

Pan-Canadian Assessment Program (PCAP)

Science Assessment Framework



cmec

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Introduction

What is PCAP?

The Pan-Canadian Assessment Program (PCAP) is the continuation of CMEC's commitment to inform Canadians about how well their education systems are meeting the needs of students and society. The information gained from this pan-Canadian assessment provides ministers of education with a basis for examining the curriculum and other aspects of their school systems.

School-curriculum programs vary from jurisdiction to jurisdiction across the country, so comparing results from these varied programs is a complex task. However, young Canadians in different jurisdictions learn many similar skills in mathematics, reading, and science. PCAP has been designed to determine whether students across Canada reach similar levels of performance in these core disciplines at about the same age, and to complement existing assessments in each jurisdiction so they have comparative Canada-wide data on the achievement levels attained by Grade 8¹ students across the country.

PCAP, which replaces an earlier assessment called the Student Achievement Indicators Program (SAIP), is coordinated by CMEC.

PCAP Science Framework

The PCAP Science Framework delineates the conceptual framework for the science component of PCAP (PCAP Science). It is informed by jurisdictional science curricula of the participating populations (CMEC, 2005b).

This framework lays out a theoretical foundation based on current research and sound practices in the field of science education. It builds upon two other CMEC initiatives in Canadian science education: SAIP Science assessments and the *Common Framework of Science Learning Outcomes K to 12* (CMEC, 1997a). It provides a working definition for scientific literacy upon which assessment items are designed.

¹ Grade 8 refers to Secondary Two in Quebec throughout the document.

A Brief History of Science Curriculum and Science Assessment in Canada

In 1984, the Science Council of Canada published a report entitled *Science for Every Student: Educating Canadians for Tomorrow's World*. Recommendations were organized around three general areas: science education for all, redirecting science education, and monitoring science education. The report endorsed the concept of science for all and described the importance to Canada of having its citizens acquire a good working knowledge of science concepts and develop inquiry skills to apply these concepts to the world around them. "Science education must be the basis for informed participation in a technological society, a part of a continuing process of education, a preparation for the world of work, and a means for students' personal development." (Science Council of Canada, 1984, p. 18).

Upon the release of *Science for Every Student*, science curriculum development in Canada's jurisdictions began to emphasize the importance of developing a scientifically literate population while continuing to encourage and support students who demonstrate a strong interest in the sciences and in possibly pursuing science-related postsecondary studies and careers.

In 1996, CMEC administered SAIP Science I as an "assessment of scientific literacy" (CMEC, 1996). The assessment items for SAIP Science were intended to provide students with an opportunity to participate in an assessment that asked them to relate their understanding of science to real-life situations that were familiar to them. "Students' knowledge of science concepts and their application to society around them, as well as the understanding of the nature of science, were measured by responses to multiple-choice and constructed-response questions. Questions were presented in groups within simple and common scenarios that required the application of knowledge to situations familiar to young people." (CMEC, 1996, p. 9).

SAIP Science I and SAIP Science II (administered in 1996 and 1999, respectively) included a practical task component that required students to demonstrate their ability to apply science inquiry and problem-solving skills to simple hands-on tasks. The practical task component was not administered in SAIP Science III (conducted in 2004).²

SAIP scoring was based on criteria outlined in the chapter entitled "SAIP Science Assessment Framework and Criteria" in the *SAIP Report on Science I Assessment* (CMEC, 1997b). Student achievement was assessed according to questions that addressed:

- Knowledge and concepts of science
 - i. physical sciences – chemistry
 - ii. physical sciences – physics
 - iii. life sciences – biology
 - iv. Earth and space sciences

² See also CMEC 1997b, 2000, 2005a reports for more details on SAIP I, II, and III assessments.

- Nature of science
- Relationship of science to technology and societal issues

Learning science as a school subject involves more than learning about conceptual knowledge related to science or the skills required for scientific inquiry. It requires understanding that science is a human endeavour that uses processes to produce evidence-based knowledge and arguments to propose explanations about the natural world. These explanations may change over time as scientists strive to provide verifiable and reliable evidence that is defensible.

In 1997, CMEC published the *Common Framework of Science Learning Outcomes, K to 12* as part of the Pan-Canadian Protocol for Collaboration on School Curriculum . The intent of this document was to provide direction for curriculum developers across Canada and to harmonize science learning when revising science curricula for their particular jurisdictions (CMEC, 1997a).

The common framework built upon the work of the Science Council of Canada and stated the following vision for scientific literacy in Canada:

The framework is guided by the vision that all Canadian students, regardless of gender or cultural background, will have an opportunity to develop scientific literacy. Scientific literacy is an evolving combination of the science-related attitudes, skills, and knowledge students need to develop inquiry, problem-solving, and decision-making abilities, to become lifelong learners, and to maintain a sense of wonder about the world around them.

Diverse learning experiences based on the framework will provide students with many opportunities to explore, analyse, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment that will affect their personal lives, their careers, and their future. (CMEC, 1997a, p. 4)

The four foundation statements in the common framework delineated four critical aspects of students' scientific literacy upon which the pan-Canadian document is organized. Although presented separately, they were intended to be interrelated:

Foundation 1: Science, Technology, Society, and the Environment (STSE)

Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

Foundation 2: Skills

Students will develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.

Foundation 3: Knowledge

Students will construct knowledge and understandings of concepts in life sciences, physical sciences, and Earth and space sciences and apply these understandings to interpret, integrate, and extend their knowledge.

Foundation 4: Attitudes

Students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society, and the environment.

PCAP builds upon the earlier work of SAIP and reflects the changes in Canadian science curricula since SAIP was administered in 1996. It reflects our evolving understanding of effective assessment instruments since SAIP.

A literature review of Canadian Grade 8 science curricula conducted in preparation for PCAP (CMEC, 2005b) clearly identifies scientific literacy as the goal of science education in all Canadian jurisdictions. This framework provides a working definition of scientific literacy for PCAP Science that underpins the design of this PCAP assessment component.

The PCAP Science Assessment Framework:

- describes the competencies and subdomains of PCAP Science;
- recommends using contexts that provide opportunities for students to demonstrate their use of science-related attitudes, skills, and knowledge;
- describes the types and characteristics of the assessment items;
- contains tables of specifications to guide item development;
- discusses scoring and reporting scales; and
- includes an appendix with samples of five PCAP Science assessment units.

This framework also takes into account findings from international large-scale assessments.

International Large-Scale Assessments in Science

There are two major international assessments for science in which many Canadian jurisdictions participate: the Programme for International Student Assessment (PISA) conducted by the Organisation for Economic Co-operation and Development (OECD), and Trends in International Mathematics and Science Study (TIMSS) administered by the International Association for the Educational Achievement (IEA).

PISA Science Assessment

PISA is an international assessment of mathematics, reading, science, problem solving and financial literacy of 15-year-old students. It defines the domain of science as encompassing both “knowledge *of* science” and “knowledge *about* science” (OECD, 2013). Knowledge *of* science refers to knowledge of the natural world across the major disciplines of physics, chemistry, biological sciences, Earth and space sciences and science-based technology. Knowledge *about* science refers to knowledge of the means (scientific inquiry) and goals (scientific explanations) of science.

TIMSS

TIMSS is an assessment of intended science curriculum content for various grade levels. TIMSS items are developed through an analysis of curriculum policies, textbooks and other curriculum materials in use in participating countries. Canadian jurisdictions coordinate and administer TIMSS participation within their own provinces or territories. CMEC does not coordinate TIMSS.

The following chart is a comparison of PCAP, PISA, and TIMSS science assessments.

Table 1: Comparison of PCAP, PISA, and TIMSS science assessments.

