GRADE **5**

GRADE 5 | UNDERSTANDING LIFE SYSTEMS
HUMAN ORGAN SYSTEMS

OVERVIEW

As students continue to make choices in their lives, they need to know that choices they make about their bodies may have lifelong effects. This topic, Human Organ Systems, helps students understand that the body is made up of a number of organs and that these organs are parts of systems that can be affected by a variety of factors. Using models and simulations, students will learn the location, structure, and function of the major organs of the respiratory, circulatory, and digestive systems. Students will also develop an understanding of the importance of proper nutrition and exercise to the healthy functioning of organ systems.

When faced with choices that may have long-term consequences for their health, students need to have skills and attitudes that will help them make reasoned, informed decisions. They need to consider issues from many perspectives and to look for bias in the information they receive. Is it really the latest style of running shoe that makes a person a better runner or basketball player, or is it the physical health, dedication, and determination of the player? Does the latest fad diet really work? What other side effects might it have that could be less desirable? As students learn to look at things from different points of view and not just accept them at face value, they will become more skilled at making good and thoughtful decisions.

Fundamental Concepts	Big Ideas
Systems and Interactions Structure and Function	Organ systems are components of a larger system (the body) and, as such, work together and affect one another. *(Overall expectations 2 and 3)* Organ structures are linked to their functions. *(Overall expectations 2 and 3)* Systems in the human body work together to meet our basic needs. *(Overall expectations 2 and 3)* Choices we make affect our organ systems and, in turn, our overall health. *(Overall expectations 1 and 3)*

OVERALL EXPECTATIONS

By the end of Grade 5, students will:

1. analyse the impact of human activities and technological innovations on human health;
2. investigate the structure and function of the major organs of various human body systems;
3. demonstrate an understanding of the structure and function of human body systems and interactions within and between systems.

SPECIFIC EXPECTATIONS

1. Relating Science and Technology to Society and the Environment

By the end of Grade 5, students will:

1.1 assess the effects of social and environmental factors on human health, and propose ways in which individuals can reduce the harmful effects of these factors and take advantage of those that are beneficial

Sample problems: (a) Each year, about 90 000 children in Ontario try smoking. Smoking kills almost 12 000 people in Ontario each year. Ad campaigns about the dangers of smoking can encourage young people to stay away from tobacco products. But the media still often portray smoking as glamorous. Develop a personal plan of action to find the information you need to make good decisions about smoking (e.g., where you might find reliable information and data; whom you might ask for help and support). (b) Overexposure to the sun in childhood can cause skin cancer in adults. But the vitamin D that we create using sunlight during "safe" hours helps to build strong bones and increases our resistance to many kinds of diseases. Make a personal plan to get the recommended one hour a week of sunlight, taking into account the safety concerns about exposure to the sun.

1.2 evaluate the effects, both beneficial and harmful, of various technologies on human body systems, taking different perspectives into account *(e.g., the perspectives of the developers of the technologies, advertisers, children and young people, parents)*

Sample issue: Industrial technology (e.g., manufacturing and communication processes) has both helped and harmed human health. For example, new running shoe designs provide better body protection, but manufacturing them may involve social (e.g., unsafe working conditions, child labour) and environmental costs and marketing them increases social pressure to wear the latest shoes. Indoor and outdoor video technology can bring us messages that promote healthy living (e.g., the importance of drinking milk or getting lots of exercise), but it can also bring messages that encourage unhealthy choices (e.g., that drinking alcohol is "cool"; that driving fast is fun), and it exposes people to constant bombardment with sound and light.

Sample guiding questions: What effects might playing video games, watching TV, or using Internet chat lines and e-mail have on human body systems? How can the increased ease of air travel affect individual and public health?

2. Developing Investigation and Communication Skills

By the end of Grade 5, students will:

2.1 follow established safety procedures for physical activities *(e.g., make the teacher aware of any physical limitations that might affect ability to perform activities)*

2.2 use scientific inquiry/experimentation skills (see page 12) to investigate changes in body systems *(e.g., heart rate, breathing, body temperature)* as a result of physical activity *(e.g., exercise, resting, eating)*

Sample guiding questions: What observations did you make about the effect of exercise on your heart rate? What happened to your breathing as your heart rate changed? How long did it take for your heart rate and breathing to return to normal after physical exertion? How did your body temperature change? What other changes did you notice (e.g., sweating)? What conclusions can you make as a result of your investigations?

