

Study Guide - Grade 9 Science PAT

This is a list of some things you'll want to be able to do for the Science PAT. This is not a complete list of everything that will be on the exam.

Unit A: Biological Diversity

Students must be able to:

- Recall all their definitions
- Identify and describe variations among and within species
- Describe aspects of a species' niche
- Explain how an organism is adapted to life in its ecosystem
- Provide examples of symbiotic relationships
- Explain how one species' survival is linked to other species
- Classify given symbiotic relationships as mutualism, commensalism, or parasitism
- Explain how species variation helps with species survival
- Distinguish between sexual and asexual reproduction
- Describe mechanisms of asexual production such as binary fission, budding, and spore production
- Describe mechanisms of sexual production
- Give examples of organisms that show both sexual and asexual production
- Describe the formation of a zygote and embryo in plant and animal production
- List examples of variation of characteristics within a species, including both discrete and continuous variation
- Identify examples of transmitted characteristics to offspring that are the same as one or both parents, intermediate between parents, or different from both parents
- Differentiate between heritable and non-heritable characteristics
- Identify examples of dominant vs recessive characteristics
- Generally explain the role and relationship of chromosomes, genes, and DNA
- Identify differences in mitosis vs meiosis
- List advantages and disadvantages of sexual and asexual production
- Explain the difference between natural and artificial selection
- Simply describe a few genetic technologies
- Describe the relative amounts of different species types on Earth and in different environmental regions
- Explain how environmental factors and changes can result in changing biodiversity, extinction, and extirpation
- Evaluate how successful specific local or global strategies are at minimizing loss of species diversity
- Analyze the use of biotechnology in environmental, agricultural, or forest management for potential impacts and issues.
- Analyze graphs related to population abundance and change over time

Unit B: Matter and Chemical Change

Students must be able to:

- Recall all their definitions
- Investigate and describe physical and chemical properties of materials (melting and boiling point, solubility, conductivity, hardness, lustre, etc.)
- Classify a given material as: pure substance, solution, mechanical mixture, metal, or nonmetal.
- Evaluate a change in material properties to decide if a chemical reaction (chemical change) has taken place

- Identify dangers of caustic materials and potentially explosive reactions
- Describe evidence of chemical change in combustion, corrosion, and other oxidation reactions
- Infer evidence of a chemical reaction between household materials
- Infer whether a reaction is exothermic or endothermic based on observed or given evidence
- List ways to alter the rate of a chemical reaction
- Explain that mass is conserved during chemical reactions
- Identify patterns in the organization of the periodic table, especially the first 18 elements
- Explain the difference between observation and theory, and how observations are used to form theories
- Use the periodic table to identify the number of protons, electrons, neutrons in any given element on the periodic table
- List examples of ionic and molecular compounds and distinguish between them
- Read and interpret chemical formulas for compounds of two elements, and give the IUPAC name and common name of such compounds
- Identify household chemical compounds and write the chemical symbols
- Predict combining ratios in ionic compounds of two elements
- Identify the number of atoms in given molecules of molecular compounds
- Build and draw models of ionic and molecular compounds
- Describe chemical reactions using word equations or chemical equations
- Match WHMIS symbols to their meaning

Unit C: Environmental Chemistry

Students must be able to:

- Recall all their definitions
- Give examples of common organic and inorganic substances that are essential to living things, and explain why they're needed
- Describe proteins, carbohydrates, and lipids
- Explain how chemicals are introduced into the environment
- Describe how living things ingest or absorb materials
- Explain how some substances (DDT, heavy metals) are difficult for organisms to break down or get rid of
- Use environmental and scientific perspectives to decide what substances in what amounts can be safely added to the environment, and how
- List examples of substrates and nutrient sources for living things in various environments
- Explain how biological monitoring can indicate environmental quality
- Explain how chemical factors (like pH, dissolved oxygen or nutrients) affect the health and abundance of living things
- Calculate chemical concentrations in ppm, ppb, or ppt
- Use indicators and the pH scale to identify acids, bases, and neutral substances
- Describe the effects of acids and bases on each other and other substances AND living things
- Describe how materials are transported through the air, water, and soil, and how this can be sped up or slowed
- Interpret information on biodegradation of materials
- Infer evidence of an environmental change near a substance release
- Interpret LD50 toxicity data
- List domestic wastes that shouldn't be sent to regular landfills
- Evaluate methods for transporting, storing, and disposing of household chemicals
- Evaluate consumer and industrial practices for their impact on the environment

