstrate different types of force													
Investigate the effects of force on the movement of objects													
Investigate simple machines and their uses													
Describe and demonstrate the effects of friction on motion													

SUGGESTED SCOPE AND SEQUENCE

Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4	Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4
Matter						**Energy**					
Define matter		**I**	**D**	**M**	**M**	Recognize that energy can be used to do work	**1**	**D**	**D**	**D**	**M**
Identify the structure and properties of different materials	**I**	**D**	**M**	**M**	**M**	Identify the types/forms of energy	**I**	**D**	**D**	**D**	**M**
						Identify the sources of energy		**I**	**D**	**D**	**D**
Classify materials as the different states of matter, elements, compounds, solutions and mixtures		**I**	**D**	**M**	**M**	Compare and contrast kinetic and potential energy			**I**	**D**	**D**
						Explain how energy is transferred from one form/type to another		**I**	**D**	**D**	**M**
Investigate and analyze ways in which matter changes	**I**	**D**	**D**	**M**	**M**	Describe how humans utilize energy	**1**	**D**	**D**	**M**	**M**
						Compare and contrast methods of heat transfer			**I**	**D**	**D**
Force and Motion						Identify ways that sources of energy can be conserved		**I**	**D**	**D**	**M**
Define force and motion	**I**	**D**	**D**	**M**	**M**						
Identify, describe and demonstrate different types of force			**I**	**D**	**M**	**Force and Motion**					
						Investigate the effects of force on the movement of objects	**I**	**D**	**M**	**M**	**M**
Investigate simple machines and their uses	**I**	**D**	**M**	**M**	**M**	Describe and demonstrate the effects of friction on motion				**I**	**D**

SCIENCE AND TECHNOLOGY

TECHNOLOGY SCIENCE

Standards

# 10 Technology Science:	The student recognizes the nature of technology.
# 11 Technology Science:	The student recognizes the function of technology.
# 12 Technology Science:	The student recognizes the influence of technology.

Essential Concepts

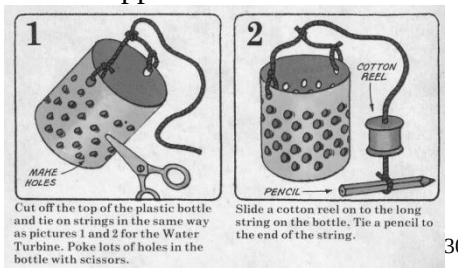
- Technology makes life and work easier.
- Technology enhances globalization.
- Technology has both positive and negative effects on society.

TOPIC: TECHNOLOGY (*10.1, 11.1, 12.1*)

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
10.1(1) Define and describe technology **10.1(2)** Identify famous inventors and their inventions **11.1(1)** Explain how technology tools have been or can be used to meet the needs of society **11.1(2)** Construct and test a technology enhanced tool, mechanism or structure **12.1(1)** Identify examples of technology's positive and or negative effects on society	Defining technology Stating examples of technology Famous inventors and their inventions The development of technological tools and their use How technology tools make life easier Construction of structures, mechanisms or technology enhanced tools Effects of technology on society (positive and negative)	Technology – work, easier Technology tools – simple machines, structures, mechanisms, computers, electronic appliances (washing machine, iron, blender) telephones, etc. Inventors and their inventions e.g. Alexander Graham Bell, Albert Einstein, Thomas Edison, Benjamin Franklin, Archimedes, Wright Brothers, etc. Construction – structure, mechanism, support, circuit, electromagnet, stability, materials, pliable, rigid, diagram, model Effects – • Positive - medical aids, enhance communication, transportation, etc. • Negative – pollution, deforestation, global warning, etc.	Teacher observes or records when a student: • Defines technology • Gives examples of technology • Researches famous inventors and their inventions • Explains how technology meets the needs of society • Explains how technology effects society in positive and negative ways

<table>
<tr><th colspan="3">Suggested Experiences</th></tr>
<tr><th>Whole Class</th><th>Small Group / Centres</th><th>Resources</th></tr>
<tr>
<td>
10.1(1)A Let the students brainstorm ways of opening a can of food without using a can opener. List their suggestions. Taking safety into consideration, allow the students to try the ways that they suggested. Then allow one student to use a can-opener. Compare the methods of opening the can. At this point introduce the definition of technology.
12.1(1)A Teacher and students discuss the positive and negative effects of technology e.g. headphones
<table>
<tr><th>Positive</th><th>Negative</th></tr>
<tr><td>Protects the ears from noise</td><td>If used regularly at a high volume, they can damage the ear drum.</td></tr>
</table>
</td>
<td>
This topic must be integrated into all other Science and Technology topics as well as other domain areas. At the end of each Science and Technology lesson, the students should be able to discuss how what they have learnt about affects us today. For example, when studying the skeleton the students can talk about medical technological tools such as the X-ray machine.
10.1(2)A

Place students in groups of three or four. Let them think of something that makes their life and work easier (technology) and tell what it does and how it works. Each group must choose one thing, create a working model of it, if possible, and then make a commercial for it. The group then presents their tool/appliance to the class.



[30]

This spin drier will take water out of a wet cloth or paper when spun by holding the cotton reel in one hand and winding the pencil round and round as fast as possible. (centrifugal force)

Give each group a cube tissue box. Cover the sides with construction paper. On side 1, the students write about an inventor; on side 2 they write about his/her invention; on side 3 they tell how life would be without the invention and on side 4 they write how the invention makes life easier.

The study of inventors and their inventions should be taught with the appropriate theme, e.g. ‘Electricity’ – Ben Franklin and Thomas Edison.
11.1(1)A

Let the students research how technology has helped human beings with disabilities, e.g. hearing aids, wheelchairs, artificial limbs, dialysis machines, Braille typewriters, stethoscopes or pacemakers.
The teacher shows the class an artifact (or a picture), e.g. a goose. The students

</td>
<td>
Web Sites
www.proteacher.org
www.msnucleus.org/membership/
www.cybersleuth-kids.com
www.inventors.about.com/library/blkids.htm

Related library books

For Spin Drier:
Plastic bottle
Pencil
Cotton reel
Scissors
String
</td>
</tr>
</table>

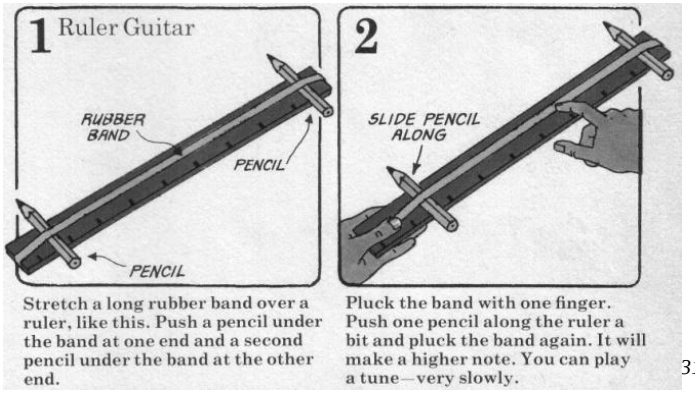
[30] Taken from The KnowHow Book of Experiments – Usbourne Publishing Ltd. 1977

can research and create a timeline of the development of the item.

- Goose → flat iron → gas iron → electric iron
  (*It would be appropriate to visit the Front Street Museum which has many local artifacts on display)*
- The students can complete a chart for a number of inventions.

Activity	Pre-technology	Technology
Washing dishes	By hand	Dishwasher
Tearing paper	By hand	Scissors

11.1(2)A *Based on the topic of study, the students will construct models, e.g. theme 'Sound' – the students will construct musical instruments or a working telephone out of 'junk' materials.*



[31]

Ruler Guitar:
Wooden ruler
Large rubber band
2 pencils

- After studying simple machines the students can 'invent' and construct a machine that has one or two simple machines incorporated in it.
- The teacher can challenge students. For example they can say, 'Create a container that will prevent a raw egg from breaking when dropped from a height greater than 30cm'.
- If the class is studying 'Bridges' in Social Studies, the students can be asked to design a bridge that works on the same principles as the Simpson Bay Bridge.