2.3 design and build a model to demonstrate how organs or components of body systems in the human body work and interact with other components *(e.g., build a model that shows how muscles, bones, and joints in the human body work together as a system to allow movement of the arms or legs; build a model to show how the lungs and heart work as a system)*

2.4 use appropriate science and technology vocabulary, including *circulation, respiration, digestion, organs,* and *nutrients,* in oral and written communication

2.5 use a variety of forms *(e.g., oral, written, graphic, multimedia)* to communicate with different audiences and for a variety of purposes *(e.g., create labelled charts or graphs to show changes in heart rate and breathing as a result of exercising)*

3. Understanding Basic Concepts

By the end of Grade 5, students will:

3.1 identify major systems in the human body *(e.g., musculoskeletal system, digestive system, nervous system, circulatory system)* and describe their roles and interrelationships

3.2 describe the basic structure and function of major organs in the respiratory, circulatory, and digestive systems *(e.g., we have two lungs; each one is about 25–30 cm long and cone-shaped; the right lung is slightly bigger because it has three lobes and the left lung has only two; our lungs are responsible for gas exchanges)*

3.3 identify interrelationships between body systems *(e.g., the respiratory system provides oxygen and removes carbon dioxide for the circulatory system)*

3.4 identify common diseases and the organs and/or body systems that they affect *(e.g., epilepsy affects the brain [central nervous system]; appendicitis affects the appendix [digestive system]; asthma and emphysema affect the lungs [respiratory system])*

GRADE 5 | UNDERSTANDING STRUCTURES AND MECHANISMS

FORCES ACTING ON STRUCTURES AND MECHANISMS

OVERVIEW

In this strand, students will identify and describe forces acting on and within structures. As they measure and compare external forces (natural or human) acting on structures and their effects on different materials, they will develop a more sophisticated understanding of the concept of force and of ways in which structures respond to forces acting upon them. Students will have an opportunity to apply their learning as they design and build structures or mechanisms.

By examining the effects of forces from natural phenomena on society and the environment, students will gain respect for the power behind these forces and appreciation for the devastating effects that they have on the natural and built environment, and they will be able to develop strategies for keeping themselves and others safe during these events.

Connections can be made between this topic and the Grade 5 social studies topic Canada and World Connections: Aspects of Citizenship and Government in Canada, as students discuss planning decisions and the construction of structures within their community.

Fundamental Concepts	Big Ideas
Structure and Function	Structures and mechanisms throughout our environment have forces that act on and within them. *(Overall expectations 1 and 3)* We can measure forces in order to determine how they affect structures and mechanisms. This information can be used to guide the design of new structures and mechanisms. *(Overall expectations 1 and 2)* Forces that result from natural phenomena have an effect on society and the environment. *(Overall expectations 1 and 3)*

OVERALL EXPECTATIONS

By the end of Grade 5, students will:

1. analyse social and environmental impacts of forces acting on structures and mechanisms;
2. investigate forces that act on structures and mechanisms;
3. identify forces that act on and within structures and mechanisms, and describe the effects of these forces on structures and mechanisms.

SPECIFIC EXPECTATIONS

1. Relating Science and Technology to Society and the Environment

By the end of Grade 5, students will:

1.1 analyse the effects of forces from natural phenomena *(e.g., tornadoes, hurricanes, earthquakes, tsunamis)* on the natural and built environment

Sample guiding questions: (a) What is a tornado? Where does the force of a tornado come from? What kinds of damage does a tornado inflict on the built environment (e.g., on structures such as houses and shopping malls)? What is the impact of a tornado on the natural environment (e.g., on trees, on animals such as fish and birds)? How can humans protect themselves from the force of a tornado? (b) What is an earthquake? Where does the force of an earthquake come from? How is the damage from an earthquake different from that of a tornado? What is the impact of an earthquake on the natural environment? What can humans do to protect themselves from the forces of an earthquake?

