

# References and Resources

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### **Science Toolkit Masters**

BLM G-3 Analyzing Issues–Science, Technology, Society, and the Environment

BLM G-4 Scientific Inquiry Organizer

BLM G-5 Technological Problem Solving Organizer

BLM G-6 Technology Innovation Worksheet

BLM G-7 Variables in Science

BLM G-8 Making Observations and Inferences

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BLM G-10 Parts of a Microscope

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- BLM G-37 Summarizing
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## **Reference Masters (to support Student textbook activities)**

- BLM G-51 Activity 2.8 Shapes
- BLM G-52 Activity 2.12 Cards
- BLM G-53 Reaction Type Cards
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- BLM G-55 Reflection Obstacle Course

# Correlation to the Ontario Grade 10 Applied Science Curriculum

## Science Links 10 to Science, Grade 10 Applied (SNC2P)

Note: The curriculum expectations are fundamental to the McGraw-Hill Ryerson *Science Links 10* program. Following are some points in the textbook where the curriculum expectations are addressed. This is not an exhaustive list.

Curriculum Expectation	Student Textbook Reference
<b>A. Scientific Investigation Skills and Career Exploration</b>	
<b>A1. Scientific Investigation Skills</b>	
<b>A1.1</b> formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research	Topic 1.1 Why are cells important? pp. 8-19 Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37 Topic 1.3 How do cells work together in the human body? pp. 38-55 Topic 1.4 How do systems work together in the human body? pp. 56-75 Topic 3.1 What is climate, and how has it changed during Earth's history? pp. 192-201 Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229 Topic 4.1 What is light and how is it produced? pp. 276-285 Topic 4.6 What are lenses and what are some of their properties? pp. 344-355
<b>A1.2</b> select appropriate instruments (e.g., a microscope, laboratory glassware, an optical bench) and materials (e.g., prepared slides, an aquarium, lenses, acid-base indicators) for particular inquiries	Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37 Topic 1.3 How do cells work together in the human body? pp. 38-55 Topic 2.4 What are acids and bases, and how do they react? pp. 158-175 Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229 Topic 4.6 What are lenses and what are some of their properties? pp. 344-355
<b>A1.3</b> identify and locate print, electronic, and human sources that are relevant to research questions	Topic 1.1 Why are cells important? pp. 8-19 Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37 Topic 1.3 How do cells work together in the human body? pp. 38-55 Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93 Topic 2.4 What are acids and bases, and how do they react? pp. 158-175 Topic 3.5 How can we assess present climate change and reduce our impact? pp. 242-261
<b>A1.4</b> apply knowledge and understanding of safe practices and procedures when planning investigations (e.g., appropriate techniques for handling, storing, and disposing of laboratory materials [following the Workplace Hazardous Materials Information System-WHMIS]; safe operation of optical equipment; safe handling and disposal of biological materials), with the aid of appropriate support materials (e.g., the Reference Manual on the WHMIS website; the Live Safe! Work Smart! website)	Topic 1.3 How do cells work together in the human body? pp. 38-55 Topic 1.4 How do systems work together in the human body? pp. 56-75 Topic 2.1 How do chemical reactions affect your daily life? pp. 110-117 Topic 2.4 What are acids and bases, and how do they react? pp. 158-175 Topic 3.2 Where are the effects of climate change felt and what is their impact? pp. 201-211 Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229 Topic 4.5 What is refraction and how can it be used? pp. 332-343

<p><b>A1.5</b> conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data</p>	<p>Topic 1.1 Why are cells important? pp. 8-19          Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37          Topic 2.4 What are acids and bases, and how do they react? pp. 158-175          Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229          Topic 4.2 How does light interact with objects to give them colour? pp. 286-293          Topic 4.3 How can you mix colours to make different colours? pp. 294-303          Topic 4.4 What is the law of reflection and how do mirrors form images? pp. 304-331          Topic 4.5 What is refraction and how can it be used? pp. 332-343</p>
<p><b>A1.6</b> gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams</p>	<p>Topic 1.1 Why are cells important? pp. 8-19          Topic 1.3 How do cells work together in the human body? pp. 38-55          Topic 1.4 How do systems work together in the human body? pp. 56-75          Topic 2.4 What are acids and bases, and how do they react? pp. 158-175          Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229          Topic 4.2 How does light interact with objects to give them colour? pp. 286-293          Topic 4.4 What is the law of reflection and how do mirrors form images? pp. 304-331</p>
<p><b>A1.7</b> select, organize, and record relevant information on research topics from various sources, including electronic, print, and/or human sources (e.g., a website for a public health organization, federal and provincial government publications, reference books, personal interviews), using recommended formats and an accepted form of academic documentation</p>	<p>Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93          Topic 2.4 What are acids and bases, and how do they react? pp. 158-175          Topic 3.4 How do human activities affect the natural greenhouse effect? pp. 230-241          Topic 4.3 How can you mix colours to make different colours? pp. 294-303          Topic 4.4 What is the law of reflection and how do mirrors form images? pp. 304-331          Topic 4.6 What are lenses and what are some of their properties? pp. 344-355</p>
<p><b>A1.8</b> analyse and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty</p>	<p>Topic 2.3 What happens during a chemical reaction, and how can it be described? pp. 140-157          Topic 2.4 What are acids and bases, and how do they react? pp. 158-175          Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229          Topic 4.1 What is light and how is it produced? pp. 276-285          Topic 4.2 How does light interact with objects to give them colour? pp. 286-293          Topic 4.3 How can you mix colours to make different colours? pp. 294-303          Topic 4.4 What is the law of reflection and how do mirrors form images? pp. 304-331          Topic 4.5 What is refraction and how can it be used? pp. 332-343</p>
<p><b>A1.9</b> analyse the information gathered from research sources for reliability and bias</p>	<p>Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93          Topic 3.5 How can we assess present climate change and reduce our impact? pp. 242-261</p>

<p><b>A1.10</b> draw conclusions based on inquiry results and research findings, and justify their conclusions</p>	<p>Topic 1.1 Why are cells important? pp. 8-19          Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37          Topic 1.3 How do cells work together in the human body? pp. 38-55          Topic 1.4 How do systems work together in the human body? pp. 56-75          Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93          Topic 2.3 What happens during a chemical reaction, and how can it be described? pp. 140-157          Topic 3.5 How can we assess present climate change and reduce our impact? pp. 242-261          Topic 4.3 How can you mix colours to make different colours? pp. 294-303          Topic 4.4 What is the law of reflection and how do mirrors form images? pp. 304-331</p>
<p><b>A1.11</b> communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)</p>	<p>Topic 1.1 Why are cells important? pp. 8-19          Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37          Topic 1.3 How do cells work together in the human body? pp. 38-55          Topic 1.4 How do systems work together in the human body? pp. 56-75          Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93          Topic 3.2 Where are the effects of climate change felt and what is their impact? pp. 202-211          Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229          Topic 3.4 How do human activities affect the natural greenhouse effect? pp. 230-241          Topic 3.5 How can we assess present climate change and reduce our impact? pp. 242-261          Topic 4.1 What is light and how is it produced? pp. 276-285          Topic 4.5 What is refraction and how can it be used? pp. 332-343          Topic 4.6 What are lenses and what are some of their properties? pp. 344-355</p>
<p><b>A1.12</b> use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurement (e.g., SI and imperial units)</p>	<p>Topic 1.1 Why are cells important? pp. 8-19          Topic 1.4 How do systems work together in the human body? pp. 56-75          Topic 3.5 How can we assess present climate change and reduce our impact? pp. 242-261          Topic 4.2 How does light interact with objects to give them colour? pp. 286-293          Topic 4.6 What are lenses and what are some of their properties? pp. 344-355</p>
<p><b>A1.13</b> express the results of any calculations involving data accurately and precisely</p>	<p>Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37          Topic 1.3 How do cells work together in the human body? pp. 38-55</p>
<p><b>A2. Career Exploration</b></p>	
<p><b>A2.1</b> identify and describe a variety of careers related to the fields of science under study (e.g., veterinarian assistant, quality control technician, conservation officer, sound and light technician) and the education and training necessary for these careers.</p>	<p>Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93          Topic 2.4 What are acids and bases, and how do they react? pp. 158-175</p>

