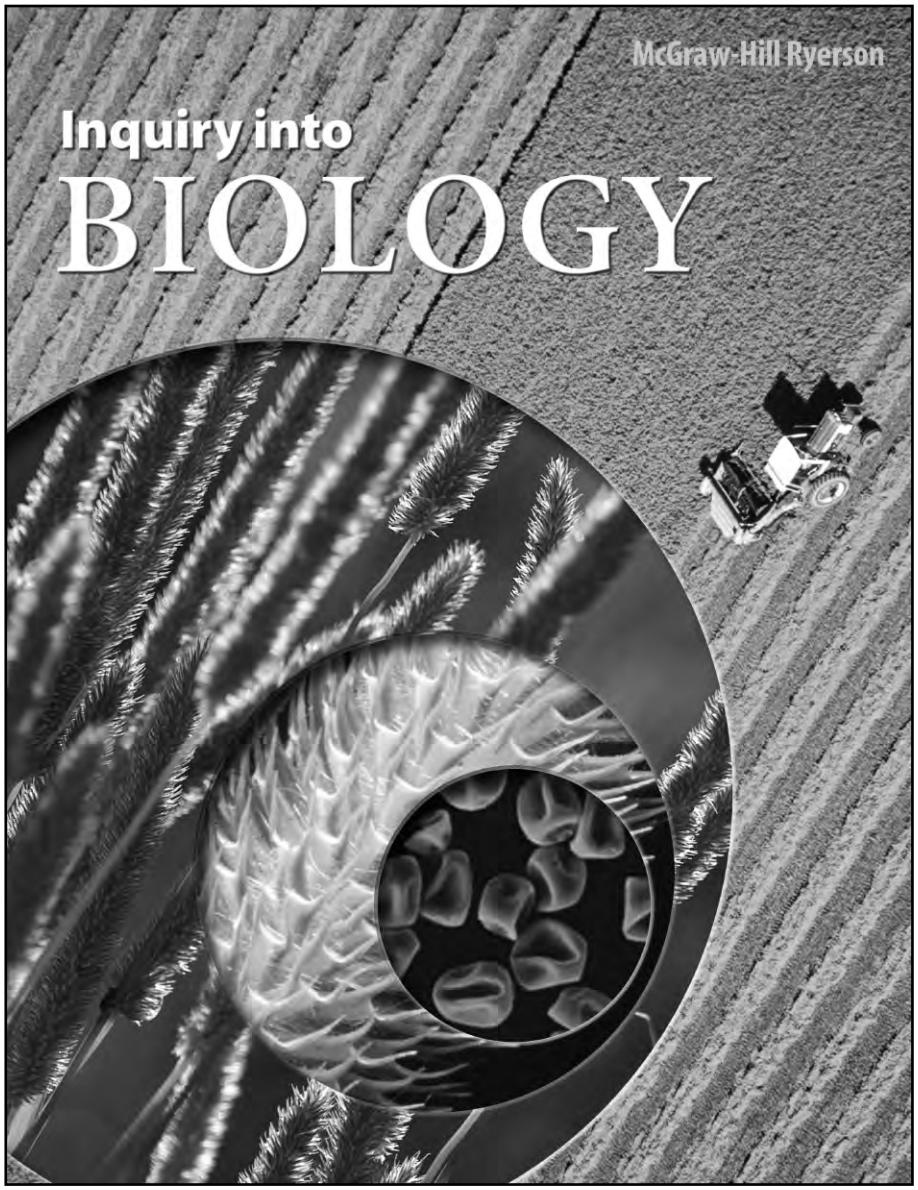
Inquiry into Biology

Curriculum Correlation

To the new **Biology 20-30** Program of Studies



McGraw-Hill Ryerson

CHAPTER 1 ENERGY TRANSFER IN THE BIOSPHERE

Curriculum Correlation

General Outcome 1: Students will explain the constant flow of energy through the biosphere and ecosystems.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–A1.1k explain, in general terms, the one-way flow of energy through the biosphere and how stored biological energy in the biosphere, as a system, is eventually "lost" as heat, e.g., **photosynthesis/chemosynthesis* **cellular respiration (muscle-heat generation, decomposition* **energy transfer by conduction, radiation and convection*	Section 1.1: How Energy Enters the Biosphere, pp. 8-14	Q questions 1-4, p. 9 Q questions 5, 6, p. 12; 11, p. 14 Section 1.1 Review: 1-4, 6, 8, p. 15 Chapter 1 Review: 3, 10, 13, p. 30 Unit 1 Review: 1, p. 68 Chapter 1 Test
20–A1.2k explain how biological energy in the biosphere can be perceived as a balance between both photosynthetic and chemosynthetic, and cellular respiratory activities, i.e., *energy flow in photosynthetic environments *energy flow in deep sea vent (chemosynthetic) ecosystems and other extreme environments	Section 1.1: Energy for Life in the Deep Ocean, pp. 12-13 A Closer Look at Consumers, p. 13	Q questions 8-10, p. 13 Section 1.1 Review: 5, p. 15 Section 1.2 Review: 4, 9, p. 27 Chapter 1 Review: 2, 8, p. 30; 21, p. 31 Unit 1 Review: 3, 7(a), p. 68; 32, p. 70 Chapter 1 Test
20–A1.3k explain the structure of ecosystem trophic levels, using models such as food chains and food webs	Trophic Levels Describe Feeding Relationships in Ecosystems, p. 16 Food Chains and Food Webs, pp. 16-18 Investigation 1.B: Weave Your Own Food Web, pp. 22-23 Thought Lab 1.2: Energy Fluctuation in an Ecosystem, p. 25 Investigation 1.C: Ecology of an Endangered Prairie Ecosystem, p. 26	Q questions 12-14, p. 16; 15, 16, p. 18 Try This: Comparing Food Webs, p. 19 Investigation 1.B: Procedure 4, 7; Analysis 4, pp. 22-23 Thought Lab 1.2: Analysis 4, p. 25 Investigation 1.C: Analysis 2, p. 26 Section 1.2 Review: 1, 2, 8, p. 27 Chapter 1 Review: 9, 10, p. 30; 20, p. 31 Unit 1 Review: 2, 7(b), p. 68 Chapter 1 Test
20–A1.4k explain, quantitatively, the energy and matter exchange in aquatic and terrestrial ecosystems, using models such as pyramids of energy, biomass and numbers.	Modelling Feeding Relationships through Ecological Pyramids, pp. 18-24 Thought Lab 1.1: Analyzing Energy Transfers, p. 20	Q question 17, p. 19 Thought Lab 1.1, Analysis 1, p. 20 Section 1.2 Review: 6, 7, p. 27 Chapter 1 Review: 4, 6, 7, 11, 14, 15, p. 30; 16, 17, 19, p. 31 Unit 1 Review: 7(c), 8, p. 68; 21, p. 69; 25,p. 70 Chapter 1 Test
Outcomes for Science, Technology and Society (Emphasis on the nature of science)		
20–A1.1sts explain that the process of scientific investigation includes analyzing evidence and providing explanations based upon scientific theories and concepts by **(NS5e)** ■ *evaluating the evidence for the influence of ice and snow on the trapping of solar energy (albedo effect), and hypothesize on the consequences of fluctuations for biological systems* ■ *explaining how metabolic heat release from harvested grain can be reduced by drying processes prior to grain storage, and explain the scientific principles involved in this technology* ■ *explaining, in terms of energy flow, the advantage of vegetarianism in densely populated countries*	Connections: Biomagnification: A Fish Story, p. 28 Figure 1.4, p. 11 Thought Lab 1.1: Analyzing Energy Transfers, p. 20 Investigation 1.B: Weave Your Own Food Web, pp. 22-23	Section 1.2 Review: 5, p. 27 Connections: 5, p. 28 Chapter 1 Review: 16, 18, p. 31 Unit 1 Review: 16, 18, p. 69; 34, 37, p. 71 Q questions 5, 6, p. 12 Section 1.1 Review: 7, p. 15 Thought Lab 1.1: Analysis 2-4, p. 20 Investigation 1.B: Ext. 5, p. 23 Chapter 1 Review: 20, p. 31