1.2 evaluate the impact of society and the environment on structures and mechanisms, taking different perspectives into account *(e.g., the perspectives of golfers, local bird-watching groups, families, a school board)*, and suggest ways in which structures and mechanisms can be modified to best achieve social and environmental objectives

Sample issues: (a) The local golf course wants to expand into an area where bald eagles are known to winter. (b) People in the Far North have to construct buildings on ground that is permanently frozen just below the surface. If their buildings have normal foundations, the heat loss from them would melt the frozen ground and unsettle the structure.

2. Developing Investigation and Communication Skills

By the end of Grade 5, students will:

2.1 follow established safety procedures for working with tools and materials *(e.g., wear protective eyewear when testing structures to the breaking point)*

2.2 measure and compare, quantitatively and/or qualitatively, the force required to move a load *(e.g., to lift a book, to open a drawer)* using different mechanical systems *(e.g., different pulley systems, a lever, a gear system)*, and describe the relationship between the force required and the distance over which the force moves

2.3 use scientific inquiry/research skills (see page 15) to investigate how structures are built to withstand forces

Sample guiding questions: What different materials and construction techniques are used to build structures that may be subjected to forces from natural phenomena such as earthquakes? In what ways are structures modified to allow them to stand up to forces from natural phenomena such as tornadoes and hurricanes? What standard building techniques are used to ensure that structures can withstand forces placed upon them (e.g., the force from the weight of snow on a roof)?

2.4 use technological problem-solving skills (see page 16) to design, build, and test a frame structure *(e.g., a bridge, a tower)* that will withstand the application of an external force *(e.g., a strong wind or simulated vibrations from a train)* or a mechanical system that performs a specific function *(e.g., a building crane)*

Sample guiding questions: What strategies will you use to ensure that you build a structure capable of withstanding an external force? What function is your device intended to perform? How will you test your structure or device? What safety measures do you need to consider when building and testing it? How will you know if your structure or device was successful? What changes might you suggest to improve its efficiency, functionality, or performance?

2.5 use appropriate science and technology vocabulary, including *tension, compression, torque, system,* and *load,* in oral and written communication

2.6 use a variety of forms *(e.g., oral, written, graphic, multimedia)* to communicate with different audiences and for a variety of purposes *(e.g., make an oral presentation explaining the techniques they used to build a model of a bridge that can withstand vibrations from a train)*

3. Understanding Basic Concepts

By the end of Grade 5, students will:

3.1 identify internal forces acting on a structure *(e.g., compression [squeezing], tension [stretching])*, and describe their effects on the structure

3.2 identify external forces acting on a structure *(e.g., the weight of people and furniture in a house, wind blowing on a tent, the movement caused by a passing train)*, and describe their effects on the structure, using diagrams

3.3 explain the advantages and disadvantages of different types of mechanical systems *(e.g., a hoist in a lifting system that comprises four pulleys will decrease the amount of force needed by four times, but the force will have to move four times as fast)*

3.4 describe forces resulting from natural phenomena that can have severe consequences for structures in the environment *(e.g., a house loses its roof in a wind storm)*, and identify structural features that help overcome some of these forces *(e.g., cross supports for roofs, steel beams in bridges)*

3.5 describe how protective sports equipment protects the body from the impact of forces *(e.g., helmets reduce the intensity of the force of the impact, spreading the impact over a larger area and preventing direct impact to the skull; knee and shin pads spread the impact over a larger area and protect against cuts and scrapes)*

GRADE 5 | UNDERSTANDING MATTER AND ENERGY

PROPERTIES OF AND CHANGES IN MATTER

OVERVIEW

In earlier grades, students learned how the properties of various materials, such as strength, flexibility, and buoyancy, determine what the materials are used for. In Grade 5, students will continue those studies and also examine the environmental impact associated with the production, use, and disposal of such materials. In addition, students will explore the concept of matter. They will learn about commonly found states of matter (solids, liquids, and gases) and the characteristics of each. They will also explore changes of state and investigate the difference between physical changes (which are reversible) and chemical changes (which are not reversible). Concepts learned in this strand about the use of heat to effect changes in matter will be relevant to the study of energy conservation in the next strand. It is necessary to provide opportunities for all students, including students with special education needs, to participate in these or comparable activities.

