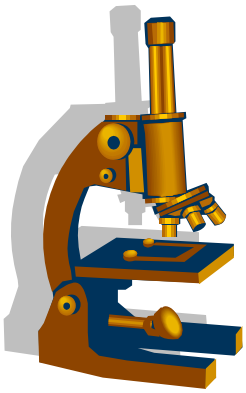
Literacy Enrichment and Academic Readiness for Newcomers (LEARN) PROGRAM

CURRICULUM GUIDE
LEARN-2 Science 701177

June 24, 2011



Newfoundland Labrador
Education

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Acronyms

ELD	English Literacy Development: An ELD student is one who, due to limited prior schooling, has an achievement gap in literacy and numeracy skills. The student is developing the skills needed to integrate into an age-appropriate grade. Most of these students will be ESL students but some may speak a variety of English as their first language.
ESL	English as a Second Language: An ESL student is one whose mother tongue is not English. The student is learning English to live in an English environment.
L1	First Language or Primary Language
L2	Second Language or Secondary Language
LEARN	Literacy Enrichment and Academic Readiness for Newcomers

Acknowledgements

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The LEARN Program

Introduction

In recent years we have seen an increase in the arrival of Government Assisted Refugees in Canada. Many of these students have little or no prior schooling or have attended schools that do not prepare them for the challenges of schooling in Canada. Literacy Enrichment and Academic Readiness for Newcomers (LEARN) courses are bridging courses developed for this group of students.

This document outlines the curriculum for LEARN-2 Science 701177, which is part of the LEARN program. It is designed to prepare newcomers who have gaps in formal education for further science studies at the high school. The course may be offered to students in the upper intermediate school as a non-credit course. The course may be offered at the high school for one alternate credit.

LEARN-2 Science 701177 is appropriate for a student who has at least a primary numeracy level and a transitional reading level (approximately grade 3). It is an enabling course and therefore will not be offered to a student who has the literacy and skill level to succeed in a regular age-appropriate science course.

Intent of the Course

The LEARN program aims to meet the unique learning and literacy needs of immigrant students who have a history of significant skill gaps in their education. This course is designed to assist students in meeting with success in the regular program of studies by teaching background knowledge, metacognition, and literacy skills that will facilitate learning in science curricular areas.

LEARN-2 Science outcomes are intended to develop and reinforce strategies, skills, and language required for further academic studies in this content area. LEARN-2 Science 701177 will provide meaningful and relevant content that emphasizes enabling strategies in preparation for the provincially prescribed high school curriculum. The suggested teaching strategies promote science skills, oral communication and overall English language development.

The resources were specifically chosen to meet the differentiated learning styles of newcomers. For example, the resource *Access Science* incorporates differentiated instruction, assessments, and suggestions to enhance language development. It gives students the academic language and skills integral to successful response.

LEARN Program Components

The LEARN Program is developed to meet the academic needs of immigrant students with major gaps in literacy and numeracy achievement. These gaps are generally due to a lack of formal schooling.

LEARN-1 consists of two courses, LEARN-1 Language Arts: Basic Literacy and LEARN-1 Mathematics. There is no time frame for these courses but it is recommended that a student enrolled in LEARN-1 should spend at least one hour per day on each of these subjects. At this rate the beginner student, functioning at a K-1 level on entry into the program, should complete LEARN-1 in two academic years. The course descriptions are as follows:

- LEARN-1 Language Arts: Basic Literacy: a non-credit basic literacy course aiming to bring the student to a transitional reading level. Emphasis is on both academic and life skills reading and writing.
- LEARN-1 Mathematics: a non-credit course aiming to bring a student up to a grade 6 math level. Emphasis is on both academic and practical life skills mathematics.

LEARN-2 consists of four high school academic enabling courses:

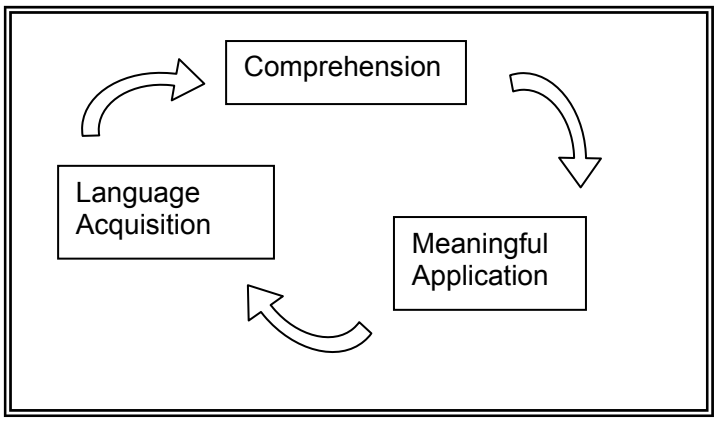
- LEARN-2 Language Arts 701272: a 110 hour academic enabling course that builds skills and strategies for further high school studies in literature and language arts.
- LEARN-2 Mathematics: a non-credit course that covers intermediate outcomes and prepares students for high school mathematics.
- LEARN-2 Social Studies 701172: a 110 hour academic enabling course for further high school social studies. This course focuses on development of literacy skills and strategies within the context of Canadian social studies.
- LEARN-2 Science 701177: a 110 hour academic enabling course for further high school studies in science. This course focuses on the development of science literacy, skills and strategies within the context of earth science, life science and physical science.

Sheltered Instruction

ESL students and students with low literacy levels benefit from being taught in a sheltered environment with a teacher who considers their unique numeracy, literacy, and language needs as well as content area needs. The aim of sheltered instruction (SI) is to help students develop literacy and content skills simultaneously. Sheltered instruction draws largely on good teaching practices and includes specific techniques and strategies to meet the needs of ESL students. Sheltered instruction offers a non-threatening learning environment and provides various ways for students to demonstrate knowledge.

Research suggests that students learn a second language (L2) best when they are presented with meaningful and relevant comprehensible input. Children learn a first language (L1) through being immersed in that language, regardless of direct instruction. The same is true for young children immersed in a second language. Adolescents and adults can also acquire a language through exposure and engagement; however, to fully reach a high level of academic competency, they need specific techniques, tasks, and materials that scaffold language skills and guide language development in an incremental way.

Sheltered instruction combines what we know about natural language acquisition with what we know about developing academic language, skills, and knowledge necessary for school success. In shelter instruction for second language and literacy students, teachers place equal value on developing the content area knowledge and the language skills required for academic success. This follows naturally from approaches to simultaneous language and content development which integrate skills in thematic units. The thematic approach is recommended for ESL and literacy students as language is recycled and strengthened through different genres and applications.



SI teachers use techniques and resources that make content comprehensible; this is the key to both understanding of the content and development of language.

Many of the techniques used in SI content courses are the same as would be used in any high-quality mainstream classroom: presenting information in a variety of forms, encouraging students to discover, acknowledging different learning styles, strengths and needs, pre-teaching, teaching, follow-up activities for application, review, and assessment. Like all students, ESL and literacy students need opportunities to reiterate and strengthen comprehension through discussion and writing activities.

What differentiates sheltered classes from mainstream classes is the emphasis on language and explicit teaching strategies used to develop language in sheltered classes. Strategies can be divided into two related categories: 1) techniques to ensure that input is comprehensible and 2) techniques to ensure that students are developing the four interrelated language skills, reading, writing, listening, and speaking.

Firstly, making content comprehensible entails that the teacher prepare lessons keeping in mind that the students have a relatively low level of English language and/or English literacy. SI relies less on long, information packed lectures and more on short, plain language explanations coupled with numerous opportunities for students to read and view texts to discover content and language themselves. Sheltered Instruction avoids the use of dense textbooks and provides texts

and materials which present content through simple sentence structures, shorter texts, graphic organizers, and visuals. Mini-lectures help develop listening skills and present content; however, students also need to develop reading, viewing, speaking, and writing.

Secondly, sheltered instruction focuses on language needs for classroom and academic success. This means teaching not only the key subject specific vocabulary, but also teaching language needed to function in the subject area classroom and to understand academic texts; for example, ESL and literacy students need to learn appropriate language for questioning, confirming and disagreeing. They need language for reporting, describing, writing about processes, following instructions, comparing and contrasting, etc. Teachers of sheltered instruction help students develop and apply these language skills in context.

Lesson Plans

Lesson planning for ESL and literacy students requires more focus on language and techniques to make content accessible than would normally be required in the mainstream. Lessons must also provide opportunity for ongoing collection of data about students and their progress.

Firstly, sheltered Instruction requires that each lesson have both content and language outcomes. These outcomes should be reached in an integrated fashion. In lesson planning, teachers set the content outcomes first and then determine the language outcomes that need to be met for success in the content area or can be met through the lesson. Vocabulary building is an ongoing outcome. Content area teaching will also lend itself to reaching other language outcomes.

For example, in a lesson on the food chain the teacher would guide the students in the understanding of vocabulary such as *producers*, *consumers,* and *decomposers*. The lesson may be extended by drawing attention to and exploring meaning of the *er* ending in those words. The lesson might compare the use of the verb form, *produce*, with the noun, *producer*, etc.

EXAMPLE of Science Lesson Outcomes:

Content Outcome	Language, Literacy, and Numeracy Outcomes
5.6 Define Weathering 5.7 Identify types of weathering, including mechanical and chemical.	Students will: • Read Access Text, 56-57 **(Reading)** • Explain weathering to a partner and describe two types of weather (chemical and mechanical) using the terms: *weathering*, *chemical weathering*, *dissolve*, *soil*, *expand*, *break off*, *sediment*. (**Speaking, Vocabulary)** • Explain, beginning with the general definition and then describe each type of weathering. **(Organization)**

Secondly, sheltered Instruction requires making content accessible. Hands-on demonstrations and interactive activities must be built into every lesson. Give students ample opportunity to participate in active learning around the content, through group and pair work and to read the materials themselves. This approach creates autonomous, active learners and offers opportunities for the teacher to assess student learning.

Finally, sheltered Instruction requires ongoing collection of data and assessment of student progress; ways to collect this data and information need to be built into every lesson plan. The students come from a wide range of educational, language, and cultural backgrounds and bring an array of experiences and knowledge to the classroom. Most of the students are bilingual. Give ample opportunity for the students to tell or demonstrate what they know and to relate it to their own personal experiences.

Through observation of active learning activities and through interaction with students, the teacher gets to know the students, which subsequently informs further teaching.

Inquiry Learning

Students are encouraged to connect with the world around them. They are encouraged to think critically and analytically in making the links between scientific information and their own every day experiences.

LEARN courses are not meant as lecture courses but rather are intended to develop inquiring minds and thinking skills. Students are expected to ask questions, make predictions, surmise reasons, and analyse data critically. Student will discover that they have a lot to bring to the learning process and are able to learn both independently and cooperatively by using the skills they are developing.

Rather than directly teaching the points to be learned, the teacher should guide the students to the necessary resources to discover the information, independently, with a partner or in a small group cooperative learning environment. Literacy means more than learning to read; it means having the skills, strategies, and confidence for further learning and applying these to academic studies or other life experiences.

A KWL chart is intended to get students thinking about what they know and finding answers to their questions.

KWL Chart

K What I **know**	**W** What I **want** to find out	**L** What I **learned**

Integrating Science and Literacy

Students have been selected for the LEARN program based on their need for literacy and numeracy upgrading. Most are ESL students. Literacy, including reading, writing, speaking, and listening, should be integrated with the development of science knowledge and skills.

Students should be given opportunities to demonstrate knowledge in a variety of ways; however, all courses in the LEARN program are intended to develop literacy skills. In the LEARN-2 Science curriculum there are many opportunities to link science with literacy development. Student should, for example:

- Read and view texts independently to reach outcomes.
- Be taught and use reading strategies, such as:
    - Pre-reading, skimming titles and graphics for main ideas and text organization.
    - Contributing to brainstorming and posing questions to heighten curiosity before reading.
    - Contributing to discussion and reflection on what was learned.
    - Figuring out the meanings of new words in context before using a dictionary.
    - Building vocabulary by word analysis, highlighting new words, keeping a personal glossary, categorizing words, extensive reading, recycling vocabulary, etc.
    - Creating graphic organizers or short notes while reading to focus comprehension.
    - Re-Reading.
    - Reading, taking notes, and summarizing in your own words, using notes only.
- Create classroom resources, such as a word wall, posters, charts, etc.
- Represent scientific processes through drawing.

- Read instructions independently or with a partner.
- Work with real life texts to illustrate scientific information or processes (e.g., recipes, newspaper articles, weather reports, appliance manuals).
- Carry out primary and secondary research.
- Articulate processes and scientific information orally.

Strategies for Working with ESL Students

Like learning a first language (L1), learning a second language (L2) is a developmental process, usually beginning with a silent period, during which time learners are building receptive language before they are ready to speak. Research has found evidence that the sequence of learning an L2 is very similar to the sequence of learning an L1. For example, people normally begin to acquire present tense forms before past tense forms, statement forms before question forms and, generally speaking, words that hold the most meaning, such as nouns and verbs, before articles and prepositions.

Language development follows a continuum and the key is to expose students to the language that they are ready to absorb. When we speak to beginning language learners we should speak in complete, simple sentences, not mimicking “broken” English. ESL students need to hear clear, standard language that they can understand and gradually acquire.

While a student may acquire day-to-day conversational English relatively quickly, it takes several years and structured ESL focus for students to acquire the level of language needed to reach their potential in academic studies. Acquisition of English may be influenced by the student’s L1. Some students tend to pick up English sounds, grammar, and sentence structures more quickly than others. The challenges vary from student to student depending on the L1 and other factors, including age, motivation, confidence, and attitude. A student who is literate in another language will benefit from transference of literacy skills; however, students in the LEARN program have limited literacy skills in any language. They will need time and guidance to develop both content and literacy skills.

