

LEARNING EXPERIENCE ONE

Guiding Question: What is the chemistry of food products?

This Learning Source provides starting points and information to investigate: - Food chemistry - Organic and inorganic compounds - Macronutrients and micronutrients - Organic farming - Environmental nutrients	Build Competencies: Food production technologies Students create nutrient illustrations, investigate food and nutrient myths, explore organic farming. This handout includes activities that support competencies and weblinks to online resources that students can explore. 	 Assess  Look for evidence of understanding of the following concepts: - Essential chemicals - Nutrients - Organic and inorganic - Macronutrients and micronutrients - Chemical and organic inputs For a formative assessment, have students create a Mind Map that identifies and compares the range of chemical elements found in food nutrients and in organic and non-organic elements in the environment (soil, water, air).
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Additional Research or Background Sources

Consult teacher or student background sources such as the examples that follow to further explore, enrich or expand activities for this guiding question. Student research sources are also provided in **Build Competencies** handouts.

Agriculture and Agri-Food Canada provides websites that can provide students with perspectives on the range of agricultural products produced in Canada. Find connections to a variety of sources of information on the Eat Canadian webpage at www.agr.gc.ca/eng/?id=1538141990966. Find links to products grown across Canada on the Discover Agriculture webpage at www.agr.gc.ca/eng/about-us/publications/discover-agriculture/?id=1411999466585.

Agriculture and Agri-Food Canada also provides a series of infographics on agriculture at www.agr.gc.ca/eng/about-us/publications/discover-agriculture/infographics-agricultural-products-and-their-impacts/?id=1530198199592. Statistics Canada also provides some infographics focused on agriculture at <https://www150.statcan.gc.ca/n1/pub/11-627-m/index-eng.htm>. Students can scan infographics for evidence that relates to the connection between food products and chemistry. Students can also be asked to identify examples of sustainable practices.

Find a series of fact sheets about organic farming from the Agriculture in the Classroom Canada website at <https://aitc-canada.ca/en-ca/learn-about-agriculture/category/organics>.



Additional information and discussion questions are provided in the carousel slide for this guiding question in the **sustainability MATTERS** section of the **LEARN** webpage.

Click on the carousel slide to open and explore the following content.

- A discussion of **chemistry of organic food production**
- A comparison of **organic or conventional**
- A video about **what makes organic milk organic**



Find **Science 9, Science 20** and **Biology 20** learning outcomes supported by this learning experience on the following pages.

Use this activity to have students focus on the role that organic and inorganic substances in both the production and consumption of food products. Have students reflect on the science behind food trends, such as organic farming and sustainable food production. Have students compare nutrients in food to nutrients in ecosystems.

After completing activities in this learning experience, have students write or discuss their thinking about the extent to which they think the food available to them is influenced by the increasing emphasis on sustainable practices in agriculture.



Look on the **VIEW** webpage for video interviews with Alberta farmers about sustainability and food trends. As students watch the video, ask them to identify perspectives shared by farmers.

A complete description of Canadian organic standards can be found on the Organic Federation website at www.organicfederation.ca/canadian-organic-standards#6%20liv%20prod.

The Organic Alberta website, accessed at <https://organicalberta.org/>, provides information on organic farming in Alberta.

Advertising can promote food with descriptive words that highlight trends, such as “no antibiotics, organic, made in Canada, additive-free, fair trade or locally produced.” Students may be interested in exploring some of these terms. *The Pendulum Swings 2016 Food Trends for Industry Processors*, at <http://westerngrocer.com/the-pendulum-swings-2016-food-trends-for-industry-processors/>, provides some insights into food-specific trends and is suitable as teacher background information.

A hands-on lab activity can be found in *How to Make a Naked Egg* on the Imagination Station website at www.imaginationstationtoledo.org/educator/activities/how-to-make-a-naked-egg. This lab can be used to reinforce concepts related to organic and inorganic substances and agricultural food products.

> EXTEND LEARNING

Challenge students with **fact or fiction statements** such as those below. Students can also develop their own statements. Have students focus on agriculture facts related to sustainability, food chemistry, organic farming, food trends and environmental or food nutrients.

- 💧 A farmer living in the 1900s produced enough food for 10 people. Today, a typical farmer feeds over 120 people. Fact.
- 💧 One in eight Canadian jobs are related to agriculture. Fiction: Agriculture employs over 2.1 million Canadians.
- 💧 One tree can remove the same amount of carbon dioxide from the air that ion average is emitted from a car driving 17,700 km. Fact.
- 💧 Canada ranks #3 in the G7 (a group of seven countries: Canada, France, Germany, Italy, Japan, United Kingdom and the United States) for low food processing cost. Fiction: Canada ranks #1.
- 💧 The world's food demand will increase 70 percent by 2050. Fact.

Cards can be created for each fact or fiction statement and collected as students explore this and other guiding questions. Use the card collection to have students create a trivia or Jeopardy game.



