

*Catholic District School Board Writing Partnership*

# Course Profile **Science**

Grade 9  
Applied

- *for teachers by teachers*

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## **Acknowledgments**

Catholic Curriculum Cooperative of Central Ontario (CCCC) Writing Partnership - Science

### Lead Board

Hamilton-Wentworth Catholic District School Board  
Remo Presutti, Manager

### Course Profile Writing Team

Alexandre Annab, Dufferin-Peel CDSB  
Josephine Ciapanna, Hamilton-Wentworth CDSB  
Maurice DiGiuseppe, Toronto CDSB  
Gerry Fuchs, Hamilton-Wentworth CDSB  
Ted Laxton, Wellington CDSB  
Marion Poole, Toronto CDSB  
Milan Sanader, Dufferin-Peel CDSB  
Siria Szkurhan, Hamilton-Wentworth CDSB  
Robert Warren, Hamilton-Wentworth CDSB

### Course Profile Internal Review Team

Dr. Anthony Cuschieri, Hamilton-Wentworth CDSB  
Milan Sanader, Dufferin-Peel CDSB

### Course Profile Format Editor

Rachael Szkurhan

Institute for Catholic Education (ICE)

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## Course Overview

### Science, Grade 9, Applied

**School:**

**Department:**

**District:**

**Course Title:** Science

**Grade:** Nine

**Course Type:** Applied

**Development Date:** July 31, 1999

**Ministry Course Code:** SNC1P

**Credit Value:** 1.0

**Secondary Policy Document:**

### Description/Rationale

This course enables students to understand basic concepts in biology, chemistry, earth and space science, and physics; to develop practical skills in scientific investigations; and to apply their knowledge of science to everyday situations. Students design and conduct investigations into practical problems and issues related to cell division and reproduction, the structure and properties of elements and compounds, astronomy and space exploration, and static and current electricity.

### How This Course Supports The Ontario Catholic School Graduate Expectations

The study of science helps students to learn to be reflective, critical, and creative thinkers, as well as discerning believers, who can apply their knowledge to the world around them. They can then make appropriate decisions in light of Gospel values and Church teachings. Through the study of the techniques of science, particularly experimentation, students learn to be collaborative contributors to an interdependent team, respecting the rights, responsibilities, and contributions of others. Through career exploration, the students think critically about the meaning and purpose of work, find meaning, dignity, and fulfillment and contribute to the common good. Overall, through the course, students become aware of the sacramental dimension of the physical world in all its aspects and of their roles as stewards of God's creation.

### Unit Titles (Time and Sequence)

Unit 1	Chemistry: Exploring Matter	27.5 hours
Unit 2	Physics: Electrical Applications	27.5 hours
Unit 3	Biology: Reproduction - Processes and Applications	27.5 hours
Unit 4	Earth and Space Science: Space Exploration	27.5 hours

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## Unit Organization

### Unit 1: Chemistry: Exploring Matter

**Time:** 27.5 hours

#### Description

This unit enables students to understand the basic concepts of chemistry; to develop practical skills in scientific investigations; to enhance their communication/research skills; and to apply their knowledge of chemistry to everyday situations within a context enriched by the Catholic Faith curriculum. Students design and conduct investigations into practical problems related to matter and its properties. In researching career and job opportunities, students gain a new respect for the dignity of work and gain knowledge on ways to contribute to the betterment of society.

#### Strand(s) and Expectations

**Ontario Catholic School Graduate Expectations:** GE 1d; 2a,b,c,d,e; 3b,c,d,e,f; 4a,b,c,d,e,f,g; 5a,b,c,d,ef,g,h; 7a,b,d,h,i,j.

**Strand(s):** Chemistry

**Overall Expectations:** CHV.01, CHV.02, CHV.03.

**Specific Expectations:** CH1.01 to CH1.09, CH2.01 to CH2.10, CH3.01 to CH3.04.

### Unit 2: Physics: Electrical Applications

**Time:** 27.5 hours

#### Description

In this unit students develop an understanding of static and current electricity. They build electrical circuits found in everyday life. Students also analyse the practical uses of electricity and its impact on everyday life. They practise being collaborative team members, respecting the rights and contributions of others. Through the study of electricity, students receive a practical lesson in stewardship as energy conservers.

