

# **NATIONAL STANDARDS CURRICULUM**

## **GRADE 9 BIOLOGY**

### **About the Unit**

In this Unit students will learn that multicellular organisms require a transport system to move substances between the cells and the environment. They will learn that humans have an elaborate transport system consisting of a pump, the heart, and a system of blood vessels – arteries, veins and capillaries – that link all the tissues of the body. Students will demonstrate the double circulation of blood around the body and the impact of exercise on the rate of flow. They will learn that, compared to humans, there are two transport systems in plants – one that transports water and mineral salts and another for manufactured food. They will investigate the pathway of water and mineral salts up the plant using herbaceous plants.

### **Range of Content**

- A transport system is needed by multicellular organisms to move substances between the cells and the environment.
- The transport system in humans consists of the heart, blood vessels and blood.
- The heart pumps the blood around the body.
- Blood is a tissue.
- The transport system in plants consists of xylem and phloem.
- Water and mineral salts are absorbed from the soil by root hairs/roots and passed from them into the xylem to be transported up the plant to the leaves.
- Manufactured food is transported by the phloem from the leaves to parts of the plant that use or store them.

### **Guidance for the Teacher**

**Prior Learning**

Check that students can:

Recall the basic functions of the cell membrane, cytoplasm and vacuole

Recall that the cell membrane is selectively permeable

Explain diffusion

**UNIT TITLE: Transport Across Cells**

**Theme:** Science Exploration, Application and Design Practice

**Attainment Target(s):**

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific theories.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

**Benchmarks:**

- Demonstrate an understanding of transport systems in plants and animals.

**Objectives**

Students will:

- investigate the process of osmosis
- explain the process of osmosis
- compare osmosis with diffusion
- prepare biological materials for investigation
- demonstrate interest in the outcomes of investigations
- make predictions using scientific knowledge and understanding

- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

**Topic :** Osmosis

**Time:** 7.5 Hours

**ICT Attainment Targets:**

- 🖥️ **COMMUNICATION AND COLLABORATION** - Use technology to communicate ideas, information and understandings for a variety of purposes.
- 🖥️ **RESEARCH, CRITICAL THINKING AND DECISION MAKING-** Use technology to develop a logical process for decision making and problem solving.
- 🖥️ **DESIGNING AND PRODUCING** – Use technology to design and produce multimedia products to demonstrate their creative thinking.
- 🖥️ **DIGITAL CITIZENSHIP** - Follow guidelines to promote healthy use of ICT tools

Suggested Teaching and Learning Activities	Key Skills	Assessment
<b>Students will:</b>		
<p>In groups, place one peg of grapefruit (or other citrus fruit) into a clean, dry, transparent plastic bag containing one tablespoon sugar or salt and shake. Place another peg of grapefruit into a similar plastic bag without sugar/salt. Leave the bags undisturbed for approximately ten (10) minutes. Observe and record what happens.</p> <p>Share their observations with the class and suggest reasons for the changes. Guided by the teacher, relate their observations to the concept of osmosis and develop a simple definition of the process.</p> <p><b>OR</b></p>	<p>Investigate, manipulate, observe, communicate, think critically, collaborate</p> <p>Define operationally,</p>	<p>Satisfactory handling of apparatus and materials Accurate record of observations</p> <p>Acceptable definitions given.</p>
<p>In groups, cut a medium Irish potato in halves. Carve out a hollow in both halves of the potato. (<i>Be careful when using sharp instruments</i>). Cut the base of each potato cup so that it can stand on its own. Stand each potato cup in a separate dish containing the same volume of water. Place one teaspoon of brown sugar or salt into the hollow of one potato cup. Leave both potato cups for 30 minutes. Observe and record what happens.</p> <p>Share their observations with the class and suggest reasons for the changes. Guided by the teacher, relate their observations to the concept of osmosis and develop a simple definition of the process.</p>	<p>Manipulate, observe, investigate communicate, think critically, collaborate</p> <p>Define operationally</p>	<p>Satisfactory handling of apparatus and materials Accurate record of observations</p> <p>Acceptable definitions given</p>
<p>Investigate the effects of pure water and strong sugar solution on raw, de-shelled chicken eggs. Make predictions about expected changes that will take place in the appearance of the eggs when submerged in pure water or in a strong sugar solution and left for some time. Take measurements of each egg – weight and circumference (use a string and ruler) then submerge one into the beaker of pure water and the other into the beaker of strong sugar solution. Cover the containers and set aside for 12 - 24 hours. Construct a suitable table to record the measurements. After 12 - 24 hours remove the eggs and rinse in tap water. Measure the circumference and weight and add the results to the table. Compare the eggs before and after placing in the liquids. Explain the changes observed in the eggs in terms of osmosis.</p>	<p>Investigate, manipulate, observe, communicate, predict, think critically</p>	<p>Accurate observations and measurements recorded in the table Results include reference to whether predictions are accepted or rejected Explanation of changes to the eggs accurately relates to process of osmosis</p>