All students can learn an additional language. This happens best in a non-threatening, comfortable environment where risk-taking is encouraged and emphasis is primarily placed on communication and secondarily on language form.

ESL students will learn English in much the same way that they learned their first language, over time, through exposure to comprehensible input, through meaningful interaction with people who speak the language and as they need it. The teacher’s guidance along the way will help students to reach their potential both in content area understanding and in language development.

The following strategies are suggested:

Classroom Routines

- Gradually introduce and reinforce classroom routines and appropriate school behaviour.
- Print and explain homework assignments clearly and consider the time and resources needed to complete the assigned work; it may take ESL learners much longer to complete certain tasks and/or language tasks may need to be simplified.
- Allow the student a silent period, a period of up to several months to listen and build receptive vocabulary before being expected to speak. Give time for the student to build confidence and familiarity with the sounds of English.
- When the student does speak, use diplomacy in understanding what was said. Do not correct pronunciation or ask for restatement unless you cannot understand what was said. Focus on meaning, not pronunciation or grammar, in spoken language.
- Allow wait time for the student to formulate responses.
- Keep in mind that functioning all day in a second language can be tiring. Give breaks and extended time for completion of work.

Making language and content comprehensible and accessible

- At the beginning of each lesson, provide a clear overview of what will be covered and the expected outcomes or assignments.
- Relate content to the student's background knowledge and personal experience when possible, but tread lightly around sensitive issues.
- Print keywords, page numbers and other important information on the board.
- Print clearly rather than use cursive writing.
- Incorporate demonstrations, models, and visuals, such as gestures, props, graphic organizers, and charts, to explain or reinforce key ideas.
- Provide models of homework assignments, projects, presentations, test items.
- Monitor teacher talk–avoid slang and colloquial expressions or introduce them gradually in context; speak clearly in simple, plain language, using a normal tone and rate of speed or slightly slower. Enunciate clearly.
- Focus on vocabulary. Consider directing students to new vocabulary and asking them to try to figure out meanings in context before direct teaching or providing a definition.
- Recycle new words and key words. Be sure to repeat the words in several contexts.
- Provide meaningful hands-on activities in class to integrate lesson content.
- Provide meaningful exercises or activities that teach or reinforce the key vocabulary.
- Check for comprehension–use questions that require one word answers, props, and gestures. Encourage students to ask teachers or other students for clarification. Beware; the question "Do you understand?" is often not answered accurately.
- Allow frequent opportunity for interaction and explanation. If the ESL student has a classmate with the same L1, allow them to discuss and help each other understand the content, using the L1 if they choose.
- Be available for extra support.

Peer Support

- Assign peers who have good communication skills to work with the student.
- Have a classmate ensure that the beginner ESL student is following instructions.

Self-Help and Autonomous Learning

- Encourage student self-assessment; for example, editing written work, correcting errors, and highlighting suspected errors.
- Correct errors in grammar and spelling sparingly. Circle errors that you think the student can self-correct and check to ensure that the self-corrections are done.
- Encourage the student to use strategies for language learning, such as noting new words in a text, and guessing meaning before checking a dictionary.[1]
- Encourage students to take ownership of their studies; for example, when they have finished an assigned task they should review their work, continue to the next task or read silently. Ensure that appropriate reading materials and activities are available.
- Set up a computer centre with appropriate software or websites bookmarked.
- Set up a listening centre with books and audio recordings.
- Provide simple resources that the student can read independently and that address topics studied in the content areas.

[1] Seek more tips on language learning strategies from an ESL teacher.

LEARN-2 Science

This course is designed to be delivered in 110 hours. Although the outcomes are organized around content knowledge and skills, the course aims to develop strategies, language, and scientific literacy.

The Three Processes of Scientific Literacy

An individual can be considered scientifically literate when he/she is familiar with, and able to engage in, three processes: inquiry, problem solving, and decision making.

Inquiry
Scientific inquiry involves posing questions and developing explanations for phenomena. While there is general agreement that there is no such thing as the scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analysing data, and interpreting data are fundamental to engaging in science. These activities provide students opportunities to understand and practise the process of theory development in science and the nature of science.

Problem Solving
The process of problem solving involves seeking solutions to human problems. It consists of the proposing, creating, and testing of prototypes, products, and techniques in an attempt to reach an optimum solution to a given problem.

Decision Making
The process of decision making involves determining what we, as citizens, should do in a particular context or in response to a given situation. Decision-making situations are not only important in their own right; they also provide a relevant context for engaging in scientific inquiry and/or problem solving.

Science Components

Introductory Science Skills

Unit 1: Introduction to Science (Scientific Method)
Unit 2: Lab Safety and Equipment
Unit 3: Lab Processes

Earth and Space Science

Unit 4: Solar System and Space
Unit 5: Rocks and Rock Cycle
Unit 6: Water Cycle

Life Science

Unit 7: Ecosystems
Unit 8: Cells, Systems and Reproduction
Unit 9: Adaptations, Kingdoms, Evolution

Physical Science

Unit 10: States of Matter
Unit 11: Mass, Volume and Density
Unit 12: Force and Motion
Unit 13: Temperature and Heat
Unit 14: Atoms, Elements and Compounds
Unit 15: Electricity

Resources

Access Science Teacher Kit, Nelson Education (ISBN 9780669516388) (student text, teacher resource, overhead transparencies, assessment folder, assessment book)
Access Science Student Book, Nelson (ISBN 97806695089560) (class set)
Access Science Student Activity Journal (ISBN 9780669509014) (class set)

Longman Science Teacher's Guide, Pearson Education (ISBN 0-13-193032-X)
Longman Science Student Book (ISBN 0-13-193030-3) (class set)
Longman Science Workbook (ISBN 0-13-193031-1) (class set)

Essential Graduation Learnings

Graduates from the public schools of Atlantic Canada are expected to demonstrate knowledge, skills, and attitudes in the following Essential Graduation Learnings:

Aesthetic Expression
Graduates will be able to respond with critical awareness to various forms of the arts and be able to express themselves through the arts.

Citizenship
Graduates will be able to assess social, cultural, economic, and environmental interdependence in a local and global context.

Communication
Graduates will be able to use the listening, viewing, speaking, reading, and writing modes of language(s) as well as mathematical and scientific concepts and symbols to think, learn, and communicate effectively.

Personal Development
Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Problem Solving
Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language, mathematical, and scientific concepts.

Technical Competence
Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

Spiritual and Moral Development
Graduates will demonstrate understanding and appreciation for the place of belief systems in shaping the development of moral values and ethical conduct.

Specific Curriculum Outcomes

The following pages outline the specific curriculum outcomes, what the student is expected to be able to know and to do. The curriculum guide also offers suggestions for learning, teaching and assessment.

The fourth column lists resources that will be helpful. The teacher may choose to supplement these. It is highly recommended that the teacher refer to the teacher guides for each of the textbook, *Longman Science* and *Access Science*, as they provide some excellent teaching strategies. The *Longman Workbook* and *Access Activity Journal* should also be used in conjunction with the textbooks.

Textbook references generally refer to the page number on which the information related to the specific outcome can be found. However, it is recommended that students read complete units or lessons in the textbook to fully understand concepts and make the scientific links.

Introductory Science Skills
Unit 1: Introduction to Science (Scientific Method)

Outcomes	***Suggested Learning/Teaching/Assessing***
1.1 Explain what science is and the three branches of Science (Life Science, Earth Science Physical Science) 1.2 Explain the steps of the scientific method: • Hypothesis/Prediction • Materials • Procedure • Observations/Results(Data collection) • Conclusions • Variables (independent/manipulated, dependent/responding, controls)	Begin with brainstorming: What is Science? What do we study in science? Make a Word Web. Brainstorming: What does a a scientist do? How does a scientist decide what to study? How do they do research – find a cure for a disease, for example. Students write a simple definition of science. (Work in pairs or groups). Pose several scientific questions (e.g., Is there water on the moon?) Ask students to pose a question –about the earth, plants, animals, rocks, etc. that they are curious about. Continue by exploring some questions, asking students how they might go about finding answers. Explain that the steps in the Scientific Method help scientists understand answers to questions in the world around them. Scientists: ask questions, make a hypothesis, test a hypothesis, observe and make conclusions. Pose the question, “What conditions are necessary for a bean plant growth?” Show students a bean seed. Use the visuals on pp 10 –11 in Longman Text to show the development of a bean plant. Plant some seeds for observation, recording observations regularly. Introduce variables. For example, an independent variable in this experiment could be the amount of water or it could be the amount of sunlight depending on what condition is being tested. The dependent variable would be growth (height) of the plant. If amount of water was the independent variable some controls would be: same pot, same room, same type of seeds and same amount of sunlight. This is a good opportunity to develop use of a ruler and appropriate units for measuring length (cm or mm). This could then be written up as a formal lab using the Scientific Method (Hypothesis, Materials, Variables, Procedure, Observation and Conclusions).
	Think, Pair, Share*: A teacher or student poses a question for critical thinking, an opinion question, for example. The question is written on the board. Students get a timed period (e.g., 3 minutes) to write individual notes on their response to the question Next, students are paired to discuss answers and write a list of well formed responses to share with another pair or the class.*

Suggested Tasks for Formal Assessment	***Resources***
1.1	Access Science, 2-7
1.2	Longman Text, 8-13 Access Science, 16-27 Appendices 8 & 9

Introductory Science Skills
Unit 2: Lab Safety and Equipment

Outcomes	***Suggested Learning/Teaching/Assessing***
2.1 Describe lab safety rules necessary before conducting any science experiment. Include: i. General Safety ii. Heating & Electrical Safety iii. Chemical Safety iv. Glassware Safety v. Plant & Animal Safety	Introduce the lab and begin by brainstorming a list of rules students think are important for lab use. Elaborate on the safety outlined in the textbook. (See Appendix 3 for other safety rules.) Teachers should refer to *Newfoundland and Labrador's School Science Safety Manual* for specific safety guidelines and when using thermometers concerning the use of mercury in school settings. (See Science Department Head to obtain a copy.) ***Teachers should familiarize themselves with the lab and the Provincial Safety Manual prior to conducting any lab work.*** *NOTE: Lab work should be conducted in a laboratory setting within the school where the appropriate safety devices, such as a first aid kit, eyewash station, spill kits, broken glass containers, safety blankets, etc. are available. Students should be familiar with the floor plan of the lab and the location of these safety devices as well as the evacuation route of the lab.*
2.2 Demonstrate knowledge of WHIMIS standards by using proper techniques for handling and disposing of lab materials, or various oils, paints, etc.	Show students visuals of WHMIS symbols and explain their purpose (Appendix 4). A matching game would be useful for teaching these symbols. Students demonstrate proper methods for disposal and storage of lab materials.

Suggested Tasks for Formal Assessment	***Resources***
2.1 Prepare safety posters illustrating some of the important safety rules. Display posters throughout the classroom or lab as continual reminders of safety practices.	Longman Text, 14-15 Appendix 4
2.2 View and interpret WHMIS symbols.	Appendix 4

Science Literacy Development

Introduce the textbooks.

- Explain, demonstrate, and give students practice in using the **table of contents** and **glossary**.
- Explore and explain the value of various features of the textbooks: **titles**, **subtitles**, **graphics** and **captions**, **questions**, and **words in bold**.

Outcomes	***Suggested Learning/Teaching/Assessing***
2.3 Identify, state the function of, and demonstrate lab equipment necessary to carry out lab processes (in this curriculum). Include: i. Metre stick and ruler ii. Graduated Cylinder iii. Beaker iv. Balance Scale v. Thermometer (lab & household/digital) vi. Stopwatch vii. Hand lens viii. Telescope ix. Camera	Students should recognize pictures of these pieces of equipment and know their functions. Labelled pictures displayed across the classroom would aid in visual instruction. Student can create and label their own drawings. Students should use a meter stick and ruler to measure length and should label parts of the thermometer (include bulb, bore, alcohol, scales, Celsius and Fahrenheit) (See Appendix 5).There will be more in depth work on thermometers in the *Temperature Heat Unit*. Students engage in a matching game using pictures of the lab equipment and a sentence on the purpose. Avoid the use of mercury thermometers. Teachers should refer to *Newfoundland and Labrador's School Science Safety Manual* concerning the use of mercury in school settings (See Science Department Head to obtain a copy of the manual). Distinguish between the purpose of a graduated cylinder and beaker (i.e. a graduated cylinder is used to measure volume and a beaker is where liquids are poured to perform experiments with particular volumes of liquid.). Students should have the opportunity to learn the proper methods of measuring volume (meniscus) (See Appendix 5). Students measure and record the temperature (using a lab thermometer) of varying temperatures of water (snow, ice water, room temperature water and hot tap water). Discuss freezing point of water, boiling point of water, normal body temperature and room temperature. A more in depth study of temperature will occur in the *Temperature and Heat Unit.*

Suggested Tasks for Formal Assessment	***Resources***
2.3 Students do a matching pen/paper worksheet with pictures, names of the equipment, and use. Students demonstrate how to use equipment.	Longman Text, 18- 19 Appendix 5

Science Literacy Development

Using the textbooks and after teacher modelling:

- Challenge students to find or figure out the meaning of some words in bold by reading the context. The student must read and then explain in his/her own words without looking at the text.
- Challenge students to explain a graphic, table, chart, etc., orally or in writing.