#### Strand(s) and Expectations

**Ontario Catholic School Graduate Expectations:** CGE 1d; 2a,b,c,d,e; 3b,c,d,f; 4a,b,e,f; 5a,b,d,e,g; 7a,b,i,j.

**Strand(s):** Physics

**Overall Expectations:** PHV.01, PHV.02, PHV.03.

**Specific Expectations:** PH1.01 to PH1.07, PH2.01 to PH2.09, PH3.01 to PH3.05.

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### **Unit 3: Biology: Reproduction - Processes and Applications**

**Time:** 27.5 hours

#### **Description**

In this unit, students demonstrate an understanding of the processes of reproduction in plants and animals (including humans). They identify issues, formulate questions, and plan and conduct investigations related to reproductive issues. Students examine the impact of scientific research and technological developments on issues related to reproduction and make decisions with an informed conscience in light of Gospel values.

#### **Strand(s) and Expectations**

**Ontario Catholic School Graduate Expectations:** CGE 1c,d,e; 2a,c,e; 3b,c,d,e,f; 4a,g; 5e; 6b,c.

**Strand(s):** Biology

**Overall Expectations:** BYV.01, BYV.02, BYV.03.

**Specific Expectations:** BY1.01 to BY1.07; BY2.01 to BY2.09; BY3.01 to BY3.05.

### **Unit 4: Earth and Space Science: Space Exploration**

**Time:** 27.5 hours

#### **Description**

This unit is the culmination of the course, making students aware of the wonder and awe of God's creation. Students demonstrate an understanding of the formation, evolution, structure, and nature of our solar system and of the universe. They design and conduct investigations into the appearance and motion of visible celestial objects. As a result of this unit, students describe how human endeavours and interest in space have contributed to our understanding of outer space, the Earth, and living things. Emphasis is placed on Canadian contributors to space explorations. Students reflect on the cost/benefit of space exploration as a societal issue. Is it ethical to spend money in this way when there is homelessness and poor medical care for the poor on Earth?

#### **Strand(s) and Expectations**

**Ontario Catholic School Graduate Expectations:** CGE 1a,d,f,h,i; 2a,b,c,d,e; 3b,c,d,e,f; 4a,b,c,d,e,f,g,h; 5a,b,c,d,e,f,g,h; 7a,b,d,e,f,g,h,i,j.

**Strand(s):** Earth and Space

**Overall Expectations:** ESV.01, ESV.02, ESV.03.

**Specific Expectations:** ES1.01 to ES1.05; ES2.01 to ES2.08; ES3.01 to ES3.05.

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## **Strategies and Resources**

### **Instructional Strategies**

Instructional strategies include the following:

#### **Computer-based Learning**

- students use simulations and relevant computer programs to explore science problems

#### **Brainstorming**

- group generation of initial ideas expressed without criticism or analysis

#### **Case Study**

- investigation of real and simulated problems

#### **Collaborative/Co-operative Learning**

- various small group learning techniques

#### **Conferencing**

- student to student or teacher to student discussion

#### **Field Study**

- students perform investigations on locations beyond the school

#### **Independent Study**

- students explore and research a topic of interest

#### **Lab-Based Inquiry**

- students perform investigations in the laboratory

#### **Report/Presentation**

- oral and written presentation of researched topic to class

### **Assessment Strategies**

The assessment plan includes the following:

#### **Personal Communication**

- journals/conferencing logs
- self-assessment
- student-teacher conferences

#### **Paper and Pencil Tests**

- unit tests (knowledge)
- final exams

#### **Observation**

- formal/informal

#### **Performance Assessment**

- research project/essay
- model building assignment

#### **Assessment tools include:**

- checklists
- marking schemes
- rubrics
- anecdotal comments with suggestions for improvement

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## Main Resources

The following resources are suggested to support teaching and learning:

### Textbooks

- various approved textbooks that exist for the previous Grade 9 and 10 Science courses as well as those that exist for the Biology, Chemistry, and Physics courses should be consulted.