	Student Textbook	Assessment Options
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
20–A1.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ *proposing a relationship between producers and available biological energy of a system* **(IP–STS1)** ■ predicting a relationship between solar energy storage by plants and varying light conditions **(IP–NS3) [ICT C6–4.1]**	Launch Lab: Considering Connections, p. 7 A Closer Look at Producers, pp. 9-12 The Fate of Energy in the Biosphere, p. 14 Investigation 1.A: Storing Solar Energy in Plants, pp. 10-11	Launch Lab: Analysis 1-3, p. 7 Chapter 1 Review: 12, p. 30 Unit 1 Review: 6, p. 68 Investigation 1.A: Ext. 8, 9, p. 11
Performing and Recording		
20–A1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by		
■ performing an experiment to demonstrate solar energy storage by plants **(PR–NS1, 2, 3, 4, 5)** ■ *drawing annotated diagrams, by hand or using technology, of food chains, food webs and ecological pyramids* **(PR–NS4) [ICT P3–4.1, C6–4.2, P4–4.3]**	Investigation 1.A: Storing Solar Energy in Plants, pp. 10-11 Investigation 1.B: Weave Your Own Food Web, pp. 22-23 Investigation 1.C: Ecology of an Endangered Prairie Ecosystem, p. 26	Investigation 1.A: Procedure 1-6, p. 10 Investigation 1.B, Procedure 7, p. 23 Investigation 1.C, Procedure 3, p. 26 Section 1.2 Review: 3, 4, p. 27 Connections: 1, p. 28 Unit 1 Review: 4, 7(b), 8, p. 68; 25, p. 70
Analyzing and Interpreting		
20–A1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ analyzing data on the diversity of plants, animals and decomposers of an endangered ecosystem and predict a future outcome, e.g., wetlands, short grass prairie **(AI–STS1, 2, 3, 4) [ICT C6–4.1, 4.4]** ■ describing alternative ways of presenting energy flow data for ecosystems: pyramids of energy, biomass or numbers **(AI–STS1) (AI–NS4, 5, 6) [ICT C6–4.2, 4.3]** ■ *analyzing data on the solar energy storage by plants* **(AI–NS2, 3, 4, 5, 6)**	Investigation 1.B: Weave Your Own Food Web, pp. 22-23 Thought Lab 1.2: Energy Fluctuation in an Ecosystem, p. 25 Investigation 1.C: Ecology of an Endangered Prairie Ecosystem, p. 26 Connections: Biomagnification: A Fish Story, p. 28 Modelling Feeding Relationships through Ecological Pyramids, pp. 18-24 Investigation 1.A: Storing Solar Energy in Plants, pp. 10-11	Section 1.1 Review: 7, 8, p. 15 Investigation 1.B: Analysis 1-4, p. 23 Thought Lab 1.2: Analysis 1-4, p. 25 Section 1.2 Review: 10, p. 27 Investigation 1.C: Procedure 1, Analysis 1-4, Ext. 5, p. 26 Connections: 2-5, p. 28 Unit 1 Review: 9, 21, p. 69 Q. question 18, p. 24 Chapter 1 Review: 7, p. 30; 17(b), 19, 21, p. 31 Investigation 1.A: Analysis 1-5; Conclusions 6-7, p. 11
Communication and Teamwork		
20–A1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *using appropriate International System of Units (SI) notation, fundamental and derived units and significant digits in the data presented in a food pyramid* **(CT–ST2)**	Investigation 1.B: Weave Your Own Food Web, pp. 22-23	Investigation 1.B, Analysis 3, p. 23
■ *working cooperatively as a team to investigate, synthesize and present information collected on the effect of organism diversity on an ecosystem* **(CT–STS1, 2, 3, 4) [ICT P6–4.1]**	Investigation 1.C: Ecology of an Endangered Prairie Ecosystem, p. 26	Investigation 1.C: Procedure 1-2, p. 26