Outcomes	***Suggested Learning/Teaching/Assessing***
2.4 Use the experimental apparatus and tools safely and accurately to carry out scientific processes (gather data).	
2.5 Identify and state the functions of the major parts of the compound microscope i. eyepiece ii. objective lenses iii. stage iv. coarse adjustment knob v. fine adjustment knob vi. light source/lamp vii. base viii. tube ix. arm x. revolving nosepiece	A detailed diagram, as well as the function of each of the parts is available in the Appendix 6 of this resource. Provide students with an unlabelled diagram of the microscope and have students label their diagram. An actual microscope should be available for viewing and use.
2.6 Demonstrate an ability to focus a compound microscope using both low and medium power objectives.	This can be achieved using low and medium power. <u>CAUTION:</u> Demonstrate the use of high power lens as unfamiliarity with microscopes and microscope use may lead to damage of the lens. Further work will be done with this in the *Cells, Systems and Reproduction Unit*.
2.7 Use a light microscope to produce a clear image of a prepared slide.	Using a prepared slide (ex. wet mount of a letter ‘e’ cut from a newspaper) the teacher can demonstrate proper procedures for focusing. When students do the unit on cells they can investigate this further by focusing on specific plant and animal cells. Students should be taught the skills necessary to maintain and use the light microscope safely and effectively. .

Suggested Tasks for Formal Assessment	***Resources***
2.4	
2.5 Label a diagram and match each part to its function. Demonstrate use of a microscope	Longman Text, 19 Access Science Text, 22 Appendix, 6
2.6 Observe students focusing a microscope.	Appendix 7: Checklist of skills for lab work.
2.7	

Science Literacy Development

Be sure to cover and practise the *Science Reading Strategies* in the Longman Text.

Introductory Science Skills
Unit 3: Lab Processes

Outcomes	***Suggested Learning/Teaching/Assessing***
3.1 An experiment i. Carry out the steps: a) State a hypothesis. b) Carry out an experiment. c) Identify and control major variables. d) State a conclusion based on experimental data. ii. Organize, compile and display information (data) collected in an investigation using tables iii. Interpret data using lists, notes in point form, oral language and other means. iv. Describe and illustrate various methods of graphing data (bar graphs and line graphs) v. Construct a bar graph using data gathered from experiments.	Students should prepare a lab report and record observations for the *Bouncy Ball Experiment* in the Access Science text (pp 19-23) OR *How Does Water Move Inside a Flower*? (Longman text pp. 16-17). Students will need a template or model for lab report writing. The Longman workbook has a template for recording lab results (pp. 9-10) or use the template for scientific method from Appendix 8. Help students create a table to organize data collected. E.g., the *Bouncy Ball Experiment* data could be displayed as indicated below. Explain the importance of organizing the table this way. (This is a logical way to organize data-coldest to warmest, or vice versa). Explain the importance of repeating the experiment, getting an average to ensure reliable, accurate results.

Height				
Trial Number	Frozen Ball	Plus 10 minutes	Plus 20 minutes	Room Temperature Ball
1				
2				
3				
4				
Average				

Discuss how data and observations can be more than just data tables and graphs. Observations can also be explained in sentence or list form, as well as orally.

Use bar and line graphs to report results.

Students should be given ample opportunity to practice graphing skills.

Suggested Tasks for Formal Assessment	***Resources***
3.1 Students complete an experiment, in pairs, and write a formal lab report. This should be graded with a rubric. Given data, create a graph.	Longman Text, 20 Access Science, 24-27 Appendices 7, 8, 9 &10 Science 10, 691-695

Science Literacy Development

Note taking develops reading, listening, writing and representing.

- Model note taking from a text as well as from a mini-lecture.
- Give students opportunities to practise and perfect note-taking from readings as well as from listening to min-lectures.
- Teach students how to focus on key ideas and take notes briefly and effectively.
- Teach students to use graphic organizers, short hand and sketching to note main ideas and details.

Earth and Space Science
Unit 4: Solar System and Space

Outcomes	***Suggested Learning/Teaching/Assessing***
4.1 Describe and explain the apparent motion of celestial bodies: moon, sun and the planets	Provide visuals such as posters. Students create a K-W-L chart for moon, sun, planets. They work in pairs to write what they know about the topic (K), then write questions on the topic (W). After the lessons and explorations, they write what they learned (L). After exploring the topic through pictures and the Solar Kit, ask student to work in pairs to write a paragraph describing the motion. Firstly, brainstorm a list of words/phrases they will need, e.g., *sun, moon*, *earth*, *revolves around*, *rotates,* etc.
4.2 Identify that planets, suns and moons revolve on a central axis.	
4.3 Identify that celestial bodies move in cyclic paths called orbits and that these orbits result from gravitational forces.	Students use plastic cups to trace and compare circular and elliptical orbits. Explore the orbits of comets and asteroids.
4.4 Identify the planets.	NOTE: Pluto is no longer an official planet. This provides a good opportunity to discuss how science is constantly changing. Discuss how scientists test hypotheses and present information based upon their tests but science is always changing when new evidence/data is gathered. Students develop their own mnemonic for memorizing the planets in order or use this suggestion (My Very Energetic Mother Just Served Us Nachos). Discuss techniques that help with study skills, such as mnemonics, sketching, making up a song or rhyme, explaining to a partner, etc.
4.5 Distinguish between the inner and outer planets.	Students read and explain.
4.6 List several constellations and recognize them.	Firstly, ask students if they have ever seen interesting shapes made by the stars. Explore different names for a constellation. Students record the constellations they see over a period of several weeks. Teacher will suggest what to look for, depending on the time of year.
4.7 Define constellation.	Firstly, ask student to try to write their own definition.

Suggested Tasks for Formal Assessment	***Resources***
4.1	Access Text, 76-87 (76-77) Access Text, 294 Longman Text, 128-158 (130)
4.2	Access Text, 78-80
4.3	
4.4	Access Text, 299. Longman Text, 136-139 Suggested Resource: Solar System Poster and Solar System Kit
4.5	Longman Text, 134-138
4.6	Longman Text, 150-151
4.7	Longman Text, 144 and 150-151

Science Literacy Development

Create autonomous learners by:

- Giving students ample time in class to read, analyse, think and produce independently. Give student follow-up tasks that involve independent thinking or discussion with partners.
- Encouraging analytical thinking by posing questions, having students draw on their own understanding or apply what they have learned to problem solving. (e.g., Why do we have day and night? Which planets are we most likely to see with the naked eye? Which planet will likely be coldest? Could humans live on Mercury? Why or why not?).
- Assigning home reading and manageable tasks related to the reading.

Earth and Space Science
Unit 5: Rocks & Rock Cycle

Outcomes	***Suggested Learning/Teaching/Assessing***
5.1 Sketch and label a model of earth's layered interior. Include: • inner core • outer core • mantle • crust	Students build a model of the earth using different coloured playdoh and layer each color to represent the earth's interior.
5.2 Recognize that Earth's crust is broken into plates and movement occurs where plate margins meet (plate tectonics).	Explore diagrams in pairs and discuss.
5.3 Define earthquakes.	Students explore pictures/diagrams and write their own definition before further reading.
5.4 Explain why earthquakes occur using the concept of plate tectonics.	Creative Writing: Imagine you were inside the house on p. 37 of Access Text. Write to a friend, explaining what caused the earthquake, what you did and how you felt.
5.5 Define volcano.	Examine diagrams and come up with a definition.
5.6 Define weathering.	Students should know that weathering is the mechanical or chemical breakdown of rock.
5.7 Identify types of weathering including mechanical and chemical.	Chemical reactions occur with rocks to create new substances ex: acid rock. Students make a journal entry discussing examples of mechanical and chemical weathering they see in their local environment. Use the Observation Journal Transparencies #18.
5.8 Define erosion.	Take a field trip to view results of weathering and erosion and types of rock. Students take notes of observations.
5.9 Differentiate weathering and erosion.	

Suggested Tasks for Formal Assessment	***Resources***
5.1	Longman Text, 99, 103 Access Text, 32
5.2	Access Text, 33-35
5.3	Access Text, 37 Longman Text, 110-112, 118-119
5.4	Access Text, 37
5.5	Access Text, 36 Longman Text, 120-121
5.6	Access Text, 56-57 Longman Text, 110-112, 114-115
5.7	Access Text, 52-54, 56-57 Access Overhead Transparency #18
5.8	Access Text, 52-54, 58 Longman Text. 116-117 http://www.gamequarium.org/cgi-bin/search/linfo.cgi?id=7701
5.9 Sketch a diagram that illustrates the differences between weathering and erosion.	Access Text, 52-58 Longman Text, 114-117

Science Literacy Development

Help students develop strategies for **vocabulary building**.

- Encourage students to figure out the meaning from reading and viewing before confirmation by a teacher, glossary or dictionary.
- Suggest vocabulary building strategies: e.g., students make vocabulary cards, with the word on one side and the definition, sample sentence and/or simple drawing on the other. Cards can be used to quiz partners.
- Develop word attack skills by helping students identify the meanings of some prefixes and suffixes commonly used in science (See Access Text pp 306-309).

Outcomes	***Suggested Learning/Teaching/Assessing***
5.10 Define igneous rock and their formation.	Show students various types of rock (real and pictures) and ask them to surmise how different rocks were formed. Show samples of igneous rock and discuss how crystal size is related to cooling of magma/lava. Granite, basalt and obsidian are common igneous rocks.
5.11 Differentiate between magma and lava.	Students view and read text independently or with a partner to find answers.
5.12 Define sedimentary rock.	Also mention fossils. Demonstrate sedimentation using a large glass jar containing water and sediments of various grain size.
5.13 List and identify examples of sedimentary rocks. Include: • Shale • Sandstone • Conglomerate • Limestone	Teachers should show students samples of rocks. Ask students to find examples and bring to class.
5.14 Define metamorphic rock.	
5.15 Describe the formation of metamorphic rocks.	
5.16 List examples of metamorphic rocks and their parent rock. Include: • slate from shale • marble from limestone • quartzite from sandstone • gneiss from granite	
5.17 Sketch and label a diagram of the rock cycle.	

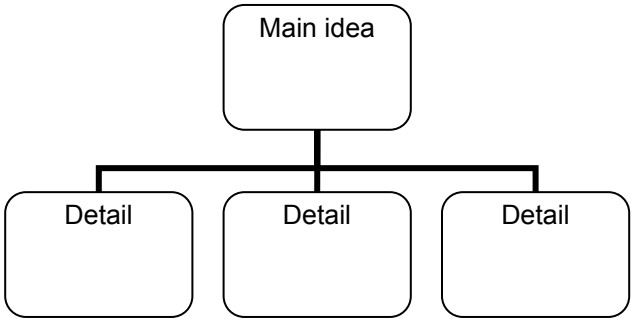
Suggested Tasks for Formal Assessment	***Resources***
5.10 Using the samples of igneous rock the student fills in a table of observations comparing the samples.	Longman Text. 94-108 (104) Access Text. 36 and 44 Suggested Resource: Igneous rock collection http://www.youtube.com/watch?v=Aqy-p41VpKU&feature=related (Rock Song)
5.11	Access Text. 36 and 44
5.12	Longman Text. 105 Access Text. 46
5.13 Using the samples of sedimentary rock the student fills in a table of observations comparing the samples.	Suggested Resource: Sedimentary rock collection
5.14	Longman Text, 106 Access Text ,47
5.15	Access Text, 42 Access Text, 47 Longman Text, 106
5.16 Using the samples of metamorphic rock the student fills in a table of observations comparing the samples.	Access Text, 47 Suggested Resource: Metamorphic rock collection
5.17	Longman Text, 107 Access Text, 48-49

Science Literacy Development

Develop problem solvers by:

- Posing questions and allowing students ample time to find or come up with answers.
- Allowing students to pose questions and find answers.

Earth and Space Science
Unit 6: Water Cycle

Outcomes…	***Suggested Learning/Teaching/Assessing***
6.1 Define water cycle.	Ask students to discuss leading questions with a partner: e.g After *it rains the streets are wet and then they dry; where does the water go? What are clouds? Why is there dew (water droplets on the grass in the early morning?)What kind of weather conditions are best to dry clothes on a clothesline? Why?* Throw a little water on a desk. Spread it out and look again a few minutes. Ask the students where the water went and why?
6.2 Sketch and label a diagram of the water cycle.	Students complete a graphic organizer to tell the steps in the water cycle (See Appendix 2). Students should be able to label a diagram of the water cycle. Students explain the water cycle to a partner, referring to their diagram or graphic organizer.
	Main Idea Mapping*: Each student or pair reads a different section of text and makes a mind map. The mind maps are displayed to share the information:* 

Suggested Tasks for Formal Assessment	***Resources***
6.1	Access Text, 70-71 http://www.youtube.com/watch?v=BayExatv8lE (The Water Cycle Song)
6.2	Access Text, 70-71

Science Literacy Development

Give students ample opportunities to write and represent on topics related to science (notes, reports, questions, display boards, charts, graphs, graphic organizers, etc.).

Life Science
Unit 7: Ecosystems

Outcomes	***Suggested Learning/Teaching/Assessing***
7.1 Define and use terms in context; • ecosystem • producer • individual • consumer • species • decomposer • populations • abiotic • community • biotic	Students try to find the meaning of new vocabulary words through reading in context. Use a Quiz-Trade activity[2] to provide students with an opportunity to practise and use these terms. Students write sentences and or a paragraph to include these words. Draw a web of an ecosystem (Access p. 122)
7.2 Given a diverse group of organisms, classify them as producers, consumers, or decomposers.	Students visit the schoolyard to come up with this list or the teacher provides them with visuals.
7.3 Define food chain.	Chains have four links. Emphasize that the direction of the arrows show the flow of energy from producers to consumers.
7.4 Construct simple food chains using local examples.	See Appendix 11 for local examples.
7.5 Define food web.	
7.6 Construct food webs using organisms from local ecosystems.	Teachers should provide local examples to supplement text. See Appendix 11.
7.7 Illustrate and explain the nutrient cycles.	Emphasize that nutrients are recycled in an ecosystem. Organisms decompose and return to the soil. The specific nutrient cycles need not be addressed (nitrogen, carbon, oxygen, etc.); they are covered in Science 1206. Listen to the song "*Circle of Life*" from the movie *Lion King*. How do the lyrics relate to this topic?
7.8 Describe how humans have influenced the environment. Include: • habitat loss/destruction • harvesting resources • pollution • introduced species	Brainstorming to generate ways that humans affected their environment ex: ATV's in wetland areas, logging, etc.