[31] Taken from The KnowHow Book of Experiments – Usbourne Publishing Ltd. 1977

GLOSSARY – TECHNOLOGY

Appliance	A tool or small machine used to do something (usually for household use), e.g. can opener, vacuum cleaner
Circuit	A complete path over which electricity flows
Deforestation	The harmful destruction of trees
Diagram	A drawing or sketch showing the important parts of something and/or how it works
Global warming	The rise in temperature of the whole earth
Electromagnet	A piece of iron which has an electric current passing through coils which surround it
Invention	The original making of something new
Mechanism	A machine or working parts
Model	A design or representation of anything made to scale; a small copy;
Pliable	Easily bent; flexible
Pollution	Harmful waste or unwanted substances released into the environment
Rigid	Stiff; firm; not bending
Simple machines	Tools that make work easier e.g. lever
Stability	The ability to remain in a given position
Structure	Something built; a construction; anything compiled of parts arranged together
Support	Something that bears weight or gives strength to prevent a construction from falling or sinking

Technology Something that makes work easier

CHECKLIST FOR TECHNOLOGY

Behaviours	Names of Children												
Write date when target behaviour is mastered													
Define and describe technology													
Identify famous inventors and their inventions													
Explain how technology tools have been or can be used to meet the needs of society													
Construct and test a technology enhanced tool, mechanism or structure													
Identify examples of technology's positive and or negative effects on society													

SUGGESTED SCOPE AND SEQUENCE

Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4
Define and describe technology	**I**	**D**	**M**	**M**	**M**
Identify famous inventors and their inventions		**I**	**D**	**D**	**M**
Explain how technology tools have been or can be used to meet the needs of society	**I**	**D**	**D**	**M**	**M**
Construct and test a technology enhanced tool, mechanism or structure			**I**	**D**	**D**
Identify examples of technology's positive and or negative effects on society	**I**	**D**	**D**	**D**	**M**

SCIENCE AND TECHNOLOGY

BASIC SCIENCE AND TECHNOLOGY SKILLS

Standards

# 13 Basic Science and Technology Skills:	The student can follow and execute steps in simple research.
# 14 Basic Science and Technology Skills:	The student recognizes the function of research.
# 15 Basic Science and Technology Skills:	The student can apply simple research skills.

Essential Concepts

- Scientific progress is made by asking questions and conducting careful investigations.
- Research is replicated and reviewed several times before it is validated.
- The use of technology enhances the ability to conduct and record research.

TOPIC: BASIC SCIENCE AND TECHNOLOGY SKILLS (*13.1, 14.1, 15.1*)

Target Behaviour	Content/Skills	Vocabulary	Assessment Opportunities
13.1(1) Identify the steps of the scientific method **13.1(1a**) Observe and record observations **13.1(1b)** Formulate questions that lead to scientific investigations **13.1(1c)** Make predictions based on observations **13.1(1d)** Design a 'fair test' to investigate a prediction **13.1(2)** Select and use appropriate tools to carry out scientific investigations **13.1(3)** Demonstrate an understanding of the importance of safety when conducting investigations and experiments **14.1(1)** Define scientific research **14.1(2)** Explain how scientists work **14.1(3)** Demonstrate an understanding that the results of similar scientific investigations may differ **14.1(4)** Compare and contrast science and technology **15.1(1)** Demonstrate an	Steps of the Scientific Method Process Skills - observing, comparing, measuring, classifying, predicting, investigating, using space / time relations, communicating, manipulating, interpreting Conditions for 'fair testing' Safety rules / procedures Definition of scientific research Importance of replication How scientists work, including different domains of science Compare and contrast 'Science' and 'Technology'	Scientific method: question, background research, predict, hypothesize (educated guess), investigation, experiment, controls, variable, control, conduct, record, data, analyze results, draw conclusions, communicate results, replicate, repeat, problem Process Skills: observe, compare, measure, classify, predict, investigate, use space / time relations, communicate, manipulate, interpret Fair Testing: Control variables, select, appropriate tools (hand lens, ruler, balance, gram weights, spring balance, measuring cups, graduated cylinders, time pieces, etc.) Safety Rules: tidy, clean apparatus, mop up spills, follow instructions, listen attentively Research; test, ideas, events, cause/effect, scientific investigation, replication, validity	Teacher observes or records when a student: • Identifies the steps of the scientific method • Observes and records observations • Formulates questions that lead to scientific investigations • Makes predictions based on observations • Designs a 'fair test' to investigate a prediction • Selects and uses appropriate tools to carry out scientific investigations • Follows safety rules during science activities • Defines scientific research • States how scientists work • Demonstrates an understanding that experiments can be replicated to validate data • Compares and contrasts science and technology • Gives examples of digital media • Utilizes ITC during science

understanding of the nature and characteristics of a variety of media and communication systems **15.1(2)** Formulate and test hypotheses **15.1(3)**Analyze data collected during investigation and draw conclusions **15.1(4)** Communicate results of scientific inquiry in a variety of ways including the use of information and design technology	Information and Communication Technology	Sciences: natural sciences - biology, ecology, chemistry, physics, astronomy, ecology Information and Communication Technology: computer, hardware, software, keyboarding, keyboard, mouse, Internet, world wide web, e-mail, search engine, word processing, files, format, spell check, headers, footers, footnotes, tables, columns, rows, graphics, video clips Digital media/camera	activities for research and/or reporting • Formulates and tests hypotheses • Analyzes data collected during investigation and draws conclusions • Communicates results of scientific inquiry in a variety of ways including the use of information and design technology

Suggested Experiences		
Whole Class	**Small Group / Centres**	**Resources**
13.1(1)A The teacher uses a topic that is currently being studied to demonstrate the scientific method, e.g. germinating seeds. Steps of the Scientific Method • *Ask a question.* Does the amount of water given to seeds affect the speed of germination? • *Do background research.* Find out what seeds need so that other variables can be controlled. • *Predict or construct a hypothesis.* Yes/No the speed of germination will/will not be affected. • *Test with an experiment.* Students set up a fair test with seeds having all prerequisites for germination. They observe and record what happens over 2 weeks. Small groups of students can do the same experiment so that there is replication. • *Analyze the results and draw conclusions.* Decide whether the prediction/hypothesis was true or false. • *Communicate your findings*	*Students must use some of the Sciencing Cycle[32] of skills during each lesson. There should be a high level of experimentation during which the students follow the steps of the scientific method. Students should also use technological skills to research, collect and record data from secondary sources. Teachers model the skills needed for effective scientific investigations. Throughout this curriculum there are different activities that can be used to promote scientific inquiry.* **13.1(a)A** Small groups of students can conduct given experiments in which they are required to observe, using their 5 senses. Teachers encourage the students to record what they observe in detail. *Every student should be encouraged to have a science journal or log book. These can also be used for assessment.* ***Observation techniques and tools should be aligned with developmental progress.*** **13.1(1b)A** *Teachers encourage students to ask questions about what they observe when doing investigations or experimentations.* *Examples of questions:* • Which are the warmest areas in the school environment? • What weather conditions are favourable for hurricane formation? • Why is there froth at the edge of the Salt Pond? • How long does it take for one ice-cube to melt? • Where is the most polluted body of water in St. Maarten? • When does a solution of sugar and water become saturated? • Who was able to find multiple uses for the peanut? • How do plants without seeds reproduce? **13.1(1d)A** The teacher through questioning and prompts, encourages students to set up fair tests that answer their questions, by ensuring that all variables are constant except the one being	Library books related to topic Web sites www.howstuffworks.com www.worldalmanacforkids.com www.sciencebuddies.org www.brainpopjr.com www.biology4kids.com/files/studies_scimethod Digital tools e.g. computer, camera, video, hardware, sofeware

[32] DATA GENERATING- Communicating, experiencing, measuring, observing, verifying: DATA ORGANIZING- Charting and graphing, classifying, comparing, ordering, sequencing, using numbers: IDEA BUILDING- Explaining, generalizing, inferring, interpreting data, making analogies, synthesizing: IDEA USING- Applying, controlling variables, hypothesizing, model building, predicting

Students report to others what took place. **1 3.1(1c)A** The teacher can set up an experiment and ask the students to predict what will happen. E.g. which will fall faster a tennis ball or a golf ball? Which paper plane will fly the farthest? **13.1(3)A** *At the beginning of the year the teacher and students discuss general safety rules and create a chart that is visible at all times. Rules may differ slightly depending on the investigation that is taking place. Safety issues should be discussed before the students experiment.* **14.1(1)A** Students can discuss their individual definitions in small groups and the class can then compile a class definition. (*Researchers do not have a specific outcome in mind when they make an hypothesis)* **14.1(2)A** The students can brainstorm and create a web. They can also replicate the work of a scientist, e.g. Galileo's experiments with gravity. **14.1(4)A** The students can use Venn diagrams to compare the two. **15.1(3)A** *The teacher should guide the students in analyzing data during a whole class investigation.*	investigated e.g. If the students are investigating which dish liquid makes the most bubbles, the only difference in the solutions will be the dish liquid brands. **13.1(2)A** *During experimentation teachers ensure that the students use the appropriate tools correctly. Teachers can also suggest alternatives if the correct commercial tool is not available, e.g. In what situation would you use a microscope instead of a hand lens?* **14.1(3)A** *This understanding will be developed as the students work and compare observation and conclusions of experiments.* **15.1(1)A** • A project on 20th century technology can be undertaken. The students can develop a timeline of technological inventions during the last 20 – 50 years. • Each student should be taught how to access information from the Internet, including the safe site symbol and use electronic tools to display data. **15.1(2)A** *An hypothesis can be formed after research has been done. It is a tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation.* Year 3 & 4 students should practice writing hypotheses. **15.1(4)A** • Students will use different means to record their work; e.g. Graphs, tables, Venn/Carroll diagrams, use of teacher made/commercial worksheets, anecdotal notes, etc. • Students can create a digital diagram of how volcanoes erupt • Use the computer to label images e.g. Parts of the water Cycle • Use the computer to find weather forecasts over a period of time and then use graphs to identify patterns. • Create multi-media presentations using various digital tools	Web Sites http://inventors.about.com/od/timelines www.sciencekids.co.nz www.teachervision.fen.com