As governments deal with ongoing concerns about growing landfill sites, problems with waste disposal, and the potential of recycling processes, it is often our students who are our best environmental stewards. The habits of mind, attitudes, and values they form now will remain with them throughout their adult lives. Therefore, we need to ensure that they learn to form their own opinions after they have fully explored the issues. This means looking at issues such as recycling not only from the perspective of recycling plant operators but also from that of providers of raw materials, manufacturers, people concerned about the environment, and consumers. By helping students get a balanced view of the issues, we help them to consider the values and perspectives of others.

When exploring changes of state, it is important that students be able to identify and demonstrate an understanding of practices that ensure their personal safety and the safety of others. This includes knowing how to heat samples safely, and why any flaws in glassware should be reported to the teacher.

Fundamental Concepts	Big Ideas
Matter Energy Sustainability and Stewardship	There are three states of matter. *(Overall expectations 2 and 3)* Matter that changes state is still the same matter. *(Overall expectations 2 and 3)* Physical change refers to the fact that a substance can be changed from one form to another. *(Overall expectations 2 and 3)* Chemical change implies the formation of a new substance. *(Overall expectations 2 and 3)* The properties of materials determine their use and may have an effect on society and the environment. *(Overall expectation 1)*

OVERALL EXPECTATIONS

By the end of Grade 5, students will:

1. evaluate the social and environmental impacts of processes used to make everyday products;
2. conduct investigations that explore the properties of matter and changes in matter;
3. demonstrate an understanding of the properties of matter, changes of state, and physical and chemical change.

SPECIFIC EXPECTATIONS

1. Relating Science and Technology to Society and the Environment

By the end of Grade 5, students will:

1.1 evaluate the environmental impacts of processes that change one product into another product through physical or chemical changes

Sample issues: Consider the impacts on the environment of changing grains such as wheat, corn, and rice into flours, and the flours into breads, pasta, crackers, or wallpaper paste; changing new trees, lumberyard scraps, and recycled paper products into pulp, and pulp into paper and paper products; changing petroleum into plastic, and plastic into everyday items such as rulers and soft drink bottles, some of which end up in landfills and some of which are recycled into clothing or rugs.

1.2 assess the social and environmental impact of using processes that rely on chemical changes to produce consumer products, taking different perspectives into account *(e.g., the perspectives of food manufacturers, consumers, landfill operators, people concerned about the environment)*, and make a case for maintaining the current level of use of the product or for reducing it

Sample issues: The use of chemical preservatives makes foods last longer, but the preservatives may have an impact on human health. Recycling paper, cardboard, plastics, and organics can keep materials out of landfills for a longer period of time, but the processes involved may have their own impacts.

2. Developing Investigation and Communication Skills

By the end of Grade 5, students will:

2.1 follow established safety procedures for working with heating appliances and hot materials *(e.g., switch hot plates off immediately after use)*

2.2 measure temperature and mass, using appropriate instruments *(e.g., a thermometer, a single-pan balance)*

2.3 use scientific inquiry/experimentation skills (see page 12) to investigate changes of state and changes in matter

Sample guiding questions: What change of state happens during condensation? During solidification? Do the changes of state you are observing take place because of a release of heat or an absorption of heat? Explain. What physical changes in matter did you observe? What caused those changes to take place? What would have to happen to reverse those changes? What chemical changes in matter did you observe? What caused those changes to take place? What conclusions did you make about changes in matter?

2.4 use scientific inquiry/experimentation skills (see page 12) to determine how the physical properties of materials make them useful for particular tasks *(e.g., when cleaning up a liquid spill in the kitchen, which material is best suited to do the job: a piece of sponge, a piece of terry cloth, a paper towel?)*

Sample guiding questions: How will you ensure that your test of the materials is fair? What properties of the materials make them useful for the task? What is the environmental impact of using each of the materials? Which of their properties might hamper the task? How might you improve one of these products to make it better suited to the task?

