

**ISPS Science K-12  
Standards and Benchmarks**

# **Grade 8**

---

**Strands**

1. Earth and Space Sciences
2. Life Sciences
3. Physical Sciences
4. Nature of Science

# **ISPS Science K-12 Standards and Benchmarks**

## **Strand 1 – Earth and Space Sciences**

---

**Standard 1 - Students will understand atmospheric processes and the water cycle.**

**Benchmarks - By the end of Grade 8, students will:**

- 1 – 1 Know that the Sun is the principle energy source for phenomena on the Earth's surface (e.g. plant growth)
- 1 – 2 Know how the tilt of the Earth's axis and the Earth's revolution around the Sun affect seasons and weather patterns (i.e., heat falls more intensely on one part or another of the Earth's surface during its revolution around the Sun)
- 1 – 3 Know the properties that make water an essential component of the Earth system (e.g., its ability to act as a solvent)

**Standard 2 - Students will understand Earth's composition and structure.**

**Benchmarks - By the end of Grade 8, students will:**

- 2 – 1 Know components of soil and other factors that influence soil texture, fertility, and resistance to erosion (e.g., plant roots and debris, bacteria, fungi, worms, rodents)

## **Strand 2 – Life Sciences**

---

**Standard 4 - Students will understand principles of heredity and related concepts.**

**Benchmarks - By the end of Grade 8, students will:**

- 4 – 1 Know that for sexually reproducing organisms, a species comprises all organisms that can mate with one another to produce fertile offspring
- 4 – 2 Understand asexual and sexual reproduction (e.g., in asexual reproduction, all the genes come from a single parent; in sexual reproduction, an egg and sperm unite and half of the genes come from each parent, so the offspring is never identical to either of its parents; sexual reproduction allows for greater genetic diversity; asexual reproduction limits the spread of disadvantageous characteristics through a species)
- 4 – 3 Know that hereditary information is contained in genes (located in the chromosomes of each cell), each of which carries a single unit of information; an inherited trait of an individual can be determined by either one or many genes, and a single gene can influence more than one trait
- 4 – 4 Know that the characteristics of an organism can be described in terms of a combination of traits; some traits are inherited and others result from interactions with the environment

# ISPS Science K-12

## Standards and Benchmarks

### Standard 5 – Students will understand the structure and function of cells and organisms.

#### Benchmarks - By the end of Grade 8, students will:

- 5 – 1 Know that multicellular organisms have a variety of specialized cells, tissues, organs, and organ systems that perform specialized functions (e.g., digestion, respiration, reproduction, circulation, movement, control and coordination)
- 5 – 2 Know that organisms have a great variety of body plans and internal structures that serve specific functions for survival (e.g., digestive structures in vertebrates, invertebrates and plants)
- 5 – 3 Know how an organism's ability to regulate its internal environment enables the organism to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment
- 5 – 4 Know that organisms can react to internal and environmental stimuli through behavioral response (e.g. animals have nervous systems that process and store information from the environment), which may be determined by heredity or from past experience

### Standard 6 - Students will understand relationships about organisms and their physical environment

#### Benchmarks - By the end of Grade 8, students will:

- 6 – 1 Know factors that affect the number and types of organisms an ecosystem can support (e.g., available resources; abiotic factors such as quantity of light and water, range of temperatures, and soil composition; disease; competition from other organisms within the ecosystem; predation)
- 6 – 2 Know ways in which organisms interact and depend on one another through food chains and food webs in an ecosystem (e.g., producer/consumer, predator/prey, parasite/host, relationships that are mutually beneficial or competitive)
- 6 – 3 Know how energy is transferred through food webs in an ecosystem (e.g., energy enters ecosystems as sunlight, and green plants transfer this energy into chemical energy through photosynthesis; this chemical energy is passed from organism to organism; animals get energy from oxidizing their food, releasing some of this energy as heat)
- 6 – 4 Know how matter is recycled within ecosystems (e.g., matter is transferred from one organism to another repeatedly, and between organisms and their physical environment; the total amount of matter remains constant, even though its form and location change)

### Standard 7 - Students will understand biological evolution and the diversity of life.

#### Benchmarks - By the end of Grade 8, students will:

## **ISPS Science K-12 Standards and Benchmarks**

- 7 – 1 Know basic ideas related to biological evolution (e.g., diversity of species is developed through gradual processes over many generations; biological adaptations, such as changes in structure, behavior, or physiology, allow some species to enhance their reproductive success and survival in a particular environment)
- 7 – 2 Know that the fossil record, through geologic evidence, documents the appearance, diversification, and extinction of many marine life forms
- 7 – 3 Understand the concept of extinction and its importance in biological evolution with a focus on marine life (e.g., when the environment changes, the adaptive characteristics of some species are insufficient to allow their survival; extinction is common; most of the species that have lived in the Earth's oceans no longer exist)
- 7 – 4 Know evidence that supports the idea that there is unity among organisms despite the fact that some species look very different (e.g., similarity of internal structures in different organisms, similarity of chemical processes in different organisms, evidence of common ancestry)
- 7 – 5 Know ways in which living things can be classified (e.g., taxonomic groups of animals groups based on the details of organisms' internal and external features; groups based on functions served within an ecosystem such as producers, consumers, and decomposers)