A2.2 identify scientists, including Canadians (e.g., Maude Abbott, Paul Kebarle, Reginald Fessenden, James Hillier), who have made a contribution to the fields of science under study	Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93
<b>B. Biology: Tissues, Organs, and Systems</b>	
<b>B1. Relating Science to Technology, Society, and the Environment</b>	
B1.1 analyse, on the basis of research, medical imaging technologies (e.g., ultrasound, X-rays, computerized axial tomography [CT or CAT] scan, magnetic resonance imaging [MRI], microscopy, biophotonics) used in Canada to explore, diagnose, or treat the human body, and communicate their findings	Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93
B1.2 evaluate the effects that use of or exposure to a technology, substance, or environmental factor (e.g., cellphones, X-rays, UV radiation, personal audio players, cigarette smoke, pesticides, food additives/preservatives, vitamins, gene therapy) may have on the function of human tissues, organs, or systems	Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93
<b>B2. Developing Skills of Investigation and Communication</b>	
B2.1 use appropriate terminology related to human cells, tissues, organs, and systems, including, but not limited to: <i>absorption, anaphase, capillaries, concentration, differentiation, diffusion, interphase, metaphase, osmosis, prophase, red blood cells, regeneration, and telophase</i>	Topic 1.1 Why are cells important? pp. 8-19 Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37 Topic 1.3 How do cells work together in the human body? pp. 38-55 Topic 1.4 How do systems work together in the human body? pp. 56-75 Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93
B2.2 examine cells under a microscope or similar instrument to identify the various stages of mitosis in animals	Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37
B2.3 investigate, using a microscope or similar instrument, cell specialization in the human body, focusing on different types of human cells (e.g., muscle cells, epithelial cells, nerve cells), and draw labelled biological diagrams of each type of cell	Topic 1.3 How do cells work together in the human body? pp. 38-55
B2.4 compare, on the basis of observation (e.g., using pictures, videos, or images), the division of cancerous cells and non-cancerous cells, and describe the impact of cancerous cells on the human body	Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37
B2.5 locate, through a laboratory or computer simulated dissection, the organs of a specific system of an animal (e.g., a worm, a frog, a fish), and describe their interrelationship	Topic 1.4 How do systems work together in the human body? pp. 56-75
B2.6 use scientific investigation skills to research health problems related to tissues, organs, or systems in humans (e.g., asthma, sickle-cell anemia, heart disease, Crohn's disease), and communicate their findings	Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37 Topic 1.5 How do technology, substances, and environmental factors affect human health? pp. 76-93

### B3. Understanding Basic Concepts

**B3.1** describe the cell cycle in animals, and explain its importance for the growth of cells and repair of tissues

Topic 1.2 Why do animal cells divide and what happens when they do? pp. 20-37

**B3.2** describe the structure, function, and importance of specialized cells and tissues in multi-cellular organisms (e.g., neurons have many branching dendrites and long axons to receive and transmit messages; muscle cells have a higher concentration of mitochondria, which produce energy)

Topic 1.3 How do cells work together in the human body? pp. 38-55

**B3.3** explain cell organization by describing the link between cells, tissues, organs, and systems in the human body

Topic 1.3 How do cells work together in the human body? pp. 38-55  
Topic 1.4 How do systems work together in the human body? pp. 56-75

**B3.4** explain the general function of some of the systems in the human body (e.g., the function of the circulatory system is to transport materials through the body; the function of the digestive system is to absorb nutrients; the function of the respiratory system is to bring oxygen into and remove carbon dioxide from the body)

Topic 1.3 How do cells work together in the human body? pp. 38-55  
Topic 1.4 How do systems work together in the human body? pp. 56-75

**B3.5** describe the interaction of systems in the human body (e.g., the respiratory system brings oxygen into the body, and the circulatory system transports the oxygen to cells), and explain why these interactions are necessary for survival

Topic 1.4 How do systems work together in the human body? pp. 56-75

### C. Chemistry: Atoms, Elements, and Compounds

#### C1. Relating Science to Technology, Society, and the Environment

**C1.1** analyse, on the basis of research, the function of chemical reactions in the production of selected products and/or in processes commonly encountered at home or in the workplace (e.g., carbonation of soft drinks; rust proofing), and communicate their findings

Topic 2.2 How can we understand, describe, and name chemical compounds? pp. 118-139  
Topic 2.4 What are acids and bases, and how do they react? pp. 158-175

**C1.2** identify practical applications of chemical reactions in a particular profession (e.g., ceramics, cosmetology, firefighting, heating and cooling system technology, food preparation, plumbing, custodial services), and assess the associated hazards, including hazards associated with the handling and disposal of chemicals

Topic 2.3 What happens during a chemical reaction, and how can it be described? pp. 140-157  
Topic 2.4 What are acids and bases, and how do they react? pp. 158-175

#### C2. Developing Skills of Investigation and Communication

**C2.1** use appropriate terminology related to chemical reactions, including, but not limited to: *antacid, dilute, neutralization, product, reactant, and word equation*

Topic 2.1 How do chemical reactions affect your daily life? pp. 110-117  
Topic 2.3 What happens during a chemical reaction, and how can it be described? pp. 140-157  
Topic 2.4 What are acids and bases, and how do they react? pp. 158-175

**C2.2** construct molecular models of simple chemical reactions (e.g.,  $C + O_2 \rightarrow CO_2$ ;  $2H_2 + O_2 \rightarrow 2H_2O$ ), and produce diagrams of these models

Topic 2.2 How can we understand, describe, and name chemical compounds? pp. 118-139  
Topic 2.3 What happens during a chemical reaction, and how can it be described? pp. 140-157

C2.3 conduct and observe inquiries related to simple chemical reactions, including synthesis, decomposition, and displacement reactions, and represent them using a variety of formats (e.g., word equations, balanced chemical equations, molecular models)	Topic 2.3 What happens during a chemical reaction, and how can it be described? pp. 140-157
C2.4 use an inquiry process to investigate the law of conservation of mass in a chemical reaction (e.g., compare the values before and after the reaction), and account for any discrepancies	Topic 2.3 What happens during a chemical reaction, and how can it be described? pp. 140-157
C2.5 use an inquiry process to investigate acid- base neutralization reactions (e.g., neutralize a dilute solution of sodium hydroxide with dilute hydrochloric acid and extract the sodium chloride produced)	Topic 2.4 What are acids and bases, and how do they react? pp. 158-175
C2.6 conduct an inquiry to classify some common substances as acidic, basic, or neutral (e.g., use acid-base indicators or pH strips to classify common household substances)	Topic 2.4 What are acids and bases, and how do they react? pp. 158-175
C2.7 investigate applications of acid-base reactions in common products and processes (e.g., compare the effectiveness of different brands of antacid tablets, using quantitative analysis)	Topic 2.4 What are acids and bases, and how do they react? pp. 158-175
<b>C3. Understanding Basic Concepts</b>	
C3.1 describe the relationships between chemical formulae, composition, and names of simple compounds (e.g., carbon dioxide, CO <sub>2</sub> , has one more oxygen atom than carbon monoxide, CO)	Topic 2.2 How can we understand, describe, and name chemical compounds? pp. 118-139
C3.2 name and write the formulae for simple ionic and molecular compounds (e.g., NaCl, NaOH, H <sub>2</sub> O, CO <sub>2</sub> )	Topic 2.2 How can we understand, describe, and name chemical compounds? pp. 118-139
C3.3 write word equations and balanced chemical equations for simple chemical reactions (e.g., 2H <sub>2</sub> + O <sub>2</sub> → 2H <sub>2</sub> O)	Topic 2.3 What happens during a chemical reaction, and how can it be described? pp. 140-157 Topic 2.4 What are acids and bases, and how do they react? pp. 158-175
C3.4 describe the process of neutralization for simple acid-base reactions (i.e., an acid reacts with a base to form a salt and often water)	Topic 2.4 What are acids and bases, and how do they react? pp. 158-175
C3.5 describe how the pH scale is used to identify the concentration of acids and bases	Topic 2.4 What are acids and bases, and how do they react? pp. 158-175
<b>D. Earth and Space Science: Earth's Dynamic Climate</b>	
<b>D1. Relating Science to Technology, Society, and the Environment</b>	
D1.1 analyse, on the basis of research, various ways in which living things and natural systems have been affected by climate change (e.g., the effect of loss of permafrost on northern roads and housing; the effect of longer growing seasons in some regions on farmers; the effect of warming oceans on coral reefs), and communicate their findings [IP, PR, AI, C]	Topic 3.2 Where are the effects of climate change felt and what is their impact? pp. 202-211