2.5 use appropriate science and technology vocabulary, including *mass, volume, properties, matter, physical/reversible changes,* and *chemical/irreversible changes,* in oral and written communication

2.6 use a variety of forms *(e.g., oral, written, graphic, multimedia)* to communicate with different audiences and for a variety of purposes *(e.g., create a labelled chart or graph to show the time required for an ice cube to melt completely)*

3. Understanding Basic Concepts

By the end of Grade 5, students will:

3.1 identify matter as everything that has mass and occupies space

3.2 identify properties of solids, liquids, and gases *(e.g., solids have definite volume and hold their shape; liquids have definite volume but take the shape of their container or spread when they are not contained; gases have no definite volume and take the volume and shape of their container or spread when they are not contained),* and state examples of each

3.3 explain changes of state in matter *(e.g., evaporation, condensation, solidification or freezing, fusion or melting, sublimation),* and give examples of each *(e.g., water from wet clothes evaporates; steam from a boiling kettle condenses on a cold window; water in ponds and lakes solidifies or freezes in winter; a frozen treat melts on a warm summer day; a moth ball sublimates in the closet)*

3.4 describe physical changes in matter as changes that are reversible *(e.g., a melted ice cube can be refrozen; a bottle of frozen water can be thawed to a liquid state again; water vapour that has condensed on a cold window can evaporate into a vaporous state again; water from a puddle that has evaporated will fall to the ground as rain)*

3.5 describe chemical changes in matter as changes that are irreversible *(e.g., when the chrome on a bicycle rusts, it can never go back to being chrome; when an egg is boiled it can never go back to being a raw egg)*

3.6 explain how changes of state involve the release of heat *(e.g., when water freezes it releases heat)* or the absorption of heat *(e.g., when an ice cube melts, it absorbs heat)*

3.7 identify indicators of a chemical change *(e.g., production of a gas, change in colour, formation of precipitate)*

3.8 distinguish between a physical change and a chemical change *(e.g., a physical change can be reversed [ice to water to ice], whereas a chemical change creates new substance[s] [wood to smoke and ash])*

GRADE 5 | UNDERSTANDING EARTH AND SPACE SYSTEMS
CONSERVATION OF ENERGY AND RESOURCES

OVERVIEW

Energy choices are becoming increasingly important. Making greater use of renewable and alternative sources and conserving energy are options that students need to know about if we are to sustain our present standard of living and ensure adequate energy supplies for future generations. Students must also recognize that there are immediate and long-term impacts and costs associated with every choice.

Never has it been more important for our students to be creative and critical thinkers. More than ever, they need to know how to understand situations and to respond to them in new ways. They need to be able to recognize the choices made by others, while being able to question the ideas behind the choices. They need to be able to think critically, to see things from many different perspectives, and to use all of the information available to make informed and reasoned personal choices about energy use and conservation.

By designing, constructing, and operating their own devices, students will learn how energy is transferred from one system to another. When building devices, it is important that students be able to identify and demonstrate an understanding of practices that ensure their personal safety and the safety of others. This includes knowing why it is important to keep work spaces neat and tidy and why batteries should be recharged only under adult supervision.

Fundamental Concepts	Big Ideas
Energy Sustainability and Stewardship	Energy sources are either renewable or non-renewable. *(Overall expectation 3)* Energy can neither be created nor destroyed, but it can be transformed. *(Overall expectations 2 and 3)* Choices about using energy and resources have both immediate and long-term impacts. *(Overall expectation 1)* Conservation (reducing our use of energy and resources) is one way of reducing the impacts of using energy and resources. *(Overall expectation 1)*

OVERALL EXPECTATIONS

By the end of Grade 5, students will:

1. analyse the immediate and long-term effects of energy and resource use on society and the environment, and evaluate options for conserving energy and resources;
2. investigate energy transformation and conservation;
3. demonstrate an understanding of the various forms and sources of energy and the ways in which energy can be transformed and conserved.