PCAP	PISA	TIMSS
National assessment	International assessment	International assessment
Grade 8	15-year-olds	Grade 4 and Grade 8
three-year cycle (science as primary domain, 2013)	three-year cycle (science as major domain, 2006)	four-year cycle

Purposes of Assessment

PCAP must reflect changes that have happened in our understanding of assessment since the first administration of SAIP Science. It is important to understand these changes in order to clarify our understanding of the purpose and limitations of national large-scale assessments.

Although public attention is often focused on the results of large-scale national and international assessments, research suggests that valid and reliable classroom assessments used by teachers in their daily practice provide powerful tools to improve student achievement (Olsen, 2002).

Provincial/territorial examinations and large-scale assessments usually have different purposes than in-class assessment and evaluation practices. They can be used for varying purposes which can include the following:

- providing information for teachers to improve student achievement;
- selecting students who go on to postsecondary studies;
- certifying graduates;
- fostering accountability for schools, school systems, provincial/territorial systems, and national systems.

Large-scale assessments such as PCAP may be used to inform education policy but they are not used to certify and select individual students. Individual students do not have any personal stake in doing well; therefore, communication about the purpose and use of large-scale assessments is critical. Clarity of purpose will help students, teachers, and administrators to understand the importance of these assessments and to take them seriously so that the results accurately reflect the amount of learning that has taken place (Simon & Forgette-Giroux, 2002).

For the purpose of understanding the role of large-scale assessments, it is useful to consider the following three major purposes of assessment that can be used in conjunction with each other to improve student achievement (Earl, 2003). These are assessment *for* learning, *as* learning, and *of* learning as described below:

- “Assessment *for* learning” is part of effective planning for teaching and learning. It involves both the teacher and students in a process of continual reflection and review about progress. When students are given quality feedback, they are empowered to understand how to improve their learning. When teachers are given quality feedback by assessing student understanding, they can reflect and adjust their teaching strategies in response.
- “Assessment *as* learning” actively involves students in their learning processes. Students take responsibility for their learning, constructing meaning for themselves. They develop the ability to determine what they have already learned and decide how to further organize and enhance their learning. Teachers assist this student-driven process by providing opportunities for reflection and critical analysis.

- “Assessment of learning” provides a snapshot of student achievement related to specific curriculum requirements. Assessment of learning is often associated with large-scale assessments, and data collected from these assessments are often made public and can be used to inform the allocation of resources, the monitoring of standards, and approaches to teaching and thus to promote accountability. Assessment of learning provides evidence of achievement for public reporting (Stiggins, 2002), and requires precision tools and elements such as tables of specifications, rating scales, and criteria to be used in the development, delivery, grading, and reporting of the assessment tasks.



PCAP is an assessment of learning.

Why Scientific Literacy?

There is general consensus that scientific literacy is an important goal for school science (Bybee, McCrae, & Laurie, 2009; Heinsen, 2011; Osborne, 2007; Roberts, 2007, 2011). This notion is reflected in the science curriculum documents not only of Canadian jurisdictions but also that of other countries such as the National Research Council Kindergarten to Grade 12 science framework in the United States (National Research Council, 2012) and the Australian science curriculum from Kindergarten to Year 10 (ACARA, 2012). Much has been written about what should be included as part of a science curriculum in order to promote a scientifically literate population (Bybee, 1997; Fensham, 2000; Hodson, 2002).

Scientific literacy reflects the emphasis of “science for all” and is inclusive of both those who choose to pursue further study in science and those who choose other careers and interests that are not specific to science. Both science and technology are creative human endeavours with a long history in all cultures of the world. The intent of scientific literacy is to appreciate the nature of science and technology, the relationships between them, and their social and environmental contexts. Scientific literacy pertains to the application of science and how it helps or hinders humankind. It involves social issues and careers.

Scientific literacy involves using knowledge to critically assess information and is important for Canadians to be able to make informed decisions about science-related issues that society faces, which can include:

- the usefulness of science to society;
- the negative effects or unintended consequences of science ;
- scientific principles that could enable scientific research or result in the development of new or improved technologies;

- issues related to science, taking into account personal, community, and environmental factors;
- social issues;
- careers.

Almost daily, we are bombarded with science-related issues that affect our environment, our health, our food, and our economy. A scientifically literate person may be better able to draw appropriate conclusions from the evidence and information that is provided by others and to distinguish personal opinion from evidence-based statements. He or she may also be better prepared to distinguish the kinds of questions and problems that can be solved by science and technology from those that cannot be answered in these ways.

Defining Scientific Literacy

Although recognized as a goal of school science, the term “scientific literacy” continues to elude a clear definition (Osborne, 2007; Roberts, 2007, 2011). Hodson (2006) suggests that there are some commonalities and that a reasonable definition of scientific literacy should include:

- “a general understanding of some of the fundamental ideas, principles, and theories of science;
- some knowledge of the ways in which scientific knowledge is generated, validated, and disseminated;
- some ability to interpret scientific data and evaluate their validity and reliability;
- a critical understanding of the aims and goals for science and technology, including their historical roots and the values they embody;
- an appreciation of the interrelationships among science, technology, society and the environment; and
- an interest in science and the capacity to update and acquire new scientific knowledge and technological knowledge in the future” (p.294).

Roberts (2007, 2011) describes two visions of scientific literacy, with Vision I focusing on science looking within itself as well as its products and processes, and Vision II focusing on the situations in which science plays a role in society and everyday life.

PCAP Definition of Scientific Literacy

PCAP Science defines scientific literacy as:

a student’s evolving competencies of understanding the nature of science using science-related attitudes, skills, and knowledge to conduct inquiries, to solve

problems, and to reason scientifically in order to understand and make evidence-based decisions about science-related issues.

This definition is amplified in the following paragraphs to ensure clarity of its intent.

...scientific literacy...

The PCAP definition of scientific literacy includes more than information recall. Using the term “scientific literacy” rather than “science” highlights the importance that PCAP places on assessing an understanding of the nature of science and the use of science knowledge and skills within societal and environmental contexts. The definition also acknowledges that the disposition to use scientific knowledge and skills is mediated by a student’s attitudes toward science and the importance of engaging in science-related issues as a reflective citizen.

...evolving competencies of...

Scientific literacy is a continually evolving process and is part of being a lifelong learner. The PCAP definition of scientific literacy recognizes that students continue to evolve and develop competencies as they move from grade to grade and mature into adulthood. The term “competency” is used to articulate the importance of students being able to identify questions or issues to pursue science knowledge that will inform the question or issue; to seek answers to practical problems requiring the application of their science knowledge in new ways; and *to reason scientifically* when making decisions based on an understanding of the relationships among science, technology, society, and the environment when engaging with science-related issues.

... understanding the nature of science...

A key aspect of scientific literacy is an understanding of the nature of science as a human endeavour. Some important characteristics of science include the type of questions posed and the approaches to data collection; the obligation to make connections to current and historical knowledge; the reporting of methods and procedures used in obtaining evidence; the use of logical evidence-based arguments and explanations; addressing issues of relevance, reproducibility, validity, integrity, and accuracy; the tentative nature of knowledge claims; and an openness to sceptical review. Thus, science is always evolving, and new knowledge and theories supersede existing ones.

...using science-related attitudes, skills, and knowledge...

Being scientifically literate implies that there is an understanding of the importance of understanding science and its role in and its interrelationships with technology, society,

and the environment to take action to make informed evidence-based decisions. This requires applying science knowledge to science-based issues. Skills such as questioning and planning, data collecting, interpreting, and communicating, as well as attitudes such as an interest in and awareness of science-related issues, respect for science inquiry, and a sense of stewardship are brought to bear in a variety of science-related contexts.