### Journals

*Crucible*

*The Science Teacher*

*Sky News: The Canadian Magazine of Astronomy and Stargazing* and other relevant science journals

### Videotapes

- various science series are available such as: Bill Nye Videos, Chem Study Videos, National Geographic and TVO Series

### Computer Software

- various computer software and Internet websites listed in the introduction to each unit.

### Models and Manipulatives

- microscopes, telescopes, batteries, multimeters, and assorted laboratory equipment

## Evaluation of Student Achievement

Assessment is the process of gathering information from a variety of sources that accurately reflects how well a student is achieving the curriculum expectations. In Science these expectations include the Understanding of Basic Concepts which may be assessed for Knowledge and Understanding; the Developing Skills of Inquiry and Communication which may be assessed for Inquiry and Communication; and Relating Science to Technology, Society, and the Environment which may be assessed for Making Connections.

Evaluation refers to the process of judging the quality of student work on the basis of established criteria, and then assigning a value to represent that quality. The value assigned is in the form of a percentage grade. According to Ministry Program Planning and Assessment Policy, 70% of the student's course grade is based on the assessments and evaluations conducted throughout the course and 30% is based on an examination, performance, essay, and/or other method of evaluation suitable to the course content and administered towards the end of the course. The assessment and evaluation in this applied science course reflects course emphasis on applications and practical connections. Each component should be evaluated for all four categories identified in the Achievement Chart, the relative value depending on the emphasis in the unit as it was taught. The final mark may be calculated as follows:

<b>Term Assessment Weighting</b>	<b>70%</b>	<b>Final Assessment Weighting</b>	<b>30%</b>
Unit Tests Knowledge/Understanding Inquiry Communication Making Connections	20%	Final Examination • Knowledge/Understanding • Inquiry • Communication • MakingConnections	10%
Unit Research Assignments • Knowledge/Understanding • Inquiry • Communication • Making Connections	20%	ScienceWorld Activities • Knowledge/Understanding • Inquiry • Communication • Making Connections	10%
Lab-Based Inquiry • Knowledge/Understanding • Inquiry • Communication • Making Connections	30%	Lab Practical • Knowledge/Understanding • Inquiry • Communication • Making Connections	10%

## **Additional Information**

### **Course Notes**

Science is an activity as much as it is an organized body of knowledge. It cannot be learned in any meaningful way by reading and discussion alone. The experimental nature of science is to be emphasized by providing ample opportunities for students to engage in safe, effective laboratory activities in all units of the course. The health and safety of teachers and students must be of paramount importance when conducting laboratory activities. All must comply with the provisions of Workplace Hazardous Materials Information Systems (WHMIS) legislation and must practise established safe laboratory procedures.

Students are expected to use computer technology that has been developed for use in science. Computer-based simulations, multimedia applications, databases, and computer-assisted laboratory apparatus and learning modules should be used wherever appropriate to do so. Care must be taken, however, to ensure that computer-assisted laboratory programs are not used in situations where students' own technical skills should be developed. Whenever possible, students should be provided with opportunities to experience the world of science first-hand by participating in field trips and excursions.

### **OSS Policy Applications**

Teachers must consider the needs of exceptional students in planning the delivery of the science curriculum. Modifications to the program and/or to the environment may be necessary.

ESL/ELD students require science teachers to respond to their needs by providing support with respect to their comprehension and use of language in a scientific context

Students can benefit from experience in science related activities in the workplace through Co-operative Education experiences. Students may consider a Co-operative Education experience after they have completed their first course in science.

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## **Course Evaluation**

Course evaluation serves to guide teachers in adapting curriculum and instruction to students' needs and in assessing the overall effectiveness of programs and classroom practices.

Teachers should consider conducting evaluations at the end of each unit. Evaluations may be as simple as asking students to identify those activities they enjoyed and those that they didn't enjoy, and then asking for their suggestions for improvement or providing students with a more detailed rating scale (1 to 5) for each of the activities of the unit. Teachers may refer to resources such as *Program Planning and Assessment*, *Making the Grade*, or *Assessing for Success* for additional suggestions for course evaluations.