GLOSSARY – BASIC SCIENCE AND TECHNOLOGY SKILLS

Analyze	To find out the essential features
Astronomy	The study of space and the changes that take place in and around all objects moving through space
Biology	The study of living things; **zoology** is the study of animals; **botany** is the study of plants
Browser	A program that allows users to view web pages, e.g. Microsoft® Internet Explorer
Cause and effect	Cause is the reason something happens, and effect is what happens as a result
CD-ROM	Compact-disk, read-only memory; it is a type of disk that has a lot of memory
Chemistry	The study of matter and the changes that take place with that matter
Computer	A machine that can perform logical calculations
Conduct	To carry out (an experiment or investigation)
Control	A standard of comparison for checking or verifying the results of an experiment.
Data	Information or facts to be used as a basis for discussing or deciding something, or prepared for being processed by a computer
Digital	Having to do with; or based on the principles of a digital computer
Download	Putting information on your computer. You can download information from the internet, discs or CDs, and other computers
Draw conclusions	To make a decision and give an opinion based on the results of an experiment
Ecology	The branch of biology concerned with the relations between organisms and their environment

E-mail	Electronic mail; a service that allows people to send messages with pictures and sounds from their computer to any other computer in the world
Experiment	Try in order to find out; make trials or test; practical tests carried out by scientists
Fair test	A test carried out under fair conditions (in science), making sure that one factor is changed at a time while keeping all other conditions the same
File	A folder on your computer that stores information
Footnote	A note at the bottom of a page that explains an indicated part of the text on that page
Format	To prepare a storage medium, usually a disk, for reading and writing
Graphics	Drawings, diagrams, pictures etc. used on the computer
Hard Copy	This is the printed/paper copy of a file from your computer
Hardware	The mechanical, electrical and structural parts of a computer
Homepage	The main page of any web site.
Hypothesis	A guess to guide investigation; an explanation of a theory that has yet to be proven
Icons	Small pictures that represent the programs on your computer
Internet	A network of millions of computers from all over the world
Investigation	A careful study in order to discover facts or find out why something takes place

Keyboard	An array of keys, in rows, used for operating a computer

Mouse	A hand-operated electronic device that controls the coordinates of a cursor on your computer screen as you move it around on a pad
Online	Having access to the internet; actively using the internet
Password	The secret word or phrase used to gain access to the computer, (for security purposes)
Predict	To tell what can happen, in advance, based on past experience or present indications
Process skills	Skills used during Science activity (See appendix)
Record	Set down in writing so as to keep for future use
Replicate	To repeat an experiment
Research	A careful hunting for facts or truths; inquiry; investigation
Result	An answer; outcome
Scanner	A device that 'takes a picture' of something and turns it into a computerized image
Scientific method	A systematic approach to gathering data and observation
Search engine	A program that searches information on the World Wide Web by looking for specific keywords and returns a list of information found on that topic, e.g. Yahoo, Google

Software	Computer instructions or data that is stored electronically
Surf	To search for information on the web in a random way
Theory	A scientific explanation
Validity	The extent to which the evidence is reliable and relevant to what is being investigated, e.g. measuring the length of a magnet does not give valid evidence of the strength of a magnet
Variables	Things in an experiment that can change, e.g. temperature, pressure, reaction rate, battery voltage
Virus	A computer program that can destroy files or make your computer "crash"
Web site	A collection of "pages" or files linked together and available on the world wide web
World Wide Web	An infinite number of games, web sites, pictures, sounds, stories, and other things all connected to each other through links on the internet

CHECKLIST FOR BASIC SCIENCE AND TECHNOLOGY SKILLS

Behaviours	Names of Children												
Write date when target behaviour is mastered													
Scientific Method													
Identify the steps of the scientific method													
• Observe and record observations													
• Formulate questions that lead to scientific investigations													
• Make predictions based on observations													
• Design a 'fair test' to investigate a prediction													
• Select and use appropriate tools to carry out scientific investigations													
• Demonstrate an understanding of the importance of safety when conducting investigations and experiments													
Define scientific research													

Explain how scientists work													
Demonstrate an understanding that the results of similar scientific investigations may differ													
Technology Skills													
Compare and contrast science and technology													
Demonstrate an understanding of the nature and characteristics of a variety of media and communication systems													
Formulate and test hypotheses													
Analyze data collected during investigation and draw conclusions													
Communicate results of scientific inquiry in a variety of ways including the use of information and design technology													

SUGGESTED SCOPE AND SEQUENCE

Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4	Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4
Basic Science and Technology Skills											
Identify the steps of the scientific method	**I**	**D**	**D**	**D**	**M**	Define scientific research		**I**	**D**	**D**	**M**
• Observe and record observations	**I**	**D**	**M**	**M**	**M**	Explain how scientists work		**I**	**D**	**D**	**M**
• Formulate questions that lead to scientific investigations	**I**	**D**	**M**	**M**	**M**	Demonstrate an understanding that the results of similar scientific investigations may differ			**I**	**D**	**D**
• Make predictions based on observations	**I**	**D**	**M**	**M**	**M**	Compare and contrast science and technology			**I**	**D**	**D**
• Design a 'fair test' to investigate a prediction			**I**	**D**	**M**	Demonstrate an understanding of the nature and characteristics of a variety of media and communication systems	**I**	**D**	**D**	**M**	**M**
• Demonstrate an understanding of the importance of safety when conducting investigations and experiments	**I**	**D**	**M**	**M**	**M**	Formulate and test hypotheses			**I**	**D**	**M**
						Analyze data collected during investigation and draw conclusions		**I**	**D**	**M**	**M**

• Select and use appropriate tools to carry out scientific investigations	**I**	**D**	**M**	**M**	**M**	Communicate results of scientific inquiry in a variety of ways including the use of information and design technology			**I**	**D**	**D**

COMPUTER SKILLS

Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4	Target Behaviours	Cycle 1	Cycle 2 Yr.1	Cycle 2 Yr.2	Cycle 2 Yr.3	Cycle 2 Yr.4
Computer Use						**Netiquette/ Social Skills**					
Use and control of the mouse or pointer device	**M**	**M**	**M**	**M**	**M**	Show respect for privacy and ownership	**I**	**D**	**M**	**M**	**M**
Turn computers and other devices on/off	**M**	**M**	**M**	**M**	**M**	Share ideas and skills with others	**I**	**D**	**M**	**M**	**M**
Familiarize placement of letters on the keyboard		**I**	**D**	**D**	**D**	Demonstrate compliance with the school computer policy	**I**	**D**	**D**	**D**	**M**
Demonstrate good form and accuracy in keyboarding				**I**	**D**	Demonstrate proper care of equipment, software etc.	**I**	**D**	**D**	**M**	**M**
Identify keyboard, mouse, monitor, printer etc.	**D**	**M**	**M**	**M**	**M**	Discuss basic issues related to the use of the computer			**I**	**D**	**M**
Open and close programs	**D**	**M**	**M**	**M**	**M**	Acknowledge/ reference the work of others			**I**	**D**	**D**
Move between active applications			**I**	**D**	**M**	Recognize and respond to inappropriate materials or messages		**I**	**D**	**D**	**M**
Use video and audio devices appropriate for projects	**I**	**D**	**D**	**M**	**M**	Describe the consequences of inappropriate use of technology		**I**	**D**	**D**	**M**
Locate and access computer directories		**I**	**D**	**D**	**M**	**Research**					
Verbalize the process of using a specific program		**I**	**D**	**M**	**M**	Demonstrate initial search strategies for finding information		**I**	**D**	**D**	**M**

Explain the concept of networking including the Internet				**I**	**D**	Use web search resources and strategies to gather relevant in formation		**I**	**D**	**D**	**M**
Critical Thinking						Select appropriate search resources and software programs for intended purposes				**I**	**D**
Use problem solving and critical thinking software		**I**	**D**	**D**	**M**						
Use word processing software to create documents		**I**	**D**	**M**	**M**	Compare results from two or more search resources		**I**	**D**	**D**	**M**
Use desktop publishing to create text and graphics		**I**	**D**	**D**	**M**	Use electronic library tools					**I**
Use a web browser		**I**	**D**	**D**	**M**	Use hyperlinks in web pages				**I**	**D**
Use DVD, CD-ROM, etc, to enhance computer presentations		**I**	**D**	**D**	**M**	Evaluate information gathered from the Internet for appropriateness		**I**	**D**	**D**	**D**
Use web page sites to explore and complete projects			**I**	**D**	**D**	Publish products and solutions using multimedia		**I**	**D**	**D**	**D**
Use e-mail (teacher-directed; group/class account)		**I**	**D**	**D**	**M**	Discriminate between internet, e-mail and other technologies			**I**	**D**	**M**
Use data bases and spreadsheets to organize and analyze information				**I**	**D**						