...to conduct inquiries...

Carrying out science inquiries requires combining an understanding of how scientific studies are undertaken and the use of content knowledge, research skills, knowledge of the nature of science, and science-related attitudes to gather verifiable evidence that supports explanations of natural phenomena. It is understood that students must often acquire knowledge that is new to them, not necessarily through their own scientific investigations, but through libraries, the Internet, and other resources. Students should recognize important characteristics of scientific investigations and the types of answers one can reasonably expect from science.

...solve problems...

While scientific inquiry involves answering questions, solving problems involves searching for solutions to practical problems. For PCAP, this includes applying science knowledge in solving problems, identifying criteria, and evaluating solutions.

...and to reason scientifically...

Reasoning scientifically involves using evidence to draw conclusions or develop and use models. It includes the ability to identify relationships, to analyze numerical and pictorial information, and to understand the basis for and limitations of models.

...in order to understand and make evidence-based decisions about science-related issues.

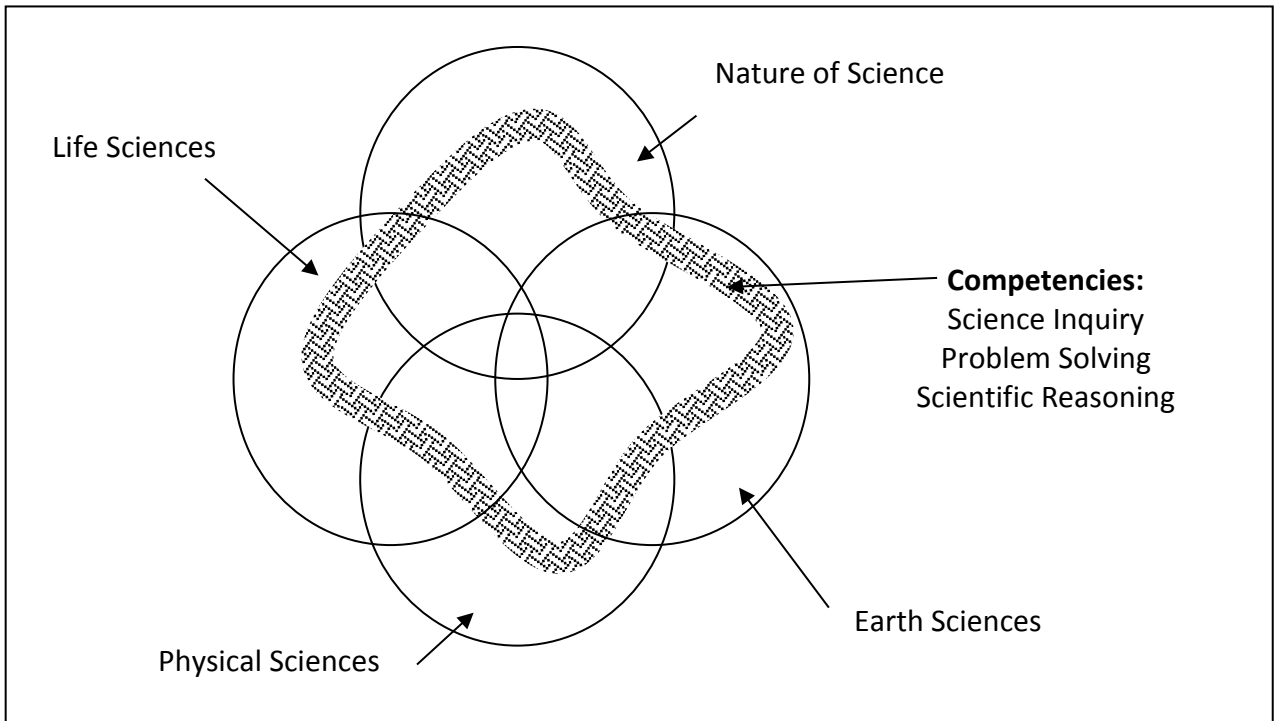
Making evidence-based decisions implies knowing, selecting, and evaluating information and data critically using scientific reasoning. Science-related issues are omnipresent and vary in complexity, often including different perspectives such as political, economic, health, and public safety. Students need to recognize that, for many issues, there may not be sufficient information to make valid evidence-based decisions, rendering it necessary to be cautious in the interpretation and the communication of the decisions.

Organization of the Domain of Science

For PCAP assessment purposes, the domain of science is divided into three competencies, four subdomains, and attitudes within a given context. The following

graph articulates the organization of PCAP Science as a major domain for assessment. It reflects the intended science curricula for students in Canadian jurisdictions,³ as well as the foundation statements in the pan-Canadian *Common Framework of Science Learning Outcomes* (CMEC, 1997a).

Figure 1: PCAP Science Framework



Competencies

An understanding of science is important for young people to be able to participate in and understand that science and technology affects their lives both in the present and in the future. Scientific literacy is developed when students are engaged in demonstrating the competencies of science inquiry, problem solving, and scientific reasoning. PCAP Science places a priority on being able to assess these competencies.

Science inquiry: Understanding how inquiries are conducted in science to provide evidence-based explanations of natural phenomena

Science inquiry requires students to address or develop questions about the nature of things, involving broad explorations as well as focused investigations (CMEC, 1997a). It is from the perspective of the student in that they focus on the “why” and “how” of science.

³ For updated science curricula, please visit official jurisdictional Web sites.

The PCAP assessment of students' ability to use scientific practices provides evidence that they can:

- formulate hypotheses;
- make observations;
- design and conduct investigations;
- organize and communicate information;
- analyze and interpret data (e.g., using graphs and tables);
- apply the results of scientific investigations;
- select alternative conclusions in relation to the evidence presented;
- provide reasons for conclusions based on the evidence provided;
- identify assumptions made in reaching the conclusion.

Problem solving: Using scientific knowledge and skills to solve problems in social and environmental contexts

Problem solving requires students to seek answers to practical problems requiring the application of their science knowledge in new ways (CMEC, 1997a). Students demonstrate this competency by applying their knowledge of science, their skills, and their understanding of the nature of science to solve science-related problems. It is part of the problem process that includes problem finding and problem shaping where problem is defined as the state of desire to reach a definite goal.

The PCAP assessment of students' ability to solve problems provides evidence that they can:

- define the problem;
- formulate questions;
- communicate the goals related to the problem;
- solve problems by recognizing scientific ideas;
- select appropriate solutions in relation to an identified problem;
- verify and interpret results (communicate, reflect);
- generalize solutions (recognize and apply science in contexts not typically thought of as scientific);
- provide reasons for the solution and how it meets the criteria to solve the problem;
- identify assumptions made in solving the problem;
- show an awareness of sustainable development and stewardship when addressing problems.

Scientific reasoning: Being able to reason scientifically and make connections by applying scientific knowledge and skills to make decisions and address issues involving science, technology, society, and the environment

Scientific reasoning involves a comparison, rationalization, or reasoning from the student in relation to an existing theory or frame of reference. Students demonstrate this competency by applying their knowledge of science, their skills, and their understanding of the nature of science to make informed, evidence-based decisions. They draw conclusions or make comparisons to an existing frame of reference or perspective. Students identify questions or issues and pursue science knowledge that will inform the question or issue.

The PCAP assessment of students' ability to reason scientifically provides evidence that they can:

- recognize patterns;
- develop plausible arguments;
- verify conclusions;
- judge the validity of arguments;
- construct valid arguments and explanations from evidence;
- connect scientific ideas and thereby build one on another to produce a coherent whole;
- use reasoning in order to make an informed decision for a particular issue in relation to the evidence;
- use reasoning in order to understand a science-related issue;
- provide reasons for the decision based on the evidence provided;
- identify assumptions and limitations of the chosen decision for that issue;
- develop and use models;
- show respect and support for evidence-based knowledge;
- display an interest and awareness in science-related issues.