Suggested Teaching and Learning Activities	Key Skills	Assessment
Construct a table to show the similarities and differences between osmosis and diffusion. Share information with the class and through a teacher led discussion, complete a combined table of these similarities and differences.	Compare, tabulate, summarise, communicate	Table contains acceptable comparison of osmosis and diffusion.  Acceptable table format – title, heading, neatness, lines etc.

Learning Outcomes
Students will be able to: <ul style="list-style-type: none"> <li>✓ Define and explain the processes of osmosis.</li> <li>✓ Demonstrate osmosis using simple materials.</li> <li>✓ Distinguish between osmosis and diffusion</li> </ul>

Points to Note	Extended Learning
<ul style="list-style-type: none"> <li>• To prepare de-shelled eggs. The shell of the eggs can be removed by placing them in 300-500 cm<sup>3</sup> dilute hydrochloric acid (HCl) or vinegar (acetic acid) in a beaker/suitable container overnight or until the shell is fully dissolved. Ensure the eggs are fully submerged in the HCl or vinegar (acetic acid) (rest another small beaker of water over the eggs to prevent flotation). Carefully, using tongs/spoon, remove the eggs and rinse them several times in tap water. Dispose of the HCl safely. The eggs are now ready for use by students. Remind them to handle the eggs gently and carefully.</li> <li>• Introduce the terms hypotonic, hypertonic and isotonic to explain osmosis.</li> </ul>	Research the applications of osmosis in every-day life using the following examples: <ul style="list-style-type: none"> <li>• How do fish and other forms of marine life survive in a salt-water environment?</li> <li>• The use of osmosis in food preservation – e.g. salting, pickling, sugar-curing.</li> <li>• The effect of osmosis on red blood cells.</li> </ul>

<b>Resources</b> Beakers or other suitable transparent plastic/glass containers, petri dishes, dilute Hydrochloric Acid, vinegar (acetic acid), eggs, Irish potato, salt, sugar, grapefruit or other citrus, plastic bags, ties	<b>Key vocabulary</b> Diffusion, concentration, concentration gradient, osmosis, dilute, selectively permeable, membrane, hypotonic, hypertonic, isotonic
<b>Links to other subjects</b> Chemistry	

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**Prior Learning**

Check that students can:

Recall that the transport system is responsible for moving substances around the body of the organism.

Identify the main parts of the transport systems of humans.

Explain diffusion and osmosis.

**UNIT TITLE:** Transport in Humans

**Theme:** Science Exploration, Application and Design Practice

**Attainment Target(s):**

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific theories.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

**Benchmarks:**

- Demonstrate an understanding of transport systems in plants and animals.

**Objectives:****Students will:**

- Investigate the need for a transport system in multicellular organisms.
- Identify the types of substances which need to be transported in animals.
- Annotate a simple diagram of the human heart.
- Relate the basic structure of the human heart to its function.
- Trace the flow of blood through the heart and around the body.
- Relate the structure of arteries, veins and capillaries to their functions.
- Identify the main components of blood and state their basic functions.
- Use scientific vocabulary and/to articulate concepts clearly and precisely







- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

**Topic:** Transport in Humans

**Duration:** 6 Hours

#### ICT ATs

-  **COMMUNICATION AND COLLABORATION** - Students use technology to communicate ideas and information, and work collaboratively to support individual needs and contribute to the learning of others.
-  **RESEARCH, CRITICAL THINKING AND DECISION MAKING-** Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.
-  **DESIGNING AND PRODUCING** – Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.
-  **DIGITAL CITIZENSHIP** - Students recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