D1.2 analyse ways in which human actions (e.g., burning fossil fuels, implementing tree-planting programs) have increased or decreased the production of greenhouse gases	Topic 3.4 How do human activities affect the natural greenhouse effect? pp. 230-241
<b>D2. Developing Skills of Investigation and Communication</b>	
D2.1 use appropriate terminology related to Earth's dynamic climate, including, but not limited to: <i>anthropogenic, atmosphere, carbon footprint, carbon sink, climate, greenhouse gases, hydrosphere, and weather</i>	Topic 3.1 What is climate, and how has it changed during Earth's history? pp. 192-201 Topic 3.2 Where are the effects of climate change felt and what is their impact? pp. 202-211 Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229
D2.2 investigate the principles of the natural greenhouse effect, using simulations, diagrams, and/or models, and compare these principles to those of an actual greenhouse	Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229
D2.3 use a research process to investigate a source of greenhouse gases (e.g., decaying garbage, animal digestive processes, burning biomass) and its effect on a region of Canada (e.g., melting of the polar ice cap in the Arctic, shrinking of glaciers in the Rockies)	Topic 3.4 How do human activities affect the natural greenhouse effect? pp. 230-241
D2.4 conduct an inquiry to determine how different factors (e.g., an increase in surface temperature, an increase in water temperature) affect global warming and climate change	Topic 3.4 How do human activities affect the natural greenhouse effect? pp. 230-241
D2.5 investigate their personal carbon footprint, using a computer simulation or numerical data (e.g., determine carbon emissions that result from their travelling to school, work, and recreation venues; from vacation travelling; from buying products imported from distant countries), and plan a course of action to reduce their footprint (e.g., a plan to increase their use of bicycles or public transit; to eat more local foods)	Topic 3.5 How can we assess present climate change and reduce our impact? pp. 242-261
D2.6 compare different tools or systems used by scientists to make informed decisions on global climate change (e.g., Ecoregions of Canada, bioclimate profiles)	Topic 3.2 Where are the effects of climate change felt and what is their impact? pp. 202-211 Topic 3.5 How can we assess present climate change and reduce our impact? pp. 242-261
D2.7 compare different perspectives and/or biases evident in discussions of climate change in scientific and non-scientific media (e.g., with reference to knowledge, beliefs, and/or values)	Topic 3.5 How can we assess present climate change and reduce our impact? pp. 242-261
<b>D3. Understanding Basic Concepts</b>	
D3.1 describe the principal components of Earth's climate system (e.g., the sun, oceans, and the atmosphere; the topography and configuration of land masses)	Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229

D3.2 describe the natural greenhouse effect, its importance for life, and the difference between it and the anthropogenic greenhouse effect	Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229
D3.3 describe how heat is transferred and stored in both hydrospheric and atmospheric heat sinks	Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229
D3.4 identify different greenhouse gases (e.g., carbon dioxide, methane, water vapour, nitrous oxide), and explain how they are produced naturally in the environment	Topic 3.3 What natural factors affect climate, and how do they affect it? pp. 212-229
D3.5 describe methods by which greenhouse gases are produced by humans (e.g., burning of biomass, chemical reactions involving pollutants)	Topic 3.4 How do human activities affect the natural greenhouse effect? pp. 230-241
D3.6 identify the natural and human causes of climate change in the world and, in particular, how Canada contributes to climate change	Topic 3.4 How do human activities affect the natural greenhouse effect? pp. 230-241
D3.7 identify indicators of global climate change (e.g., changes in: the mass of glacial and polar ice, sea levels, wind patterns, global carbon budget assessments, migratory patterns of birds)	Topic 3.1 What is climate, and how has it changed during Earth's history? pp. 192-201 Topic 3.2 Where are the effects of climate change felt and what is their impact? pp. 202-211
<b>E. Physics: Light and Applications of Optics</b>	
<b>E1. Relating Science to Technology, Society, and the Environment</b>	
E1.1 analyse how additive and/or subtractive colour theory are applied in technologies used in everyday life (e.g., stop lights, high-definition television, colour monitors, coloured spotlights)	Topic 4.3 How can you mix colours to make different colours? pp. 294-303
E1.2 describe the role of selected optical technologies in the transmission of information, and analyse their impact on society (e.g., cellphones, optical fibre cables, satellite dishes)	Topic 4.6 What are lenses and what are some of their properties? pp. 344-355
<b>E2. Developing Skills of Investigation and Communication</b>	
E2.1 use appropriate terminology related to light and optics, including, but not limited to: <i>angle of incidence, angle of reflection, angle of refraction, centre of curvature, focal length, luminescence, magnification, principal axis, radius of curvature, and vertex</i>	Topic 4.1 What is light and how is it produced? pp. 276-285 Topic 4.2 How does light interact with objects to give them colour? pp. 286-293 Topic 4.3 How can you mix colours to make different colours? pp. 294-303 Topic 4.4 What is the law of reflection and how do mirrors form images? pp. 304-331 Topic 4.5 What is refraction and how can it be used? pp. 332-343 Topic 4.6 What are lenses and what are some of their properties? pp. 344-355
E2.2 use an inquiry process to investigate the laws of reflection; use these laws to explain the characteristics of images formed by plane, converging (concave), and diverging (convex) mirrors; and draw ray diagrams to illustrate their observations	Topic 4.4 What is the law of reflection and how do mirrors form images? pp. 304-331

E2.3 use an inquiry process to investigate the refraction of light as it passes through a variety of media (e.g., the angles of incidence and refraction as light passes through a clear acrylic block)	Topic 4.5 What is refraction and how can it be used? pp. 332-343
E2.4 predict the qualitative characteristics of images (e.g., location, orientation, size, type) formed by converging lenses, test their predictions through inquiry, and draw ray diagrams to record their observations	Topic 4.6 What are lenses and what are some of their properties? pp. 344-355
E2.5 investigate how various objects or media (e.g., opaque, translucent, and transparent materials; black-and-white surfaces) reflect, transmit, or absorb light, and record their observations using ray diagrams	Topic 4.2 How does light interact with objects to give them colour? pp. 286-293
E2.6 predict the effect of shining a coloured light on objects of different colours, and test their predictions through inquiry	Topic 4.2 How does light interact with objects to give them colour? pp. 286-293
E2.7 construct an optical device (e.g., a funhouse mirror, a device that produces an optical illusion, a solar oven) that uses a variety of mirrors	Topic 4.6 What are lenses and what are some of their properties? pp. 344-355
<b>E3. Understanding Basic Concepts</b>	
E3.1 describe various types of light emissions (e.g., chemiluminescence, bioluminescence, incandescence, electric discharge) and how they produce light	Topic 4.1 What is light and how is it produced? pp. 276-285
E3.2 identify and label the visible and invisible regions of the electromagnetic spectrum, and identify the colours that make up visible white light	Topic 4.1 What is light and how is it produced? pp. 276-285
E3.3 explain the laws of reflection of light, and identify ways in which light reflects from various types of mirrors (e.g., plane, converging, diverging)	Topic 4.4 What is the law of reflection and how do mirrors form images? pp. 304-331
E3.4 describe qualitatively how visible light is refracted at the interface between two different media	Topic 4.5 What is refraction and how can it be used? pp. 332-343
E3.5 use additive colour theory to predict the results of combining primary and secondary light colours	Topic 4.3 How can you mix colours to make different colours? pp. 294-303
E3.6 use subtractive colour theory to describe the effect of colour filters on white light	Topic 4.3 How can you mix colours to make different colours? pp. 294-303
E3.7 explain how the colour of an object is determined by reflection, absorption, and transmission of colour	Topic 4.2 How does light interact with objects to give them colour? pp. 286-293 Topic 4.3 How can you mix colours to make different colours? pp. 294-303
E3.8 explain how the properties of light or colour are applied in the operation of an optical device (e.g., a reflecting telescope, stop lights, stage lights)	Topic 4.6 What are lenses and what are some of their properties? pp. 344-355

# Suggested Course Materials Summary

The following chart lists the items you may wish to use for a class of 30 using the Science Links 10 program. The activities can be carried out by pairs or small groups of students, unless the instructions clearly specify that students should work on their own. Suppliers of science lab materials and equipment are listed in the suppliers' section of this Teacher' Resource.