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## Ontario Catholic School Graduate Expectations

The graduate is expected to be:

### **A Discerning Believer Formed in the Catholic Faith Community** who

- CGE1a** -illustrates a basic understanding of the **saving story** of our Christian faith;
- CGE1b** -participates in the **sacramental life** of the church and demonstrates an understanding of the centrality of the Eucharist to our Catholic story;
- CGE1c** -actively reflects on **God’s Word** as communicated through the Hebrew and Christian scriptures;
- CGE1d** -develops attitudes and values founded on Catholic **social teaching** and acts to promote social responsibility, human solidarity, and the common good;
- CGE1e** -speaks the **language of life**... “recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it.” (Witnesses to Faith)
- CGE1f** -seeks intimacy with God and celebrates **communion** with God, others and creation through prayer and worship;
- CGE1g** -understands that one’s purpose or **call in life** comes from God and strives to discern and live out this call throughout life’s journey;
- CGE1h** -respects the **faith traditions**, world religions and the life-journeys of **all people of good will**;
- CGE1i** -integrates faith with life;
- CGE1j** -recognizes that “sin, human weakness, conflict and forgiveness are part of the human journey” and that the cross, the ultimate sign of forgiveness is at the heart of **redemption**. (Witnesses to Faith)

### **An Effective Communicator** who

- CGE2a** -listens actively and critically to understand and learn in light of gospel values;
- CGE2b** -reads, understands and uses written materials effectively;
- CGE2c** -presents information and ideas clearly and honestly and with sensitivity to others;
- CGE2d** -writes and speaks fluently one or both of Canada’s official languages;
- CGE2e** -uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology and information systems to enhance the quality of life.

### **A Reflective and Creative Thinker** who

- CGE3a** -recognizes there is more grace in our world than sin and that hope is essential in facing all challenges;
- CGE3b** -creates, adapts, evaluates new ideas in light of the common good;
- CGE3c** -thinks reflectively and creatively to evaluate situations and solve problems;
- CGE3d** -makes decisions in light of gospel values with an informed moral conscience;
- CGE3e** -adopts a holistic approach to life by integrating learning from various subject areas and experience;
- CGE3f** -examines, evaluates and applies knowledge of interdependent systems (physical, political, ethical, socio-economic and ecological) for the development of a just and compassionate society.

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**A Self-Directed, Responsible, Life Long Learner** who

- CGE4a** -demonstrates a confident and positive sense of self and respect for the dignity and welfare of others;
- CGE4b** -demonstrates flexibility and adaptability;
- CGE4c** -takes initiative and demonstrates Christian leadership;
- CGE4d** -responds to, manages and constructively influences change in a discerning manner;
- CGE4e** -sets appropriate goals and priorities in school, work and personal life;
- CGE4f** -applies effective communication, decision-making, problem-solving, time and resource management skills;
- CGE4g** -examines and reflects on one's personal values, abilities and aspirations influencing life's choices and opportunities;
- CGE4h** -participates in leisure and fitness activities for a balanced and healthy lifestyle.

**A Collaborative Contributor** who

- CGE5a** -works effectively as an interdependent team member;
- CGE5b** -thinks critically about the meaning and purpose of work;
- CGE5c** -develops one's God-given potential and makes a meaningful contribution to society;
- CGE5d** -finds meaning, dignity, fulfillment and vocation in work which contributes to the common good;
- CGE5e** -respects the rights, responsibilities and contributions of self and others;
- CGE5f** -exercises Christian leadership in the achievement of individual and group goals;
- CGE5g** -achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others;
- CGE5h** -applies skills for employability, self-employment and entrepreneurship relative to Christian vocation.

**A Caring Family Member** who

- CGE6a** -relates to family members in a loving, compassionate and respectful manner;
- CGE6b** -recognizes human intimacy and sexuality as God given gifts, to be used as the creator intended;
- CGE6c** -values and honours the important role of the family in society;
- CGE6d** -values and nurtures opportunities for family prayer;
- CGE6e** -ministers to the family, school, parish, and wider community through service.