<b>Suggested Teaching and Learning Activities</b> <b>Students will:</b>	<b>Key Skills</b>	<b>Assessment</b>
<p>In groups Investigate how surface area influences the rate of diffusion in cubes of different sizes by carrying out the following activity. Measure the sides and calculate the surface area and volume of the cubes provided and record in a suitable table. Using forceps, place the coloured cubes into a 250 cm<sup>3</sup> beaker of dilute HCl and note the time. Record the time taken for each cube to become colourless. Determine the average time taken for each cube size and plot a suitable graph of the results. As a class discuss the results and complete the lab report.</p> <p>Peg or draw out a map of the human circulatory system on the school field or classroom floor. Label each area on the map. Take turns representing the blood, walk around the system explaining what happens at each point. Guided by the teacher, infer that the human circulatory system is a double circulation, explain why it is given this name and discuss the advantages of such a circulation. Demonstrate and explain what happens to the flow of blood if the rate of the heart beat increases.</p> <p>Annotate simple diagrams of the human heart [external features and longitudinal section (L/S)]. Examine, in groups, the external and internal features of a pig's/cow's heart and with reference to the diagrams identify the main parts.</p> <p>View a chart / video/ interactive animation on how the heart pumps blood around the body. Use arrows on their labelled diagrams (from previous activity) to indicate the flow of blood through the heart.</p>	<p>Investigate, measure, think critically, manipulate, collaborate, communicate</p> <p>Collaborate, communicate, infer</p> <p>annotate, make observations, collaborate, make comparisons</p> <p>Think critically, make comparisons, illustrate</p>	<p>Correct relationship between surface area and rate of diffusion explained and supported by data.</p> <p>Acceptable demonstration and explanation of blood flow.</p> <p>Appropriate labels and annotations</p> <p>Arrows indicate correct flow of blood through the heart.</p>
<p>In groups, research, plan and design models of the different types of blood vessels, using available materials. Plans should include constraints. Present designs to the class, explaining how they will represent the blood vessels. Then, refine designs based on feedback. Construct the model using the modified designs and display in the science corner.</p>	<p>think critically, create, manipulate, plan and design, evaluate, communicate,</p>	<p>Models accurately depict blood vessels</p>

<b>Suggested Teaching and Learning Activities</b> Students will:	<b>Key Skills</b>	<b>Assessment</b>
View a prepared smear of human blood using a microscope, or a projected image or chart online/offline and, aided by the teacher, identify red and white blood cells and platelets. In groups, make models of red and white blood cells and platelets by cutting shapes from cardboard, paper, plastic, foam, modelling clay/plasticine or rubber. Develop criteria to peer assess the models. Display models in the science corner.	Make observations, construct, think critically, critique, collaborate, communicate,	Blood components and their functions correctly identified and represented by models. Appropriate criteria developed for peer assessment.

<b>Learning Outcomes</b>
Students who demonstrate understanding can: <ul style="list-style-type: none"> <li>✓ Explain that multicellular organisms need a transport system.</li> <li>✓ Describe the structure and functions of the human circulatory system</li> </ul>

<b>Points to Note</b>	<b>Extended Learning</b>
Teacher led discussion for activity 1 should focus on surface area: volume ratio and how this influences the rate of diffusion.  To make good solid agar, stir 2 g of plain agar powder into 100 cm <sup>3</sup> of water. Heat in a water bath filled with boiling water, while stirring, until the agar solution boils. Colour the agar with potassium permanganate (add a few crystals and stir until the desired colour is obtained). Pour the coloured agar into straight-sided dishes or ice cube trays then allow to cool. Cut the agar cubes for the students – 0.5 cm <sup>3</sup> , 1.0 cm <sup>3</sup> and 1.5 cm <sup>3</sup> . Provide each group with two cubes of each size.	<ul style="list-style-type: none"> <li>• Research selected diseases of the circulatory system and state the possible causes and preventive measures.</li> <li>• Research issues relating to the use of blood transfusions in medicine (e.g. ethical, religious).</li> <li>• Explore the benefits of exercise as it relates to the heart and circulatory system.</li> <li>• Research legal and illegal methods of increasing red blood cell concentration to improve athletic performance.</li> </ul>