For each competency, students will be assessed on their understanding and ability to critique the practices and processes related to these competencies.

Subdomains

The four subdomains targeted by PCAP science are aligned to pan-Canadian science curricula and *Common Framework of Science Learning Outcomes* (CMEC, 1997a). They include: nature of science, life science, physical science and earth science.

Nature of science

PCAP defined the nature of science as involving an understanding of the nature of scientific knowledge and processes by which that knowledge develops. Science provides a way of thinking and learning about the biological and physical world based on observation, experimentation, and evidence. Science builds upon past discoveries. Theories and knowledge are continually tested, modified, and improved as new knowledge and theories supersede existing ones. Scientific debate on new observations

and hypotheses is used to challenge, share, and evaluate data through peer interaction and dissemination of information through written publications and presentations.

“School education can develop the abilities to relate evidence to conclusions and distinguish opinion from evidence-based statements and so feed into the public understanding of science” (Fensham & Harlen, 1999, p. 762).

The PCAP assessment of students’ understanding of the nature of science provides evidence that they can:

- understand the relationship among collecting evidence, finding relationships, and proposing explanations in the development of scientific knowledge;
- distinguish between processes and terminology that are scientific and those that are not;
- describe the processes of science inquiry and problem solving in evidence-based decision making;
- distinguish between qualitative and quantitative data;
- identify characteristics of measurement (e.g., replicability, variation, accuracy/precision in equipment and procedures);
- distinguish between various types of scientific explanations (e.g., hypothesis, theory, model, law);
- give examples of scientific principles that have resulted in the development of technologies;
- demonstrate scientific literacy with respect to nature of science issues.

The subdomains of life sciences, Earth sciences and physical sciences are assessed through the following descriptors:⁴

Life sciences

- Explain and compare processes that are responsible for the maintenance of an organism’s life.
- Describe the characteristics and needs of living things.
- Distinguish between cells and cell components.
- Describe the function and interdependence of systems related to inputs and outputs of energy, nutrients, and waste.
- Demonstrate scientific literacy with respect to life science issues.

Physical sciences

- Describe the properties and components of matter and explain interactions between those components [e.g., states of matter (i.e. solids, liquids, and gases); properties and changes of matter; particle theory; mass and volume].

⁴ Please note that although these descriptors reflect the commonalities of pan-Canadian curricula, they are not intended to be an exhaustive list.

- Demonstrate scientific literacy with respect to physical science issues.

Earth sciences

- Explain how water is a resource for society.
- Explain patterns of change and their effects on water resources on Earth (e.g., water distribution; weather; weathering and erosion; effect of water on regional climates).
- Demonstrate scientific literacy with respect to Earth science issues.

NOTE: Although the interrelationships between science and technology are an important part of developing scientific literacy, it must be emphasized and made clear that PCAP Science is not designed to assess the technological literacy of students writing this assessment.

Attitudes

Attitudes toward science determine students' interest to pursuing scientific careers (Osborne, Simon, & Collins, 2003). Since creation of new scientific knowledge is essential for economic growth, students' attitudes toward science are a subject of societal concern and debate in many countries (OECD, 2006b).

To analyze students' attitudes, PCAP Science assesses:

- interest in and awareness of science-related issues;
- respect and support for evidence-based knowledge;
- awareness of sustainable development and stewardship.

Assessment Design

General Design of the Assessment

PCAP Science is organized into "assessment units" that provide a developmentally appropriate context for which specific questions (assessment items) will follow. Assessment units comprise an opening situation usually followed by three to six assessment items assessing both a competency and a subdomain.

Five sample assessment units with their corresponding items are included in the appendix.

Any text assumes that students will have a degree of reading literacy. In PCAP Science, text selections are at a level that is accessible to the vast majority of Grade 8 students. Questions that predominately assess reading or mathematics are avoided. The vocabulary is consistent with the level of understanding that can be expected of Canadian students at this level.

Since PCAP Science is an assessment of scientific literacy, each assessment item is coded to one of the three competencies and one of the four subdomains. Attitude items are embedded in the units within specific contexts.

Contexts

Each assessment unit has a context that is interesting and relevant to Grade 8 students and relates to the science, technology, society, and environment (STSE) component of Canadian science education. Health, sports, media, the environment, and consumerism or consumption are possible areas of application relevant to Grade 8 students where science and technology has an effect on their lives. Developers of the assessment items ensure that the contexts are developmentally appropriate and not culturally or geographically dependent.

The selection of contexts is mindful of the scientific competencies, understanding, and attitudes that students have acquired by the end of Grade 8. In the majority of Canadian education systems, this grade marks a transition period in the curriculum.

PCAP Science recognizes that as students advance from grade to grade, competency to use science-related attitudes, skills, and knowledge builds over time. Students who are in Grade 8 are in the stage of early adolescence and experience dramatic changes in physical, intellectual, social, and emotional growth. Their social and environmental experiences are more personal and local, although they are highly curious and can relate to real-life problems and situations. It must be recognized that, in this period of early adolescence, Grade 8 students are idealistic, have a strong sense of fairness, and are reflective and introspective in thoughts and feelings. They confront moral and ethical questions head-on and have a willingness to learn new things they consider to be useful (Forte & Schurr, 1993).

The contexts chosen for PCAP Science assessment units were intended to captivate the interests of Canadian Grade 8 students and, therefore, to increase their motivation to participate in writing the test.

PCAP Science item developers identify appropriate and relevant contexts for Canadian Grade 8 students. A question they asked themselves is “What is important for Grade 8 students to know, value, and be able to do with respect to understanding science within a situated context?” Contexts must be relevant to students’ interests and lives and need to be sensitive to linguistic and cultural differences. The context for the assessment unit is introduced through an opening situation and could be in the form of a brief narrative and include tables, charts, graphs, or diagrams.

Recommended Item Format and Item Type

PCAP item developers select item types that are most appropriate to what is asked. These include selected-response and constructed-response items. The test contains approximately 70 per cent selected-response, 30 per cent constructed-response, and 5 per cent attitude items.

Selected-response items

Some PCAP Science assessment items are in the form of selected-response items. Selected-response items are those that give the student a choice of responses from which the student must choose. They include multiple-choice, check boxes, circling part of the test, true-or-false statements, yes–no observations, and drawing lines connecting words and statements. All multiple-choice items consist of a stem statement with four choices, one of which is the correct answer and three of which are logical distractors.

The directions in the stem are designed to be clear, and the wording is intended to let students know exactly what is asked. Wordiness is avoided in the stem as well as in the situation that precedes the assessment items. The response choices are independent so that options do not overlap. The length of options is kept reasonably consistent. Plausible distractors are used, and illogical distractors avoided.

Constructed-response items

Some PCAP Science assessment items are also in the form of constructed-response items. Constructed-response items refer to items that require students to provide a written response. These responses range from short phrases or two to three sentences to extended constructed-response items that can require a longer response. They may also ask the student to create tables or graphs or sketch diagrams. PCAP Science includes constructed-response items that require one- to three-line responses for students. They are open-ended and must measure higher-order cognitive skills and content knowledge.

The inclusion of constructed-response items also reflects good assessment practice in that different assessment formats are required, depending on what students are expected to demonstrate. Constructed-response items allow for partial credit. PCAP Science is designed to include no more than 30 per cent to 40 per cent constructed-response items.