CHAPTER 2 CYCLES OF MATTER

Curriculum Correlation

General Outcome 2 Students will explain the cycling of matter through the biosphere.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–A2.1k explain and summarize the biogeochemical cycling of carbon, oxygen, nitrogen, and phosphorus, and relate this to general reuse of all matter in the biosphere	Section 2.2: Biogeochemical Cycles, pp. 42-52	Q questions 6, 7, p. 43 Figure 2.11 question, p. 43 Q question 8, p. 44; 9, p. 46 Web Link: Winogradsky column, p. 47 Q questions 11, 12, p. 48; 13, 14, p. 49; 15, 16, p. 50 Section 2.2 Review: 1-8, p. 52 Section 2.3 Review: 9(a), p. 61 Chapter 2 Review: 1, 3, 6, 7, 10, 11, 12, 13, 17, p. 64 Unit 1 Review: 5, p. 68; 11, 17, p. 69; 33(b), p. 71 Chapter 2 Test
20–A2.2k explain water's primary role in the biogeochemical cycles, using its chemical and physical properties, i.e., universal solvent, hydrogen bonding	Section 2.1: The Role of Water in Cycles of Matter, pp. 34-40 Thought Lab 2.1: Water Gains and Losses, p. 38	Q question 1, p. 36; 2, p. 37 Thought Lab 2.1: Analysis 1-3, p. 38 Q questions 3-5, p. 39 Web Link: Dr. David Schindler, p. 39 Section 2.1 Review: 1-7, p. 40 Chapter 2 Review: 2, 14, 18, p. 64 Unit 1 Review: 10, 14, p. 69 Chapter 2 Test
Outcomes for Science, Technology, and Society (Emphasis on social and environmental contexts)		
20–A2.1sts explain that science and technology have both intended and unintended consequences for humans and the environment by **(STS3)**	Launch Lab: Whose Planet?, p. 33 Connections: Phytoremediation, p. 62	Launch Lab, Analysis 1-2, p. 33 Chapter 2 Test
■ *discussing the influence of human activities on the biogeochemical cycling of phosphorus, sulfur, iron, and nitrogen, e.g.,* *- feedlot operations* *- composting* *- fertilizer applications* *- waste and sewage disposal* *- vehicular and refinery emissions* *- acid deposition* *- persistent organic pollutants*	Thought Lab 2.2: Carbon, Sulfur, and Iron, p. 48	Web Link: CO_2 consumption, p. 44 Q question 10, p. 46 Thought Lab 2.2: Analysis 1-4, p. 48 Section 2.2 Review: 7(b), 8(b), p. 52 Section 2.3 Review: 8, p. 61 Chapter 2 Review: 8, 12, p. 64; 20, p. 65 Unit 1 Review: 11, p. 69; 24, 28, p. 70; 33(a), p. 71
■ *discussing the use of water by society, the impact such use has on water quality and quantity in ecosystems, and the need for water purification and conservation, e.g.,* *- manufacturing and processing* *- oil industry* *- agricultural systems* *- mining industry* *- domestic daily water consumption*	Investigation 2.A: Societal Uses of Water, p. 41 Investigation 2.C: What's in the Water?, p. 51	Section 2.1 Review: 8, 9, p. 40 Investigation 2.A: Gath. Data and Info. 1; Op. and Rec. 1-4, p. 41 Investigation 2.C: Conclusion 4-5, Ext. 6, p. 51 Chapter 2 Review: 21, 22, p. 65 Unit 1 Review: 36, p. 71
■ *analyzing the relationship between heavy metals released into the environment and matter exchange in natural food chains/webs, and the impact of this relationship on the quality of life*	Connections: Phytoremediation, p. 62	Connections: 6, p. 62 Unit 1 Review: 31, p. 70

	Student Textbook	Assessment Options
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
20–A2.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ designing an experiment to compare the carbon dioxide production of plants with that of animals **(IP–NS1, 2, 3, 4, 5) [ICT C7–4.1]** ■ hypothesizing how alterations in the carbon cycle as a result of the burning of fossil fuels might interact with other cycling phenomena, e.g., sulfur, iron, water **(IP–NS3) [ICT C6–4.1]** ■ predicting disruptions in the nitrogen and phosphorus cycles that are caused by human activities **(IP–NS3) [ICT C6–4.1]**	Investigation 2.B: Carbon Dioxide Production in Plants and Animals, pp. 44-45 Thought Lab 2.2: Carbon, Sulfur, and Iron, p. 48 Investigation 2.C: What's in the Water?, p. 51	Chapter 2 Review: 19, p. 64 Thought Lab 2.2: Analysis 1-4, p. 48 Investigation 2.B: Exp. Plan 1-3, p. 45 Q question 17, p. 50 Investigation 2.C: Conclusion 4-5, p. 51 Chapter 2 Review: 20, p. 65
Performing and Recording		
20–A2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ measuring and recording the pH and the amount of nitrates, phosphates, iron, or sulfites in water samples within the local area **(PR–NS2, 3, 4) (PR–STS 1) [ICT P2–4.1]**	Investigation 2.B: Carbon Dioxide Production in Plants and Animals, pp. 44-45 Investigation 2.C: What's in the Water?, p. 51	Investigation 2.B: Data and Obs. 4, p. 45 Investigation 2.C: Procedure 1-4, p. 51
Analyzing and Interpreting		
20–A2.3s analyze data and apply mathematical and conceptual models to develop and address possible solutions by ■ analyzing data collected on water consumption and loss in plants and animals **(AI–NS2, 3, 4) [ICT C7–4.2]**	Investigation 2.A: Societal Uses of Water, p. 41 Investigation 2.B: Carbon Dioxide Production in Plants and Animals, pp. 44-45 Thought Lab 2.1: Water Gains and Losses, p. 38	Investigation 2.B: Analysis 1-3, Conclusion 4-6, Ext. 7, p. 45 Unit 1 Review: 20, p. 69 Chapter 2 Test Thought Lab 2.1, Procedure 2-3, Analysis 1-5, p. 38
Communication and Teamwork		
20–A2.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively in a group to investigate the influence of human activities on the biogeochemical cycles and, using appropriate multimedia, presenting the information to a group* **(CT–STS1, 2, 3, 4) [ICT C1–4.1, P6–4.1]**	Launch Lab: Whose Planet?, p. 33 Investigation 2.A: Societal Uses of Water, p. 41	Launch Lab: Procedure 1, p. 33 Investigation 2.A: Gath. Data and Info. 1; Org. Find. 2, p. 41