**A Responsible Citizen** who

- CGE7a** -acts morally and legally as a person formed in Catholic traditions;
- CGE7b** -accepts accountability for one's own actions;
- CGE7c** -seeks and grants forgiveness;
- CGE7d** -promotes the sacredness of life;
- CGE7e** -witnesses Catholic social teaching by promoting equality, democracy, and solidarity for a just, peaceful and compassionate society;
- CGE7f** -respects and affirms the diversity and interdependence of the world's peoples and cultures;
- CGE7g** -respects and understands the history, cultural heritage and pluralism of today's contemporary society;
- CGE7h** -exercises the rights and responsibilities of Canadian citizenship;
- CGE7i** -respects the environment and uses resources wisely;
- CGE7j** -contributes to the common good.

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## Coded Expectations: Science, Applied, Grade 9

### Chemistry: Exploring Matter

#### Overall Expectations

##### CHV.01

– describe the atomic structure of common elements and their organization in the periodic table;

##### CHV.02

– investigate the physical and chemical properties of common elements and compounds, and relate the properties of elements to their location in the periodic table;

##### CHV.03

– demonstrate an understanding of the importance, production, use, and environmental hazards of common elements and simple compounds.

#### Specific Expectations

##### Understanding Basic Concepts

##### CH1.01

– describe an element as a pure substance made up of one type of particle or atom with its own distinct properties;

##### CH1.02

– recognize compounds as pure substances that may be broken down into elements by chemical means;

##### CH1.03

– describe compounds and elements in terms of molecules and atoms;

##### CH1.04

– identify each of the three fundamental particles (neutron, proton, and electron), and its charge, location, and relative mass in a simple atomic model (e.g., the Bohr-Rutherford model);

##### CH1.05

– identify general features of the periodic table (e.g., arrangement of the elements based on atomic structure, groups or families of elements, periods or horizontal rows);

##### CH1.06

– demonstrate an understanding of the relationship between the properties of elements and their position in the periodic table (e.g., metals appear on the left of the periodic table; non-metals appear on the right);

##### CH1.07

– identify and write symbols/formulae for common elements and compounds (e.g., H, Mg, S, N and NaCl, O<sub>2</sub>, H<sub>2</sub>O, CO<sub>2</sub>);

##### CH1.08

– describe, using their observations, the evidence for chemical changes (e.g., energy change, formation of a gas or precipitate, change in colour or odour, change in temperature);

##### CH1.09

– distinguish between metals and non-metals and identify their characteristic properties (e.g., most metals are lustrous or shiny and good conductors of heat; most non-metals in solid form are brittle and not good conductors of heat).

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## Developing Skills of Inquiry and Communication

### CH2.01

– demonstrate knowledge of laboratory, safety, and disposal procedures while conducting investigations (e.g., wear safety glasses; practise orderliness and cleanliness; follow WHMIS guidelines and emergency procedures; use proper procedures for handling and storage);

### CH2.02

– determine how the properties of substances influence their use (e.g., how the reactions of metals with air influence their use);

### CH2.03

– formulate scientific questions about a problem or issue involving the properties of substances;

### CH2.04

– demonstrate the skills required to plan and conduct an inquiry into the properties of substances, using apparatus and materials safely, accurately, and effectively (e.g., investigate the physical properties of common elements and classify them as metals or non-metals);

### CH2.05

– select and integrate information from various sources, including electronic and print resources, community resources, and personally collected data, to answer the questions chosen;

### CH2.06

– organize, record, and analyse the information gathered (e.g., interpret patterns and trends; discuss relationships among variables; predict consequences of action or inaction);

### CH2.07

– communicate scientific ideas, procedures, results, and conclusions using appropriate language and formats (e.g., present data on different chemical substances in a table using appropriate headings such as compound, element, chemical property, physical property);

### CH2.08

– investigate, by laboratory experiment or classroom demonstration, the chemical properties of representative families of elements (e.g., combustibility, reaction with water of Mg, Ca or C, Si);

### CH2.09

– investigate the properties of changes in substances, and classify them as physical or chemical based on experiments (e.g., solubility, combustibility, change of state, changes in colour);

### CH2.10

– construct molecular models of simple molecules (e.g., H<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>O, NH<sub>3</sub>, CH<sub>4</sub>, CO<sub>2</sub>).