Contextualized embedded attitude items

The vast majority of Canadian jurisdictions include the development of positive attitudes as an important component to be embedded within science teaching and learning. This importance must be mirrored in PCAP Science. PCAP Science will gather data about

students' attitudes using both contextualized embedded attitude items and a student questionnaire. Gathering data about students' attitudes both in context and out of context will provide data on whether attitudes vary between these two types of methodologies and how this affects achievement. Hidi and Berndoff (1998) argue that situational interest can have an important effect on both cognitive and motivational functioning; however, investigations of its role remain "haphazard and scattered." By using both contextualized attitude items and a student questionnaire, PCAP Science could provide data to further this area of research.

The framework for PISA 2006 (OECD, 2006a) describes two types of contextualized embedded attitude items that are worthy of including in PCAP Science. These are "match-the-opinion" items and items consisting of a set of Likert-style responses. Samples of embedded attitude question styles can be found in the appendix.

"Match-the-opinion" items require students to choose the opinion that best matches their own from a list of four ordered opinions about an issue. Each given opinion represents a different level of commitment toward evidence-based knowledge and toward sustainable development and stewardship.

In a Likert-style item, students are asked to indicate their agreement to specific statements. Different scales may be used to operationalize statements in a given context. In PCAP Science, the criteria used to define "interest in science" have response scales that use a format that indicates interest (e.g., high interest, medium interest, low interest, no interest) rather than agreement (e.g., strongly agree, agree, disagree, strongly disagree), which tends to favour responses thought to be "socially desirable." Likert-style items are efficient and minimize demands on student response time.

PCAP Science contains sufficient attitude items to prepare a reliable scale; however, responses to the attitude items will not typically be included in the overall score of scientific literacy. Nevertheless, they will provide an important component of profiling student scientific literacy.

Several, but not all, assessment units contain contextualized, embedded attitude items.

Student Questionnaire

A student questionnaire will gather demographic information and information that will be consistent with the PCAP Questionnaire Framework. It includes some questions related to students' attitudes to and about science to complement the other contextualized attitude items.

Challenges to Assessment Unit Developers

The overall purpose of PCAP Science is to measure scientific literacy, and therefore assessment items focus on critical components (competencies and subdomains) that contribute to scientific literacy. This is different from traditional test items in science, which may have a greater emphasis on knowledge recall and application. All items must be clearly mapped to both a competency and a subdomain. PCAP Science items provide students with the opportunity to demonstrate both competency and knowledge regarding the practices of science.

Limitations of the Assessment Tasks

Although the design of this framework has been consistent with the intent of science curricula across Canada, PCAP Science is not a comprehensive assessment that includes every aspect of content knowledge, skills, and attitudes that are in every science curriculum for Canadian Grade 8 students.

The assessment will use paper-and-pencil tasks.

PCAP Science will not have a performance-based practical component. Performance-based tasks usually require observation and the completion of a product or practical task. The time constraints for PCAP Science are such that the test is to be written by students in 90 minutes with each booklet containing assessment items for both the primary domain (science) and the minor domains (mathematics and reading). These time constraints, as well as financial considerations, do not allow for practical items. Teamwork and cooperative skills identified as important in Canadian science curriculum documents are not evaluated in this domain.

Tables of Specifications

A table of specifications is a guide for assessment that indicates the emphasis that is placed on the measurement of students' understandings within various learning domains, and it reflects the degree of curricular commonality among Canadian jurisdictions. Percentages in the cells of the tables were used as a development guide to design assessment items.

The following identifies tables of specifications for the subdomains and competencies.

Table 2: Specifications for Competencies

Competencies	Percentage of score points
Science inquiry	30–40
Problem solving	10–25
Scientific reasoning	35–45
Total	100

Table 3: Specifications for Subdomain Items

Subdomains	Percentage of score points
Nature of science	25–35
Life sciences	25–35
Physical sciences	20–30
Earth sciences	10–25
Total	100

Embedded attitude questions comprise approximately 5 per cent of the assessment.

Reporting Scales and Subscales

To meet the intended goal of PCAP Science to be an assessment of scientific literacy, the development of numeric scales of student achievement is required. The process of arriving at these scales is iterative and draws upon past experiences of assessing science achievement; it is also informed by the research into the cognitive development of science. Reporting scales need continuous examination through data accumulated in the administration of PCAP Science.

When PCAP Science is a primary domain, it will report on numeric scales for each of the three competencies and four subdomains for which the pan-Canadian average will be set at 500 points and the standard deviation will be set at 100 points. This is similar to the numeric scale used by OECD’s PISA assessments. When PCAP Science is a minor domain, student achievement will be reported in terms of one scale only.⁵

⁵ Student results will not be segregated by competency or subdomain; instead, one general scale will be provided.

Appendix: Sample Science Units

Overview of Sample Units

For assessment purposes, the PCAP definition of scientific literacy may be characterized as consisting of four interrelated aspects: context, competencies, knowledge, and attitudes. The following five sample units serve to illustrate the overall style of the PCAP Science assessment units, although no attempt has been made to ensure complete coverage of the PCAP Science Framework. The classification for each question and a scoring guideline is provided. Sample units A, B, and E contain embedded attitude assessment items.

Sample Unit A: Investigating a Salt Marsh Ecosystem

It has been estimated that 65% of salt marshes in the upper Bay of Fundy have been lost because of human activity related to agriculture, residential development, and constructing barriers and culverts to limit the movement of tidal waters.

Salt marshes are important to coastal marine ecosystems. They are areas of primary production for coastal food chains, and habitats for wildlife such as fish, insects, and birds.

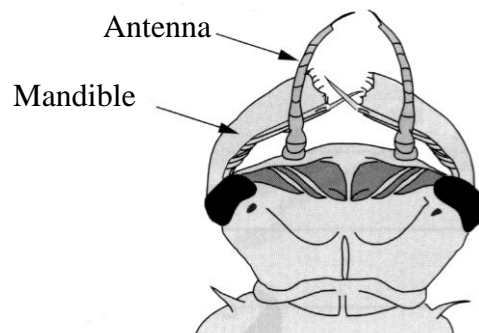


A salt marsh in New Brunswick, Canada

Question 1

Carole and Nathalie decide to go to a marsh to observe the variety of life forms it contains. They plan to track the changes in that ecosystem.

Using a net, they capture organisms that live in the marsh. They carefully observe one that has sharp, pointed mandibles (shown enlarged in the drawing below).



From their observations, select the action that they predict would *best* describe how this organism takes in its food.

- A. Sucking
- B. Chewing
- C. Absorbing
- D. Shredding

Classification: Competency – Scientific reasoning; Subdomain – Life sciences;

Full Credit: B

Question 2

The girls decide to keep the organism that they captured alive in order to show it to their science teacher. List two criteria they need to consider to keep the organism alive and transport it safely to their class.

1. _____

2. _____

Classification: Competency – Problem solving; Subdomain – Life sciences;

Full Credit

The organism must have:

1. a container to protect it;
2. air holes so that it can breathe.

Question 3

During their research on the marsh, Carole and Nathalie learn that the water is being contaminated by an insecticide used to control flies in a pig farm close by. The girls write five statements in their notebooks regarding topics that they are interested in learning more about.

Which of the statements below can be investigated scientifically?

(Note: you are **not** responding to the statement itself but to how it can be investigated).

Choose **Yes** or **No** for each statement.

Can the statement be investigated scientifically?	Yes	No
The insecticide decomposes over time.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
The insecticide does not scare the ducks away.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
The insecticide affects all of the organisms in the pond.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
The blue herons are not aware of the presence of insecticide.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
The organisms in the pond develop a resistance to the insecticide.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂

Classification: Competency – Science Inquiry; Subdomain – Nature of sciences;

Full Credit

Yes, No, Yes, No, Yes, in that order.