General Outcome 3: Students will explain the balance of energy and matter exchange in the biosphere, as an open system, and how this maintains equilibrium.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–A3.1k explain the interrelationship of energy, matter and ecosystem productivity (biomass production), e.g., ■ *Antarctic ocean versus tropical seas* ■ *tropical rainforest versus desert* ■ *taiga versus tundra* ■ *intertidal zone versus deep-sea benthos* ■ *Arctic versus Antarctic*	Section 2.3: The Balance of the Matter and Energy Exchange, pp. 53-58	Web Link: Gaia Hypothesis, p. 55 Section 2.3 Review: 1-6, 9(b), p. 61 Chapter 2 Review: 15, p. 64 Unit 1 Review: 12, p. 69; 30, p. 70
20–A3.2k explain how the equilibrium between gas exchanges in photosynthesis and cellular respiration influences atmospheric composition	Section 2.2 The Carbon and Oxygen Cycles, pp. 43-44 The Slow Cycling of Carbon, pp. 44-46	Chapter 2 Review: 16, p. 64 Unit 1 Review: 19, p. 69; 27, p. 70
20–A3.3k describe the geological evidence (stromatolites) and scientific explanations for change in atmospheric composition, with respect to O_2 and CO_2, from anoxic conditions to the present and the significance to current biosphere equilibrium	Section 2.3 The Biosphere in Balance, pp. 55-57	Section 2.3 Review: 7, p. 61 Chapter 2 Review: 9, p. 64 Unit 1 Review: 13, 22, p. 69
Outcomes fro Science, Technology and Society (Emphasis on social and environmental contexts)		
20–A3.1sts explain that science and technology are developed to meet societal needs and expand human capabilities by **(STS1)**	Thought Lab 2.3: Too Much of a Good Thing, p. 54 Thought Lab 2.4: Evaluating Water Treatments, p. 58 Career Focus: Ask a Sustainability Expert, pp. 66-67	Thought Lab 2.3: Analysis 4, p. 54 Thought Lab 2.4: Analysis 1-2, p. 58 Career Focus: 1-3, p. 67
■ *evaluating the technology of a closed system in terms of energy and matter, e.g.,* *- space stations and spaceships* *- Biosphere experiments* *- manned exploration of Mars surface*	Investigation 2.D: Biosphere in a Bottle, p. 57 Thought Lab 2.5: Design a Self-Sustaining Mars Colony, p. 60	Investigation 2.D: Analysis 1-7, p. 57 Thought Lab 2.5: Procedure 1-2, Analysis 1-5, p. 60 Unit 1 Review: 23, p. 69
20–A3.2sts explain that science and technology have both intended and unintended consequences for humans and the environment by **(STS3)** ■ *describing how human activities can have a disrupting influence on the balance, in the biosphere, of photosynthetic and cellular respiratory activities, e.g.,* *- fossil fuel combustion* *- depletion of stratospheric ozone* *- forest destruction*	Thought Lab 2.3: Too Much of a Good Thing, p. 54	Thought Lab 2.3: Analysis 2-3, p. 54 Chapter 2 Review: 25, p. 65 Unit 1 Review: 35, p. 71
Skill Outcomes (Focus on decision making)		
Initiating and Planning		
20–A3.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by *predicting the effects of changes in carbon dioxide and oxygen concentration on the atmospheric equilibrium due to factors such as significant reduction of photosynthetic organisms, combustion of fossil fuels, and agricultural practices **(IP–NS3)** [ICT C6–4.1]*	Investigation 2.D: Biosphere in a Bottle, p. 57 Thought Lab 2.5: Design a Self-Sustaining Mars Colony, p. 60	Investigation 2.D: Procedure 1, 3, Conclusion 9, p. 57 Thought Lab 2.5: Procedure 1-2, p. 60 Unit 1 Review: 6, p. 68; 16, p. 69; 35, p. 71

	Student Textbook	Assessment Options
Performing and Recording		
20–A3.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ *collecting evidence from various print and electronic sources on how human activities can have a disrupting influence on photosynthetic and cellular respiratory activities* **(PR–STS1, 2) [ICT C2–4.1]**	Investigation 2.D: Biosphere in a Bottle, p. 57	Investigation 2.D: Procedure 2-4, p. 57
Analyzing and Interpreting		
20–A3.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ designing and evaluating a model of a closed biological system in equilibrium with respect to carbon dioxide, water and oxygen exchange **(PR–ST2) (AI–ST1) [ICT C6–4.2]**	Thought Lab 2.3: Too Much of a Good Thing, p. 54 Thought Lab 2.4: Evaluating Water Treatments, p. 58 Investigation 2.D: Biosphere in a Bottle, p. 57 Thought Lab 2.5: Design a Self-Sustaining Mars Colony, p. 60	Thought Lab 2.3: Analysis 2-4, p. 54 Thought Lab 2.4: Analysis 1-2, p. 58 Investigation 2.D: Procedure 1-4; Analysis 1-7, p. 57 Thought Lab 2.5: Procedure 1-2, Analysis 1-5, p. 60
Communication and Teamwork		
20–A3.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively as a group to investigate, synthesize and present information on the effects of changes to stratospheric ozone levels on society, agriculture, plants and animals* **(CT–STS1, 2, 3, 4) [ICT C2–4.1, P6–4.1]**	Investigation 2.D: Biosphere in a Bottle, p. 57 Thought Lab 2.5: Design a Self-Sustaining Mars Colony, p. 60	Investigation 2.D: Procedure 1, Analysis 7, p. 57 Thought Lab 2.5: Procedure 1-2, p. 60

CHAPTER 3 ECOSYSTEMS AND THEIR DIVERSITY

Curriculum Correlation

Unit 2, General Outcome 1: Students will explain that the biosphere is composed of ecosystems, each with distinctive biotic and abiotic characteristics.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–B1.1k define and explain the interrelationships among species, population, community and ecosystem	Launch Lab: The Mountain Pine Beetle vs an Ecosystem, p. 77 Section 3.1: Individuals, Populations, and Communities in Ecosystems, pp. 78-84	Launch Lab: Analysis 2, 3; Ext. 4, p. 77 Q question 4, p. 82 Try This: Ecological Organization, p. 82 Section 3.1 Review: 1, 2, 4, 5, p. 84 Chapter 3 Review: 4, p. 110 Unit 2 Review: 1, 2, p. 148 Chapter 3 Test
20–B1.2k explain how a terrestrial and an aquatic ecosystem support a diversity of organisms through a variety of habitats and niches, e.g., ■ terrestrial: *canopy, sub-canopy, forest floor, soil* ■ aquatic: *littoral, limnetic, profundal and benthic zones*	Section 3.3: Studying Organisms in Ecosystems, pp. 93- 98 Section 3.1: The Bigger Picture: Earth's Biosphere , p. 83 Section 3.1: Habitats, pp. 95-96 Habitats and Niches within Ecosystems, pp. 97-98	Web Link: Biomes, p. 95 Section 3.1 Review: 2, 7, p. 84 Thought Lab 3.1: Analysis 2, p. 99 Chapter 3 Test Section 3.3 Review: 1, 2, p. 108 Chapter 3 Review: 2, 5, 6, p. 110 Unit 2 Review: 4, p. 148
20–B1.3k identify biotic and abiotic characteristics and explain their influence in an aquatic and a terrestrial ecosystem in a local region, e.g., ■ *stream, lake, prairie, boreal forest, vacant lot, sports field*	Launch Lab: The Mountain Pine Beetle vs an Ecosystem, p. 77 Section 3.1: Organisms and Their Environment, pp. 78-81 Environments Change Over Time, pp. 81-82 Ecosystems, pp. 82-83	Launch Lab: Analysis 1, p. 77 Q questions 1-3, p. 78 Investigation 3.A: Analysis 1, p. 80 Try This: Rising Temperatures in the Arctic, p. 81 Fig. 3.6, Fig 3.7, p. 82 Section 3.1 Review: 3, 6, p. 84 Web Link: Ecoregions, p. 98 Section 3.3 Review: 3, p. 108 Chapter 3 Review: 1, 7, p. 110 Unit 2 Review: 5, p. 148 Investigation 3.C: Procedure 1, 2, p. 100 Chapter 3 Test
20–B1.4k explain how limiting factors influence organism distribution and range, e.g., ■ *abiotic factors: soil, relative humidity, moisture, ambient temperature, sunlight, nutrients, oxygen* ■ *biotic factors: competitors, predators, and parasites*	Section 3.3: Factors Limiting Growth in Ecosystems, pp. 98-100 Launch Lab: The Mountain Pine Beetle vs an Ecosystem, p. 77 Section 3.3: Abiotic Limiting Factors, pp. 100-101 Biotic Limiting Factors, pp. 101-103	Fig. 3.4 question, p. 80 Try This: Rising Temperatures in the Arctic, p. 81 Chapter 3 Test Launch Lab: Ext. 4, p. 77 Section 3.1 Review: 7, p. 84 Q question 8, p. 96; 9, p. 97; 10, p. 101; 11, p. 103 Figure 3.26 question, p. 100 Section 3.3 Review: 4, 5, p. 108 Chapter 3 Review: 8, 14, p. 110; 18(c), p. 111 Unit 2 Review: 6, 9, 10, 11, 12, 13 p. 148; 49, p. 151
20–B1.5k explain the fundamental principles of taxonomy, i.e., domains, kingdoms, and binomial nomenclature.	Section 3.2: Classifying and Naming Organisms, pp. 85-92	Q question 5, p. 87 Try This: Biological Classification, p. 87 Fig. 3.13 question, p. 89 Section 3.2 Review: 1-4, p. 92 Chapter 3 Review: 9, 10, 13, p. 110; 15, 16, 18, 19, 22 p. 111 Unit 2 Review: 3, 8, p. 148; 26, p. 149 Chapter 3 Test