LEARNING EXPERIENCE ONE: LEARNING OUTCOMES AND COMPETENCY MAP

project AGRICULTURE Activity	GRADE 9 SCIENCE	SCIENCE 20	BIOLOGY 20
	CONCEPTUAL KNOWLEDGE	CONCEPTUAL KNOWLEDGE	CONCEPTUAL KNOWLEDGE
LEARNING SOURCE What is the chemistry of food products? [CONTINUED ON NEXT PAGE]	Unit C: Environmental Chemistry 1. Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things - Identify common organic and inorganic substances that are essential to the health and growth of humans and other living things, and illustrate the roles served by these substances (e.g., identify calcium as an essential material for bones; identify minerals that are known to enhance plant growth but that limit growth if too little or too much is available) - Describe, in general terms, the forms of organic matter synthesized by plants and animals, including carbohydrates, proteins and lipids - Describe and illustrate processes by which chemicals are introduced to the environment or their concentrations are changed (e.g., dilution in streams, biomagnification through food chains) - Identify questions that may need to be addressed in deciding what substances – in what amounts – can be safely released into the environment (e.g., identify questions and considerations that may be important in determining how much phosphate can be released into river water without significant harm to living things) 3. Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment - Investigate and evaluate potential risks resulting from consumer practices and industrial processes, and identify processes used in providing information and setting standards to manage these risks (e.g., interpret and explain the significance of manufacturer's information on how wood preservatives can be safely applied; recognize that some individuals may have greater sensitivity to particular chemical substances than do others in the general population) - Identify and evaluate information and evidence related to an issue in which environmental chemistry plays a major role (e.g., evaluate evidence that the use of insecticides to control mosquitoes has an effect/has no effect on bird populations) Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., consider observations and ideas from a number of sources during investigations and before drawing conclusions; strive to assess a problem or situation accurately, by careful analysis of evidence gathered)	Unit D: Changes in Living Systems 20–D1.1k Investigate and analyze an aquatic or a terrestrial local ecosystem, distinguish between biotic and abiotic factors, describe how these factors affect population size and - Infer the abiotic effects on life; e.g., light, nutrients, water, temperature - Infer biotic interactions; e.g., predator-prey relationships, competition, symbiotic relationships - Infer the influence of biota on the local environment; e.g., microclimates, soil, nutrients	Unit A: Energy and Matter Exchange in the Biosphere 20–A1.1k Explain, in general terms, the one-way flow of energy through the biosphere and how stored energy in the biosphere, as a system, is eventually “lost” as heat; e.g., - Photosynthesis/chemosynthesis - Cellular respiration (muscle-heat generation, decomposition) 20–A2.1k Explain and summarize the biogeochemical cycling of carbon, oxygen, nitrogen and phosphorus and relate this to general reuse of all matter in the biosphere 20–A2.1st Explain that science and technology have both intended and unintended consequences for humans and the environment (SEC3) [ICT F3–4.1] - Discuss the influence of human activities on the biogeochemical cycling of phosphorus, sulfur, iron and nitrogen: - fertilizer applications - waste and sewage disposal - acid deposition - persistent organic pollutants Unit B: Ecosystems and Population Change 20–B1.1k Define species, population, community and ecosystem and explain the interrelationships among them 20–B1.3k Identify biotic and abiotic characteristics and explain their influence in an aquatic and a terrestrial ecosystem in the local region; e.g., stream, lake, prairie, boreal forest, vacant lot, sports field



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project AGRICULTURE Activity	GRADE 9 SCIENCE	SCIENCE 20	BIOLOGY 20
	PROCEDURAL KNOWLEDGE	PROCEDURAL KNOWLEDGE	
[CONTINUED] BUILD COMPETENCIES Nutrient science      	Unit C: Environmental Chemistry Ask questions about the relationships between and among observable variables, and plan investigations to address those questions - Identify science-related issues (e.g., identify issues regarding the use of soil fertilizers) - Identify questions arising from practical problems and issues (e.g., ask questions about the needs of different living things for nutrients and about the mechanisms by which these nutrients are obtained) Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data - Identify data and information that are relevant to the issue - Organize data, using a format that is appropriate to the task or experiment Analyze qualitative and quantitative data, and develop and assess possible explanations - Apply given criteria for evaluating evidence and sources of information (e.g., use scatterplot data in evaluating how strong a relationship exists between two variables; evaluate claims of environmental impacts, based on the scope and relevance of supporting evidence) Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results - Defend a given position on an issue or problem, based on their findings (e.g., provide a clear rationale for a choice between alternative chemical products in a consumer application)	Unit D: Changes in Living Systems 20-D1.2s Conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information - Use library and electronic research tools to collect information on a given topic, such as: - protection of the environment as a priority over economic interest 20-D1.3s Analyze data and apply mathematical and conceptual models to develop and assess possible solutions - Analyze the information presented by opposing sides on an environmental issue, such as that of an environmental group and that of an industry representative, to determine bias (AI-NS4, AI-SEC1) [ICT C2-4.1, C2-4.2]	Unit A: Energy and Matter Exchange in the Biosphere 20-A2.1s Formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues - Design an experiment to compare the carbon dioxide production of plants with that of animals (IP-NS1, IP-NS2, IP-NS3, IP-NS4) - Predict disruptions in the nitrogen and phosphorus cycles that are caused by human activities (IP-NS3) [ICT C6-4.1] 20-A3.2sts Explain that science and technology have both intended and unintended consequences for humans and the environment (SEC3) [ICT F3-4.1] - Describe how human activities can have a disrupting influence on the balance in the biosphere of photosynthetic and cellular respiratory activities: – fossil fuel combustion – depletion of stratospheric ozone – forest destruction Unit B: Ecosystems and Population Change 20-B1.1s Formulate questions about observed relationships; plan investigations of questions, ideas, problems and issues; and define and delimit problems to facilitate investigation - Hypothesize the role of biotic and abiotic factors in ecosystems; e.g., competition and chinooks (IP-NS3) [ICT C6-4.1]