SPECIFIC EXPECTATIONS

1. Relating Science and Technology to Society and the Environment

By the end of Grade 5, students will:

1.1 analyse the long-term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts *(e.g., turning off the faucet while brushing teeth or washing and rinsing dishes conserves water; reusing or recycling products, or using fewer products, conserves natural resources and energy)*

Sample issue: Natural gas is a clean, reliable, and safe fuel for heating our homes, but it is non-renewable and its use contributes to climate change (although not as much as other fossil fuels). Alternative forms of energy such as solar energy or wind energy do not deplete natural resources or contribute to climate change, but they may have other drawbacks (such as being more expensive and less reliable).

1.2 evaluate the effects of various technologies on energy consumption *(e.g., improving our home's insulation allows us to conserve heat and reduce energy consumption; aerodynamic design can improve the energy efficiency of cars and buses; household appliances designed to make our lives easier use large amounts of energy; some cars and recreational vehicles use energy less efficiently than others)*, and propose ways in which individuals can improve energy conservation

Sample problem: Conduct an energy audit of your home (e.g., look for places where there are drafts; check the wattage of light bulbs; with the help of an adult, estimate the standard of insulation; check the energy efficiency ratings of heating and cooling equipment and large appliances), and create a plan for how your family could improve their energy conservation efforts.

2. Developing Investigation and Communication Skills

By the end of Grade 5, students will:

2.1 follow established safety procedures for using tools and materials *(e.g., use hand drills correctly when making holes in wood)*

2.2 use scientific inquiry/research skills (see page 15) to investigate issues related to energy and resource conservation *(e.g., interview an Aboriginal person about his or her traditional teachings on conservation)*

Sample guiding questions: Why did you choose this issue to research? Where will you find information about it? How will you determine if the source of information is a good one (e.g., unbiased, current, knowledgeable)? Why might some of the sources be biased one way or another on the issue? What are some of the concerns that were raised in your research? How might this issue be relevant to our local community? Who can take action on this issue? How might you as an individual influence the outcome of the issue?

2.3 use technological problem-solving skills (see page 16) to design, build, and test a device that transforms one form of energy into another *(e.g., create a child's toy that uses the electrical energy from a battery or solar cell to move across the floor [kinetic energy] and make a noise [sound energy])*, and examine ways in which energy is being "lost" in the device

Sample guiding questions: Describe the energy transformations that are taking place in your device. What challenges did you encounter in making these transformations take place? As one form of energy is being transformed into another, where is energy being lost in your device? How might you minimize that loss?

2.4 use appropriate science and technology vocabulary, including *energy*, *heat*, *light*, *sound*, *electrical*, *mechanical*, and *chemical*, in oral and written communication

2.5 use a variety of forms *(e.g., oral, written, graphic, multimedia)* to communicate with different audiences and for a variety of purposes *(e.g., in a small group, discuss ways in which technological innovations increase and/or decrease our ability to conserve energy)*

3. Understanding Basic Concepts

By the end of Grade 5, students will:

3.1 identify a variety of forms of energy *(e.g., electrical, chemical, mechanical, heat, light, kinetic)* and give examples from everyday life of how that energy is used *(e.g., electrical energy for cooking; chemical/electrical energy to run our cars; mechanical energy to hit a baseball; light energy for managing traffic on the roads; heat energy to warm homes and schools)*

3.2 identify renewable and non-renewable sources of energy *(e.g., renewable: sun, wind, ocean waves and tides, wood; non-renewable: fossil fuels such as coal and natural gas)*

3.3 describe how energy is stored and transformed in a given device or system *(e.g., in a portable electric device, chemical energy stored in a battery is transformed into electrical energy and then into other forms of energy such as mechanical, sound, and/or light energy)*

3.4 recognize that energy cannot be created or destroyed but can only be changed from one form to another *(e.g., chemical energy in a battery becomes electrical energy)*

3.5 explain that energy that is apparently "lost" from a system has been transformed into other energy forms (usually heat or sound) that are not useful to the system *(e.g., sound from a car's engine does not help the car move)*