APPENDIX

[33]*PROCESS SKILLS*

- ***Classifying:***
    - Identifying properties useful for classifying objects
    - Grouping objects by their properties or similarities and differences
    - Constructing and using classification systems

- ***Communicating:***
    - Constructing and using written reports, diagrams, graphs, or charts to transmit information learned from science experiences
    - Verbally asking questions about, discussing, explaining, or reporting observations
    - After an investigation, reporting the question tested, the experimental design used, the results, and conclusions drawn and using tables and graphs where appropriate
- ***Comparing:***
    - Identifying similarities and differences among objects

- ***Controlling Variables:***
    - Changing one factor that may affect the outcome of an event whilst keeping the others constant (the same)

- ***Defining Operationally:***
    - Stating definitions of objects or events in terms of what the object is doing or what is occurring in the event
    - Stating definitions of objects or events based on observable characteristics

- ***Experimenting:***
    - Designing an investigation to test a hypothesis
    - Conducting simple experiments

[33] Reference: Mechling, K., Bires, N., Kepler, L., Oliver, D., and Smith, B. (1985) A Recommended Science Competency Continuum for Grades K-6 for Pennsylvania Schools . Harrisburg, PA. Pennsylvania Department of Education

- ***Hypothesizing:***
    - Identifying questions or statements which can and cannot be tested
    - Designing statements, i.e., questions, inferences, predictions, that can be tested by an experiment

- ***Inferring:***
    - Suggesting explanations for events based on observations
    - Distinguishing between an observation and an inference

- ***Interpreting Data:***
    - Organising and stating in his/her own words information derived from a science investigation
    - Revising interpretations of data based on new information or revised data

- ***Investigating:***
    - Finding out what happens when certain things are done

- ***Manipulating:***
    - Handling objects or materials
    - Comparing and ordering objects by length, area, weight, volume, etc.

- ***Measuring:***
    - Measuring properties of objects or events by using standardized units of measure

- ***Observing:***
    - Identifying properties of an object, i.e., shape, colour, size, and texture
    - Using indirect methods, i.e., hand lenses, microscopes, thermometers, to observe objects and events
    - Observing objects or events by counting, comparing, estimating, and measuring

- ***Predicting:***
    - Proposing results or outcomes based on observation and inference

- ***Using Space / Time Relation:***
    - Describing an object's position i.e., above, below, beside, etc., in relation to other objects
    - Describing the motion, direction, spatial arrangement, symmetry, and shape of an object compared to another object
    - Describing events in terms of sequence or duration or period of time compared to other events
    - Measuring volume, mass, weight, temperature, area, length, and time, using appropriate units and appropriate measuring instruments

[34]SAMPLE SCIENCE PROCESS SKILLS ACTIVITIES

Classifying

- Classify collected plants according to their phylum and/or class.

Communicating

- Communicating involves the sharing of information through words, pictures, graphs and diagrams. Students can make a poster to share information about the Wright Brothers and their inventions

Comparing

- Compare the weights of students in the class and graph the results

[34] Note that these are all simple sample activities that help to develop and teach the process skills. You will need to decide the appropriateness of each for whole class or small group instruction as well as pose the right questions for each skill.

Controlling Variables

- In first trial, raise a pendulum and release it from a height of 100 cm. In second trial, raise and release the same pendulum from a height of 60 cm. In third trial, raise and release the same pendulum from a height of 20 cm. Do the trials while keeping two variables the same which are the string length (100 cm) and the bob size. Have pupils identify which variable is being tested and which variables are being controlled.

Defining Operationally

- The process by which a scientific term is defined according to what must be done and what should be observed in order to identify the concept. For example, we can define what "strength" is. If we decide that strength is the weight that a paper bag can hold without tearing or bursting, then we can make meaningful comparisons when we test different paper bags made of various materials in a variety of ways.
- Pupils can practice making operational definitions using a simple circuit. They will need a battery, flashlight bulb and insulated wire with both ends stripped. Have students look at a diagram of a simple closed circuit. Set up the battery, bulb and wire so that the bulb lights. Have them write their definition of a closed circuit based on what they did. Next, let then look up the word circuit in their dictionary and write it down. Have them discuss how their definition is different from the one given in the dictionary. Ask them how their definition communicated what the closed circuit did. How did making a closed circuit help them define it.

Hypothesizing

- Hypothesize about how to solve a problem.

First encourage hypothesizing (guessing). Then use several objects - soap, a dry sock, a wooden block, sponge, and a block. Ask children to guess which objects will float when dropped into water in a tub. Then drop the objects in the water, one by one, to see what happens. Have them compare each result with their hypotheses.

Inferring

- Identify various internal body parts (heart, lungs, stomach and brain). After discussing the body's use of these organs, students will infer where these organs are located within the body. To record this information, students will make a traced model of the outer body and position cut-outs of internal organs.

Interpreting Data

- Collect, record and interpret data about the beat of the heart just before and after exercise. Have children create improvised devices for listening to the heart such as using empty napkin rolls. Select six children whose hearts they will listen to before exercising. Have the children perform various rapid exercises in the presence of the others. Thereafter, let them listen to their hearts again. Have them interpret the before and after data.

Investigating

- Pupils can investigate what happens to water when it is boiled for a long time.

Manipulating

- Allow children to engage in the use and manipulation of various hands-on materials.

Measuring

- Students can determine how many pitchers of water are needed to let each student drink eight ounces of water after a physical education class.
- Students create a simple classroom graph showing the rate of growth when germinating seeds.

Observing

- Observe the physical properties of water in different states (solid, liquid, gas)
- Various species of birds are commonly found around our island especially near bodies of water. Take a nature walk and look for them. Ask children to observe their size and colour patterns they display, what they eat, what they like to stand on, and how they fly.

Predicting

- Predict, identify and record data regarding what plants need to survive by observing plants being grown under different conditions. First encourage children to predict what will happen. Use two similar, healthy plants. Ask the children to take turns watering one plant while ignoring the other for a week or two. Keep both plants in the same place. Have them check the results of the experiment and compare this with their prediction.

Using Space / Time Relations

- Have students engage in activities whereby they must tell the position of one object in relation to others. (Over, under, between etc.)
- Sequence the events of a water experiment

Experimenting

- This involves making a plan to test a hypothesis. Students can make a plan to test which magnet is stronger. First have them write a hypothesis about which magnet will pick up more paper clips. Let them design their experiment. The only variable that changes is the magnet. The paper clips must remain constant. Students can design a chart to show their results. Have them perform the experiment. Let them compare their hypothesis with the results through discussion.

CHECKLISTS

(Taken from the National Curriculum Frameworks)

Integrated Science and Technology
Process Checklist

Name: _____ **Year:** _____

Place an artifact in the student's portfolio which shows he or she is using the following process skills	DATES			
Observing				
Comparing				
Classifying				
Measuring				
Discussing/Reporting				
Predicting				
Making Hypotheses				
Controlling Variables				

Integrated Science and Technology
Inquiry Skills Checklist

Name: _____ **Year:** _____

Place an artifact in the student's portfolio which shows he or she is using the following Inquiry skills (based on Bloom's taxonomy).	DATES			
LOW LEVEL				
Knowledge • Identify • Recall • Define • Describe • Name • State • List • Tell • Match • Write				
Comprehension • Explain • Summarize • Paraphrase • Give examples • Restate				
HIGHER LEVEL				
Application • Demonstrate • Sequence • Dramatize • Compare/Contrast • Illustrate • Solve				
Analysis • Analyze •Distinguish • Classify • Verify • Diagram • Discrimate				
HIGHEST LEVEL				
Synthesis • Compose • Invent • Design • Speculate • Hypothesize • Create				
Evaluation • Criticize • Prioritize • Judge • Rate • Justify • Evaluate				