	Student Textbook	Assessment Options
Outcomes for Science, Technology and Society (Emphasis on Social and Environmental Contexts)		
20–B1.1sts explain that science and technology have both intended and unintended consequences for humans and the environment, by **(STS3)**	Section 3.3: Habitats and Niches within Ecosystems, pp. 97-98	
■ *evaluating the impact that human activity has had, or could have, on the biodiversity in an ecosystem and the influence of the needs and interests of society on this practice, e.g.,* ■ *draining of wetlands* ■ *interbasin water transfer* ■ *habitat fragmentation* ■ *land use* ■ *urbanization* ■ *slash-and-burn and clear-cutting practices* ■ *monoculturing, e.g., forests, lawns, agriculture*	Investigation 3.A: Observing Leaves, p. 80 Figure 3.24, p. 98 Thought Lab 3.2: Forest Habitat and Bird Biodiversity, p. 99	Investigation 3.A: Procedure 1, Analysis 1, p. 80 Thought Lab 3.2: Analysis 4, p. 99 Chapter 3 Review: 20, 21, p. 111 Unit 2 Review: 37, p. 150
■ *assessing the environmental consequences of introducing new species to established ecosystems and the responsibility of society to protect the environment through science and technology, e.g.,* ■ *tropical fish in Banff Hot Springs, starlings, quack grass, scented chamomile, purple loosestrife*	Predators Limit Populations (Arctic Fox), pp. 102-3 Thought Lab 3.3: Super Competitor: Knapweed, p. 102	Q question 11, p. 103 Thought Lab 3.3: Analysis 1-4, p. 102 Chapter 3 Review: 11, p. 110; 18(d), p. 111
20–B1.2sts explain that conventions of mathematics, nomenclature, and notation provide a basis for organizing and communicating scientific theory, relationships, and concepts, e.g., **(NS6b)** ■ *researching the historical development of the modern classification system, e.g., the structural and molecular basis.*	Section 3.1: Populations, Fig. 3.5A and 3.5B (Collared Pika), p. 81 Section 3.2: Fig. 3.10, p. 85 Naming Systems, pp. 88 The Classification of Organisms, Classification in Transition, pp. 85-87	Q question 6, p. 89 Section 3.2 Review: 1, 3, 6, p. 92 Chapter 3 Review: 22, p. 111
SKILL OUTCOMES (FOCUS ON SCIENTIFIC INQUIRY)		
Initiating and Planning		
20–B1.1s ask questions about observed relationships and plan investigations of questions, ideas, problems, and issues, and define and delimit problems to facilitate investigation by	Thought Lab 3.1: Planning for Your Field Study, p. 83 Investigation 3.C: Preparing for Your Field Study, p. 100	Thought Lab 3.1: Procedure 2-4, p. 83 Investigation 3.C: Procedure 2, p. 100
■ hypothesizing the ecological role of biotic and abiotic factors, e.g., *competition and Chinooks* **(IP–NS3) [ICT C6–4.1]**; by	Launch Lab: The Mountain Pine Beetle vs an Ecosystem, p. 77 Investigation 3.A: Observing Leaves, p. 80 Investigation 3.C: Preparing for Your Field Study, p. 100	Launch Lab: Analysis 1, p. 77 Investigation 3.A: Analysis 3, p. 80 Investigation 3.C: Procedure 2, p. 100 Unit 2 Review: 27(a), p. 149; 35, p. 150; 45, 46, p. 151
■ *planning a field study to gather and evaluate biotic and abiotic characteristics associated with an ecosystem or ecosystems, e.g., effects that dominant plants have on abiotic conditions such as soil and microclimate* ***(IP–NS1, 2, 3, 4) [ICT C7-4.1)***	Investigation 3.A: Observing Leaves, p. 80	Investigation 3.A: Procedure 1, p. 80