[2] See next page for a description of Quiz-Trade.

Suggested Tasks for Formal Assessment	***Resources***
7.1	Access Text, 116-117 and 120 Access Word Web overhead transparency # 36
7.2	Appendix 11
7.3	Access Text, 121
7.4	Access Text, 121 Appendix 11
7.5	Access Text, 121
7.6 This could be done in poster format.	Access Text, 121 Appendix 11
7.7	Access Text, 118-119
7.8	

Quiz-Trade Activity

In this review game each student is given a card with a question and answer on it.

- When the teacher says "Quiz, Quiz, Trade!" every student must find a partner and they ask each other their questions.
- Students must answer quickly or say, "I don't know."
- When the teacher calls, "Quiz, Quiz, Trade," again, students quickly exchange cards and find new partners.

To keep it moving quickly, you may make a rule such as, "The shortest person/person whose name is first in alphabetical order, etc. asks first!"

Life Science
Unit 8: Cells, Systems and Reproduction

Outcomes	***Suggested Learning/Teaching/Assessing***
8.1 Define cell.	Students read the text to find the definition.
8.2 i. Use a light microscope to produce a clear image of cells and ii. prepare and observe a wet mount slide	This is an expansion on the introductory microscope work that was done in *Introductory Science Skills Unit.* Use prepared slides and or prepare a wet mount of an onion cell. See Appendix 12 (Preparing an onion cell wet mount). ***It is important to note that students should not harvest live human cells (e.g., cheek scraping).*** Review safety and microscope handling procedures.
8.3 Examine and explain the role of the following organelles: • cell wall • cell membrane • chloroplast • cytoplasm • nucleus • vacuole • mitochondria	Limit treatment of this outcome to the main features of organelles (location, function, and distinguishing features). After the terminology is introduced use a Quiz-Trade activity (See previous page) to provide students with an opportunity to practice and use these terms. Show a video on cells.
8.4 Label organelles on diagrams of typical plant and animal cells.	
8.5 i. Distinguish between typical plant and animal cells by listing three differences between these cells: • plant cells have chloroplasts • plant cells have cell walls, therefore have a regular shape • plant cells have fewer and larger vacuoles ii. Produce labeled drawings of a plant cell and an animal cell.	Brainstorm similarities and differences between a plant and an animal cell. Students create a Venn diagram to compare plant and animal cells.

Suggested Tasks for Formal Assessment	***Resources***
8.1	Access Text, 129-30, 140 http://www.schooltube.com/video/5883521fda9293df5bc9/Bill-Nye-on-Cells
8.2	Appendix 12
8.3 Quiz the terminology used in this outcome. Students should write sentences and or a paragraph to include these terms and indicate understanding.	Access Text, 140 -142 Appendix 13
8.4 Label diagrams of both plant and animal cells.	Access Text, 142 Appendix 13
8.5	Access Text, 142 Appendix 13

Science Literacy Development

Help students explore the textbooks, the layout of chapters and the purpose of the different sections (*Unit Concepts*, *Before Reading*, *Review and Practice*, etc.).

Outcomes	***Suggested Learning/Teaching/Assessing***
8.6 Explain that growth and reproduction depend on cell division.	No need to discuss mitosis and meiosis here.
8.7 Describe the levels of organization found in living things. • cells • tissues • organs • organ systems • organisms	Students view a variety of slides (ex. Cardiac cells-stack of cells form tissues, organ –heart). Discuss various organs that make up the digestive system to show how organs work in unison.
8.8 Identify the main function of the following organ systems in keeping organisms alive. • circulatory • respiratory • digestive • excretory • nervous • muscular	Begin by asking students to think about and guess at the meaning of each word as it relates to the body. Keep it simple and identify main function only. Charts and visuals aid in instruction here.
8.9 Explain the roles that diet, nutrition, exercise and stress have on the systems mentioned above.	Obtain pamphlets from the cancer or lung society or other organizations that provide such information. Guest speakers may also be available from some of these organizations.
8.10 Debate lifestyle choices such as diet, smoking, drinking alcohol or sedentary lifestyle and their effects on body systems.	Discuss local programs available (local community centres such as Buckmaster Circle/ Boys and Girls Club, etc.).
8.11 Carry out an experiment to compare and contrast heart rate and breathing rate in an individual during various levels of activity and identify and control variables.	Compare results before and after walking up the stairs, running, jumping etc.

Suggested Tasks for Formal Assessment	***Resources***
8.6 Explain cell division.	Access Text, 144
8.7 Quiz the terminology used in this outcome.	Access Text, 154-155
8.8 Quiz the terminology used in this outcome.	Access Text, 155
8.9	
8.10 Students use Argument Chart (Overhead #1) or Cause and Effect Organizer (Over head # 3) from overhead transparencies.	Access Overhead Transparency #1 & #3
8.11	See Scientific Method in Introductory Science Skills Unit.

Outcomes	***Suggested Learning/Teaching/Assessing***
8.12 Define: • traits • genes • chromosomes (as being part of numerous genes)	Students should understand how genetic information is passed onto offspring. Be aware that genes and chromosomes are often incorrectly used terms. ANALOGY: train (train would represent the chromosomes while each individual car would represent a gene)
8.13 Distinguish between asexual and sexual reproduction and give an example of each.	<u>Asexual:</u> Fission- algae and protozoa Spore production- molds Budding- yeasts, spider plants, hydra Tubers – potato Bulbs – tulips and daffodils Runners - strawberries, blackberries ad raspberries Cuttings- houseplants

Suggested Tasks for Formal Assessment	***Resources***
8.12	Access Text, 186 and 190
8.13	Access 188 -189

Life Science
Unit 9: Adaptations, Kingdoms, Evolution

<table>
<tr><th>Outcomes</th><th>Suggested Learning/Teaching/Assessing</th></tr>
<tr><td>9.1 Define the terms:

• mammal • herbivore • species
• reptile • carnivore • invertebrate
• amphibian • omnivore • vertebrate</td><td>Begin by brainstorming to contrast traits of two animals that live in different environments. Use a table or Venn Diagram.
Ask student to explain why each trait is helpful.

e.g., Polar Bear (picture Longman p. 86) and Iguana (picture Longman p.84)

<table><tr><th>Iguana</th><th>Polar Bear</th></tr><tr><td>No hair
Small, light
Large eyes
Green</td><td>Thick hair
Big, heavy
Small eyes
White</td></tr></table></td></tr>
<tr><td>9.2 Define adaptations and variations.</td><td>As a practical example, lead a discussion on variations in bacteria and antibiotic resistant bacteria.</td></tr>
<tr><td>9.3 Define evolution.</td><td>Evolution: change in the genetic composition of populations over many generations.</td></tr>
<tr><td></td><td>Jigsaw Reading: Each group is assigned a different, but related, text to read and discuss. Then the members of Group #1 spread out to explain to other groups what they’ve read. Next Group # 2 members spread out and become the teachers, etc. Follow up by asking some students to report what they learned from a classmate. (Ensure students know beforehand that they will have to retell what classmates share with them.)

Alternately, each member of a group reads a different section of the same text. Then each member, in the sequence of the reading, relays the main ideas of his/her section to the other group members. Follow up by quizzing some students on information that they did not read but were informed of. (Ensure students know beforehand that they will have to retell what classmates share with them.)</td></tr>
</table>

Suggested Tasks for Formal Assessment	***Resources***
9.1	Longman Text, 60-90
9.2	Access Text, 196-203
9.3	

Physical Science
Unit 10: States of Matter

<table>
<tr><th>Outcomes</th><th>Suggested Learning/Teaching/Assessing</th></tr>
<tr><td>10.1 Define matter.</td><td></td></tr>
<tr><td>10.2 List the three states of matter.</td><td></td></tr>
<tr><td>10.3 Compare solids, liquids and gases in terms of shape and volume.</td><td>Teachers should review the following characteristics:
<table>
<tr><th>Solids</th><th>Liquids</th><th>Gases</th></tr>
<tr><td>Definite shape</td><td>Varied Shapes</td><td>Varied shapes</td></tr>
<tr><td>Fixed volume</td><td>Fixed volume</td><td>Volume not fixed</td></tr>
</table>
Involve the students in making ice cubes. Ice cube bags could be used to demonstrate the differences between solids and liquids.</td></tr>
</table>

Suggested Tasks for Formal Assessment	***Resources***
10.1	Access Text, 117 and 220
10.2	Access Text, 221 - 225
10.3 Students draw sketches to illustrate the particles in solids, liquids and gases.	Access Text, 225 Longman Text, 182-184

Physical Science
Unit 11: Mass, Volume and Density

Outcomes	***Suggested Learning/Teaching/Assessing***
11.1 Describe the relationship between mass, volume and density using definitions of: • mass • volume • density	Students should be given the opportunity to observe layering of different liquids as a method of comparing densities. In Longman pp. 194-195 there is a lab activity involving observing the densities of various solids and liquids.
11.2 Measure the mass of various objects.	Students will need access to a balance scale.
11.3 Measure the volume of liquids and granular solids.	
11.4 Measure the volume of irregular shaped objects by water displacement.	
11.5 Define balanced and unbalanced forces.	
11.6 Define weight.	
11.7 Define mass.	

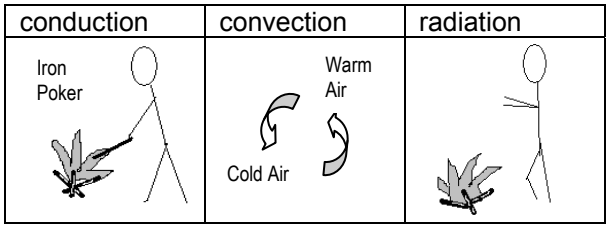
Suggested Tasks for Formal Assessment	***Resources***
11.1 Students complete a lab comparing densities of various liquids.	Longman Text, 194-195 Access Text, 210
11.2	See *Introductory Science Skills Unit.*
11.3	See *Introductory Science Skills Unit.*
11.4	Longman Text, 194-195
11.6	Access Text, 273
11.7	Access Text, 210
11.8	Access Text, 210

Physical Science
Unit 12: Force and Motion

Outcomes	***Suggested Learning/Teaching/Assessing***
12.1 Define force	Brainstorm on the meaning of “force”. Compare class definition to the definition in the text.
12.2 Understand how force (gravity and friction) effect shape and movement.	Students experiment with movement across different surfaces to explore friction (pushing a block across a smooth versus rough surface.) Students experiment with how shapes are affected by gravity (a plastic bag with different objects or air inside, a balloon full of water, etc.) Students view pictures of vehicles and discuss what makes a better design for speed, reduced friction.
12.3 Understand velocity, distance and acceleration.	View and discuss a simple *distance time chart* and corresponding graph. Students create a distance time chart with a partner running, a toy car across a floor, etc. using a stop watch.
12.4 Calculate net force.	Perform simple net force calculation. Brainstorm what forces are acting on students in the classroom. Students create their own net force problems and exchange with a partner.

Suggested Tasks for Formal Assessment	***Resources***
12.1	Access Text, 59, 272-273
12.2	Access Text, 271-273
12.3	Access Text, 274-275 Science 10, 362
12.4	Access Text, 273
12.5	
12.6	

Physical Science
Unit 13: Temperature and Heat

Outcomes	***Suggested Learning/Teaching/Assessing***
13. 1 Define temperature.	Teachers should discuss differences between Fahrenheit and Celsius scales to avoid confusion later when measuring with a lab thermometer in Celsius.
13.2 Relate temperature to everyday experiences. Include: daily temperature changes, cooking temperature, refrigeration temperature, average temperature in different geographic regions and seasons.	Data may be obtained from Environment Canada (www.weather.ec.gc.ca) or The Weather Network (www.theweathernetwork.ca).
13.3 Record the various temperatures of water.	***See Safety Unit before proceeding with this activity. Do not use boiling water in this activity.*** **See *Introductory Science Skills Unit.*** Students measure the temperature (using a lab thermometer) of varying temperatures of water (ice water, room temperature water, hot tap water, snow). Discuss freezing point of water, boiling point of water, normal body temperature and room temperature.
13.4 Explain the changes of state: • Melting • Condensation • Freezing • Sublimation • Boiling	Sublimation involves a change of state from a solid to a gas (or gas to solid). Dry ice and moth balls are examples of substances that change directly from solid to gas when heated.
13. 5 Compare temperature and heat.	Heat is energy that is transferred from hotter substances to colder ones not the other way around as students sometimes think. A cold drink in a warm room becomes warmer because the surrounding warm air warms the drink.
13.6 i. Compare transmission of heat by conduction, convection and radiation. ii. List common examples of the three: (conduction-cookware and ice pack; convection- heating water on a stove, convection air currents and radiation-sunlight, microwaves)	Students draw a pictures to illustrate: e.g., 

<table>
<tr><th>Suggested Tasks for Formal Assessment</th><th>Resources</th></tr>
<tr><td>13.1</td><td>Access Text, 220-227 (222, 226 -227)