Unit D: Electrical Principles and Technologies

Students must be able to:

- Recall all their definitions
- Identify examples of mechanical, chemical, thermal, electrical, and light energy
- Differentiate between renewable and non-renewable
- Describe evidence of energy transfer and transformation
- Evaluate the effectiveness of different electrodes, electrolytes, and electrolytic concentrations in electrical storage cells
- Build, use, and evaluate devices that transform energy from one form to another
- Evaluate and modify designs
- Describe the danger associated with electrical devices
- Differentiate between voltage and amperage
- Explain the difference between current and static electricity
- Test different materials to compare resistance to electrical flow
- List examples of conductors and insulators
- Build circuits using switches, resistors, cells, lamps, buzzers, wires, etc.
- Use voltmeters and ammeters
- Analyze and draw circuit diagrams
- Use Ohm's law to calculate resistance, voltage, and current in circuits
- Troubleshoot circuit designs
- Compare microcircuits to larger scale circuits
- Identify forms of energy inputs and outputs in a device or system
- Calculate $P=IV$
- Calculate $E = P \times t$
- Define efficiency and conservation
- Calculate % efficiency
- Describe techniques and technologies for reducing energy waste in household devices
- Evaluate electrical energy sources like oil, gas, coal, biomass, wind, and solar from societal and environmental perspectives
- Describe by-products and electricity generation and their environmental impact
- Complete cost-benefit analyses of electrical technologies
- List examples of concerns relating to energy conservation and sustainability

Unit E: Space Exploration

Students must be able to:

- Recall all their definitions
- List different ideas about the nature of Earth and Space based on culture and science
- Explain how technology (like optical telescopes, spectral analysis, and space travel) have contributed to our understand of space
- Describe how matter is distributed in star systems, galaxies, nebulae, and the universe
- Describe characteristics of objects in the solar system and compare them to Earth
- Create drawings and models to show the motion of objects in space
- Describe how parallax and the Doppler effect are used to estimate distance and motion of objects in space
- Describe the position of objects in space using angular coordinates
- Identify challenges to developing life-support systems in space

- Describe technology for life support systems
- List different technologies for space transport
- Identify materials and processes developed to meet needs in space and related applications
- Describe the development of artificial satellites and their purposes
- Explain how optical telescopes work
- Explain what radio telescopes do and generally how they work
- Describe generally how GPS and remote sensing work
- Describe risks and dangers of space exploration
- List Canadian contributions to space research
- Analyze decisions regarding space exploration and development from multiple perspectives (political, fiscal, environmental, scientific, etc.)

Other items related to Science, the Scientific Method, the Nature of Science, Technology, Social and Environmental Contexts, Skills, and Attitudes

Students must be able to:

- Define and identify research/inquiry questions or purposes for experiments
- Write procedures
- Accurately observe, record, and measure
- State predictions and hypotheses based on background info or observations
- Select methods and tools for data collection
- Identify the controlled (constant), manipulated, and responding variables in experiments
- Control the variables in experiments to carry out fair tests
- Organize data
- Work safely
- Interpret data, charts, observations, and graphs to find patterns, trends, and make inferences
- Interpolate or extrapolate a variable's value from a graph
- Suggest explanations for discrepancies, errors, or outliers in data
- State (infer) a conclusion based on evidence
- Evaluate designs based on function, reliability, safety, efficiency, and environmental impact
- Define problems
- Identify new questions arriving from an investigation
- Evaluate an issue from multiple viewpoints. Reach a decision based on evidence and reasoning
- Create tables and draw graphs