### **Strand 3 – Physical Sciences**

---

#### **Standard 8 - Students will understand the structure and properties of matter.**

##### **Benchmarks - By the end of Grade 8, students will:**

- 8 – 1 Know that atoms often combine to form a molecule (or crystal), the smallest particle of a substance that retains its properties
- 8 – 2 Know that substances containing only one kind of atom are elements and do not break down by normal laboratory reactions (e.g., heating, exposure to electric current, reaction with acids); over 100 different elements exist
- 8 – 3 Understand the conservation of mass in physical and chemical change (e.g., no matter how substances within a closed system interact with one another, the total weight of the system remains the same; the same number of atoms weighs the same, no matter how the atoms are arranged)
- 8 – 4 Know methods used to separate mixtures into their component parts (boiling, filtering, chromatography, screening)
- 8 – 5 Know that substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties
- 8 – 6 Know that oxidation involves the combining of oxygen with another substance (e.g., burning, rusting)

# ISPS Science K-12

## Standards and Benchmarks

**Standard 9 - Students will understand the sources and properties of energy.**

**Benchmarks - By the end of Grade 8, students will:**

- 9 – 1 Know that energy is a property of many substances (e.g., chemical energy is in the arrangement of atoms)
- 9 – 2 Understand the law of conservation of energy (i.e., energy cannot be created or destroyed but only changed from one form to another)
- 9 – 3 Know that light travels in straight lines and can be reflected, refracted or absorbed
- 9 – 4 Know how the Sun acts as a major source of energy for changes on the Earth's surface (i.e., the Sun loses energy by emitting light; some of this light is transferred to the Earth in a range of wavelengths including visible light, infrared radiation, and ultraviolet radiation)
- 9 – 5 Know that most chemical reactions involve a transfer of energy (e.g., heat, light, mechanical motion, electricity)
- 9 – 6 Know that only a narrow range of wavelengths of electromagnetic radiation can be seen by the human eye; differences of wavelength within that range of visible light are perceived as differences in color

## Strand 4 – Nature of Science

---

**Standard 11 - Students will understand the nature of scientific knowledge.**

**Benchmarks - By the end of Grade 8, students will:**

- 11 – 1 Know that an experiment must be repeated many times and yield consistent results before the results are accepted as correct
- 11 – 2 Understand the nature of scientific explanations (e.g., use of logically consistent arguments; emphasis on evidence; use of scientific principles, models, and theories; acceptance or displacement of explanations based on new scientific evidence)
- 11 – 3 Know that all scientific ideas are tentative and subject to change and improvement in principle, but for most core ideas in science, there is much experimental and observational confirmation

**Standard 12 - Students will understand the nature of scientific inquiry.**

**Benchmarks - By the end of Grade 8, students will:**

- 12 – 1 Know that there is no fixed procedure called "the scientific method," but that investigations involve systematic observations, carefully collected, relevant evidence, logical reasoning, and some imagination in developing hypotheses and explanations
- 12 – 2 Understand that questioning, response to criticism, and open communication are integral to the process of science (e.g., scientists often

## **ISPS Science K-12 Standards and Benchmarks**

- differ with one another about the interpretation of evidence or theory in areas where there is not a great deal of understanding; scientists acknowledge conflicting interpretations and work towards finding evidence that will resolve the disagreement)
- 12 – 3 Designs and conducts a scientific investigation (e.g., formulates hypotheses, designs and executes investigations, interprets data, synthesizes evidence into explanations, proposes alternative explanations for observations, critiques explanations and procedures)
  - 12 – 4 Know that observations can be affected by bias (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results)
  - 12 – 5 Use appropriate tools (including computer hardware and software) and techniques to gather, analyze, and interpret scientific data
  - 12 – 6 Establish relationships based on evidence and logical argument (e.g., provides causes for effects)
  - 12 – 7 Know that scientific inquiry includes evaluating results of scientific investigations, experiments, observations, theoretical and mathematical models, and explanations proposed by other scientists (e.g., reviewing experimental procedures, examining evidence, identifying faulty reasoning, identifying statements that go beyond the evidence, suggesting alternative explanations)
  - 12 – 8 Know possible outcomes of scientific investigations (e.g., some may result in new ideas and phenomena for study; some may generate new methods or procedures for an investigation; some may result in the development of new technologies to improve the collection of data; some may lead to new investigations)

### **Standard 13 - Students will understand the scientific enterprise.**

#### **Benchmarks - By the end of Grade 8, students will:**

- 13 – 1 Know that people of all backgrounds and with diverse interests, talents, qualities, and motivations engage in fields of science and engineering; some of these people work in teams and others work alone, but all communicate extensively with others
- 13 – 2 Know that the work of science requires a variety of human abilities, qualities, and habits of mind (e.g., reasoning, insight, energy, skill, creativity, intellectual honesty, tolerance of ambiguity, skepticism, openness to new ideas)
- 13 – 3 Know various settings in which scientists and engineers may work (e.g., colleges and universities, businesses and industries, research institutes, government agencies)
- 13 – 4 Understand ethics associated with scientific study (e.g., potential subjects must be fully informed of the risks and benefits associated with the research and their right to refuse to participate; potential subjects must be fully informed of possible risks to community and property)

## **ISPS Science K-12 Standards and Benchmarks**

- 13 – 5 Know that throughout history, many scientific innovators have had difficulty breaking through accepted ideas of their time to reach conclusions that are now considered to be common knowledge
- 13 – 6 Know ways in which science and society influence one another (e.g., scientific knowledge and the procedures used by scientists influence the way many individuals think about themselves, others, and the environment; societal challenges often inspire questions for scientific research; social and economic forces strongly influence which science research programs are pursued and funded)