The Great Canadian Adventure Series Book 9, Climate, p. 7 (LEARN-2 Social Studies textbook)</td></tr>
<tr><td>13.2 Predict the temperature of various objects then use the internet to find the actual temperatures. Sample table could include:
<table>
<tr><th>Object</th><th>Estimated temperature</th><th>Actual temperature</th></tr>
<tr><td>Human Body</td><td></td><td></td></tr>
<tr><td>Oven to cook a chicken</td><td></td><td></td></tr>
<tr><td>Boiling water</td><td></td><td></td></tr>
<tr><td>Freezing point of water</td><td></td><td></td></tr>
<tr><td>Room temperature</td><td></td><td></td></tr>
<tr><td>Freezer</td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>13.3</td><td></td></tr>
<tr><td>13.4</td><td>Longman Text, 182-187(185), 191
Access Text, 220-227 (226)</td></tr>
<tr><td>13.5</td><td>Access Text, 222</td></tr>
<tr><td>13.6</td><td>Access Text, 265</td></tr>
</table>

Physical Science
Unit 14: Atoms, Elements and Compounds

Outcomes	***Suggested Learning/Teaching/Assessing***
14.1 Define: *matter* and *atom.*	Matter is review from *States of Matter Unit.*
14.2 Define element.	
14.3 Identify and write chemical symbols for common elements (Hydrogen (H), Oxygen (O), etc.) and elements they are familiar with (e.g., gold, silver, iron)	Periodic table should be read from a general perspective (i.e. names, symbols, rows, etc.). See Appendix 14 Bring realia, such as an iron pot, a gold ring, silver earring, a nickel, a copper, a helium balloon, etc. Help students learn symbols for those elements. Draw and label pictures or display labelled realia.
14.4 Identify each element symbol as an upper-case letter or an upper-case followed by a lower case letter (Fe, Ag, etc.)	Examine food labels and identify the mineral content. (e.g., yogurt lists Iron (Fe)Magnesium (Mg), Phosphorus (P) and Sodium (Na).) Students re-write labels to list both words and symbols.
14.5 Identify the periodic table as a listing of known elements.	Play the Periodic Table song from the web. (It's available on a few sites.)
14.6 Distinguish between period and family.	Periods are horizontal rows and families are vertical columns.
14.7 Define atomic number.	Students read *Access* top of page 237 (Protons and Electrons), vocabulary list at bottom and view the diagram. Then, ask one or several students to explain the diagram and why iron has an atomic number of 26.
14.8 Define compound.	
14.9 Identify that a compound is represented by a combination of element symbols. This combination indicates the proportion in which elements are present.	

Suggested Tasks for Formal Assessment	***Resources***
14.1	Access Text, 234 Longman Text, 164-165 See glossary for definition of atom.
14.2	Access Text, 232 – 234, 236 See glossary for definition of element.
14.3	Access Text, 238 – 239
14.4	Access Text, 238 - 239
14.5	Access Text, 238 – 239 Appendix 14
14.6	See glossary for definition of period. See glossary for definition of family.
14.7	Access Text, 238 – 239; 240 -241
14.8	Access Text, 251 See glossary for definition of compound.
14.9	Access Text, 251

Outcomes	***Suggested Learning/Teaching/Assessing***
14. 10 Distinguish between physical and chemical changes.	
14.11 List examples of physical and chemical changes. Include: **Physical**: melting, dissolving, evaporation **Chemical**: corrosion, fruit ripening	
14.12 List evidence that a chemical change may have occurred. Include: heat is produced or absorbed, a new color appears, gas produced, precipitate formed, process difficult to reverse.	Demonstrate changes. Refer to Safety Unit before any demonstration is conducted. Vinegar and baking soda is chemical. Salt dissolved in water is physical.
14.13 List chemical formulas for some common chemical compounds • Salt, NaCl • Carbon Dioxide, CO2 • Water, H2O	
14.14 Complete simple chemical reaction equations.	
14.15 Be aware and provide examples of where chemistry has affected everyday life by development of materials (medicine, clothing, etc.)	

Suggested Tasks for Formal Assessment	***Resources***
14.10	Access Text, 234 http://www.billnye.com/for-kids-teachers/episode-details/ (Chemical Reactions)
14.11	Access Text, 250 Appendix 15
14.12	Appendix 15
14.13	
14.14	Access Text, 248-251 See glossary for definition of chemical reaction.
14.15	

Physical Science
Unit 15: Electricity

Outcomes	***Suggested Learning/Teaching/Assessing***
15.1 Define electric current.	Brainstorm what devices use electricity. Ask student to come up with a definition of electricity.
15.2 Identify the ampere (symbol A) as the SI unit for current.	Incorporate a lesson on electrical safety. Safety issues re household devices, e.g., toasters (not putting knife in), water and electricity, light fixtures, etc.
15.3 Define electric circuit. Include source, load, control and conductor.	Students make an electric circuit using appropriate lab supplies. Refer to Safety Unit before conducting any laboratory activity. Students draw circuit diagrams using the symbols provided in Appendix 16. Students view circuit diagrams from various websites; some sites are interactive such as: http://phet.colorado.edu/simulations/sims.php?sim=Circuit_Construction_Kit_DC_Only Students view a video on Electricity.
15.4 Distinguish between series and parallel circuits.	Using batteries, small bulbs, wire, students make a parallel and series circuit. Mount for display.
15.5 Define electrical power.	
15.6 Identify the Watt (symbol W) as the unit to measure electrical power.	Examine light bulbs, toasters, electric kettle, etc. and find the wattage (W). Draw a table to illustrate the wattage of different devices.
15.7 Read and explain an electric bill.	Students read monthly electric bills.
15.8 Propose a course of action that reduces the consumption of electrical energy (improve insulation, turn off lights, use energy efficient light bulbs, air dry clothes, turn down thermostats).	Students compare monthly electric bills and suggest reasons for differences in kWh used. Consider which appliances use a lot of electricity (heating elements, stove, dryer, etc.)
15.10 Provide examples of careers related to electricity (electrician, photocopier technician, linesman, etc.).	

<table>
<tr><th>Suggested Tasks for Formal Assessment</th><th>Resources</th></tr>
<tr><td>15.1</td><td>Appendix 16
http://www.billnye.com/for-kids-teachers/episode-details/ (Electricity)</td></tr>
<tr><td>15.2</td><td>Appendix 16</td></tr>
<tr><td>15.3</td><td>Appendix 16</td></tr>
<tr><td>15.4</td><td>Appendix 16</td></tr>
<tr><td>15.5</td><td>Appendix 16</td></tr>
<tr><td>15.6 Project: Complete a table showing wattage of 10 household items. Wattage can be found on most appliances.
<table>
<tr><th>Item</th><th>Wattage (W)</th></tr>
<tr><td>Electric kettle</td><td>1500</td></tr>
<tr><td>Light bulb in my bedroom</td><td>60</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table></td><td>Appendix 16</td></tr>
<tr><td>15.7</td><td>Appendix 16</td></tr>
<tr><td>15.8 Write a list of rules for your family to save electricity.</td><td>Appendix 16</td></tr>
<tr><td>15.9</td><td>Appendix 16</td></tr>
<tr><td>15.10</td><td>Appendix 16</td></tr>
</table>

Assessment and Evaluation

Formative assessment is ongoing and is intended to help form or promote student learning. Teachers observe and assess student performance daily and use the information gained to inform further teaching. Teachers assess each student's performance to determine needs as well as give feedback to help the student progress. Formative assessment is student centered and individualized.

Suggested Evaluation

Journal Writing 10%
Projects 30%
Assignments 20 %
*Chapter Tests/Quizzes 20%
**Performance Assessments 20%

*Word banks provided, multiple choice, limited number of short answers requiring full sentences

**Lab Activities, Oral Presentation, Posters, Songs, Poetry, etc.

Recommended Resources

Bill Nye Videos: http://www.billnye.com/for-kids-teachers/episode-guides/

- Climate
- Earth's Seasons
- Electrical Current
- Rocks and Soil
- The Planets
- Atoms
- Cells

References

Echevarria, J., Vogt, M. E., & Short, D. (2004). *Making Content Comprehensible for English Learners: The SIOP Model*. Boston: Allyn and Bacon.

Appendix 1: Learning Strategies

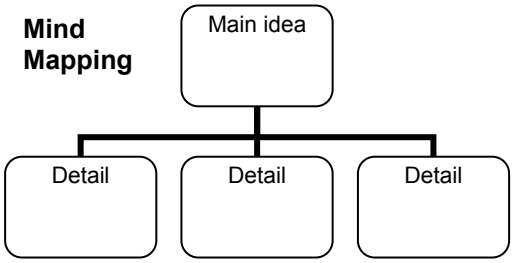
Many of the strategies can be used at all levels of language and literacy learning.	decoding	reading comp.	writing	vocab building	study skills
Pre-reading by scanning a text, examining titles, cover pictures, subtitles, graphics and captions		✓	✓	✓	✓
Pre-reading first sentence of each paragraph, words in bold or other salient features that establish main ideas and flow of the text		✓	✓	✓	✓
Viewing titles and asking yourself what you know about the topic before reading. (KWL chart is helpful)		✓			✓
Guessing unfamiliar words by asking, “What would make sense?”	✓	✓		✓	
Reading on and coming back to difficult words	✓	✓		✓	
Re-reading for self-correction of errors	✓	✓			
Looking at the picture to figure out new words	✓	✓		✓	
Sounding out to read unfamiliar words	✓				
Using print clues (bold words, punctuation, quotation marks, capital letters) to aid comprehension.		✓			
Reading multiple texts which overlap in topic or vocabulary		✓		✓	
Using flashcards and games to build new vocabulary				✓	
Sounding out words for spelling	✓		✓		
Copying individual words from text for spelling. (Use sparingly and wean off except for difficult words, unfamiliar names, etc.)			✓		
Skim a text for specific information		✓			✓
Connect texts to other texts read and/or to personal experience or the world		✓			
Visualizing (Read or listen and picture it in your head.)		✓			✓
Being Independent: Try to figure it out before looking for help	✓	✓		✓	✓
Think aloud to analyze text at the sentence level for vocabulary understanding	✓	✓		✓	
Read-Think-Read: Stop at the end of a sentence or paragraph and summarize or paraphrase it mentally or aloud		✓		✓	✓
Summary writing		✓	✓	✓	✓
Taking brief notes of key points of a text		✓	✓	✓	✓
Creating an outline or graphic organizer before writing			✓		

Many of the strategies can be used at all levels of language and literacy learning.	decoding	reading comp.	writing	vocab building	study skills
Creating graphic organizers of texts while or after reading		✓	✓	✓	✓
Predicting test questions		✓			✓
Making up questions on a text and asking a partner		✓			✓
Deductive grammar analysis (age 10+): Study forms in context and deduce and articulate the grammar rule		✓	✓	✓	
Deductive word analysis: study words in context and deduce the role of prefixes and suffixes		✓	✓	✓	
Breaking words into parts to understand meaning		✓		✓	
Underlining new words, printing them and reviewing them				✓	
Making connections between vocabulary words – linking to cognates in the L1 if possible		✓		✓	
Using glossary, index and table of contents		✓		✓	✓
Viewing a text critically (e.g., questioning author or character statements, actions, motives; forming opinions about text)		✓			
Clearly understanding the purpose of and carefully planning tasks.			✓		✓
Writing a first draft for ideas – then editing for form			✓		
Keeping a diary, journal or reading response journal			✓		
Organizational skills • Organizing learning materials • Prioritizing tasks • Weeding out unnecessary materials • Keeping an agenda • Meeting deadlines (e.g., returning take-home books)					✓

Appendix 2: Samples of Graphic Organizers

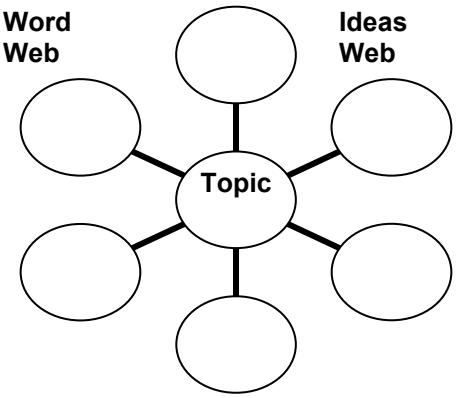
Students should learn to create graphic organizers independently: 1) While reading to organize information, 2) When planning for a writing project or other presentation, 3) When reporting.

Mind Mapping

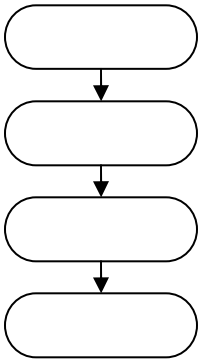


Word Web

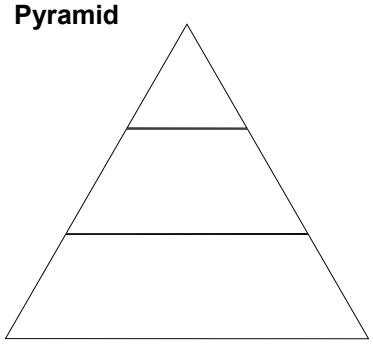
Ideas Web



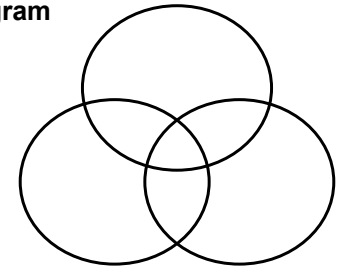
Flow Chart



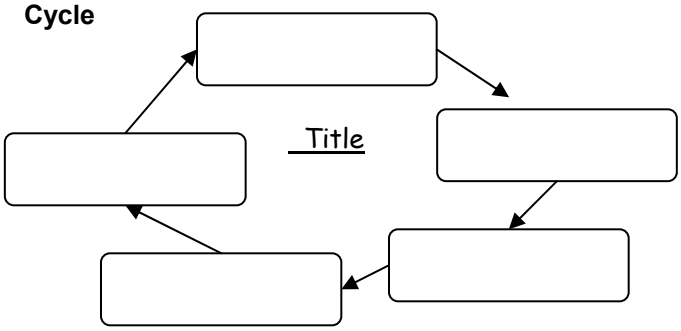
Pyramid



Venn Diagram



Cycle



Appendix 3: Additional Safety Rules

Note: Teachers should refer to Newfoundland and Labrador's School Safety Manual for a detailed explanation of safety rules prior to conducting any lab work.