Item Description	Suggested Quantity	Needed for These Units
<b>NON-CONSUMABLE</b>		
aquariums	8	3
balance	2	2
balls of various sizes	12	1
beaker, 50 mL	15	2
beakers, 250 mL	60	2
beakers, 500 mL	30	3
bells (small, light)	15	4
boxes	4	1
boxes from decks of cards	15	1
bright lamp	15	4
bright shiny objects (red, blue, white)	15 of each colour	4
bucket	1	4
bulbs, 100 W, incandescent	15	3
Bunsen burners	8	2, 3
buttons, pennies, or poker chips	500	2
calculators	30	1
cell models or diagrams	5	1
clamps	16	3
coins	15	4
colour transparencies (cyan, magenta, yellow)	30 of each colour	4
conductivity testers	15	2
containers with lids	24	3
cup, plastic, 500 mL	15	1
cups, opaque	15	4
dissection pins, trays, scissors, forceps, probe, scalpel	15 sets	1
droppers and dropper bottles	15	2, 3
Erlenmeyer flask, 200 mL	30	2, 3
Erlenmeyer flask stoppers	15	2

film canisters	12	1
filters (red, blue, green)	15 of each colour	4
flashlight	15	3, 4
flashlight with intense, narrow beam	1	4
funnels	15	3
goggles	30	1, 2, 3
graduated cylinder	30	1, 2
hand lenses	15	3
heart monitor, electronic	1	1
heat lamps	16	3
Hoffman apparatus	1	2
hot plate	15	2
jars with lids	15	2
lab apron	30	1, 2, 3
lens holders	15	4
lenses, converging	30 of one focal length, 15 of each of two other different focal lengths	4
lenses, diverging	30	4
current magazines and newspapers with articles about climate change	3-4	3
magnifying glass	15	1
map of the world, large	1	3
medicine droppers	45	2, 4
medicine dropper bottles	15	2
metre sticks	15	4
microscopes	15	1
mirrors, concave	30	4
mirrors, convex	30	4
mirrors, plane	30	4
mirror stands for plane mirrors	15	4
molecular model kits	15	2
pH meter (optional)	15	2
pipette, long	15	1
plastic trays	16	3
plastic tubs	15	1

prepared slides of human skin, bone, blood, nerve, and muscle cells	15 of each	1
prepared slides of whitefish embryo cells	15	1
prism, triangular	15	4
prisms, rectangular, plastic or glass	15	4
prisms, semicircular, glass	15	4
protractors	30	3, 4
push pins	15	4
ray box with single slits	15	4
retort stands	16	3
rope	30 m	4
rulers	30	3, 4
scale	4	3
scissors	15	2, 4
scissors, round tipped	15	1
scoops	15	2
scoopulas	15	2
spark lighter	1	2
spoon	15	2
spoons, large, shiny	30	4
sports equipment (balls, skipping ropes, etc.)	at least 15	1
spot plates with 10 wells	15	2
stirring rods	15	2
stoppers, one-holed	30	3
stopwatches	15	1
string in small balls	15	1
tank, transparent (aquarium or storage box)	15	4
tennis balls	15	1
test tube clamp	1	2
test tube racks	15	2
test tubes, small	15	2
test tubes	30	2, 3
test tubes, Pyrex™	8	3
thermometers	30	3
thumbtack	1	4

timers	15	3
tongs	8	2, 3
trays, large, flat	8	3
tree cross sections	15	3
tubing, plastic	15 m	1
tweezers	15	2
utility knives	15	4
watch or stopwatch	15	1
X rays (real)	5	1
<b>CONSUMABLE</b>		
aluminium metal	10 cm <sup>2</sup>	2
aluminum foil	1 roll	4
antacids (Tums®, Roloids®, Alka-Seltzer®, and generic)	50 mL of each	2
baking soda	500 mL	2
balloons, round and transparent	15	2
balloons, large	45	1
balloons, small	60	1
barium hydroxide solution	100 mL	2
bottles, clear plastic, 1 L	20	3, 4
bromothymol blue indicator	100 mL	2
cabbage, red	1	2
calcium carbonate	50 mL	2
calcium chloride	100 mL	2
calcium oxide	50 mL	2
candles, identical	46	4
candle holder	1	2
cardboard	30 pieces	4
cardboard boxes (cubed shaped)	30	1
cardboard tubes	120	4
cardboard tubing (4 cm–8 cm diameter, 25 cm long)	20	4
cardboard, white	15 pieces	4
chart paper	1 pad	2
chicken bones, cleaned and dried	15	2
coffee creamer	100 ml	3

cola	2 L	3
coloured pencils (red, blue, green, cyan, magenta, yellow, and other colours)	30 of each colour	1, 2, 4
copper (II) chloride solution	100 mL	2
craft materials (e.g., paper, cards, rulers, erasers, stencils, pipe cleaners, yarn, wide and narrow ribbon, string, paper, straws)	variety	1
effervescent powder	200 mL	3
eggs	24	3
elastic bands, large	60	1
elastic bands, small	80	1
Epsom salts	250 mL	2
flexible foam	2 m <sup>2</sup>	1
food colouring (blue and red)	1 bottle of each	1, 3
frogs, preserved	10	1
fruit juices	250 mL of each kind	2
gloves	60	1
glue	1 bottle	1
graph paper	100 sheets	1, 3
graph paper, large	15 sheets	3
household cleanser	250 mL	2
hydrochloric acid	750 mL dilute	2
iron (III) nitrate solution	500 mL	2
isopropyl alcohol	150 mL	2
knee high nylon stockings	15	1
liquid soap	1 bottle	1
litmus paper (red and blue)	1 sheet each colour	2
magnesium ribbon	20 cm	2
marker, waterproof	8	3
markers	15	2
matches	50	2, 4
modelling clay	2 kg	1
newspaper	15 pages	4
paper cups, small, disposable	75	2
paper towel rolls	12	1
paper towels	200 sheets	1, 2



pencils, china	8	3
pH paper	200 small pieces	2
pH paper, universal	30 small pieces	3
pipette filter	15	1
plastic wrap	1 roll	1, 4
plastic, black (or garbage bags)	16 bags or equivalent	3
silver nitrate solution	25 mL	2
sodium hydroxide	1 L	2
soft drinks, clear	15 cans of one kind, plus 250 mL of another one or two kinds	2
splints	60	2
steel wool	1 box	2
stickers of many colours	1 package of each colour	3
stir sticks	8	3
straws, plastic	30	1
sugar	250 mL	2
tape, sticky	4 rolls	1, 4
masking tape	5 rolls	3, 4
toothpicks	5 boxes	2
vegetable oil	5 L	2, 3
vinegar	10 L	2, 3
washing soda	250 mL	2
water, distilled	10 L	2
wax paper, translucent	1 roll	4
wire, electrical	5 m	1
zinc	15 pea-sized pieces	2
zinc nitrate solution	100 mL	2
zinc strips	4	2