Question 4

The Southeastern New Brunswick Coastal Stewardship Project (SENBCSP) was established to increase public awareness of the value of coastal habitats and their associated issues and threats. The SENBCSP goal is to promote ecologically sound land-use practices, which will result in the preservation of wildlife habitat and wetland functions.

Describe two steps that humans can take to help sustain coastal marine ecosystems for future generations.

1. _____

2. _____

Classification: Competency – Scientific reasoning; Subdomain – Life sciences;

Full Credit

Describes two ways that humans can protect marine ecosystems; for example, limiting residential/industrial development near the water to protect habitats or identifying a way to prevent agricultural runoff to limit the amount of chemicals entering the water.

Partial Credit

Identifies two ways to protect ecosystems without a description OR describes only one way with a description.

Question 5

Select the letter that **best** corresponds to your opinion about Carole and Nathalie's decision to remove the organism from the marsh and bring it to school. There is no right or wrong answer to this question.

- A. I agree with the decision to bring the organism to school because the responsibility of protecting the environment belongs to the government.
- B. I agree with the decision to bring the organism to school because it is just a small organism.
- C. I would not bring the organism back to school if my classmates didn't either.
- D. I would not bring the organism back to school even if all my classmates decided to do so.

Classification: Attitude

Sample Unit B: Measuring physical fitness with breathing volume

Eighty per cent of Canadians said they believe physical activity is “as important as nutrition” to the health of children and teenagers, and 16 per cent said they consider physical activity “more important.”

Breathing volume is a measure of physical fitness. Breathing volume is the volume of air that is inhaled and exhaled in one breath.



Question 1

In a physical education class, the teacher asks the students to determine their breathing volume both at rest and during exercise. They must come up with a process for measuring their breathing volume.

The teacher asks them to measure their breathing volume more than once. Explain why this is important.

Classification: Competency – Science inquiry; Subdomain – Nature of sciences;

Full Credit: If more measurements are taken, then the average should be closer to the true value OR to provide more accurate results.

Question 2

The table below records the results for Naomi's physical fitness test. Use this table to answer questions 2 and 3.

	Naomi	
	Trial 1 (L/breath)	Trial 2 (L/breath)
Resting	0.37	0.41
Walking	0.45	0.47
Running	0.49	0.50

What is the best conclusion that can be drawn from the table?

- A. Breathing volume is not affected by running.
- B. Less breathing volume is required after running.
- C. Greater breathing volume is required after running.
- D. Running and walking require similar breathing volumes.

Classification: Competency – Science inquiry; Subdomain – Nature of science;

Full Credit: C

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Question 3

Naomi plays on a local hockey team. Predict her breathing volume after she has skated at full speed for 30 seconds.

- A. 0.37 L/ breath
- B. 0.40 L/breath
- C. 0.44 L/breath
- D. 0.49 L/breath

Classification: Competency – Science inquiry; Subdomain – Nature of science;

Full Credit: D

Question 4

Scientific research strongly supports the idea that physical activity is essential to keeping your body healthy.

Choose **True** or **False** for each of the statements below.

Statement	True	False
People who become physically active can reduce the financial burden on our health-care system.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
As long as you are physically active, it does not matter what body weight you have.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Physical activity requires special equipment that not all Canadians can afford.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Physical activity has a role in the prevention of disease.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂

Classification: Competency – Scientific reasoning; Subdomain – Life sciences

Full Credit:

True, False, False, True, in that order.

Question 5

In *Canada's Physical Activity Guide to Healthy Active Living*, health care professionals recommend that youth gradually increase their physical activity from 30 minutes per day to 90 minutes per day with a mix of moderate and vigorous activities.

Indicate your level of interest in finding out more about each of the following issues related to healthy active living. There are no right or wrong answers.

	<i>High Interest</i>	<i>Medium Interest</i>	<i>Low Interest</i>	<i>No Interest</i>
A. What you can do to live a healthier active life.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
B. How smoking affects your health.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
C. How drugs and alcohol affect your health	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
D. Why some people get sick more often than others.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

Classification: Attitude

Sample Unit C: Bottled Water

Many people drink bottled water.

Plastic water bottles can be found in schools, homes, offices, and many other places.

A single plastic water bottle that takes a few minutes to drink can take up to a thousand years to biodegrade.



20% of Canadians drink only bottled water.

Question 1.

You are making a presentation to argue for a reduction in the quantity of bottled water used in your community.

Outline two arguments you can use to support your case.

Argument 1 :

Argument 2:

Classification: Competency – Scientific reasoning; Subdomain – Nature of science

Full Credit:

Provides two valid arguments to support the case to reduce the amount of bottled water used. Need examples for coders.

Partial Credit

Provides only one valid argument to support the case. Need examples for coders.

Question 2.

Your community is considering suggestions for reducing the use of bottled water.

Circle Yes or No for each of the following suggestions to indicate if it would reduce the use of bottled water.

Suggestion	Yes	No
A. Increase the price of bottled drinks.	Yes	No
B. Install drinking fountains in public places.	Yes	No
C. Provide special funds for bottling plants to reduce their production costs.	Yes	No
D. Launch a campaign to raise awareness of the high quality of tap water.	Yes	No

Classification: Competency – Scientific reasoning; Subdomain – Earth sciences;

Full Credit:

Yes, Yes, No, Yes, in that order.

Question 3.

One of your team members suggests that plastic bottles should be replaced with glass bottles.

Provide one argument in support of the suggestion and one argument against the suggestion.

Argument in support:

Argument against:

Classification: Competency – Scientific reasoning; Subdomain – Earth sciences;

Full Credit:

Provides one valid argument in support of replacing plastic bottles with glass bottles AND one valid argument against. Need examples for coders.

Partial Credit

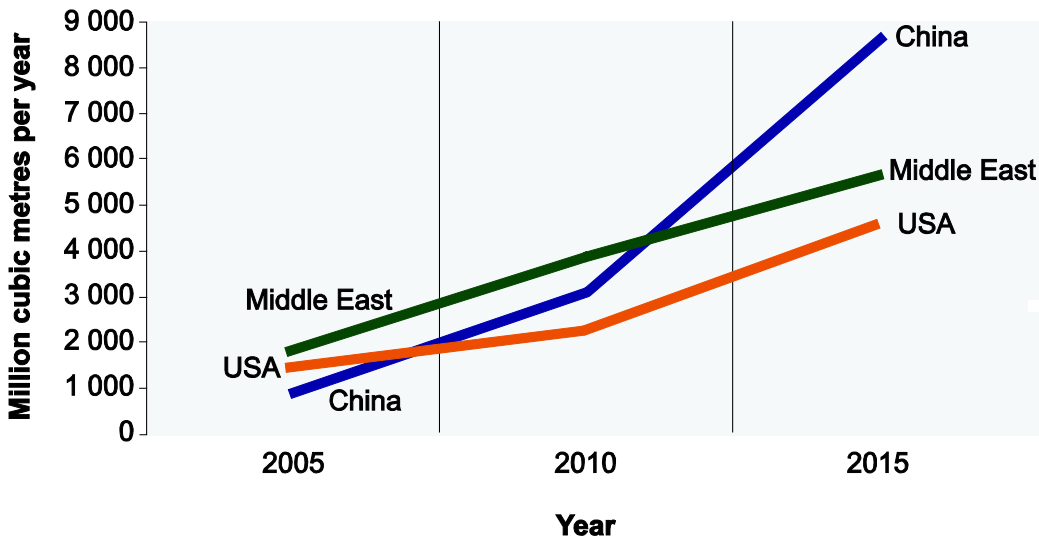
Provides only one valid argument in support of or against the case. Need examples for coders.