	Student Textbook	Assessment Options
Performing and Recording		
20–B1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by	Investigation 3.B: Creating a Dichotomous Key, pp. 90-91 Investigation 3.C: Preparing for Your Field Study, p. 100	Investigation 3.B: Procedure 1-3, p. 90 Investigation 3.C: Analysis 1-3, p. 100 Unit 2 Review: 29, p. 149
■ performing a field study to quantitatively measure appropriate abiotic characteristics of an ecosystem or ecosystems and to gather evidence for analysis, both quantitatively and qualitatively, of the diversity of life of the ecosystem(s) studied **(PR–NS1, 2, 4, 5)**	Investigation 3.A: Observing Leaves, p. 80 Thought Lab 3.1: Planning for Your Field Study, p. 83 Investigation 3.D: An Ecosystem Field Study, pp. 106-107	Investigation 3.A: Procedure 3, p. 80 Thought Lab 3.1: Procedure 3, p. 83 Investigation 3.D: Analysis 1, p. 107
■ *researching and developing a land reclamation strategy for a disturbed area as a solution to environmental damage, e.g., open pit mine, garbage dump, school yard reclamation* ***(PR–STS1) (PR–NS1, 4) [ICT C5–4.1, C1-4.1)***		
Analyzing and Interpreting		
20–B1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by	Section 3.1: Populations, Fig. 3.5A and 3.5B (Collared Pika), pp. 79-81	Fig. 3.16, p. 94
■ applying classification and binomial nomenclature systems in a field study **(AI-NS1)**	Investigation 3.D: An Ecosystem Field Study, pp. 106-107 Investigation 3.D: Exp. Plan 1, p. 106-107	Chapter 3 Review: 15, 16, p. 111
■ analyzing the interrelationship of biotic and abiotic characteristics that make up the ecosystem(s) studied in the field **(AI–NS2, 3, 5, 6)**	Investigation 3.A: Observing Leaves, p. 80	Investigation 3.A: Analysis 3, p. 80
■ evaluating the accuracy and reliability of instruments used for measurement and identifying the degree of error in the field study data **(AI-NS4)**	Investigation 3.B: Creating a Dichotomous Key, pp. 90-91 Investigation 3.C: Preparing for Your Field Study, p. 100 Investigation 3.D: An Ecosystem Field Study, pp. 106-107	Investigation 3.B: Analysis 1-3, pp. 90-91 Section 3.2 Review: 5, 6, p. 92 Investigation 3.C: Analysis 1-3, p. 100 Investigation 3.D: Conclusion 7, 8, p. 107
■ *compiling and organizing evidence from a variety of sources, for or against human activity being responsible for ecosystem change and analyzing the relationship between human activity and changing ecosystems* ***(AI–NS2, 6) (AI–STS2) (ICT C2-4.1)***	Thought Lab 3.2: Forest Habitat and Bird Biodiversity, p. 99 Thought Lab 3.3: Super Competitor: Knapweed, p. 102	Thought Lab 3.2: Analysis 1-4, p. 99 Chapter 3 Review: 17, 18(d), 20, 21, p. 111
Communication and Teamwork		
20–B1.4s work as members of a team to address problems and apply the skills and conventions of science to communicate information and ideas and to assess results, by	Investigation 3.B: Creating a Dichotomous Key, pp. 90-91	Investigation 3.B: Procedure 9; Analysis 2, pp. 90
■ *working co-operatively to gather and share data on field trip* ***(CT–NS1, 2) [ICT P2–4.1, P4–4.3]***	Investigation 3.A: Observing Leaves, p. 80 Thought Lab 3.1: Planning Your Field Study, p. 83 Investigation 3.B: Preparing Your Field Study, pp. 90-91 Investigation 3.D: An Ecosystem Field Study, pp. 106-107	Investigation 3.A: Procedure 3, p. 80 Thought Lab 3.1: Procedure 2, p. 83 Investigation 3.B: Procedure 9; Analysis 1, 2, pp. 90-91 Investigation 3.C: Exp. Plan 1-4, pp. 106-107
■ *working co-operatively to make clear and logical arguments to defend a decision on a given issue, e.g., human impact, land reclamation, wildlife habitat preservation* ***(CT–STS1, 2, 3, 4) [ICT C7–4.1, 4.3]***	Investigation 3.D: An Ecosystem Field Study, pp. 106-107	Investigation 3.D: Conclusion 6, p. 107 Unit 2 Review: 36, 37, p. 150
■ *developing, presenting and defending a strategy to improve wildlife habitats* ***(CT–STS3) [ICT C7–4.1, 4.2, 4.3]***	Connections (Social and Environmental Contexts): The Smeetons and the Swift Fox, p. 104	Connections: 1, p. 104

CHAPTER 4 MECHANISMS OF POPULATION CHANGE

Curriculum Correlation

General Outcome 2: Students will explain the mechanisms involved in the change of populations over time.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–B2.2k discuss the significance of sexual reproduction to individual variation in populations and to the process of evolution	Section 4.1: Variation within a Species, pp. 115-118 Investigation 4.A Variations Great and Small, p. 116 Natural Selection, pp. 118-120	Q question 2, p. 115 Investigation 4.A: Conclusion 3, p. 116 Section 4.1 Review: 2, 3, 7, p. 121 Chapter 4 Review: 3, p. 144 Chapter 4 Test
20–B2.1k explain that variability in a species results from heritable mutations and that some mutations may have selective advantage(s)	Launch Lab: Could Cockroaches Rule Earth?, p. 113 Section 4.1: Adaptations and Survival, pp. 114-115 Variation within a Species, pp. 115-118 Biology File FYI: mutated genes and diseases, p. 117 Biology File FYI: sickle cell and resistance to malaria, p. 118 Thought Lab 4.1 Evolving "Superbugs", p. 119 Thought Lab 4.2 Analyzing Changes in Beak Depth, p. 120	Launch Lab: Analysis 3, 4, p. 113 Q question 3, p. 118 Thought Lab 4.1: Procedure 2; Analysis 1-2, p. 119 Q questions 4, 5, p. 120 Thought Lab 4.2: Analysis 1-3, p. 120 Section 4.1 Review: 1, 4, 5, 6, 8, p. 121 Chapter 4 Review: 1, 2, 4, p. 144 Unit 2 Review 14, 21, p. 148; 31, p. 149; 40, p. 150 Chapter 4 Test
20–B2.3k compare Lamarckian and Darwinian explanations of evolutionary change	Section 4.2: Lamarck: The Inheritance of Acquired Characteristics, pp. 123-124 Darwin's Evidence, pp. 124-125 Darwin and Wallace and the Theory of Evolution by Natural Selection, p. 126 Biology File FYI: Why Natural Selection Does Not Demonstrate Progress, p. 126 Thought Lab 4.3 Comparing the Ideas of Lamarck and Darwin, p. 127	Q questions 8, 9, p. 124 Table 4.1 Darwin's Observations and Questions Arising from Them, p. 125 Q question 10, p. 126 Thought Lab 4.3, p. 127 Section 4.2 Review: 2, 4, 5, 6, p. 133 Chapter 4 Review: 5, 6, 7, p. 144 Unit 2 Review: 17, p. 148 Chapter 4 Test
20–B2.4k summarize and describe lines of evidence to support the evolution of modern species from ancestral forms, i.e., fossil record, Earth's history, embryology, biogeography, homologous and analogous structures, biochemistry	Section 4.2: Further Evidence of Evolution, pp. 126-133 Thought Lab 4.4 Homologies of Hair, p. 131	Web Link: The Burgess Shale, p. 128 Q question 11, p. 129 Web Link: Plate Tectonics, p. 130 Thought Lab 4.4: Procedure 3; Analysis 1, p. 131 Q questions 12, 13, p. 132; 14, p. 133 Section 4.2 Review: 3, 5, 8, 9, 10, p. 133 Chapter 4 Review: 8, 9, 10, p. 144; 17, 19, p. 145 Unit 2 Review: 16, 19, 24, p. 148; 39, p. 150, 43, p. 151 Chapter 4 Test
20–B2.5k explain speciation and the conditions required for this process	Section 4.3: What Is a Species?, p. 136 Forming a New Species, pp. 136-137 Biology File FYI: DNA evidence to support speciation, p. 137 Keeping Populations Separate, pp. 137-138 Speciation Occurs in Reproductively Isolated Populations, pp. 139-140 Adaptive Radiation, p. 140	Q question 15, p. 137 Try This: global warming and the evolution of species, p. 137 Web Link: speciation in greenish warblers, p. 138 Q question 16, p. 139 Thought Lab 4.5: Analysis 1-2, p. 139 Q question 17, p. 140 Section 4.3 Review: 1, 2, 3, 4, 5, 7, 8, p. 142 Chapter 4 Review: 11, p. 144 Unit 2 Review: 33, p. 150 Chapter 4 Test