# Activity and Investigation Planner

Activity/ Investigation/Project	Advance Preparation and Alternative Materials	Apparatus/Materials (per group or per student)	Time Required
<b>Unit 1 Tissues, Organs, and Systems</b>			
<b>Topic 1.1 Why are cells important?</b>			
Starting Point activity	- collect cell models and/ or diagrams (optional)	cell models or diagrams (optional)	<ul style="list-style-type: none"> <li>• 25 min in class</li> <li>• 5 min preparation</li> </ul>
Activity 1.1 Why Study Cells?	- collect articles (optional)	short articles about recent medical discoveries (optional)	<ul style="list-style-type: none"> <li>• 20 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 1.2 Organelles on Strike			<ul style="list-style-type: none"> <li>• 25 min in class</li> </ul>
Activity 1.3 Organelle Bingo	- ask students to bring cardboard and other materials they may need from home	chart paper (optional) materials to construct games	<ul style="list-style-type: none"> <li>• 15 min in class</li> <li>• 5 min preparation</li> </ul>
Activity 1.4 Diffusion in Action	- gather materials	25 mL graduated cylinder warm tap water 1 long pipette 1 pipette filter 1 mL undiluted blue or red food colouring watch or stopwatch graph paper	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 15 min preparation</li> </ul>
<b>Topic 1.2 Why do cells divide and what happens when they do?</b>			
Starting Point Activity		pictures of organisms that can regenerate body parts (optional)	<ul style="list-style-type: none"> <li>• 20 min in class</li> </ul>
Activity 1.5 Cell Number Crunch	- gather boxes	calculators (approximately) cube shaped cardboard boxes of different sizes	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 15 min preparation</li> </ul>
Activity 1.6 Modelling the Coiling and Condensing of DNA	- gather materials	box from a deck of cards ball of string pictures of coiled and condensed DNA (optional)	<ul style="list-style-type: none"> <li>• 15 min in class</li> <li>• 5 min preparation</li> </ul>
Activity 1.7 How is DNA replication like a game of "Telephone"?			<ul style="list-style-type: none"> <li>• 20 min in class</li> </ul>
Activity 1.8 Cell Cycle Mnemonics			<ul style="list-style-type: none"> <li>• 20 min in class</li> </ul>
Activity 1.9 Comparing Cells	- gather drawings - photocopy BLM	labelled drawings of normal and cancerous cells (optional) <b>BLM G-39</b> (optional)	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 10 min preparation</li> </ul>

Investigation 1A Observing the Cell Cycle in Animals	- set up demonstration microscopes - photocopy BLMs - gather or create pictures	microscopes prepared slides of whitefish embryo cells prepared slides of human skin cells (optional) enlarged pictures of each stage of the cell cycle in whitefish embryo cells (optional) <b>BLM G-10, BLM 1-15, BLM 1-16</b> (optional)	<ul style="list-style-type: none"> <li>• 60 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 1.10 How Many Times Have You Shed Your Skin?	- photocopy BLM	calculators <b>BLM 1-17</b> (optional)	<ul style="list-style-type: none"> <li>• 20 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 1.11 Cells Cycling Out of Control	- gather pictures - book computer lab	Internet access pictures of normal cells, mutated cells, and cancerous cells (optional)	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 1.12 Elephants and Cells Run Amok	- photocopy BLMs	<b>BLM G-39 to BLM G-49</b> (optional)	<ul style="list-style-type: none"> <li>• 15 min in class</li> </ul>
<b>Topic 1.3 How do cells work together in the human body?</b>			
Starting Point Activity			<ul style="list-style-type: none"> <li>• 10 min in class</li> </ul>
Activity 1.13 Model Specialized Cells	- gather materials	coloured pencils craft materials (e.g., paper, cards, rulers, erasers, stencils, pipe cleaners, modelling clay, elastic bands, yarn, plastic wrap)	<ul style="list-style-type: none"> <li>• 60 min in class</li> <li>• 20 min preparation</li> </ul>
Activity 1.14 Different Cells, Different Jobs, Different You!			<ul style="list-style-type: none"> <li>• 30 min in class</li> </ul>
Activity 1.15 Tissue Models	- gather materials	1 elastic band 1 piece of plastic wrap 1 piece of electrical wire modelling clay other materials as required	<ul style="list-style-type: none"> <li>• 15 min in class</li> <li>• 5 min preparation</li> </ul>
Activity 1.16 Thinking About Changes to Organs			<ul style="list-style-type: none"> <li>• 60 min in class</li> </ul>
Activity 1.17 The Beat that Goes On and On	- gather stopwatches	stopwatches	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 5 min preparation</li> </ul>
Investigation 1B Viewing Specialized Human Cells	- gather slides and familiarize yourself with them	microscopes prepared slides of human skin, bone, blood, nerve, and muscle cells	<ul style="list-style-type: none"> <li>• 45 min in class</li> <li>• 10 min preparation</li> </ul>

**Topic 1.4 How do systems work together in the human body?**

Starting Point Activity	- photocopy BLMs	<b>BLM 1-27</b> (optional)	• 30 min in class
Activity 1.18 Catching the Wave	- gather materials - instead of a plastic tub, students could work over a sink	1 tennis ball liquid soap 1 knee high nylon stocking 1 plastic tub (optional)	• 20 min in class • 15 min preparation
Activity 1.19 Which Organ Systems Work Together			• 15 min in class
Activity 1.20 How do You Breathe?	- gather materials as a class kit or as group kits - consider building a model of each stage as a reference for students	1 large and 2 small balloons 2 plastic straws 1 large and 2 small elastic bands modelling clay 500 mL plastic cup	• 45 min in class • 15 min preparation
Activity 1.21 A Tube with Twists	- gather materials - Students may be able to bring some supplies from home.	art materials (e.g., wide and narrow ribbon or string, paper, balloons, modelling clay, straws) round tipped scissors, tape, glue	• 60 min in class • 10 min preparation
Investigation 1C The Effect of Exercise on Breathing Rate and Heart Rate	- gather sports equipment, photocopy BLMs	sports equipment graph paper electronic heart monitor (optional) <b>BLM 1-32, BLM 1-33, BLM G-34, BLM G-35</b> (optional)	• 60 min in class • 15 min preparation
Investigation 1D Frog Dissection	- gather materials photocopy BLMs	preserved frog dissection pins, tray, and scissors forceps, probe, scalpel magnifying glass gloves, goggles, and lab apron paper towels <b>BLM 1-34, BLM 1-35, BLM G-43</b> (optional)	• 60-90 min in class • 15 min preparation

**Topic 1.5 How do technology, substances, and environmental factors affect human health?**

Starting Point Activity	- gather the materials and build the models	materials to create four digestive system models, e.g., balls, tubing, paper towel rolls, elastic bands, film canisters one box for each model flexible foam to cover each model	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 30 min preparation</li> </ul>
Activity 1.22 What Are the Health Risks?	- gather brochures	brochures about health risks associated with smoking, X rays, UV exposure, headphones, cell phone use, etc.	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 15 min preparation</li> </ul>
Activity 1.23 Medical Technology Breakthrough?	- photocopy BLMs	Internet access (optional) <b>BLM G-5, BLM G-6</b> (optional)	<ul style="list-style-type: none"> <li>• 60 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 1.24 Interpreting X Rays	- display X rays	real X Rays (optional)	<ul style="list-style-type: none"> <li>• 20 min in class</li> <li>• 5 min preparation</li> </ul>
Investigation 1E Advances in Medical Technology	- gather brochures, - book computer lab - photocopy BLMs	Internet access brochures about medical technology <b>BLM 1-38 to BLM 1-40</b> (optional)	<ul style="list-style-type: none"> <li>• 120 min in class</li> <li>• 30 min preparation</li> </ul>
Investigation 1F How Much Exposure Is Too Much?	- gather materials - photocopy BLMs	Internet access art supplies as required podcasting capability (optional) <b>BLM 1-41, BLM 1-42, BLM G-39 to BLM G-49</b> (optional)	<ul style="list-style-type: none"> <li>• 120 min in class</li> <li>• 10 min preparation</li> </ul>
Unit 1 Inquiry Investigation How Disease Affects Organs	- gather resources and materials - photocopy BLMs	Internet access resources about common diseases and their effects craft materials as required <b>BLM 1-44, BLM G-13, BLM G-16 to BLM G-18, BLM A-47</b> (optional)	<ul style="list-style-type: none"> <li>• 90 min in class</li> <li>• 10 min preparation</li> </ul>
Unit 1 An Issue to Analyze Encouraging Healthy Lifestyles	- gather resources - photocopy BLMs	Internet access resources related to healthy lifestyles <b>BLM 1-45, BLM G-13, BLM G-16 to BLM G-18, BLM A-48</b> (optional)	<ul style="list-style-type: none"> <li>• 60 min in class</li> <li>• 5 min preparation</li> </ul>