Question 4.

There is an increasing need to reduce the amount of water that is used worldwide. One way to do this is to reuse wastewater.

The graph below shows a forecast of the increase in waste-water reuse for three global regions, from 2005 to 2015. No data were available for Canada for this period of time.

2005–2015 Wastewater Reuse



Question 4. Use the information in the graph to circle True or False for each of the statements below.

Statement	True	False
A. In 2005, wastewater reuse was lower in the USA than in China.	True	False
B. In 2010, wastewater reuse was higher in the USA than in the Middle East.	True	False
C. From 2005 to 2015, wastewater reuse increases more in the USA than in the Middle East.	True	False
D. From 2005 to 2015, wastewater reuse increases more in China than in the Middle East.	True	False

Classification: Competency – Science Inquiry; Subdomain – Earth sciences;

Full Credit:

False, False, False, True, in that order.

Question 5.

People can have a stronger impact on the environment than other living things. Which on the reasons below gives the best explanation for this?

- A. This is because of humans' need for food.
- B. This is because of humans' need for water.
- C. This is because of humans' ability to adapt to change.
- D. This is because of humans' ability to alter the environment.

Classification: Competency – Scientific reasoning; Subdomain – Life sciences;
Full Credit: D

Sample Unit D: Diabetes

When we eat food that contains carbohydrates, the body breaks them down into sugars. These sugars are used for energy during exercise and for growth and repair of cells. Insulin is needed by the cells in order to absorb sugars into the blood.

Diabetes is a disease in which sugar is not properly absorbed from the blood. There are two types of diabetes.

Type 1	<ul style="list-style-type: none">• the body does not produce insulin• caused by genetic factors• usually found in young children
Type 2	<ul style="list-style-type: none">• cells in the body stop using insulin• cells can no longer absorb sugar effectively• more often found in people who are overweight, have high blood pressure and cholesterol, or who have a family history of diabetes• usually occurs in older people• increasingly found in young children

Question 1.

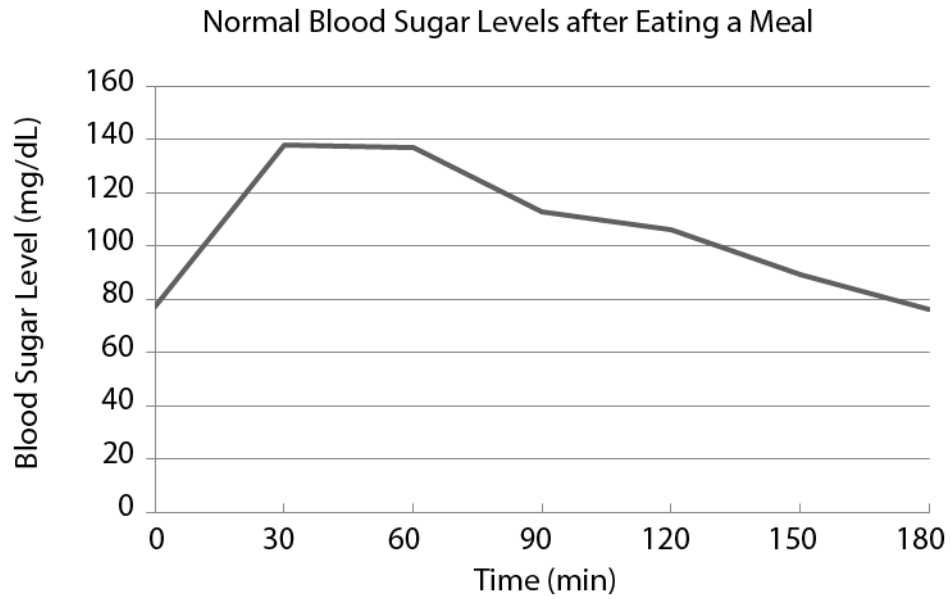
Which statement below would provide a reason for the increase in number of children with Type 2 diabetes?

- A. Children are exposed to an increased amount of pollution.
- B. Children are watching more television and playing more video games.
- C. Children are eating more foods with higher sugar content and are exercising less.
- D. Children are more exposed to disease through increased contact with other children.

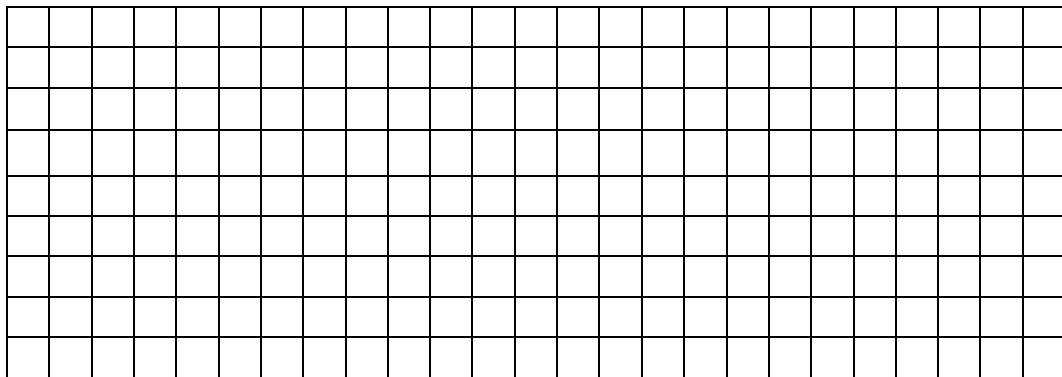
Classification: Competency – Scientific reasoning; Subdomain – Life sciences;
Full Credit: C

Question 2.

After eating a meal, blood sugar levels in a healthy person slowly increase as food is broken down and then decrease as the cells of the body use the sugar, as shown below.



Nutritionists recommend eating three meals a day in addition to small snacks in the middle of the morning and afternoon. **Sketch a diagram below to represent the blood sugar levels of a non-diabetic person who follows this eating pattern for 24 hours. Include a title and labels for the axes on the lines given.**



Classification: Competency – Science inquiry; Subdomain – Life sciences

Full Credit: Provides a sketch that shows three meals (higher peaks) and two snacks (lower peaks) and includes labels (i.e., title, axis labels, axis units).

Partial Credit: Provides a sketch that shows three instead of five changes (snacks not included) in blood sugar but all labels included OR the data is graphed correctly with 5 meals/snacks but missing labels.

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Question 3.

Explain how your sketch would look different if the person eating the meals were a diabetic.

Classification: Competency – Scientific reasoning; Subdomain – Life sciences;

Full Credit: Mentions the change in the shape of the sketch (e.g., the top of the peaks and the bottom of the valleys would be closer together OR the graph would look flatter/ the peaks would be lower) and offers an explanation for the change (e.g., because the sugar would not be absorbed by the body without insulin OR the blood-sugar levels would not decrease as much).

Question 4.