<p>Mammalian hearts (complete with fat and major blood vessels), obtained from freshly slaughtered pig, cattle or goat can be sourced from public health inspectors, abattoirs and markets.</p> <p>Observe safety precautions when handling fresh specimens and sharp instruments. Students must wash hands using soap and water after the activity.</p>	
<p><b>Resources</b>  Videos, charts, posters, hearts (goat, cattle or pig), prepared blood smear slide, microscope, cardboard, foam, paper, plastic, modelling clay (e.g. Plasticine) or rubber, stop watch/clock, blunt needles (seekers), forceps, beakers, heating apparatus, agar, potassium permanganate, Hydrochloric acid, scalpel, straight sided containers or ice trays  <a href="#">Computers</a>, <a href="#">Internet</a>, <a href="#">speaker</a>, <a href="#">multimedia projector</a>, <a href="#">interactive video tutorials</a>, <a href="#">CDs/DVDs</a></p>	<p><b>Key vocabulary</b>  Arteries, veins, capillaries, valves. heart, lungs, blood, unicellular, multicellular, diffusion, osmosis, red blood cells, white blood cells, plasma, platelets, double circulation, transport system, haemoglobin, surface area, volume,</p>
<p><b>Links to other subjects</b>  Physical Education</p>	

**Prior Learning**

Check that students can:

- describe the basic structure of plants, e.g. leaf, root, stem, flower
- recall that green plants take in water through their roots and that the leaf is important for photosynthesis
- explain diffusion and osmosis

**UNIT TITLE: Transport in Plants**

**Theme:** Science Exploration, Application and Design Practice

**Attainment Target(s):**

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific theories.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

**Objectives:****Students will:**

- Identify the substances that are transported in plants
- describe how roots are adapted for taking in water
- Identify the location of transport tissues in a dicotyledonous plant stem and root sections.
- Describe the basic functions of the xylem and phloem.
- Investigate the movement of water from the soil to the leaves





**Benchmarks:**

- Demonstrate an understanding of transport systems in plants and animals.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.

**Topic:** Transport in Plants

**Duration:** 5 Hours

**ICT ATs**

-  **COMMUNICATION AND COLLABORATION** - Students use technology to communicate ideas and information, and work collaboratively to support individual needs and contribute to the learning of others.
-  **RESEARCH, CRITICAL THINKING AND DECISION MAKING**- Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.
-  **DESIGNING AND PRODUCING** – Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.
-  **DIGITAL CITIZENSHIP** - Students recognise the human, ethical, social,

**cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.**

Suggested Teaching and Learning Activities	Key Skills	Assessment
<b>Students will:</b>		
<p>In groups, examine roots with root hairs, e.g. germinating peas or beans, or secondary sources such as prepared slides and animations, and brainstorm to identify the role of the root hairs. Share ideas with the class.</p> <p>In groups, examine and record evidence of movement of a dye in plants using Balsam/'lady slipper' (<i>Impatiens</i>) plants which have been placed in the dye/food colouring for a few hours or overnight. Cut transverse sections from the stem and root of the plant and examine (using a hand lens) to show the location of the dye. View a prepared slide of the transverse section through a stem and root showing the vascular bundles and compare with the sections cut from the plant. Describe the movement of substances from the soil through the plant, and present their observations in a variety of ways. (<i>Teacher should emphasize that only the xylem will be stained by the dye and point out the association of the phloem with the xylem in the vascular bundle. Mention that food manufactured during photosynthesis is transported in the phloem. No further detail on the phloem is needed.</i>)</p> <p>In groups, draw two circles on the floor or on a poster sheet (one representing the stem and the other the root). Cut 20 discs of two different colours and sizes from card or paper (10 representing xylem and 10, phloem). Arrange the discs to demonstrate how the vascular tissues in a dicotyledonous root and stem are arranged.</p> <p>Investigate the uptake of dye/coloured ink by white flowers by placing the freshly cut flower stalks into a beaker/glass containing the dye/ink solution. Leave for 1-2 hours and observe what happened to the white petals. Suggest</p>	<p>Collaborate, communicate</p> <p>investigate, observe, manipulate communicate, think critically, collaborate</p> <p>think critically, create</p> <p>investigate, observe, communicate, think critically, collaborate</p>	<p>Acceptable role of root hairs identified.</p> <p>Accurate description of the movement of substances from the roots to the leaves</p> <p>Arrangement of vascular tissues in the dicotyledonous stem and root accurately depicted</p> <p>Accurate explanations on movement of substances</p>

Suggested Teaching and Learning Activities	Key Skills	Assessment
an explanation for their results. Suggest how this practice could be used commercially.		