Activity/ Investigation/Project	Advance Preparation and Alternative Materials	Apparatus/Materials (per group or per student)	Time Required
<b>Unit 2 Chemical Reactions and Their Practical Applications</b>			
<b>Topic 2.1 How do chemical reactions affect your daily life?</b>			
Starting Point Activity	- photocopy BLM	<b>BLM 2-9</b> (optional)	• 15 min in class
Activity 2.1 Inflating a Balloon	- gather materials photocopy BLMs	round transparent balloon 15 mL baking soda plastic water bottle or Erlenmeyer flask 50-100 mL white vinegar graduated cylinder, spoon <b>BLM 2-12, BLM 2-13</b> (optional)	• 10 min in class • 5 min preparation
Activity 2.2 Becoming Familiar with an MSDS	- gather MSDSs and photocopy, if necessary	Materials Safety Data Sheets	• 20 min in class • 20 min preparation
<b>Topic 2.2 How can we understand, describe, and name chemical compounds?</b>			
Starting Point Activity			• 15 min in class
Activity 2.3 Electrons and Protons of Elements	- photocopy BLM	<b>BLM 2-17</b> (optional)	• 30 min in class
Activity 2.4 Interpreting Chemical Formulas	- photocopy BLM	molecular model kits (optional) <b>BLM 2-22</b> (optional)	• 15 min in class
Activity 2.5 Building Ions	- photocopy BLMs	30 small round objects, such as pennies, buttons, or poker chips <b>BLM 2-23, BLM 2-24</b> (optional)	• 15 min in class • 15 min preparation
Activity 2.6 Ionic or Molecular	- photocopy BLM	<b>BLM 2-25</b> (optional)	• 15 min in class
Activity 2.7 Building Models of Molecular Compounds	- gather materials	molecular model kits or modelling clay and toothpick	• 30 min in class • 10 min preparation
Activity 2.8 Modelling Ionic Compounds	- photocopy BLMs	scissors <b>BLM G-51, BLM 2-26</b> (optional)	• 30 min in class • 10 min preparation
Activity 2.9 Kitchen Chemistry		Internet access or research materials	• time at home • 5 min in class to explain the activity

Investigation 2A Ionic or Molecular?	<ul style="list-style-type: none"> <li>- gather materials</li> <li>- photocopy BLMs</li> <li>- You can make your own conductivity testers as described in the activity notes.</li> </ul>	250 mL beaker scoop stirring rod conductivity tester 500 mL distilled water 15 mL Epsom salts 10 mL isopropyl alcohol (rubbing alcohol) 15 mL washing soda 15 mL sugar 10 mL vegetable oil <b>BLM 2-27, BLM 2-28, BLM G-29</b> (optional)	<ul style="list-style-type: none"> <li>• 45 min in class</li> <li>• 20 min preparation</li> </ul>
<b>Topic 2.3 What happens during a chemical reaction, and how can it be described?</b>			
Starting Point Activity	- photocopy BLM	match or lighter classroom fire extinguisher, <b>BLM 2-4</b> (optional)	<ul style="list-style-type: none"> <li>• 15 min in class</li> </ul>
Activity 2.10 Evidence of Chemical Reactions	<ul style="list-style-type: none"> <li>- gather the materials and assemble them in kits</li> <li>- photocopy BLM</li> </ul>	candle, candle holder, matches ice cubes 250 mL beaker tongs, scoop pea-sized piece of zinc test tube, test-tube rack 10 mL dilute hydrochloric acid (0.1M to 0.5 M) 10 mL vinegar bromothymol blue indicator 15 mL baking soda <b>BLM 2-33</b> (optional)	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 20 min preparation</li> </ul>
Activity 2.11 Balancing Chemical Equations		molecular model kits, or modelling clay and toothpicks, or paper cutouts	<ul style="list-style-type: none"> <li>• 75 min in class</li> </ul>

<p>2.12 Word Equations, Chemical Equations, and Balancing</p>	<ul style="list-style-type: none"> <li>- gather materials</li> <li>- set up four stations as described in activity notes</li> <li>- photocopy BLMs</li> </ul>	<p>6 beakers  3 test tubes, 2 test tube racks  scoopula, pH paper  calcium oxide  calcium carbonate  Bunsen burner, spark lighter, splint  test tube clamp  zinc metal strip  silver nitrate solution in a dropper bottle  steel wool  paper towel  barium hydroxide solution  zinc nitrate solution  medicine dropper  <b>BLM G-52, BLM G-53</b>  <b>BLM 2-34, BLM 2-35</b> (optional)</p>	<ul style="list-style-type: none"> <li>• 75 min in class</li> <li>• 30 min preparation</li> </ul>
<p>Activity 2.13 Writing Word Equations</p>	<ul style="list-style-type: none"> <li>- gather materials and set up stations</li> <li>- photocopy BLMs</li> </ul>	<p>Hoffman apparatus  electrical power source  2 wooden splints  3 test tubes, 2 test tube racks  1 cm<sup>3</sup> piece of steel wool  1 cm<sup>2</sup> piece of aluminium metal  copper (II) chloride solution (saturated)  3 beakers, 3 medicine droppers  paper towel  spot plate, tongs  0.1 - 0.5 M sodium hydroxide  calcium chloride  magnesium ribbon or sparkler  Bunsen burner, matches  <b>BLM G-53, BLM G-54</b>  <b>BLM 2-36</b> (optional)</p>	<ul style="list-style-type: none"> <li>• 75 min in class</li> <li>• 30 min preparation</li> </ul>
<p>Investigation 2B The Law of Conservation of Mass</p>	<ul style="list-style-type: none"> <li>- gather materials and equipment</li> <li>- mix solutions</li> </ul>	<p>graduated cylinder  sodium hydroxide solution (0.1 - 0.5 M)  200 mL Erlenmeyer flask, stopper  dilute iron (III) nitrate solution (10%)  small test tube, balance</p>	<ul style="list-style-type: none"> <li>• 20 min in class</li> <li>• 10-30 min preparation</li> </ul>



**Topic 2.4 What are acids and bases, and how do they react?**

Starting Point Activity	<ul style="list-style-type: none"> <li>- boil and dry chicken bones</li> <li>- Egg shells or marble chips could be used instead of chicken bones.</li> </ul>	chicken bones white vinegar jars with lids <b>BLM 2-40</b> (optional)	<ul style="list-style-type: none"> <li>• 5 min in several classes</li> <li>• 10-30 min preparation</li> </ul>
Activity 2.14 Using Indicators to Identify Acids and Bases	<ul style="list-style-type: none"> <li>- gather materials</li> <li>- photocopy BLM</li> </ul>	spot plate with 10 wells paper towels solutions with pH values from 3 to 11 tweezers litmus paper (red and blue) cut into small squares coloured pencils or markers medicine dropper cabbage juice indicator <b>BLM 2-43</b> (optional)	<ul style="list-style-type: none"> <li>• 45 min in class</li> <li>• 30 min preparation</li> </ul>
Activity 2.15 Minimizing the Risks		Internet access or research materials about chemicals used in various careers	<ul style="list-style-type: none"> <li>• 80 min in class</li> </ul>
Activity 2.16 Neutralization Reactions	<ul style="list-style-type: none"> <li>- gather materials</li> <li>- photocopy BLM</li> </ul>	graduated cylinder 20 mL dilute hydrochloric acid (1.0 M) small test tube, test-tube rack medicine dropper and bottle for each solution bromothymol blue indicator 20 mL dilute sodium hydroxide (1.0 M) <b>BLM 2-46</b> (optional)	<ul style="list-style-type: none"> <li>• 30-40 min in class</li> <li>• 15 min preparation</li> </ul>
Activity 2.17	<ul style="list-style-type: none"> <li>- prepare materials, including setting out samples in paper cups</li> </ul>	household cleanser fruit juices, soft drinks, distilled water small beaker universal pH paper in small pieces spot plate dropper with dropper bottle for each solution small, disposable paper cups (optional)	<ul style="list-style-type: none"> <li>• 75 min in class</li> <li>• 30 min preparation</li> </ul>
Investigation 2C Acid-Base Neutralization Reactions	<ul style="list-style-type: none"> <li>- prepare materials</li> <li>- photocopy BLMs</li> </ul>	10 mL 0.1 M hydrochloric acid 10 mL 0.1 M sodium hydroxide graduated cylinder medicine dropper pH indicators (cabbage juice, pH paper, bromothymol blue) hot plate 250 mL beaker <b>BLM 2-48</b> (optional)	<ul style="list-style-type: none"> <li>• 90 min in class</li> <li>• 10 min preparation</li> </ul>