The best diet for a person with diabetes is the same healthy diet that is good for everyone. A healthy meal includes a combination of fats, proteins, and carbohydrates, but not in equal proportions. Analyze the two nutrition labels below. **Identify which one you think is a healthier choice and explain why.**

Sample 1	
Nutrition Facts	
Valeur nutritive	
Per 1 cup / Pour 1 tasse (250 mL)	
Amount	% Daily value
Quantité	% valeur quotidienne
Calories / Calories 260	
Fat / Lipides 13 g	20%
Saturated / Saturés 3 g	25%
Trans / Trans 2 g	
Cholesterol / Cholestérol 30 mg	
Sodium / Sodium 660 mg	28%
Carbohydrate / Glucides 31 g	10%
Fibre / Fibres 0 g	0%
Sugars / Sucres 5 g	
Protein / Protéines 5 g	
Vitamin A / Vitamine A	4%
Vitamin C / Vitamine C	2%
Calcium / Calcium	15%
Iron / Fer	4%

Sample 2	
Nutrition Facts	
Valeur nutritive	
Per 1 cup / Pour 1 tasse (250 mL)	
Amount	% Daily value
Quantité	% valeur quotidienne
Calories / Calories 130	
Fat / Lipides 5 g	8%
Saturated / Saturés 3 g	21%
Trans / Trans 0 g	
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 15 mg	1%
Carbohydrate / Glucides 17 g	6%
Fibre / Fibres 2 g	4%
Sugars / Sucres 16 g	
Protein / Protéines 2 g	
Vitamin A / Vitamine A	0%
Vitamin C / Vitamine C	0%
Calcium / Calcium	4%
Iron / Fer	2%

The healthier food choice is

Sample 1 or Sample 2

₁
₂

Explain your answer.

Classification: Competency – Scientific reasoning; Subdomain – Life sciences;

Full Credit: Provides a valid explanation based on the criteria identified for the choice. If additional information is present that is incorrect, it must not contradict correct information. Need to provide examples for coders.

Sample Unit E: Pesticides in Freshwater Lakes

Dead birds were found along the shore of a lake. Scientists examined the bodies of the birds and found high levels of pesticides in their tissues. Scientists collected samples of various species of fish that live in the lake. They found that they had moderate levels of pesticides in their tissues. Pesticides could not be detected in the water in the lake or in the ground surrounding the lake.

Question 1.

Based on the information above, a conclusion that can be drawn is that the main food source for the birds is

- A. fish from the lake.
- B. plants from the lake.
- C. frogs and smaller birds.
- D. insects that live in the lake.

Classification: Competency – Scientific reasoning; Subdomain – Life sciences;
Full Credit: A

Question 2.

Which statement below best corresponds to your opinion on the agricultural use of chemical pesticides near lakes or rivers. There is no right or wrong answer.

- A. I would never recommend the use of pesticides.
- B. I would encourage farmers to use modified, insect-resistant plants.
- C. I would strongly recommend the use of pesticides to improve crop yields.
- D. Before recommending the use of pesticides, I would research their effects on the environment and on humans.

Classification: Attitude

Question 3.

Which of the statements below describes the water found in freshwater lakes?

- A. It is a renewable, limited resource.
- B. It is a renewable, unlimited resource.
- C. It is a non-renewable, limited resource.
- D. It is a non-renewable, unlimited resource.

Classification: Competency – Scientific reasoning; Subdomain – Earth sciences;

Full Credit: A

Question 4.

In the table below, identify the differences in the characteristics of water between summer and winter in a lake.

Characteristics of Water	Summer	Winter
State of matter		
Movement of particles		
Arrangement of particles		

Classification: Competency - Scientific reasoning; Subdomain – Physical sciences;

Full Credit: Three properties identified for both seasons.

Partial Credit: Properties of one season identified OR two properties identified per season.

Question 5.

The smallest unit that can be considered to be alive in a fish found in a lake is a

- A. cell
- B. muscle
- C. nucleus
- D. molecule

Classification: Competency – None, this is only knowledge; Subdomain – Life sciences; question.

Full Credit: A

Glossary

Assessment (*Évaluation*): A systematic measure of obtaining information for the purpose of quantifying student performance.

Assessment item (*Question d'évaluation*): An inquiry requiring a response and used for measuring student learning.

Assessment unit (*Unité d'évaluation*): A developmentally appropriate context that provides a science-related issue for which specific items will follow.

Category (*Catégorie*): A general classification of three contexts reflecting the science, technology, society, and environment (STSE) component of Canadian science education.

Competencies (*Compétences*): The combination of attitudes, knowledge, and skills that enable a student to effectively demonstrate science inquiry, problem solving, and reasoning and connections.

Context (*Mise en situation*): An issue that is developmentally appropriate for Canadian Grade 8 students and brings meaning to a set of items within an assessment unit.

Contextualized-embedded attitude item (*Item intégré et contextualisé d'évaluation des attitudes*): An item that is not scored and reflects the subdomain of attitudes as related to the context of the assessment unit; examples are “match-the-opinion” items and Likert-style items.

Constructed-response item (*Item ou question à réponse construite*): An item that requires a written response.

Curriculum (*Curriculum*): Canadian jurisdictional policy documents on an intended program of study.

Distractor (*Leurre*): An incorrect alternative in a multiple-choice item that can be selected to complete the stem.

Domain (*Matière*): A discipline/field/area of study, e.g., science, mathematics, or reading).

Field trial (*Mise à l'essai*): The initial administration of new assessment items and procedures with the intent of evaluating and revising the items and procedures for future use.

Goal (*Objectif*): A broad, general instructional intent expressed in terms of what learners will demonstrate.

Human endeavour (*Entreprise humaine*): A purposeful undertaking by people.

Item (*Item ou question*): An inquiry requiring a response.

Likert-style item (*Item du type Likert*): An item that requires students to indicate their level of agreement to specific statements.

“Match-the-opinion” item (*Item d’appropriation*): An item that requires students to choose the opinion that best matches their own from a list of four ordered opinions about an issue; each given opinion represents a different level of commitment toward evidence-based knowledge and toward sustainable development and stewardship.

Multiple-choice item (*Item ou question à choix multiple*): A type of selected-response item that consists of one introductory stem followed by a list of response choices that include the correct or best answer and several incorrect but logical distractors.

PCAP (*PPCE*): Pan-Canadian Assessment Program, which assesses three domains: reading, mathematics, and science; primary domain assessments will report results at the domain level (overall score) and at the subdomain level; minor domain assessment will report only at the domain level.

PCAP Science (*PPCE Sciences*): The science assessment of Canadian Grade 8 students conducted under the Pan-Canadian Assessment Program (PCAP).

PISA 2006: The Programme for International Student Assessment scientific literacy framework developed for the 2006 assessment, in which science was the major focus.

Practical task (*Tâche pratique*): Demonstration of skill or knowledge through observation and manipulation of materials and/or equipment.

Reporting scale (*Échelle de notation*): Value assigned to measure students’ performance for assessing subdomains (life sciences, physical sciences, Earth sciences, and nature of science) and competencies (science inquiry, problem solving, reasoning, and connections) that can be used to summarize levels of scientific literacy.

Response choice (*Choix de réponse*): An alternative in a multiple-choice item that can be selected to complete the stem.

Selected-response item (*Item ou question à réponse choisie*): An item that presents alternative responses from which the student chooses the correct or preferred answer.

Scientific literacy (*Culture scientifique*): Defined in PCAP Science as a student’s evolving competencies of using science-related attitudes, skills, and knowledge, as well as an understanding of the nature of science to conduct inquiries, solve problems, and use

reasoning and connections to make evidence-based decisions about science-related issues.

Scoring (*Notation*): The process of assigning numbers to reflect students' performance on an assessment.

Strand (*Domaine*): A component of a subdomain.

Subdomain (*Sous-domaine*): A component of a domain.

Table of specifications (*Tableau de spécifications*): A guide for assessment that indicates the emphasis that should be placed on the measurement of students' understandings within various learning domains.

Technological literacy (*Culture technologique*): The ability to use, manage, assess, and understand technology involving knowledge, abilities, and the application of both knowledge and abilities to real-world situations.

Validity (*Validité*): The degree to which items measure what they are intended to measure and the extent to which inferences and actions made on the basis of assessment scores are appropriate and accurate.

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