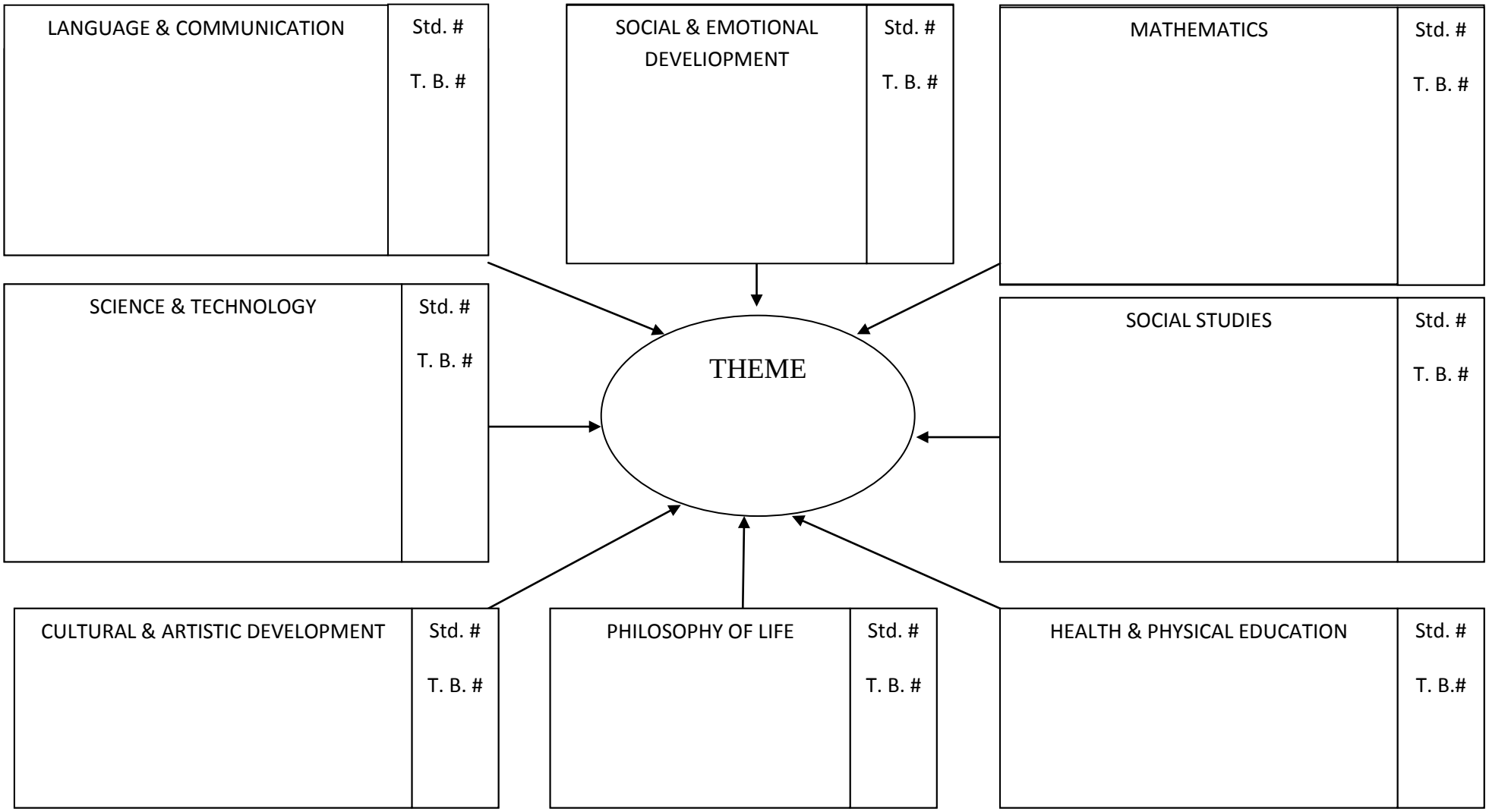
PROCESS SKILLS CHECKLIST

Place this checklist in the student's portfolio to record when the student used the skill.
Include the student's evidence of skill use, e.g. the student's work, photographs or anecdotal records.

Name of Student:							
Skills	**Dates**						
Observing							
Using Space/Time Relations							
Comparing							
Communicating							
Manipulating							
Classifying							
Measuring							
Investigating							
Predicting							
Inferring							
Defining Operationally							
Interpreting Data							

Hypothesizing							
Controlling Variables							
Experimenting							

SAMPLE INTEGRATED CURRICULUM WEB[35]



[35] Std. = Standard; T.B. = Target Behaviour.

SAMPLE SCIENCE LESSON PLAN FORMAT

Science Theme: _____

Target behaviours to be addressed:

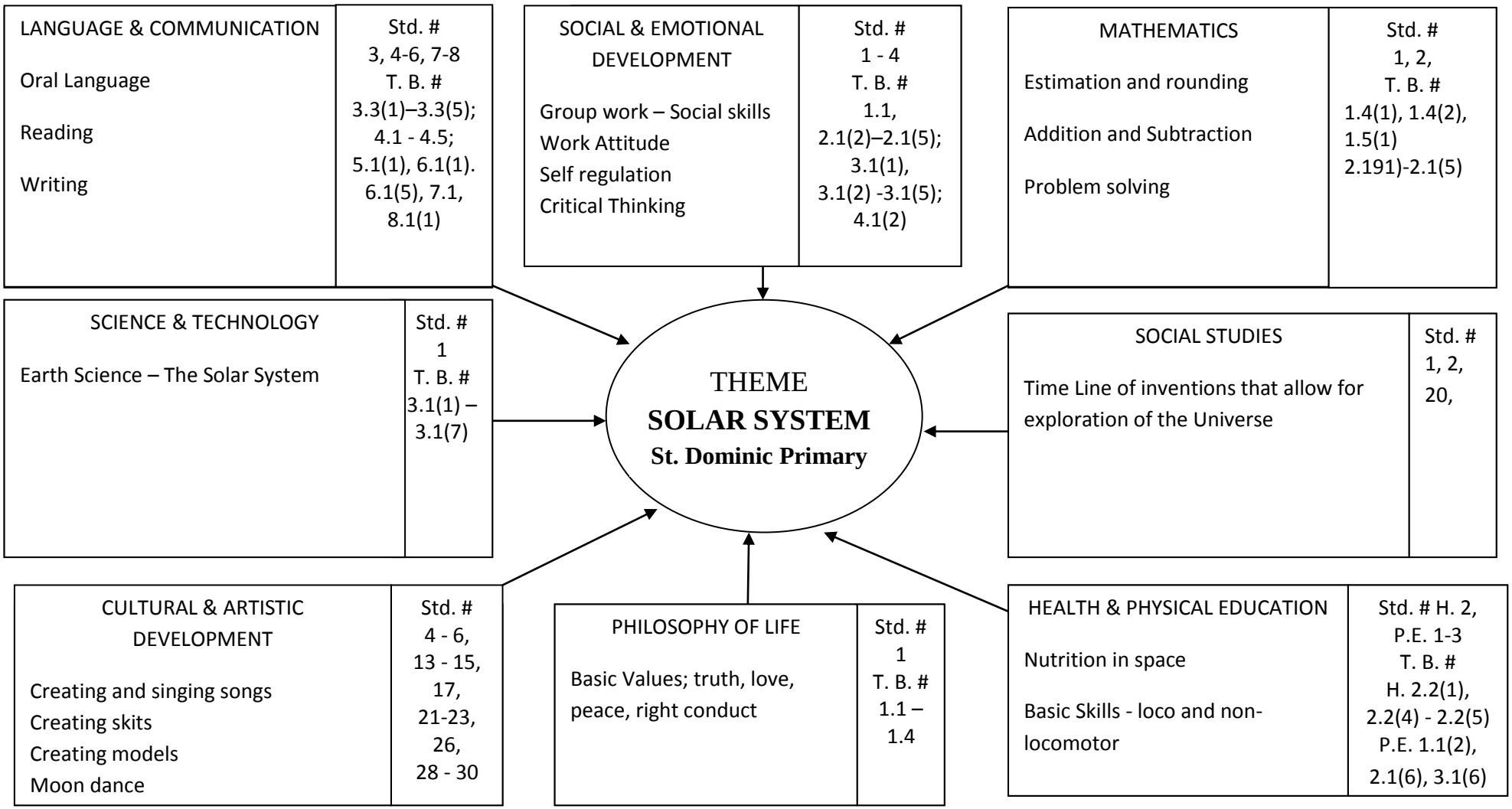
Process Skills to be introduced:

Activities

Whole Class	**Small Group**	**Centres**
Materials	**Materials**	**Materials**

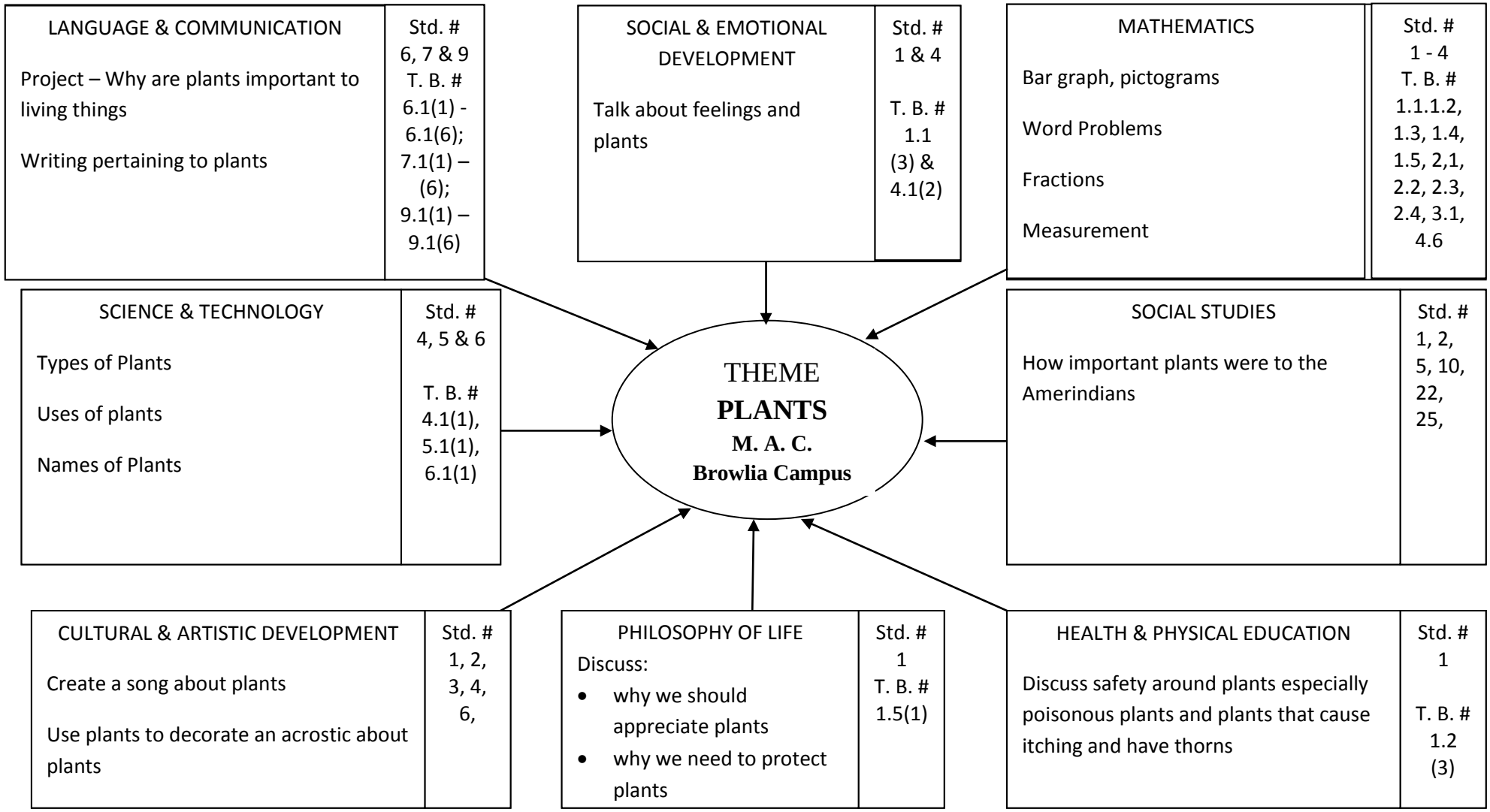
SAMPLE INTEGRATED CURRICULUM WEB FROM T.R.U.P.[36]

(Teachers' Retraining and Upgrading Program)



[36] At the time of publication Target Behaviours for Cultural & Artistic Development and Social Studies were not available

SAMPLE INTEGRATED CURRICULUM WEB



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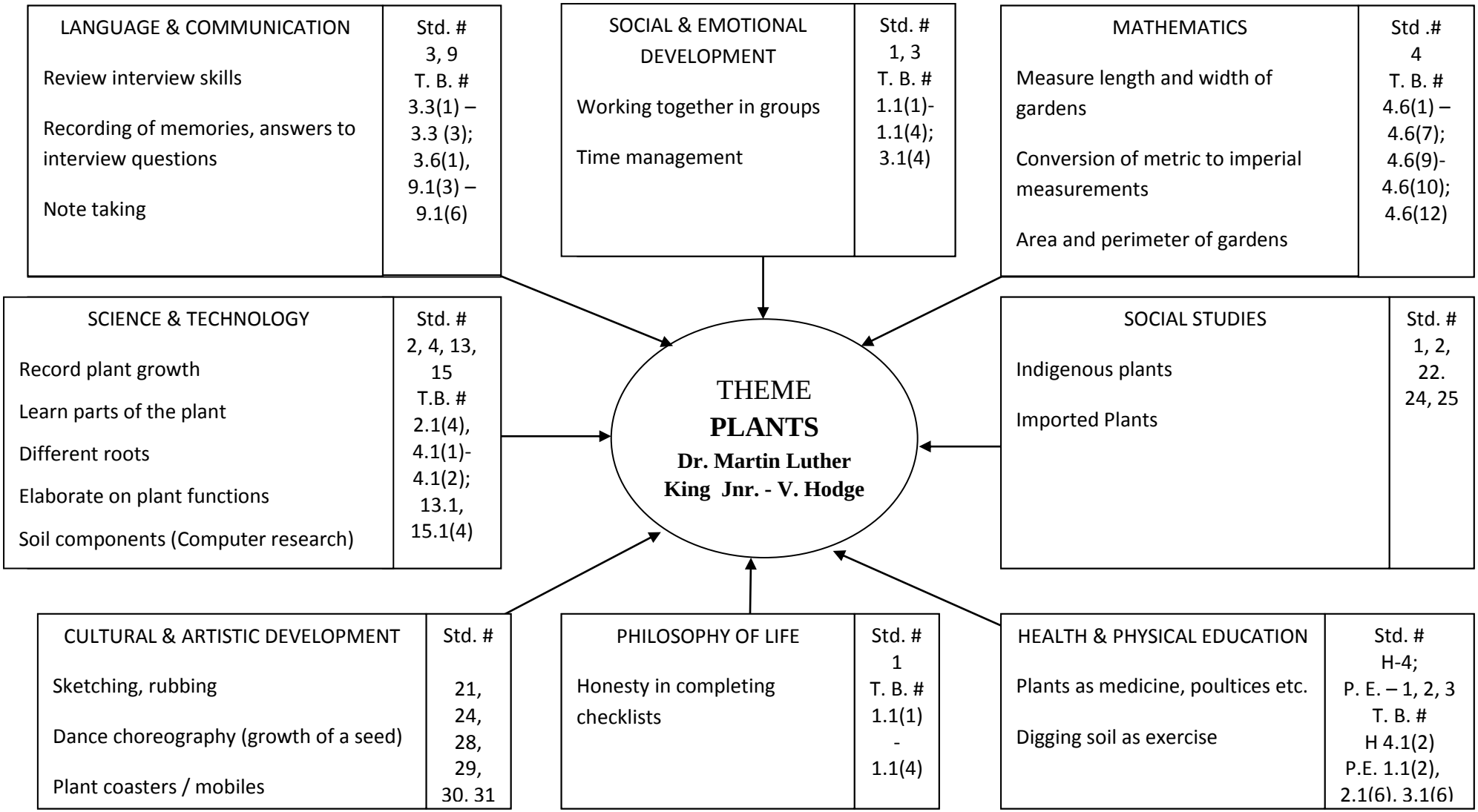