Investigation 2D The Effectiveness of Antacids	- prepare materials - photocopy BLMs	antacids such as baking soda, Tums®, Rolaids®, Alka-Seltzer®, and generic antacids medicine droppers three-250 mL beakers pH indicators such as bromothymol blue, pH paper, cabbage juice <b>BLM 2-49 to BLM 2-51</b> (optional)	<ul style="list-style-type: none"> <li>• 75 min in class</li> <li>• 30 min preparation</li> </ul>
Activity 2.18 The Effect of pH on Corrosion	- gather materials - prepare solutions	paper towels, markers steel wool four-250 mL beakers 3 acidic solutions (pH 4, 5, and 6) (10 mL each) 10 mL pH 7 solution	<ul style="list-style-type: none"> <li>• 20 min in class</li> <li>• 15 min preparation</li> </ul>
Unit 2 Inquiry Investigation The pH of your "Pop"	- gather materials - photocopy BLMs	clear, carbonated soda pop pH paper, universal indicator, or pH meter 250 mL beaker <b>BLM A-49, BLM 2-53</b> (optional)	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 5 min preparation</li> </ul>
Unit 2 An Issue to Analyze Mining Gold from e-Waste	- photocopy BLMs	Internet access or research materials about reclaiming elements from e-waste chart paper <b>BLM A-50, BLM 2-54</b> (optional)	<ul style="list-style-type: none"> <li>• 75 min in class</li> <li>• 5 min preparation</li> </ul>

Activity/ Investigation/Project	Advance Preparation and Alternative Materials	Apparatus/Materials (per group or per student)	Time Required
<b>Unit 3 Earth's Dynamic Climate</b>			
<b>Topic 3.1 What is climate, and how has it changed during Earth's history?</b>			
Starting Point Activity	- photocopy BLM	<b>BLM G-49</b> (optional)	• 30-40 min in class
Activity 3.1 Climate Change: What Have You Heard?	- photocopy BLMs	<b>BLM G-44, BLM 3-7</b> (optional)	• 30-40 min in class
<b>Topic 3.2 Where are the effects of climate change felt, and what is their impact?</b>			
Starting Point Activity		large world map stickers of several colours	• 15-20 min in class
Activity 3.2 Elephant Seal E-Mail	- photocopy BLM	Internet access or research materials <b>BLM A-35</b> (optional)	• 60-90 min in class
Activity 3.3 Worrying about Water			• 15-20 min in class
Activity 3.4 How a Hurricane Works	- photocopy BLMs - set up stations	Pyrex™ test tube large flat tray, china pencil Bunsen burner, tongs, ruler <b>BLM 3-15, BLM A-1</b> (optional)	• 30-40 min in class • 20 min preparation
<b>Topic 3.3 What natural factors affect climate, and how do they affect it?</b>			
Starting Point Activity			• 20-30 min in class
Activity 3.5 Modelling Air Movement	- gather materials - fill bottles with water	1 L clear plastic bottle, funnel 250 mL vegetable oil red or blue food colouring effervescent powder (or tablet) flashlight (optional)	• 30-40 min in class • 20 min preparation
Activity 3.6 The Effect of Temperature on Water Movement	- gather materials - photocopy BLM	two 500 mL beakers 250 mL ice and cold water 15 drops blue food colouring 250 mL warm water eye dropper or pipette <b>BLM G-37</b> (optional)	• 20-30 min in class • 20 min preparation
Activity 3.7 Modelling Volcano Effects	- prepare aquarium and projector - photocopy BLMs	5 L or 10 L aquarium 4 L to 9 L water overhead projector 5 mL coffee creamer stir stick <b>BLM A-1, BLM G-39</b> (optional)	• 15-30 min in class • 20 min preparation

Activity 3.8 How Melting Sea Ice Affects Global Temperature	<ul style="list-style-type: none"> <li>- gather materials</li> <li>- photocopy BLM</li> <li>- Dark garbage bags can be used instead of black plastic.</li> </ul>	2 plastic trays, 2 heat lamps black plastic ice cubes 2 thermometers, 2 clamps 2 retort stands with clamped thermometers masking tape waterproof marker, timer <b>BLM 3-21</b> (optional)	<ul style="list-style-type: none"> <li>• 30-40 min in class</li> <li>• 15 min preparation</li> </ul>
Investigation 3A Solar Radiation and Earth's Surface	<ul style="list-style-type: none"> <li>- gather materials</li> <li>- photocopy BLMs</li> <li>- Duct tape or masking tape can be used instead of twine.</li> </ul>	flashlight twine or packing tape metre stick, protractor large sheet of graph paper <b>BLM G-9, BLM 3-16, BLM 3-17</b> (optional)	<ul style="list-style-type: none"> <li>• 40-60 min in class</li> <li>• 10 min preparation</li> </ul>
Investigation 3B Modelling the Greenhouse Effect	<ul style="list-style-type: none"> <li>- gather materials</li> <li>- photocopy BLMs</li> </ul>	two 200 mL Erlenmeyer flasks 2 one-holed stoppers with thermometers inserted partway into the holes 100 W incandescent bulb and lamp 15 mL effervescent powder test tube, timer <b>BLM 3-18, BLM 3-19, BLM G-26, BLM A-38</b> (optional)	<ul style="list-style-type: none"> <li>• 30-40 min in class</li> <li>• 20 min preparation</li> </ul>
Activity 3.9 The Effects of Ocean Acidity	<ul style="list-style-type: none"> <li>- prepare eggs</li> <li>- gather materials</li> <li>- photocopy BLM</li> </ul>	3 hard-boiled eggs, or shells only 3 containers with lids cola, vinegar universal pH paper, scale <b>BLM A-1</b> (optional)	<ul style="list-style-type: none"> <li>• 15-20 min in class (day 1)</li> <li>• 15-20 min in class (day 2)</li> <li>• 10-15 min preparation</li> </ul>
<b>Topic 3.4 How do human activities affect the natural greenhouse effect?</b>			
Starting Point Activity	- photocopy BLMs	<b>BLM G-44, BLM G-49</b> (optional)	• 20-30 min in class
Activity 3.10 Which Greenhouse Gas?	- photocopy BLMs	<b>BLM G-9, BLM A-1, BLM A-10, BLM A-11</b> (optional)	• 30-40 min in class
Investigation 3C Cross-Country Climate Changes	- photocopy BLMs	Internet access (optional) <b>BLM 3-25, BLM A-9, BLM A-34, BLM G-13</b> (optional)	• 60-120 min in class

**Topic 3.5 How can we assess present climate change and reduce our impact?**

Starting Point Activity			<ul style="list-style-type: none"> <li>• 20-30 min in class</li> </ul>
Activity 3.11 You Can Help Assess Climate Change		Internet access	<ul style="list-style-type: none"> <li>• 30-40 min in class</li> <li>• 20-30 min preparation (optional)</li> </ul>
Activity 3.12 Projecting Earth's Future Climate	- photocopy BLMs	graph paper <b>BLM G-34, BLM G-35</b> (optional)	<ul style="list-style-type: none"> <li>• 30-40 min in class</li> </ul>
Activity 3.13 Climate Change on Prime Time			<ul style="list-style-type: none"> <li>• 60-120 min in class</li> </ul>
Activity 3.14	- photocopy BLM	tree cross-section with visible rings hand lens, ruler <b>BLM 3-29</b> (optional)	<ul style="list-style-type: none"> <li>• 30-40 min in class</li> </ul>
Activity 3.15 Assessing Climate Change Articles	- gather materials - photocopy BLM	magazines and newspapers with scientific and non-scientific articles about climate change <b>BLM 3-30</b> (optional)	<ul style="list-style-type: none"> <li>• 30-40 min in class</li> </ul>
Activity 3.16 Run a Climate-Friendly Business	- photocopy BLM	<b>BLM 3-31</b> (optional)	<ul style="list-style-type: none"> <li>• 60-80 min in class</li> </ul>
Investigation 3D Transportation Choices and Your Carbon Footprint	- photocopy BLMs	<b>BLM A-29, BLM G-35, BLM G-49</b> (optional)	<ul style="list-style-type: none"> <li>• 30-40 min in class</li> </ul>
Unit 3 Inquiry Investigation Reflecting on White Roofs	- photocopy BLMs	Internet access topic-related reading materials <b>BLM A-51, BLM G-26 to BLM G-29</b> (optional)	<ul style="list-style-type: none"> <li>• 70-100 min in class</li> </ul>
Unit 3 An Issue to Analyze Dealing with Climate Change	- photocopy BLM	<b>BLM A-52</b> (optional)	<ul style="list-style-type: none"> <li>• 110-160 min in class</li> </ul>