	Student Textbook	Assessment Options
20–B2.6k describe modern evolutionary theories, i.e., punctuated equilibrium versus gradualism.	Section 4.3: The Pace of Evolution, pp. 140-141	Section 4.3 Review: 6, p. 142 Chapter 4 Review: 11, p. 144 Unit 2 Review: 32, p. 149 Chapter 4 Test
OUTCOMES FOR SCIENCE, TECHNOLOGY, AND SOCIETY (EMPHASIS ON THE NATURE OF SCIENCE)		
20–B2.1sts explain that scientific knowledge and theories develop through hypotheses, the collection of evidence through experimentation, observation, and the ability to provide explanations, e.g., (**NS2**)	Section 4.2: Connections: Debating Science, pp. 134-135	Connections Questions 1-4, p. 135 Section 4.2 Review: 1, 4, 7, p. 133 Unit 2 Review: 18, p. 148
■ *discussing the nature of science as a way of knowing, e.g., contributions of Georges Buffon, Charles Lyell, Thomas Malthus and Alfred Russel Wallace to evolution; contributions of Aristotle, Bacon and Popper to the philosophy of science*	Developing the Theory of Evolution by Natural Selection, pp. 122-125	Q question 7, p. 123; 9, p. 124; 14, p. 133 Chapter 4 Review: 15(c), 19, p. 145 Unit 2 Review: 20, p. 148, 41, 42, p. 150
■ *describing how paleontology and the role of evidence in the accumulation of knowledge has provided invaluable data for theories explaining observable variations in organisms over time, e.g., Burgess Shale*	Career Focus: Ask a Paleontologist, p. 146	Q question 6, p. 123 Web Link: The Burgess Shale, p. 128 Q question 11, p. 129 Web Link: Plate Tectonics, p. 130 Career Focus: 2, p. 147
■ *discussing probable causes and geological evidence for past mass extinctions and contrasting these to the forces driving the current decline in species*		Try This: Global Warming and the Evolution of Species, p. 137 Career Focus: 3, p. 147
Skill Outcomes (Focus on Scientific Inquiry)		
Initiating and Planning		
20–B2.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by	Launch Lab: Could Cockroaches Rule Earth?, p. 113	Launch Lab: Analysis 3, 4, p. 113
■ designing an investigation to measure or describe an inherited variation in a plant or animal population **(IP–NS1, 2, 3, 4)[ICT C7–4.1]**	Investigation 4.A: Variations Great and Small, p. 116	Investigation 4.A: Exp. Plan 1-6, p. 116 Chapter 4 Review: 12, 14, p. 144; 19, p. 145 Career Focus: 1, p. 147 Unit 2 Review: 30, p. 149
■ hypothesizing the adaptive significance of the variations in a range of homologous structures in extant and extinct organisms **(IP–NS3)[ICT C6–4.1]**	Thought Lab 4.4: Homologies of Hair, p. 131	Thought Lab 4.4: Analysis 1, p. 131
Performing and Recording		
20–B2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by	Investigation 4.A: Variations Great and Small, p. 116	Investigation 4.A: Data and Obs. 1-4, p. 116
■ *gathering data, actual or simulated, on organisms to demonstrate how inherited characteristics change over time, e.g., Darwin's finches, peppered moth, bacteria, domesticated plants and animals* **(PR–NS1, 4) [ECT C1–4.1]**	Thought Lab 4.4: Homologies of Hair, p. 131	Thought Lab 4.4: Procedure 3, p. 131

	Student Textbook	Assessment Options
Analyzing and Interpreting		
20–B2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by	Investigation 4.A: Variations Great and Small, p. 116 Thought Lab 4.5: Leopard Frogs: One Species or Seven?, p. 139	Investigation 4.A: Analysis 1; Conclusion 2-4, p. 116 Thought Lab 4.5: Analysis 2, p. 139
■ analyzing data, actual or simulated, on plants and animals to demonstrate how morphology changes over time, e.g., Darwin's finches, peppered moth, bacteria, domesticated plants or animals **(AI–NS2) [ICT C6–4.4, C1–4.1]**	Thought Lab 4.1: Evolving "Superbugs", p. 119	Thought Lab 4.1: Procedure 1; Analysis 1, p. 119
■ *analyzing DNA sequences from online or other sources to infer the relationship between different organisms at various classification levels such as kingdom, phylum, species, and subspecies* **(AI–NS2) [ICT C1–4.1]**	Section 4.3 Molecular Biology, p. 132	Section 4.2 Review: 10, p. 133 Unit 2 Review: 19, p. 148
■ *stating a conclusion or generalization based on research data, suggesting how it supports or refutes an explanation for biological change such as the case of the peppered moth and identify new questions or problems that arise from what was learned* **(AI–NS5, 6) [ICT C7–4.2]**	Thought Lab 4.2: Analyzing Changes in Beak Depth, p. 120 Thought Lab 4.3: Comparing the Ideas of Lamarck and Darwin, p. 127 Thought Lab 4.4: Homologies of Hair, p. 131	Thought Lab 4.2; Analysis 1-3, p. 120 Thought Lab 4.3: Analysis 1-2, p. 127 Thought Lab 4.4: Analysis 3, p. 131
Communication and Teamwork		
20–B2.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by	Launch Lab: Could Cockroaches Rule Earth?, p. 113 Thought Lab 4.1: Evolving "Superbugs", p. 119 Thought Lab 4.3: Comparing the Ideas of Lamarck and Darwin, p. 127	Launch Lab: Analysis 3, p. 113 Thought Lab 4.1: Analysis 2, p. 119 Thought Lab 4.3: Analysis 2, p. 127
■ *using appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results* **(CT–NS1, 2) [ICT P2–4.1]**	Investigation 4.A: Variations Great and Small, p. 116 Thought Lab 4.4: Homologies of Hair, p. 131	Investigation 4.A: Exp. Plan 1-6, p. 116 Thought Lab 4.4: Procedure 1; Analysis 2, p. 131