<p>Learning Outcomes</p> <p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> <li>✓ Describe the adaptations of roots for absorption of water.</li> <li>✓ Describe the location and basic functions of the xylem and phloem.</li> <li>✓ Describe the route taken by substances from the soil up the plant</li> <li>✓ <a href="#">Communicate information using discussion forums or social network</a></li> </ul>
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Points to Note	Extended Learning
<p>Wash roots carefully before placing plant in the dye solution. Sections of the parts of the plant may be projected for class viewing.</p>	<p>Research the adaptations of roots and leaves of plants in different environments (aquatic –brackish/freshwater; terrestrial – typical/desert)</p>
<p><b>Resources</b> microscope, prepared slides/posters/ of T/S stem and root, live seedlings, video clips, measuring cylinders, beakers, paper/cards, balsam/lady slipper, dye <a href="#">Computers, Internet, speaker, multimedia projector, interactive video</a></p>	<p><b>Key vocabulary</b> xylem, phloem, vascular bundle, veins,</p>
<p><b>Links to other subjects</b> Agriculture</p>	



### **About the Unit**

In this unit students will learn about the importance of the body's ability to respond to external and internal stimuli. They will investigate a range of stimuli to identify the specific receptors/sense organs which detect them. They will learn that the brain and spinal cord constitute the central nervous system which coordinates all responses to stimuli. They will learn about the main parts of the brain and their basic functions. They will also appreciate that many processes in the body are controlled by chemical regulators called hormones and identify the location and specific functions of selected endocrine glands.

### **Range of Content**

- The nervous and endocrine systems enable us to respond to changes in the external and internal environment.
- A variety of specific receptor cells detect stimuli in the environment and pass the information to the Central Nervous System (CNS).
- The CNS receives and sends information via nerve cells/neurons as it coordinates all the body's responses to stimuli
- Reflex actions are rapid, automatic responses to stimuli.
- Hormones are chemical substances secreted by endocrine/ductless glands and are transported in the blood to the parts of the body where they work.
- Hormones regulate the functions of many organs and cells.

### **Guidance for the Teacher**

**Prior Learning**

Check that students can:

Recall the definition of hormones.

Identify the sense organs of humans and the stimuli to which they respond.

**UNIT TITLE: SENSITIVITY AND COORDINATION**

**Theme:** Science Exploration, Application and Design Practice

**Attainment Target(s):**

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific theories.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

**Benchmarks:**

- Understand the role of the key organs and systems in humans and animals in sensing and responding to the environment.
- Apply the principles of measurement in the solution of everyday problems.





**Students should be able to:**

- Deduce the importance of responding to changes in the environment
- State that each sense organ contains sensory / receptor cells that detect a specific type of stimulus.
- State that the brain and spinal cord comprise the Central Nervous System (CNS) which coordinates the body's responses.
- Name the main parts of the human brain and state their basic functions.
- Differentiate between voluntary and involuntary /reflex actions.
- Explain the importance of reflex actions using examples.
- Describe the endocrine system as consisting of ductless glands that respond to internal stimuli by producing hormones.
- Identify selected endocrine glands, their location, the hormones they produce and their importance in maintaining the internal environment
- Compare the nervous system with the endocrine system
- Use appropriate scientific language to describe features of the nervous and endocrine systems

- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate concern for the preservation of natural resources.
- Demonstrate concern for man's impact on the environment.
- Demonstrate sensitivity to others who are different.

**Topic:**

**Duration:** 7 hours

-  **COMMUNICATION AND COLLABORATION** - Students use technology to communicate ideas and information, and work collaboratively to support individual needs and contribute to the learning of others.
-  **RESEARCH, CRITICAL THINKING AND DECISION MAKING**- Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.
-  **DESIGNING AND PRODUCING** – Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.
-  **DIGITAL CITIZENSHIP** - Students recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