The following list of safety rules will supplement reading from the Access and Longman texts.

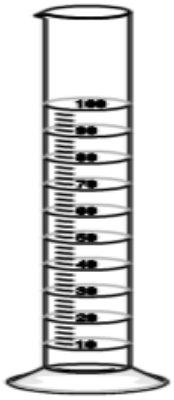
1. Tell your teacher if you have any allergies or medical conditions. These could affect your work in the Science classroom.
2. Know where the nearest fire exit is. Also know where to find the safety blanket, eyewash station, first aid kit and fire alarm.
3. Know how to evacuate the laboratory.
4. Always wear protective clothing such as a lab coat or safety glasses when instructed to do so.
5. Tie back long hair.
6. Do not wear loose or baggy clothing in the laboratory.
7. Do not wear shorts or open toed sandals or shoes in the laboratory.
8. Do not eat, drink or chew gum in the laboratory.
9. Do not taste any substances in the laboratory.
10. When using electrical cords always pull by the plug and not the cord and make sure your hands are dry when handling the cords.
11. Know how to recognize safety labels such as WHMIS symbols (See Appendix 4).
12. Report any sharp or jagged objects to teacher.

13. Broken glass should be disposed of in a broken glass bin as instructed by your teacher.
14. If your body comes in contact with a liquid chemical, wash the area immediately with water.
15. Never smell a substance directly. Hold the container away from your nose and waft fumes.
16. When working with living organisms wash your hands after handing the organisms.
17. Treat all living things with respect and try not to disturb an area unless it is absolutely necessary. Return living things to their natural area when completed work.
18. Clean up any equipment you use.
19. Wash your hands after any work in the laboratory.
20. Dispose of materials as directed by your teacher.

Appendix 4: WHMIS Symbols

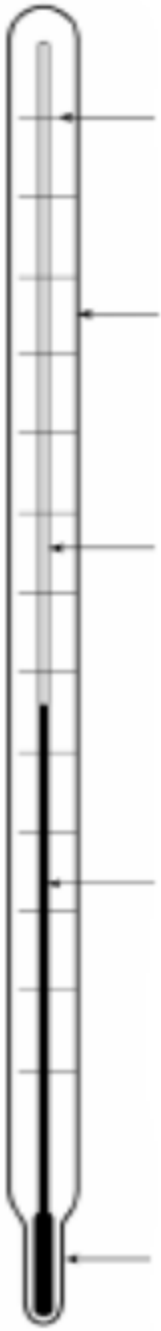
Symbol	Meaning
	Compressed Gas
	Flammable and Combustible Material
	Oxidizing Material
	Poisonous and Infectious Material Causing Immediate and Serious Toxic Effects
	Poisonous and Infectious Material Causing Other Toxic Effects
	Biohazardous Infectious Material
	Corrosive Material
	Dangerously Reactive Material

Appendix 5: Lab Equipment



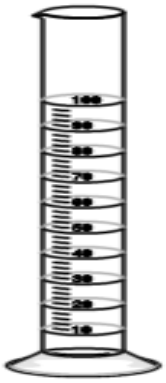
Graduated Cylinder

Beaker



Thermometer

Label the diagrams.



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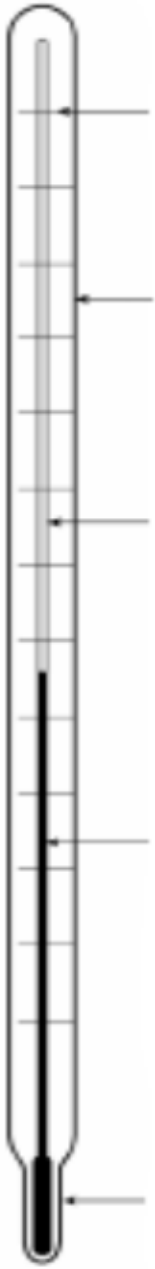

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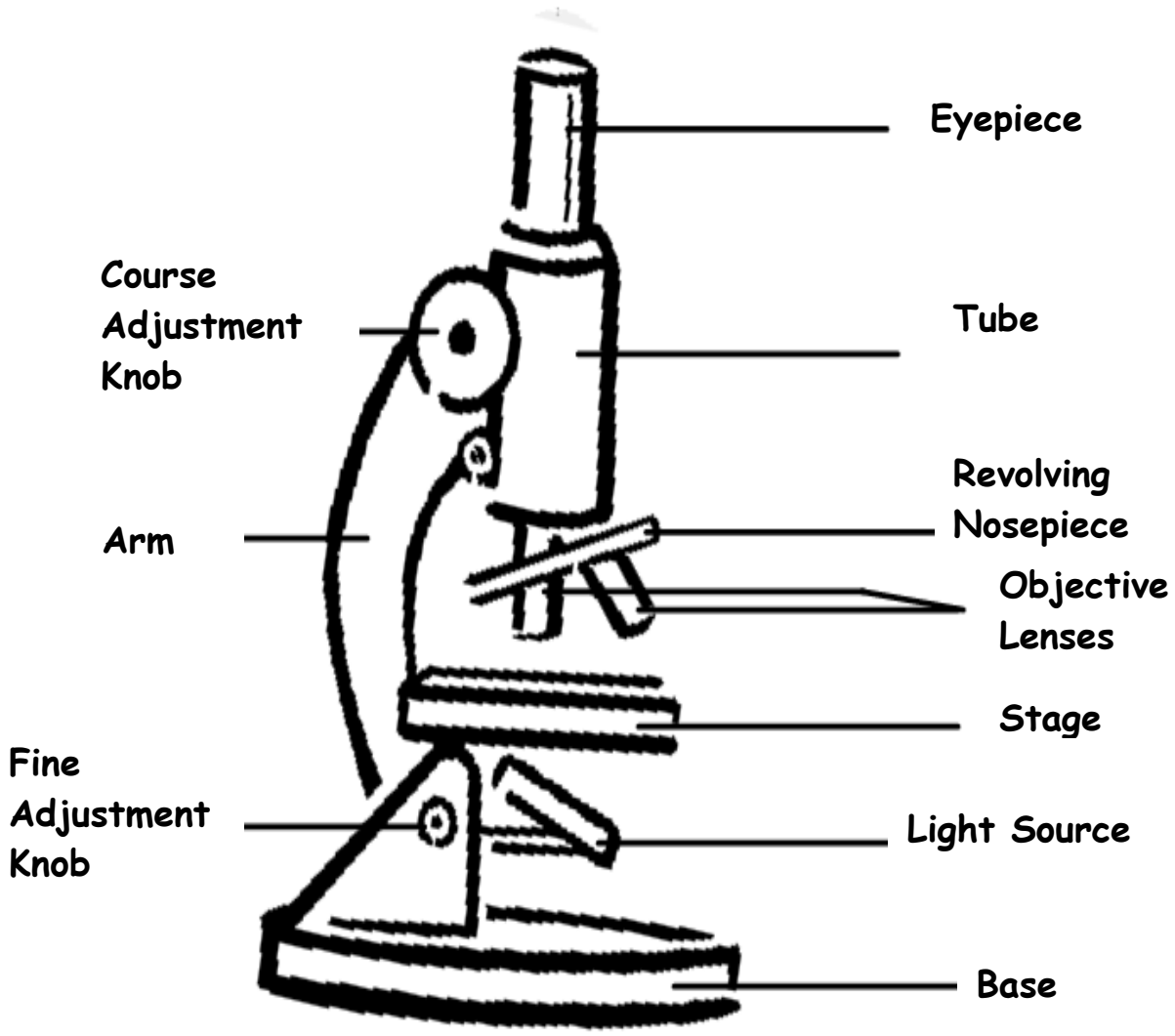
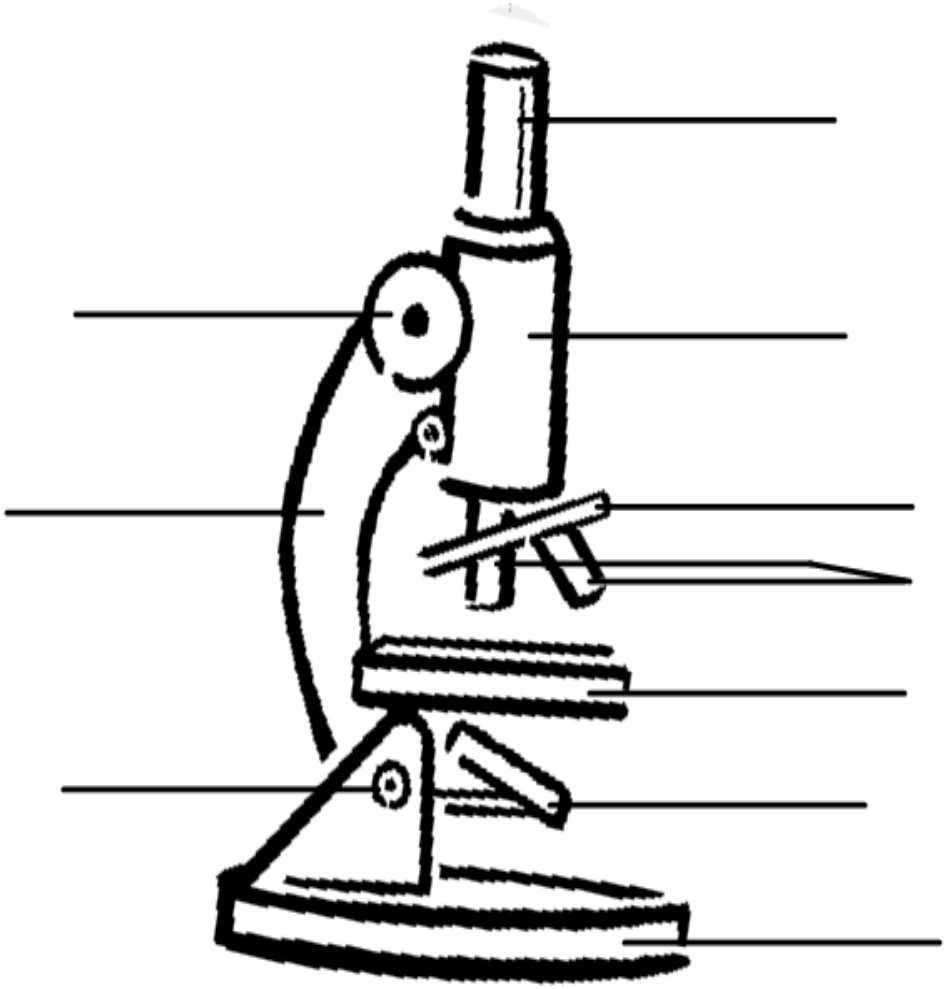
Appendix 6: Microscope



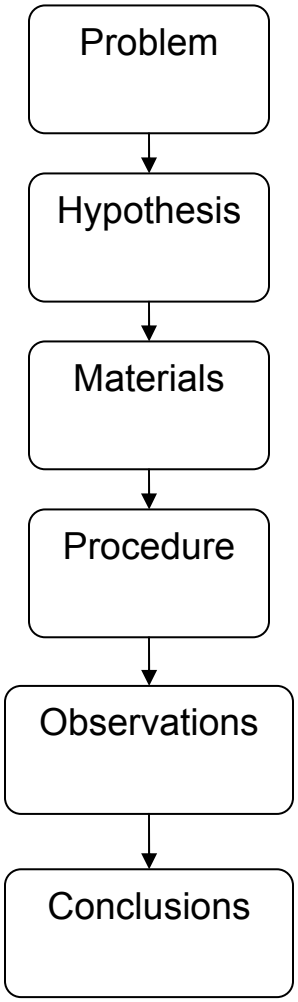
Label the diagram.



Appendix 7: Checklist of Lab Skills

Lab Rule	✓ or ✗	Comment
1. Student wore appropriate safety equipment.		
2. Student handled equipment safely.		
3. Student kept the work area clean and tidy.		
4. Student informed teacher of any problems or accidents.		
5. Student did not eat drink or taste anything.		
6. Student listened to teacher's instruction and observed proper rules for handing the equipment.		
7. Student cleaned the work area and hands when class was over.		

Appendix 8: Scientific Method



Problem

This is the question you are trying to solve by performing a lab activity. A possible question could be: Do bean seeds grow best in wet or dry conditions?

Hypothesis

A hypothesis is an educated guess or a prediction of the outcome of the experiment. If the problem is to find out which environment bean seeds grow the best in then a hypothesis could be general (such as bean seeds grow best under wet conditions) or specific (such as beans seeds grow best in one cup of water versus no water).

Materials

This is lab the equipment necessary to carry out an experiment. It may include a pencil, paper, beaker, microscope, etc.

Procedure

These are the steps necessary to carry out the experiment.

Observations

Observations refer to what we see, hear, smell, taste and touch during an experiment. Observations must be precise and include measuring quantities of a substance then recording these results. Observations are often recorded as data tables, graphs or explanations.

Conclusions

When the experiment is completed and all the observations have been made, a conclusion can be made. A conclusion provides an answer to the problem.

Appendix 9: Variables

Independent (manipulated) variable: the variable that is manipulated or adjusted by the experimenter. For example, when growing bean seeds in different water conditions amount of water would be the independent variable.

Dependent (responding) variables: the variable that is being measured. For example in the above bean seed experiment the height/growth of bean seed would be the dependent variable.

Controlled variables (controls): conditions kept constant during the experiment. For example in the above bean seed experiment the controls would be the amount of light, containers for bean seeds, amount of soil, etc.