Activity/ Investigation/Project	Advance Preparation and Alternative Materials	Apparatus/Materials (per group or per student)	Time Required
<b>Unit 4 Light and Applications of Optics</b>			
<b>Topic 4.1 What is light and how is it produced?</b>			
Starting Point Activity		mirrors	• 10 min in class
Activity 4.1 Transferring Energy		2 m rope a small, light bell	• 10 min in class
<b>Topic 4.2 How does light interact with objects to give them colour?</b>			
Starting Point Activity	- tape filters to flashlights (optional)	flashlight, red and blue filters, tape bright, shiny objects (red, blue, white)	• 15 min in class • 10 min preparation
Activity 4.2 Shining the Spotlight on Colour	- tape filters to flashlights (optional)	blue marking pen, white paper flashlight with blue filter	• 15 min in class • 5 min preparation
Activity 4.3 Exploring the Properties of Light	- construct a sample pinhole camera	cardboard tubing (4 cm–8 cm diameter, 25 cm long) ruler, utility knife, push pin translucent wax paper aluminum foil, masking tape	• 30 min in class • 10 min preparation
<b>Topic 4.3 How can you mix colours to make different colours?</b>			
Starting Point Activity			• 5 min in class
Activity 4.4 Tricking the Eye	- check that ray boxes are in working order	3 ray boxes, white paper 3 filters (red, blue, green) coloured pencils (optional)	• 15 min in class • 15 min preparation
Activity 4.5 Mixing more Colours	- gather lamps and transparencies	bright lamp or overhead projector white paper 3 colour transparencies (cyan, yellow, magenta) coloured pencils (optional)	• 15 min in class • 15 min preparation
Activity 4.6 Subtracting Colour with Films and with Your Eyes		3 colour films or transparencies (cyan, magenta, yellow)	• 20 min in class
Activity 4.7 Using Diagrams to Illustrate Subtracting Colours	- photocopy BLM	6 coloured pencils (red, blue, green, cyan, magenta, yellow) <b>BLM 4-7</b> (optional)	• 30 min in class
<b>Topic 4.4 What is the law of reflection and how do mirrors form images?</b>			
Starting Point Activity	- check that ray boxes are in working order - photocopy BLM	ray box with slit 2 mirrors with stands <b>BLM G-55</b>	• 20 min in class • 10 min preparation
Activity 4.8 Drawing Ray Diagrams for Plane Mirrors	- photocopy BLM	ruler protractor <b>BLM 4-14</b> (optional)	• 15 min in class

Activity 4.9 Drawing Ray Diagrams for the Region Beyond C	- photocopy BLM	ruler <b>BLM 4-15</b> (optional)	<ul style="list-style-type: none"> <li>• 15 min in class</li> </ul>
Activity 4.10 Trends in Images in Convex Mirrors	- photocopy BLM	ruler <b>BLM 4-10</b> (optional)	<ul style="list-style-type: none"> <li>• 25 min in class</li> </ul>
Activity 4.11 How Light Reflects	- check that ray boxes are in working order	plane mirror, ruler, protractor ray box with single slit white paper	<ul style="list-style-type: none"> <li>• 25 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 4.12 Like, Where's the Likeness?	- gather materials	2 identical candles in holders or 2 battery powered lamps matches, white paper, ruler plane mirror with stand	<ul style="list-style-type: none"> <li>• 25 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 4.13 See Yourself in a Spoon	- gather materials	plane mirror large, very shiny kitchen spoon	<ul style="list-style-type: none"> <li>• 10 min in class</li> <li>• 5 min preparation</li> </ul>
Activity 4.14 Reflecting an Image		concave mirror, white paper bright light source, such as a window	<ul style="list-style-type: none"> <li>• 10 min in class</li> </ul>
Investigation 4A Exploring Images with a Concave Mirror	- gather materials cut tape - photocopy BLMs	concave mirror, candle, metre stick white cardboard, masking tape <b>BLM 4-16, BLM 4-17</b> (optional)	<ul style="list-style-type: none"> <li>• 55 min in class</li> <li>• 15 min preparation</li> </ul>
<b>Topic 4.5 What is refraction and how can it be used?</b>			
Starting Point Activity	- fill tanks with water	transparent tank (aquarium or storage box) or large beaker	<ul style="list-style-type: none"> <li>• 10 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 4.15 Interpret a Model to Describe Refraction			<ul style="list-style-type: none"> <li>• 15 min in class</li> </ul>
Activity 4.16 Modelling an Optical Fibre	- set up and test - the apparatus	clear plastic, bottle duct tape, thumbtack, masking tape bucket (or sink) flashlight (with an intense, narrow beam)	<ul style="list-style-type: none"> <li>• 10 min in class</li> <li>• 15 min preparation</li> </ul>
Activity 4.17 The Reappearing Coin	- test suitability of cups	cup, or another container with opaque sides container for water, coin	<ul style="list-style-type: none"> <li>• 5 min in class</li> <li>• 5 min preparation</li> </ul>
Activity 4.18 Refraction of Light	- test prisms	ray box with a single slit, ruler glass or plastic rectangular prism	<ul style="list-style-type: none"> <li>• 15 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 4.19 Reflection and Refraction of Light	- test prisms - photocopy BLM	ray box with a single slit protractor, ruler glass semicircular prism <b>BLM G-9</b> (optional)	<ul style="list-style-type: none"> <li>• 25 min in class</li> <li>• 10 min preparation</li> </ul>

**Topic 4.6 What are lenses and what are some of their applications?**

Starting Point Activity	- cut waxed paper and newspaper	waxed paper, newspaper medicine dropper	<ul style="list-style-type: none"> <li>• 10 min in class</li> <li>• 10 min preparation</li> </ul>
Activity 4.20 Finding the Focal Length of a Converging Lens		3 or more converging lenses of different focal lengths ruler, metre stick (optional)	<ul style="list-style-type: none"> <li>• 20 min in class</li> </ul>
Activity 4.21 Drawing and Analyzing Ray Diagrams for Converging Lenses	- photocopy BLMs	ruler <b>BLM 4-20, BLM G-9</b> (optional)	<ul style="list-style-type: none"> <li>• 25 min in class</li> <li>• 5 min preparation</li> </ul>
Investigation 4C Investigating Converging Lenses	- gather materials cut tape	converging lens, lens holder metre stick, masking tape, white paper candle and matches or battery powered lamp	<ul style="list-style-type: none"> <li>• 55 min in class</li> <li>• 15 min preparation</li> </ul>
Investigation 4D	- gather materials - photocopy BLM	convex lens with a large curve convex lens with a small curve cardboard, scissors, tape, ruler <b>BLM 4-22</b> (optional)	<ul style="list-style-type: none"> <li>• 30 min in class</li> <li>• 15 min preparation</li> </ul>
Unit 4 Inquiry Investigation Design a Light Tunnel	- gather materials - photocopy BLM	2 concave and 2 convex mirrors 2 diverging and 2 converging lenses triangular prism, light source acetate, plastic wrap, or glass cardboard tubes, foil <b>BLM A-53</b> (optional)	<ul style="list-style-type: none"> <li>• 115 min in class</li> <li>• 30 min as possible homework</li> </ul>
Unit 4 An Issue to Analyze LEDs Brighten Up the Darkness	- photocopy BLMs	Internet access and research material <b>BLM A-54, BLM G-13, BLM G-16 to BLM G-18</b> (optional)	<ul style="list-style-type: none"> <li>• 150 min in class plus research time</li> </ul>



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