<b>Suggested Teaching and Learning Activities Students will:</b>	<b>Key Skills</b>	<b>Assessment</b>
View a video on the human nervous system. Participate in teacher led discussion to highlight the importance of responding to changes in the environment and identify the role the nervous system plays.	Communicate, collaborate	
In groups, review the sense organs and formulate definitions for stimulus, receptor, response and effector. Share definitions with the class in a teacher led discussion. Construct a table to list each sense organ, the stimulus which it detects and its corresponding function.	Collaborate, define operationally, think critically, communicate, tabulate	Acceptable definitions given Accurate information linking sense organs to functions Acceptable presentation of table
View diagram / picture / video or examine a model of the human brain then label the main parts on a teacher prepared hand out. Construct a table to show the parts identified and their functions.	Label diagrams, tabulate	Diagram accurately labelled  Acceptable presentation of table with accurate information
Participate in a teacher-led discussion then formulate a definition of involuntary /reflex actions. In groups, generate and sort a list of actions into voluntary and involuntary. As a class, share their ideas from the lists and identify the benefits that can be derived from the involuntary/reflex actions cited.	Define operationally, collaborate, communicate, infer, classify	Acceptable definition of reflex actions given Voluntary and involuntary actions correctly identified. Acceptable benefits of reflex actions identified.
Work in pairs to demonstrate some reflex actions identified in the previous activity (e.g. blinking, knee jerk, pupil reflex etc.) then in a teacher led discussion, identify the common features involved in the reflex actions and the role each plays.	Think critically, collaborate, manipulate, communicate	Acceptable identification of common features involved in the selected reflex actions.
Work in groups to compare their reaction times. Hold ruler with fore finger and thumb. On a signal given by group leader, release ruler and try to grasp it with fingers before it hits the surface. Record the time taken to catch the ruler. Perform the activity two more times. Tabulate the results and calculate the average reaction time. Repeat the activity to determine the average reaction time for each member of the group. Plot a suitable graph (reaction time/ students) using the group results. Share	Think critically, collaborate, manipulate, communicate, Tabulate, construct graph, analyse and interpret data, draw conclusions	Accurate presentation of data in table and graph Acceptable comparisons of response times  Acceptable interpretation of the variation in reaction times

<b>Suggested Teaching and Learning Activities</b> <b>Students will:</b>	<b>Key Skills</b>	<b>Assessment</b>
<p>data with the class and compare reaction times of the students and discuss reasons for any differences.</p> <p>Use interactive online reaction time monitor and compare values.  <a href="https://faculty.washington.edu/chudler/java/redgreen.html">https://faculty.washington.edu/chudler/java/redgreen.html</a></p>		
<p>View video/power point presentation/poster or chart of the human endocrine system showing selected glands (pituitary, thyroid, adrenal, pancreas, ovaries, and testes) and in teacher led discussion identify the glands, their location, the hormones that they produce and their effects on the body. Record the information in a suitable table. Annotate a blank diagram prepared by the teacher.</p> <p>In groups, compare the nervous and endocrine systems and share findings with the class. Summarise the information presented.</p>	Collaborate, communicate, tabulate, annotate	<p>Acceptable presentation of table with accurate information</p> <p>Accurate annotation of diagram</p> <p>Accurate information presented in summary.</p>

<b>Learning Outcomes</b>
<p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> <li>✓ Explain the role of sense organs in providing information on the external environment.</li> <li>✓ Describe the central nervous system as comprising the brain and spinal cord.</li> <li>✓ Identify the main parts of the brain and state their functions.</li> <li>✓ Distinguish between voluntary and involuntary/reflex actions.</li> <li>✓ Explain the importance of reflex actions using examples.</li> <li>✓ Describe the endocrine system as consisting of ductless glands that respond to internal stimuli by producing hormones.</li> <li>✓ Identify selected endocrine glands, their location, secretions and roles.</li> <li>✓ Use appropriate scientific language to describe features of the nervous and endocrine systems</li> </ul>

<b>Points to Note</b>	<b>Extended Learning</b>
<p>Components of reflex action to include – parts that detect stimuli and parts that carry out responses. Details of components of <i>reflex arc</i> not required.</p> <p>Parts of the brain to include (cerebrum, cerebellum, medulla oblongata, pituitary gland)</p> <p>Endocrine glands to include (pituitary, pancreas, ovaries, testes, thyroid, and adrenal),</p>	<p>Research and report on the effects of the malfunction of selected endocrine glands (e.g. thyroids, pancreas), the diseases which may develop and the methods of treatment available.</p> <p>Research the work of Pavlov and his dogs in the context of the reflex action.</p>
<p><b>Resources</b></p> <p>Charts, posters, videos, power point presentations on the nervous and endocrine systems; hand-outs and worksheets; stop watch, rulers</p>	<p><b>Key vocabulary</b></p> <p>Hormones, receptor, stimulus, spinal cord, brain, medulla oblongata, cerebrum, cerebellum, sense organ, pancreas, insulin, thyroid, pituitary, adrenal, adrenaline, thyroxin(e), voluntary , involuntary , reflex action , reflex arc, response, nerves, nervous system, central nervous system, endocrine, ductless gland.</p>
<p><b>Links to other subjects</b></p>	