Appendix 10: Rubric for Science Labs

Performance Indicators

Level 1: Has not yet met expectations
Level 2: Minimal expectations met
Level 3: All expectations met
Level 4: Goes beyond expectations

Criteria	Level 1	Level 2	Level 3	Level 4
Problem/Hypothesis States problem and hypothesis. Hypothesis clearly leads to an answer to the problem.	Problem is absent or unclear. Hypothesis is absent, not stated in the correct form or not related to the problem.	Problem is stated correctly. Hypothesis is not stated in the correct form or not related to the problem.	Problem is stated correctly. Hypothesis is stated correctly. Hypothesis is related to the problem.	Problem is stated correctly Hypothesis is stated correctly and is very clear and concise. Hypothesis clearly leads to an answer to the problem.
Materials Materials are listed in report.	Materials are not listed.	Material list is incomplete.	Most materials are listed.	All materials are listed.
Procedure Procedure clearly stated in report. Uses correct materials to complete procedure. Follows all steps carefully in an organized manner.	Procedure is not clearly stated. Student does not follow all steps of procedure when performing investigation.	Procedure is stated but some steps are missing. Student follows all steps of procedure when performing investigation.	Procedure is stated. All steps of procedure are followed when performing investigation.	Procedure is clearly stated. All steps of procedure are followed in an organized and careful manner when performing investigation.
Observations Records detailed observations in an organized manner. Makes use of written explanations as well as data tables and graphs (if necessary).	Observations are not stated or unclear.	Observations are stated but are unclear or poorly organized.	Observations are recorded and tables and graphs are used (if necessary).	Observations are very detailed and organized with written explanations and tables and graphs (if necessary).
Conclusions Conclusions are stated in report. Appropriate conclusions are drawn after analysis of data.	Conclusions are not stated.	Conclusions are stated but unclear and unrelated to data.	Reasonable conclusions are stated.	Conclusions are very well stated based upon analysis of data.

Safety Safety is adhered to during investigation. Clean work area. All equipment is retuned and cleaned at the end of the investigation. Materials are disposed of as directed.	Student ignored safety precautions. Work area is messy. Equipment is not put away. Materials are not disposed of appropriately.	Student has to be reminded about safety. Work area is somewhat messy. Equipment is put away but not in the correct place. Materials are disposed of carelessly.	Student follows safety precautions. Work area is clean and tidy. Equipment is put away and materials are disposed of correctly.	Student always considers safety. Work area is tidy at all times. Equipment is cleaned and put in appropriate location. Area is cleaned thoroughly and materials are disposed of correctly.
Lab Report Presentation Lab report is organized, complete and neat. Spelling and grammatical errors are fixed.	Report is incomplete, unorganized and messy. There are spelling and grammatical errors.	Report is complete but unorganized. There are spelling and grammatical errors.	Report is complete and organized. It is neat but has a few spelling and grammatical errors.	Report is complete and well organized. It is neat with no spelling or grammatical errors.

Appendix 11: Local Food Chains and Food Web

Food Chains

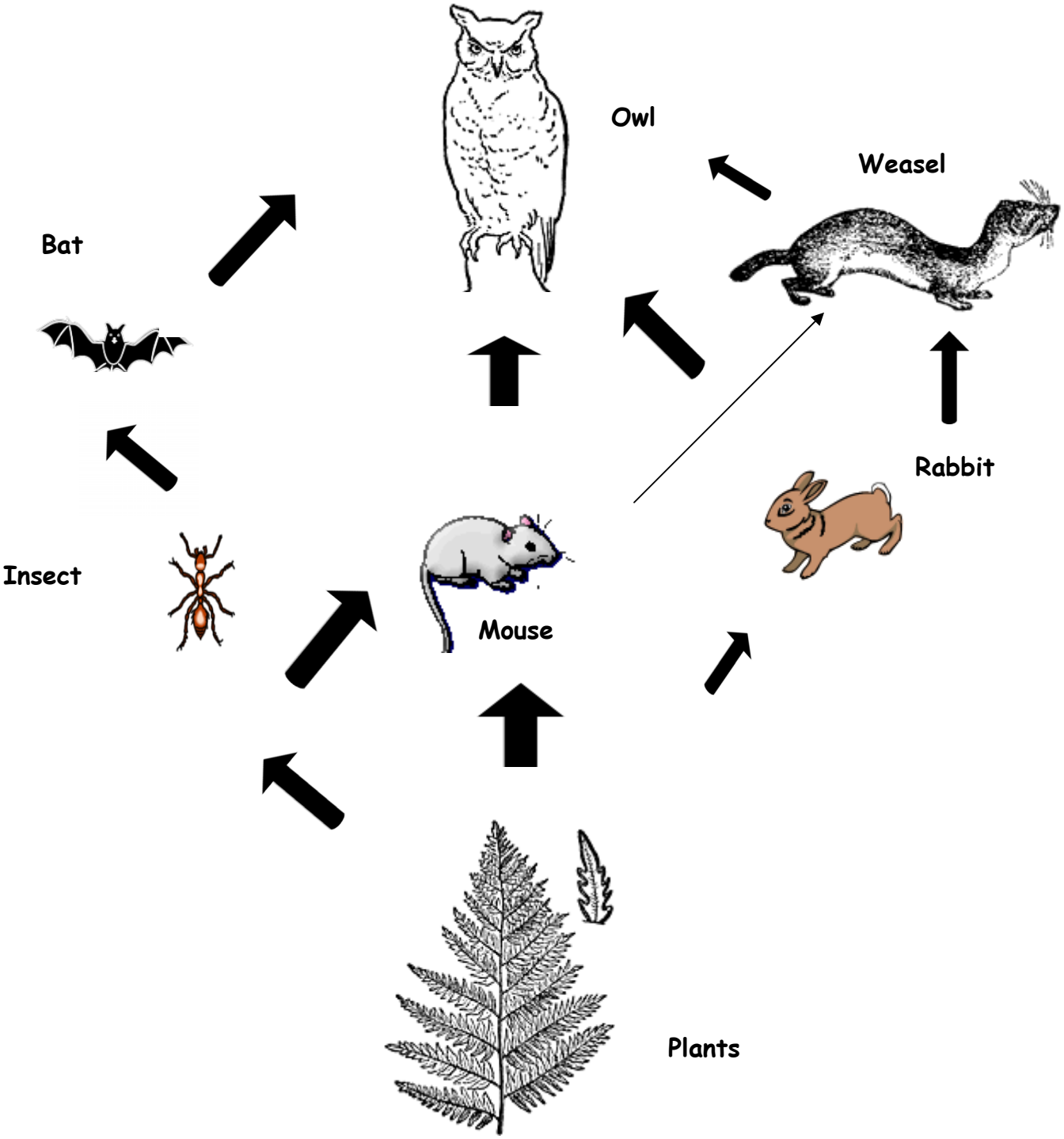
1. Daisy → Ladybug → Grouse → Wolf

2. Carrots → Earwig → Mouse→ Weasel→ Owl

3. Algae → Zooplankton→ Mussels→ Starfish

4. Dandelion → Snowshoe hare→ Great Horned Owl

Food Web



Appendix 12: Preparing an Onion Cell Wet Mount

Safety precautions

Microscope slides and cover slips can break easily so be careful when handling them.

- Be careful with tweezers.
- Wash your hands thoroughly after this activity.
- Wear lab coat and safety goggles.

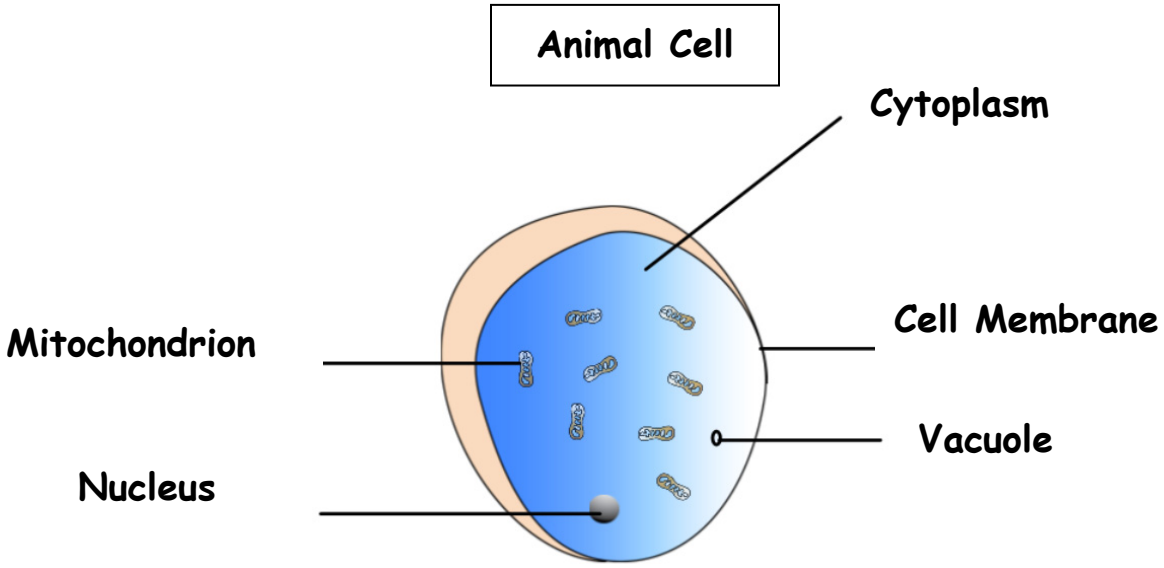
Materials

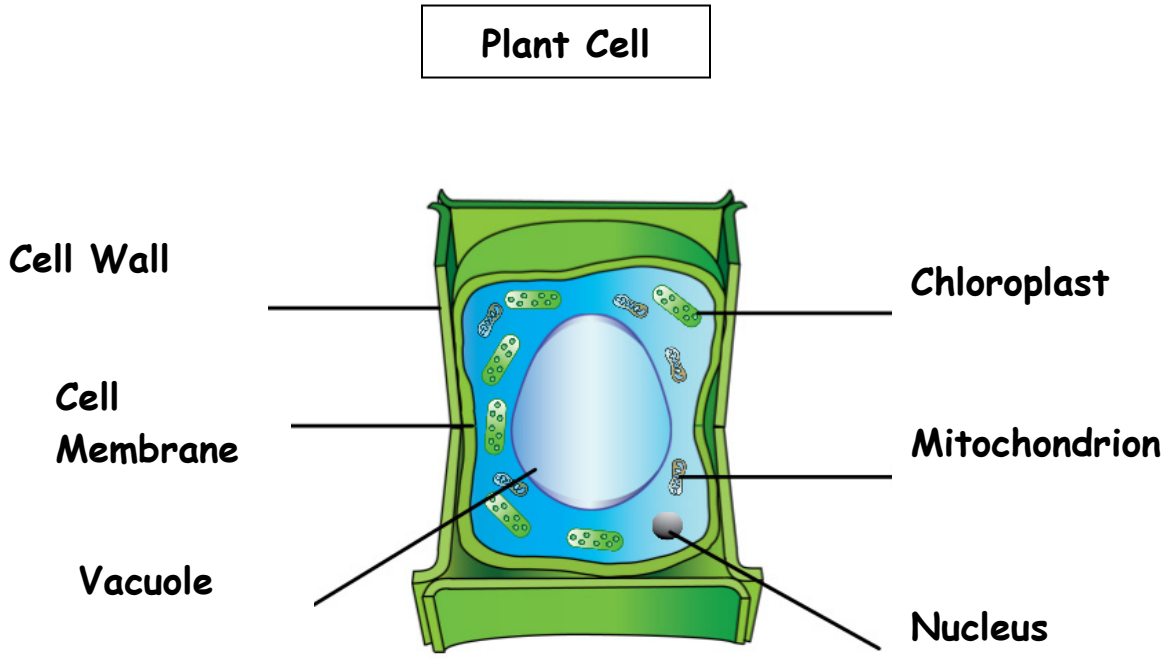
- Microscope
- Microscope slide
- Cover slip
- Tweezers
- Medicine dropper
- Water
- Onion
- Iodine solution
- Paper towel
- Lens or tissue paper

Procedure

1. Place one drop of water on a clean microscope slide.
2. Take a small piece of onion from the outer layer and carefully break it in half. As the two sections separate use tweezers to pull a translucent top layer of the thin onion skin off.
3. Using tweezers lay it carefully on the drop of water on the slide.
4. Carefully lay a cover slip over the drop of water by placing the edge of the cover slip diagonally to the side of the drop of water allowing the water to run along the edge of the cover slip.
5. Lower the other edge of the cover slip until it touches the skin. The water should fill in the space below the cover slip with no air bubbles.
6. Blot the excess water by gently blotting tissue paper along the edge of the cover slip.
7. If you want to see cells structures more clearly, place a drop of iodine solution along the edge of the cover slip using a medicine dropper so that it slowly covers the onion skin. Place a small piece of paper towel on the opposite side to absorb the excess stain.