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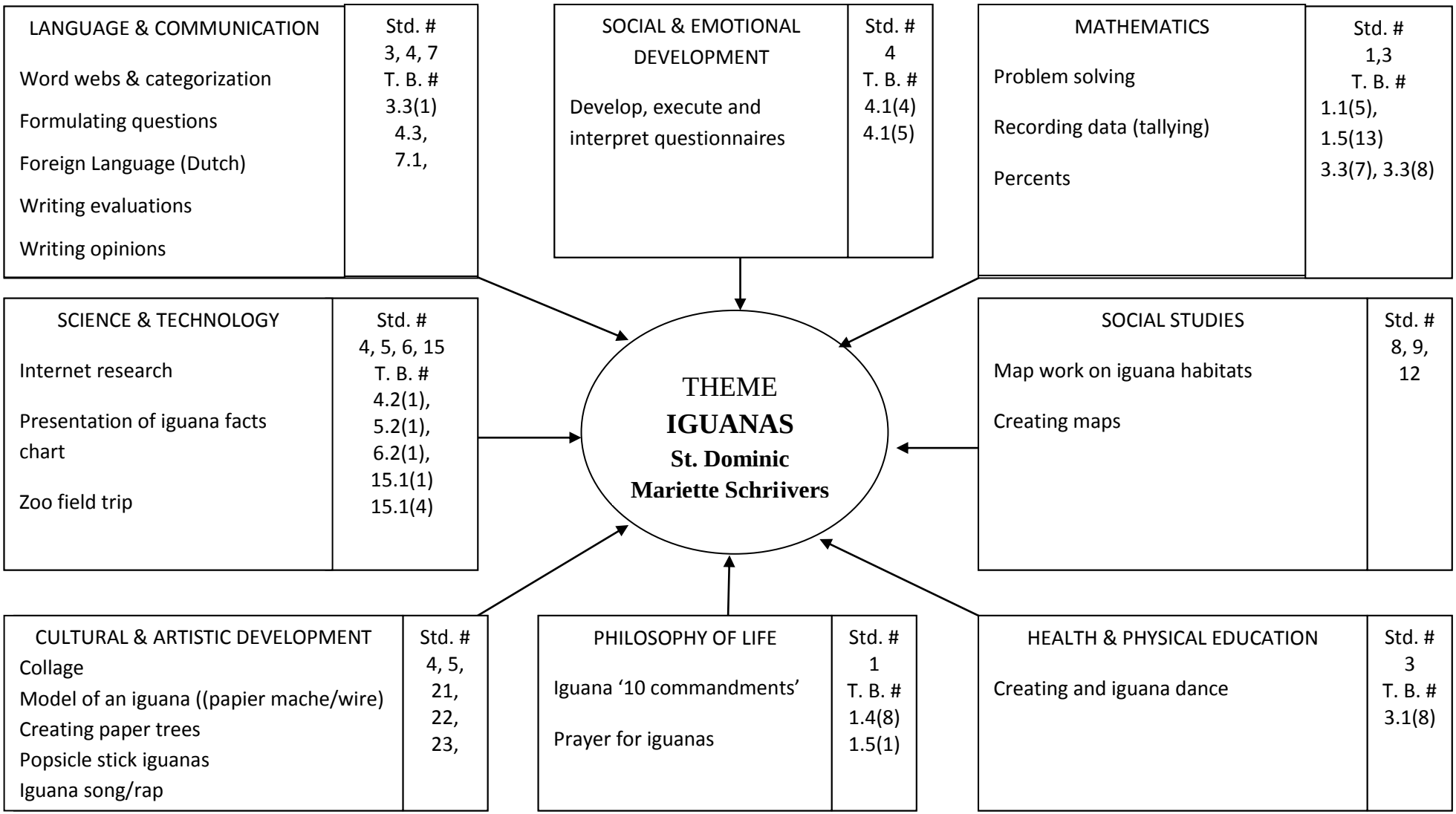

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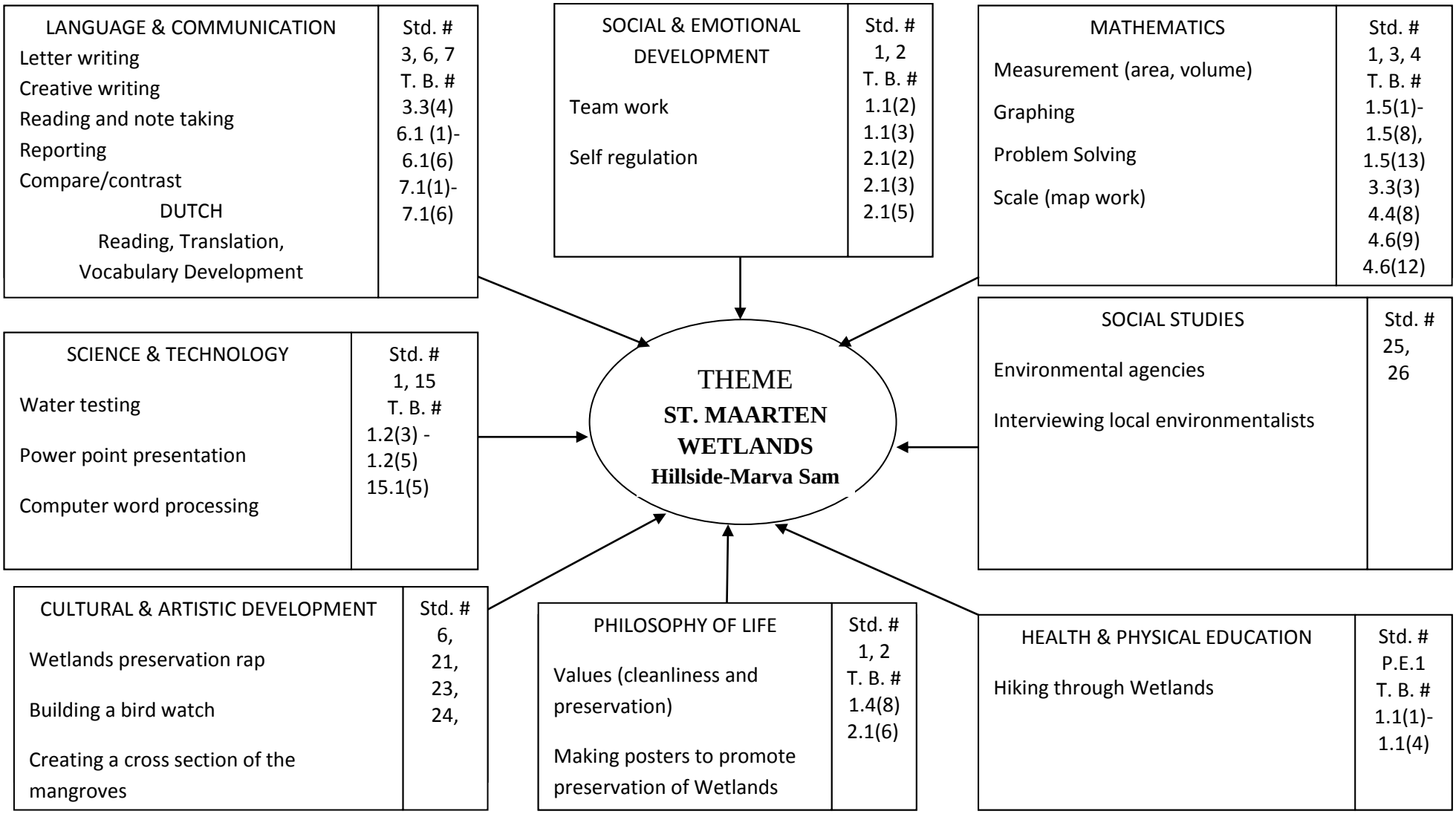

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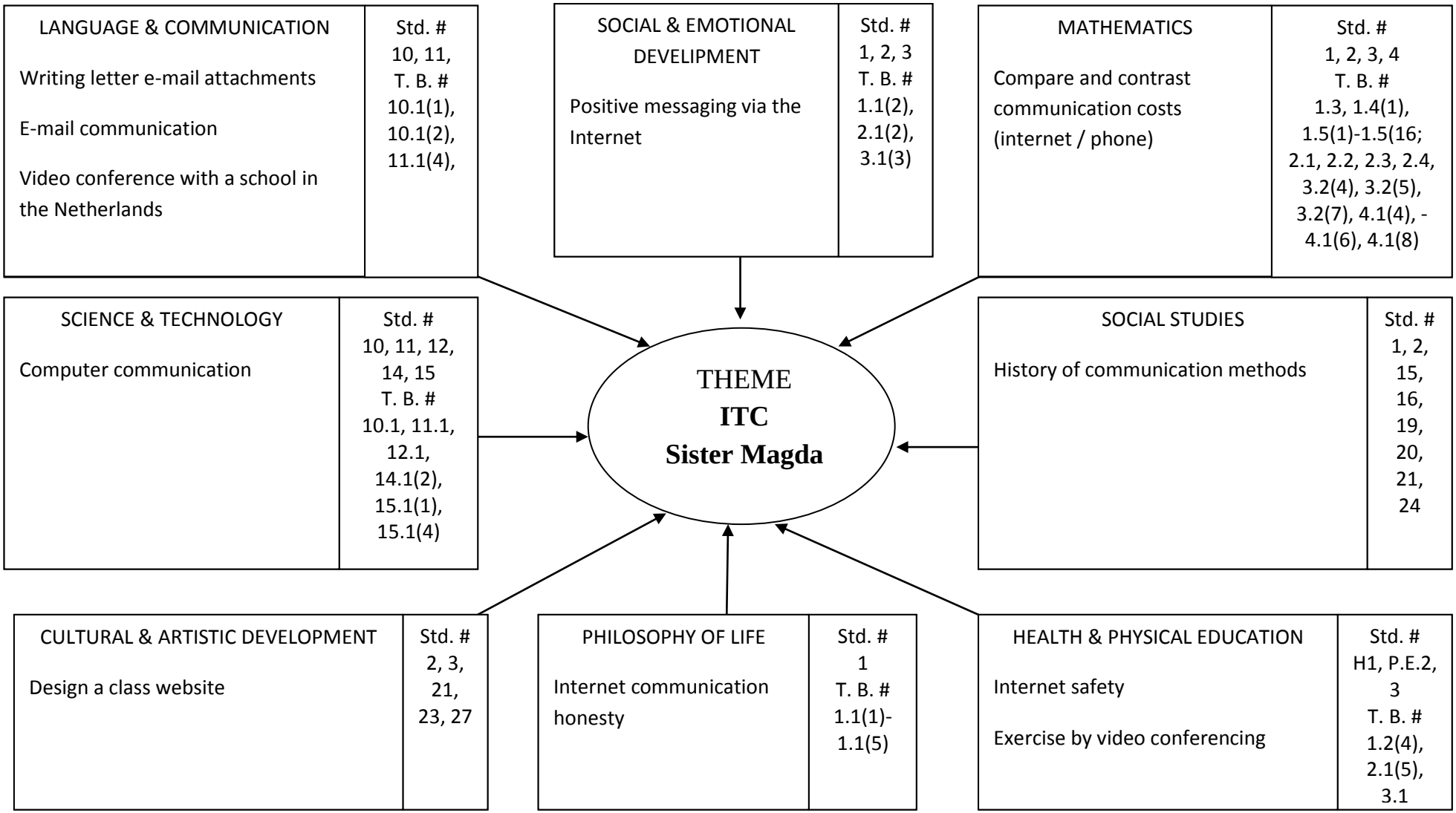