### **About the Unit**

In this Unit students will learn about the changes that occur during pregnancy as the human zygote develops into an embryo, then a foetus until it is born. During pregnancy the developing baby is supported by the placenta – all its oxygen and nutrient needs and all wastes are exchanged there. Students will appreciate that disease microorganisms and some drugs can also pass across the placenta and cause harm to the baby. It is therefore very important that the mother gets prenatal care and avoids practices such as smoking and drinking alcohol, which can harm the baby. They will learn about the importance of planning the family and explore the variety of methods of birth control used to prevent pregnancy. Students will debate issues related to teenage pregnancy.

### **Range and Content**

The key concepts, skills and knowledge students will learn in this unit are:

- The human zygote undergoes repeated cell divisions to produce an embryo.
- The embryo becomes implanted in the wall of the uterus and develops into a foetus/baby during the period of gestation.
- The placenta is the point of contact between mother and foetus.
- Nutrients, oxygen and wastes are exchanged across the placenta.
- Disease organisms and drugs can pass across the placenta.
- Maternal habits such as smoking, drinking alcohol, use of drugs and inadequate diets can have significant negative effects on the developing embryo/foetus.
- Prenatal care is vital for the health of mother and baby.
- Birth control methods prevent pregnancy in a variety of ways.

### **GUIDANCE FOR THE TEACHER**

Preview all videos to ensure they are appropriate in addressing the learning objectives.

Be aware of students' religious and cultural backgrounds, and also their attitudes to sexual development and conception.

**Prior Learning**

Check that students can:

- Identify the structure and basic function of the human reproductive system
- Define puberty and adolescence
- Explain the stages of the menstrual cycle
- Define ovulation and fertilization
- Recall that fertilisation involves the fusion of the nuclei of sperm and egg/ovum

**UNIT TITLE:** Embryo Development and Birth Control

**Theme:** Science Exploration, Application and Design Practice

**Attainment Target(s):**

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific theories.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

**Objectives:****Students will:**

- State that the fertilised egg (zygote) undergoes repeated cell divisions to produce an embryo which becomes implanted in the uterus
- Identify key structures in a pregnant uterus (placenta, amniotic sac, amniotic fluid, umbilical cord and uterine wall) and state their basic functions in the growth and development of the human embryo/foetus.
- Describe how the embryo obtains nutrients and oxygen and eliminates waste.
- Describe the effects of negative maternal behaviour during pregnancy on the development of the embryo/foetus.
- Explain the importance of prenatal care during pregnancy.
- Critique methods of birth control.
- Assess the importance of family planning
- Evaluate problems associated with teenage pregnancy
- Show respect for each other's views



**Benchmarks:**

- Understand the role of the key organs and systems in humans and animals in sensing and responding to the environment.
- Understand embryo development and birth, appreciate the importance of maintaining a healthy lifestyle during pregnancy, and be aware of birth control methods.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

**Topic:** Embryo development and birth control

**Duration:** 7 Hours

**ICT Attainment Targets**

- ❖ **COMMUNICATION AND COLLABORATION** – Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.
- ❖ **DESIGNING AND PRODUCING** – Use digital tools to design and produce creative multimedia products to demonstrate their learning and understanding of basic technology operations.
- ❖ **RESEARCH, CRITICAL THINKING, PROBLEM SOLVING AND DECISION MAKING** - Use appropriate digital tools and resources to plan and

<p>conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.</p> <p>❖ <b>DIGITAL CITIZENSHIP</b> - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.</p>	
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<b>Suggested Teaching and Learning Activities</b> <b>Students will:</b>	<b>Key Skills</b>	<b>Assessment</b>
<p>View chart/ model/ video (online or offline) showing the development of the human embryo in the uterus.</p> <p>Annotate a given diagram of the longitudinal section of the pregnant uterus.</p>	<p>Annotate</p>	<p>Correct annotation of diagram</p>
<p>Sequence prepared statements about the human life cycle (e.g. on cell specialisation, fertilisation, embryo development, birth etc.).</p> <p>In groups, create an album or a booklet to show the stages of growth of the foetus using pictures collected from the internet/posters/magazines. Display albums/booklets in the science corner.</p> <p>Use suitable software (e.g., presentation or moviemaking) to create digital version of the album.</p>	<p>Summarise</p> <p>Design , construct, collaborate</p> <p>Navigate digital content Use search engines safely</p>	<p>Acceptable sequence of stages of life cycle</p> <p>Pictures accurately sequenced</p>