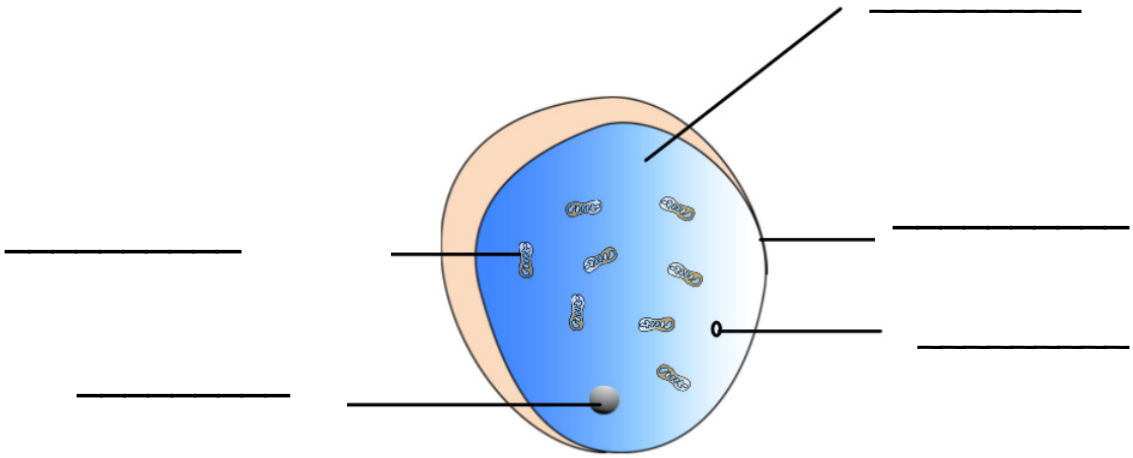
Appendix 13: Plant and Animal Cells



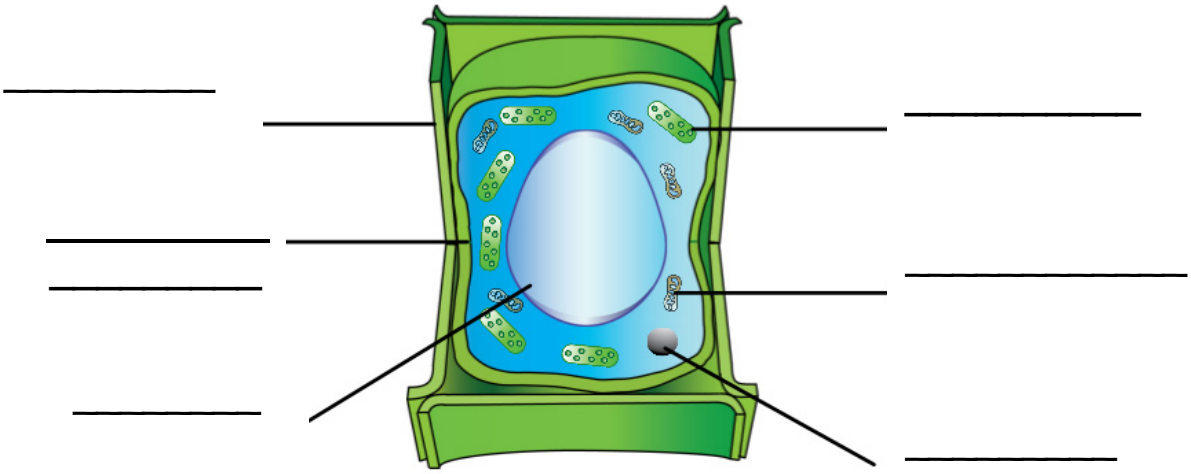


Label the diagrams.

Animal Cell



Plant Cell



Appendix 14: Periodic Table

Periodic Table of Elements

H 1																	He 2
Li 3	Be 4											B 5	C 6	N 7	O 8	F 9	Ne 10
Na 11	Mg 12											Al 13	Si 14	P 15	S 16	Cl 17	Ar 18
K 19	Ca 20	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30	Ga 31	Ge 32	As 33	Se 34	Br 35	Kr 36
Rb 37	Sr 38	Y 39	Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48	In 49	Sn 50	Sb 51	Te 52	I 53	Xe 54
Cs 55	Ba 56	La 57	Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80	Tl 81	Pb 82	Bi 83	Po 84	At 85	Rn 86
Fr 87	Ra 88	Ac 89	Rf 104	Ha 105	?? 106												
Lanthinide Series		Ce 58	Pr 59	Nd 60	Pm 61	Sm 62	Eu 63	Gd 64	Tb 65	Dy 66	Ho 67	Er 68	Tm 69	Yb 70	Lu 71		
Actinide Series		Th 90	Pa 91	U 92	Np 93	Pu 94	Am 95	Cm 96	Bk 97	Cf 98	Es 99	Fm 100	Md 101	No 102	Lr 103		

Elements Listed by Atomic Number

Number, Name and Symbol

1	Hydrogen	H
2	Helium	He
3	Lithium	Li
4	Beryllium	Be
5	Boron	B
6	Carbon	C
7	Nitrogen	N
8	Oxygen	O
9	Fluorine	F
10	Neon	Ne
11	Sodium	Na
12	Magnesium	Mg
13	Aluminum	Al
14	Silicon	Si
15	Phosphorus	P
16	Sulfur	S
17	Chlorine	Cl
18	Argon	Ar
19	Potassium	K
20	Calcium	Ca
21	Scandium	Sc
22	Titanium	Ti
23	Vanadium	V
24	Chromium	Cr
25	Manganese	Mn
26	Iron	Fe
27	Cobalt	Co
28	Nickel	Ni
29	Copper	Cu
30	Zinc	Zn
31	Gallium	Ga
32	Germanium	Ge
33	Arsenic	As
34	Selenium	Se
35	Bromine	Br
36	Krypton	Kr
37	Rubidium	Rb
38	Strontium	Sr
39	Yttrium	Y
40	Zirconium	Zr
41	Niobium	Nb
42	Molybdenum	Mo
43	Technetium	Tc
44	Ruthenium	Ru
45	Rhodium	Rh
46	Palladium	Pd
47	Silver	Ag
48	Cadmium	Cd
49	Indium	In
50	Tin	Sn
51	Antimony	Sb
52	Tellurium	Te
53	Iodine	I
54	Xenon	Xe
55	Cesium	Cs
56	Barium	Ba
57	Lanthanum	La
58	Cerium	Ce
59	Praseodymium	Pr
60	Neodymium	Nd
61	Promethium	Pm
62	Samarium	Sm
63	Europium	Eu
64	Gadolinium	Gd
65	Terbium	Tb
66	Dysprosium	Dy
67	Holmium	Ho
68	Erbium	Er
69	Thulium	Tm
70	Ytterbium	Yb
71	Lutetium	Lu
72	Hafnium	Hf
73	Tantalum	Ta
74	Wolfram	W
75	Rhenium	Re
76	Osmium	Os
77	Iridium	Ir
78	Platinum	Pt
79	Gold	Au
80	Mercury	Hg
81	Thallium	Tl
82	Lead	Pb
83	Bismuth	Bi
84	Polonium	Po
85	Astatine	At
86	Radon	Rn
87	Francium	Fr
88	Radium	Ra
89	Actinium	Ac
90	Thorium	Th
91	Protactinium	Pa
92	Uranium	U
93	Neptunium	Np
94	Plutonium	Pu
95	Americium	Am
96	Curium	Cm
97	Berkelium	Bk
98	Californium	Cf
99	Einsteinium	Es
100	Fermium	Fm
101	Mendelevium	Md
102	Nobelium	No
103	Lawrencium	Lr
104	??	Rf
105	??	Ha

Appendix 15: Physical and Chemical Changes

Physical Changes	**Chemical Changes**
Cutting paper	Burning a Match
Chopping Wood	Rusting
Dissolving Salt in Water	Baking a Cake
Melting an Ice Cube	Fireworks Going Off
Boiling Water	Baking Soda Bubbling in Vinegar

Practice:

Identify each of the following as either a physical or chemical change.

Question	Physical or Chemical
1. Rusting of a nail	
2. Grinding up sea salt	
3. Burning a candle	
4. Tearing clothes	

Appendix 16: Electricity Resource



WHAT IS ELECTRICITY?

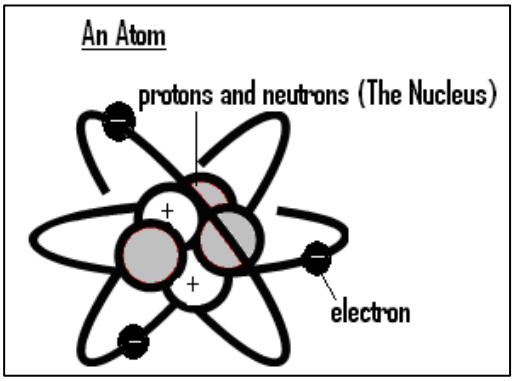
Electricity is a form of energy.

Electricity is a basic part of nature and it is one of our most widely used forms of energy. We get electricity, which is a secondary energy source, from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called primary sources.

Many cities and towns were built alongside waterfalls (a primary source of mechanical energy) that turned water wheels to perform work. Before electricity generation began over 100 years ago, houses were lit with kerosene lamps, food was cooled in iceboxes, and rooms were warmed by wood-burning or coal-burning stoves.

In the mid-1800s, everyone's life changed with the invention of the electric light bulb.

Electricity

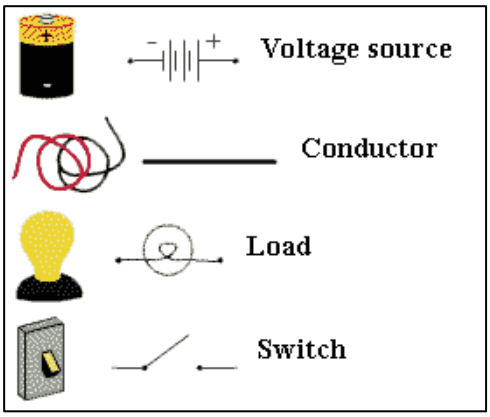


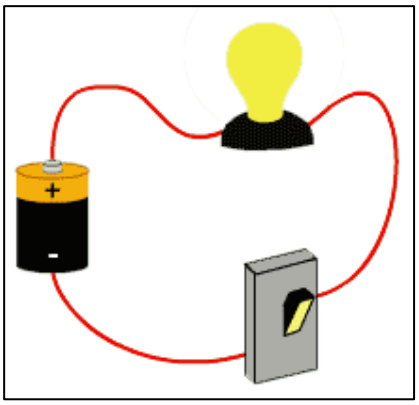
Electricity is a form of energy involving the flow of electrons.

All matter is made up of atoms, and an atom has a center, called a nucleus. The nucleus contains positively charged particles called protons and uncharged particles called neutrons. The nucleus of an atom is surrounded by negatively charged particles called electrons.

The negative charge of an electron is equal to the positive charge of a proton, and the number of electrons in an atom is usually equal to the number of protons.

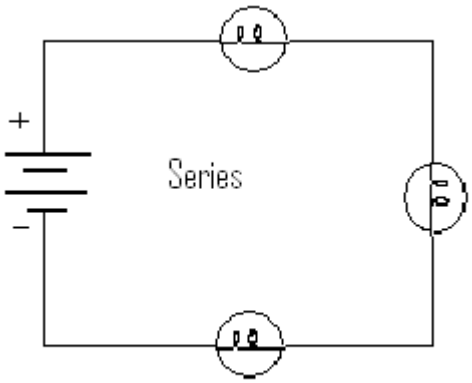
When the balancing force between protons and electrons is upset by an outside force, an atom may gain or lose an electron. When electrons are "lost" from an atom, the free movement of these electrons constitutes an **electric current** (flow of electricity).

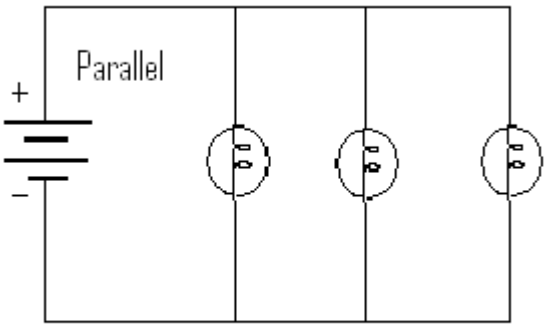




Electricity flows through an **electric circuit.** A circuit includes a **source**, **load, conductor** and **control.** The source provides the voltage (ex: battery) and the load receives the energy (ex: light bulb). The conductor carries the electricity through the electric circuit (ex: wire). The control can shut the circuit on and off (ex: switch).

Circuits can be series or parallel. A **series circuit** follows one path through a number of loads. A **parallel circuit** follows two or more paths. Parallel circuits are used in our homes. Parallel circuits are used because if one of the loads (ex: electrical appliance or light bulb) shuts down the electricity can still flow to the other loads and they will continue to work.





HOW IS ELECTRICITY MEASURED?

Amperes (amps) (A) are used to measure electric current. The more electrons flowing, the higher the amps.

Electricity is measured in units of power called **watts**. One watt is a very small amount of power. It would require nearly 750 watts to equal one horsepower.

A kilowatt represents 1,000 watts. A kilowatt-hour (kWh) is equal to the energy of 1,000 watts working for one hour. The amount of electricity a power plant generates or a customer uses over a period of time is measured in kilowatt hours (kWh).

If you use a 40-watt light bulb 5 hours a day, you use 200 watts of power, or .2 kilowatt hours of electrical energy.

Adapted from About.com, retrieved online August 26, 2009 at
http://inventors.about.com/library/inventors/blelectric1.htm

Appendix 17: Suggested Website

Bill Nye The Science Guy (Various Topics)	http://www.billnye.com/for-kids-teachers/episode-guides/
Solar System	http://topdocumentaryfilms.com/cell/
Ecosystems/Food Chains	http://www.geography4kids.com/files/land_foodchain.html
Kingdoms of Life: Bacteria	http://wn.com/Bacteria_in_the_human_body
Kingdoms of Life: Protists	http://www.youtube.com/watch?v=-zsdYOgTbOk&feature=related
Path of a Red Blood Cell	http://www.5min.com/Video/Path-of-a-Red-Blood-Cell-1354219
The Cell	http://topdocumentaryfilms.com/cell/
Cell Division (embryo)	http://www.pbs.org/wgbh/nova/miracle/program.html
Cell Division (Mitosis)	http://www.youtube.com/watch?v=m73i1Zk8EA0&feature=related