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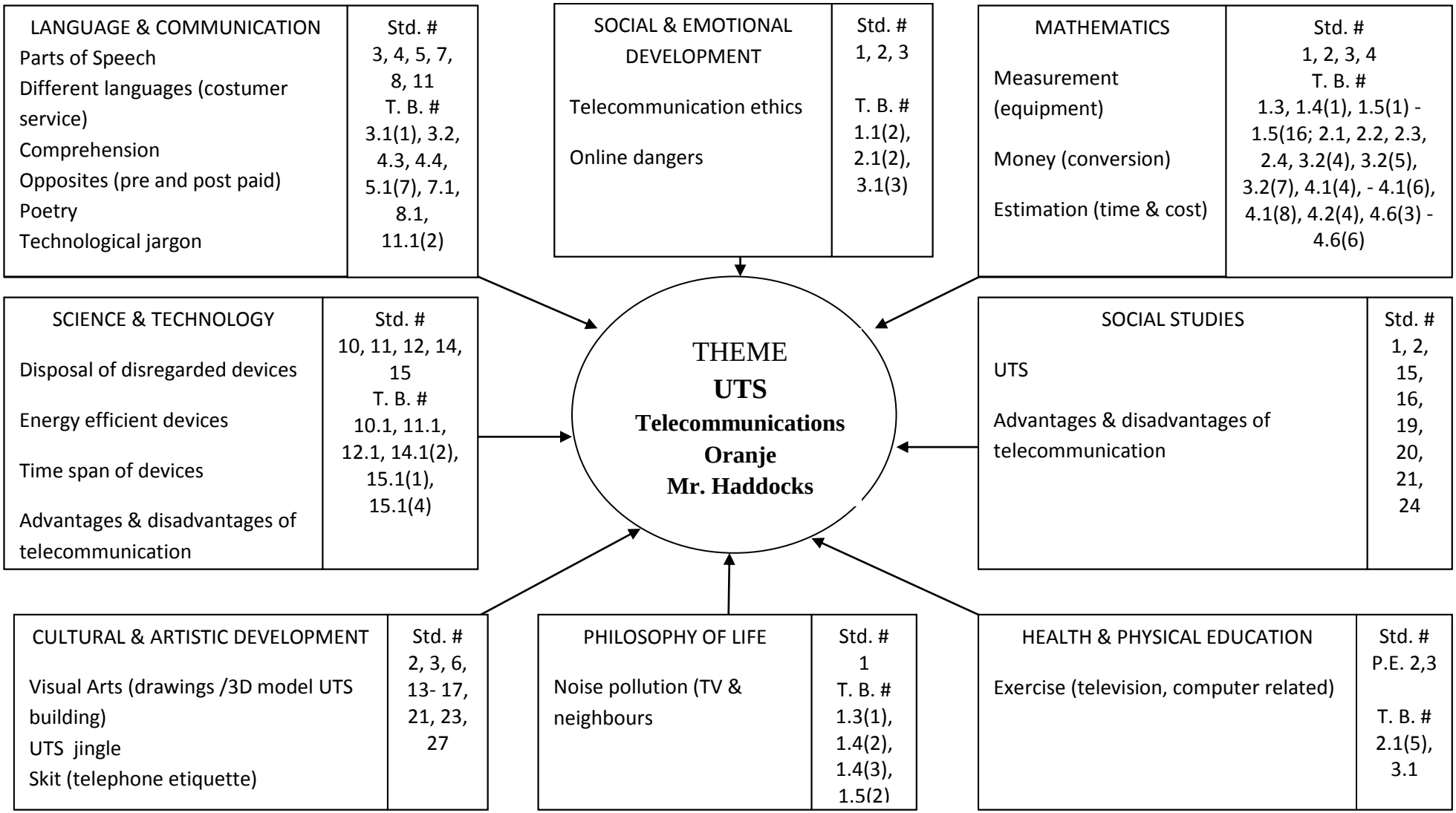

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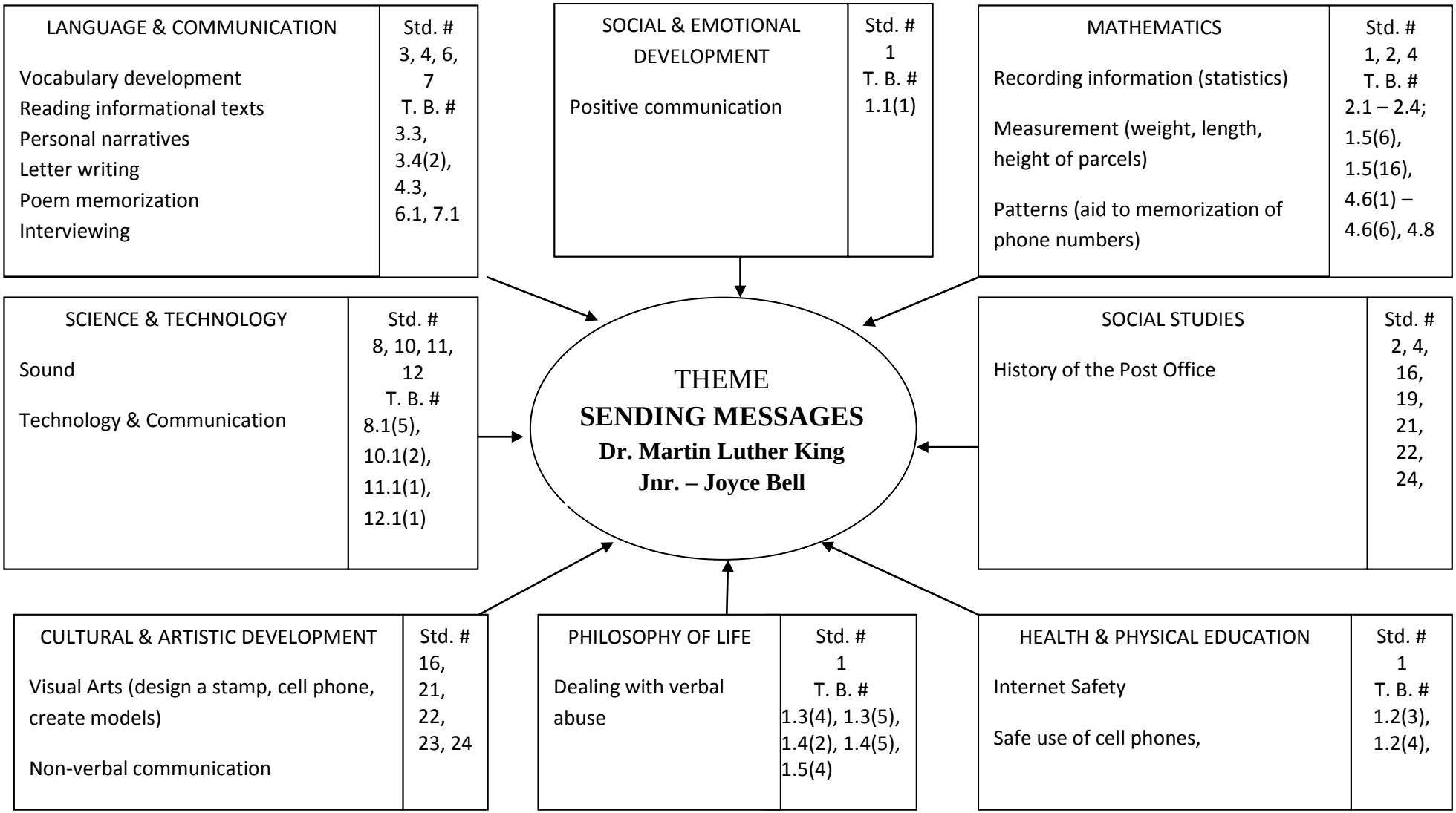

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