<p>In groups, research (online/offline) the effects of negative maternal behaviours (e.g., diet, drugs, alcohol and smoking) on the developing embryo/foetus. Discuss information and prepare related questions that could be used during a panel discussion/press conference.</p> <p>OR</p> <p>In groups, design and make a poster or <a href="#">movie/digital story</a> to persuade pregnant mothers to give up negative behaviours during pregnancy. Display posters on the classroom wall <a href="#">or present movie to class or post movie on class page</a>.</p>	<p>Research, collaborate, critique, think critically, communicate</p> <p>Create, collaborate, communicate, think critically, <a href="#">Create and format document and multimedia presentation</a></p>	<p>Questions adequately address the negative maternal behaviours</p> <p>Poster/movie/digital story adequately address the negative maternal behaviours. <a href="#">Accurate content, logical arguments, images convey message</a></p>
<p>role play two pregnant women visiting a prenatal clinic, one who is taking good advice on prenatal care and the other who is disregarding it.</p>	<p>Think critically, critique, create, communicate</p>	<p>Role-play accurately depicts good prenatal care</p>
<p>Participate in a discussion led by a nurse/ doctor/teacher on the importance of family planning, the effects of teenage pregnancy and the different methods of birth control/contraception.</p> <p>In groups, collect samples of different contraceptives and create a display chart.</p> <p>Debate on the moot “Be it resolved that condoms should be distributed in secondary schools.”</p>	<p>Communicate , collaborate</p> <p>Create, communicate, collaborate</p> <p>Critique, analyse, develop logical arguments, think critically, communicate, collaborate</p>	<p>Poster captures the variety, nature and importance of contraception; is attractively presented and reflects creativity</p> <p>Arguments reflect understanding of teenage sexuality and the effects of teenage pregnancy.</p>

**Learning outcomes**

Students who demonstrate understanding can:

- ✓ Explain that the fertilised egg (zygote) develops into an embryo which becomes implanted in the uterus.
- ✓ Describe the basic structure and function of a pregnant uterus.
- ✓ Describe the exchange of substances across the placenta.
- ✓ Explain the effects of negative maternal behaviours on the developing embryo/foetus.
- ✓ Value the importance of prenatal care.
- ✓ Evaluate methods of birth control in preventing pregnancy.
- ✓ Appreciate the problems associated with teenage pregnancy.
- ✓ Use digital story/movie to communicate information.

<b>Points to Note</b>	<b>Extended Learning</b>
<p>Maternal behaviours to include diet, drugs, alcohol and smoking, responsible sexual habits. Prenatal care to include maternal nutrition, exercise and immunisation.</p> <p>Remind students of the following when using technology:</p> <ul style="list-style-type: none"> <li>• Recognise and acknowledge the owners or creators of digital materials and encourage their peers to do so.</li> <li>• Follow guidelines to promote healthy use of ICT tools</li> </ul>	<p>Collect and sequence ultra-sound pictures showing the stages of the developing foetus.</p> <p>Visit the National Family Planning Agency or online, collect data from the different parishes in Jamaica and plot graphs to illustrate the incidence of teenage pregnancy.</p> <p>Research in vitro fertilization (test-tube babies), fertility drugs and surrogate motherhood.</p> <p>Explain how identical, non-identical and Siamese twins occur.</p> <p>Research the rate of 'infant mortality' (death of new-born babies) in Jamaica.</p> <p>Find out how different animals e.g., developing bird or reptile, meet their needs inside the egg.</p>

<b>Resources;</b> Charts, models, videos and movies of various aspects of human reproduction and family planning, resource personnel , samples of birth control methods, cartridge paper, markers, tape, glue <a href="#">Computers</a> , <a href="#">Internet</a> , <a href="#">multimedia projector</a> , <a href="#">speakers</a>	<b>Key vocabulary:</b> zygote, cell division, embryo, foetus, uterus, placenta, amniotic fluid, amniotic sac, umbilical cord, conception, implantation, gestation, labour, delivery, birth, family planning, contraceptives, pre-natal care
<b>Links to other subjects</b> Social studies, Religious Education, HFLE	

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