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

### CH3.01

– identify uses of elements in everyday life (e.g., iron and other elements in steel; aluminum, oxygen, chlorine in water);

### CH3.02

– describe the methods used to obtain elements in Canada, and outline local environmental concerns and health and safety issues related to the ways in which they are mined and processed (e.g., explain how gold, nickel, carbon, or uranium is obtained and processed);

### CH3.03

– explain how a knowledge of the physical and chemical properties of elements enables people to determine the potential uses of the elements and assess the associated risks (e.g., helium versus hydrogen in balloons, copper versus aluminum in wiring, copper versus lead in plumbing);

### CH3.04

– identify and describe careers that require knowledge of the physical and chemical properties of elements and compounds.

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## Physics: Electrical Applications

### Overall Expectations

#### PHV.01

– demonstrate an understanding of the principles of static and current electricity;

#### PHV.02

– design and build electrical circuits that perform a specific function;

#### PHV.03

– analyse the practical uses of electricity and its impact on everyday life.

### Specific Expectations

#### Understanding Basic Concepts

##### PH1.01

– explain common electrostatic phenomena (e.g., clothes that “stick” together, attraction of hairs to combs);

##### PH1.02

– compare qualitatively static and current electricity (e.g., a charge on a charged electroscope and the charge in an operating circuit);

##### PH1.03

– describe the concepts of electric current, potential difference, and resistance, with the help of a water analogy;

##### PH1.04

– explain how electric current, potential difference, and resistance are measured using an ammeter and a voltmeter;

##### PH1.05

– describe qualitatively the effects of varying electrical resistance and potential difference on electric current in an electrical circuit;

##### PH1.06

– apply the relationship  $\text{potential difference} = \text{resistance} \times \text{current}$  to simple series circuits;

##### PH1.07

– determine quantitatively the percent efficiency of an electrical device that converts electrical energy to other forms of energy, using the relationship:

#### Developing Skills of Inquiry and Communication

##### PH2.01

– demonstrate knowledge of electrical safety procedures when planning and carrying out investigations and choosing and using materials, tools, and equipment;

##### PH2.02

– identify an authentic practical challenge or problem related to the use of electricity (e.g., to design household wiring; to increase the efficiency of electrical usage in the school);

##### PH2.03

– formulate questions about the problem or issue;

##### PH2.04

– demonstrate the skills required to plan and conduct an inquiry into the use of electricity, using instruments, tools, and apparatus safely, accurately, and effectively;

##### PH2.05

– select and integrate information from various sources, including electronic and print resources, community resources, and personally collected data, to answer the questions chosen;

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**PH2.06**

– organize, record, and analyse the information gathered (e.g., interpret patterns and trends; discuss relationships among variables; and predict consequences of action or inaction);

**PH2.07**

– communicate scientific ideas, procedures, results, and conclusions using appropriate SI units, language, and formats (e.g., electrical power, voltage, resistance; drawings, charts, graphs);

**PH2.08**

– design, draw, and construct series and parallel circuits that perform a specific function (e.g., given light bulbs, wires, and batteries, produce circuits with: one light bulb on; two light bulbs of the same brightness; one light bulb disconnected and the other light bulb on);

**PH2.09**

– use appropriate instruments to collect and graph data, and determine the relationship between voltage and current in a simple series circuit with a single resistor.

**Relating Science to Technology, Society, and the Environment****PH3.01**

– describe and explain household wiring and its typical components (e.g., parallel circuits with switches, fuses, circuit breakers, outlets);

**PH3.02**

– develop a solution to a practical problem related to the use of electricity in the home, school, or community (e.g., choose an appropriate fuse or circuit breaker for a specific circuit);

**PH3.03**

– compare electrical energy production technologies, including risks and benefits (e.g., explain the advantages and disadvantages of using hydro, photovoltaic, wind, and tidal generators to produce electrical energy);

**PH3.04**

– explain how some common household electrical appliances operate (e.g., electric kettle, electric baseboard heater, electric light bulb);

**PH3.05**

– describe careers that involve electrical technologies, and use employability – assessment programs, newspaper job advertisements, and/or appropriate Internet sources to identify the knowledge and skill requirements of such careers.