CHAPTER 5 PHOTOSYNTHESIS AND CELLULAR RESPIRATION

Curriculum Correlation

General Outcome 1: Relate photosynthesis to the storage of energy in organic compounds.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–C1.1k explain, in general terms, how pigments absorb light and transfer that energy as reducing power in nicotinamide adenine dinucleotide phosphate (NADPH) and finally into chemical potential in adenosine triphosphate (ATP) by chemiosmosis, describing where the process occurs in the chloroplast	Launch Lab: Seeing Green, p. 161 Section 5.1 Photosynthesis: Capturing and Converting Light Energy from the Sun, p. 162 Chloroplasts: Site of Photosynthesis, p. 164 Section 5.2 The Process of Photosynthesis, pp. 169-170 The Light-Dependent Reactions of Photosynthesis, pp. 170-176	Launch Lab: Analysis 1-2, p. 161 Q question 1, p. 163; 5, 6, p. 164 Section 5.1 Review: 2, 7 Q questions 12-15, p. 170; 16, 17, p. 171; 18-24, p. 174 Thought Lab 5.1, p. 175 Section 5.2 Review: 1-12, p. 179 Unit 3 Review: 5, 6, 7, 14-21, 23, p. 198 Chapter 5 Test
20–C1.2k explain, in general terms, how the products of the light-dependent reactions, NADPH and ATP, are used to reduce carbon in the light-independent reactions for the production of glucose, describing where the process occurs in the chloroplast	Section 5.2 Biology File FYI: "Dark reactions", p. 170 The Light-Independent Reactions of Photosynthesis, pp. 176-177	Section 5.1 Review: 8, p. 168 Q questions 27, 28, p. 177 Section 5.2 Review: 13, p. 179 Unit 3 Review: 8, 22, 24, 25, p. 198; 34, p. 199 Chapter 5 Test
Outcomes for Science, Technology and Society (Emphasis on Science and Technology)		
20–C1.1sts explain how scientific knowledge may lead to the development of new technologies and new technologies may lead to scientific discovery ■ *analyze the role of photosynthesis as the biological basis of agriculture and forestry*	Biology File FYI: Replacing retinal cells, p. 176	Q questions 25, 26, p. 176 Unit 3 Review: 41, 44, p. 199 Chapter 5 Test
20–C1.2sts explain that the appropriateness, risks, and benefits of technologies need to be assessed for each potential application from a variety of perspectives, including sustainability ■ *research and analyze the effects of herbicides on the biochemistry of photosynthesis*	Thought Lab 5.2: Adaptations and Applications of Photosynthesis, p. 178 Biology File FYI: Carotenoids, p. 170	Unit 3 Review: 43, p. 199 Thought Lab 5.2: Ext. 4, p. 178 Chapter 5 Test Unit 3 Review: 45, p. 199 Chapter 5 Test
Skill Outcomes (Focus on Scientific Inquiry)		
Initiating and Planning		
20–C1.1s ask questions about observed relationships and plan investigations of questions, ideas, problems, and issues	Thought Lab 5.1: Modelling the Source of Oxygen in the Light-Dependent Reactions, p. 175	Thought Lab 5.1: Procedure 4, 5; Analysis 2, p. 175 Section 5.2 Review: 14, p. 179
■ *identifying a testable factor that would affect the rate of photosynthesis* ■ *predicting and hypothesizing the effect of changes in carbon dioxide and oxygen concentration on photosynthesis*	Investigation 5.C: The Rate of Photosynthesis, pp. 180-181	Investigation 5.C: Conclusion 4, p. 181 Investigation 5.C: Part 2, p. 181

	Student Textbook	Assessment Options
Performing and Recording		
20–C1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information	Investigation 5.A: Gases Released During Photosynthesis and Cellular Respiration, pp. 166-167 Investigation 5.B: Using Chromatography to Separate Plant Pigments, p. 172	Investigation 5.A: Procedure Part 1, 1-6, Part 2, 1-4, pp. 166-167 Investigation 5.B: Procedure 1-11, p. 173
■ *measuring rates of evapotranspiration under various environmental conditions and relate to photosynthetic activity*	Investigation 5.C: The Rate of Photosynthesis, pp. 180-181	Investigation 5.C: Procedure 9-10, p. 181
■ *investigating and integrating, from print and electronic sources, information of the C3 and C4 photosynthetic mechanisms and applications of cellular biochemistry in medicine or industry*	Thought Lab 5.2: Adaptations and Applications of Photosynthesis, p. 178	Thought Lab 5.2, Procedure 1-2; Analysis 1-3, p. 178
Analyzing and Interpreting		
20–C1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions	Investigation 5.A: Gases Released During Photosynthesis and Cellular Respiration, pp. 166-167	Investigation 5.A: Conclusion 4-6, p. 167 Unit 3 Review: 45, p. 199
■ collecting and interpreting data and calculating Rf (reference flow) values from chromatography experiments	Investigation 5.B: Using Chromatography to Separate Plant Pigments, p. 172	Investigation 5.B: Procedure 12, Analysis 2-4; Conclusion 5, p. 173
■ drawing analogies between the storage of energy by photosynthesis and the storage of energy by active solar generating systems	Section 5.2: Mimicking Nature, pp. 175-176	Unit 3 Review: 42(b), p. 199
■ *explaining how data supports or refutes the hypothesis on how changes in carbon dioxide and oxygen concentration affect photosynthesis*	Investigation 5.C: The Rate of Photosynthesis, pp. 180-181	Investigation 5.C: Conclusion 5, p. 181
■ *collecting and interpreting experimental data that demonstrate that plant leaves produce starch in the presence of light*	Chapter 1: Investigation 1.A: Storing Solar Energy in Plants, pp. 10-11	Chapter 1: Investigation 1.A: Procedure 1-6; Analysis 1-5; Conclusion 6, pp. 10-11
Communication and Teamwork		
20–C1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results	Thought Lab 5.2: Adaptations and Applications of Photosynthesis, p. 178	Thought Lab 5.2, Procedure 1-2, p. 178
■ *working cooperatively as a group to investigate, synthesize, and present information on the effects of herbicides on the biochemistry of photosynthesis*	Biology File FYI: Carotenoids, p. 170	

General Outcome 2: Explain the role of cellular respiration in releasing potential energy from organic compounds

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–C2.1k explain, in general terms, how carbohydrates are oxidized by glycolysis and the Krebs cycle to produce reducing power in NADH and FADH and chemical potential in ATP, describing where in the cell those processes occur	Section 5.1 Cellular Respiration: Releasing Stored Energy, pp. 162-163 Mitochondria: Site of Cellular Respiration, p. 164 Section 5.3 The Process of Cellular Respiration, p. 182 Examining Aerobic Cellular Respiration, p. 183 Outside the Mitochondria: Glycolysis, pp. 183-186 Inside the Mitochondria: Krebs Cycle Preparation, p. 187 The Krebs Cycle, p. 187	Q question 2, p. 163; 7, 8, p. 164 Section 5.1 Review: 8, p. 168 Q questions 31, 32, p. 186; 33-35, p. 187 Section 5.3 Review: 3, 4, 5, p. 194 Unit 3 Review: 2, 26, 27, p. 198; 31, 36, p. 199
20–C2.2k explain, in general terms, how chemiosmosis converts the reducing power of NADH and FADH to the chemical potential of ATP, describing where in the mitochondria the process occurs	Section 5.3 Electron Transport, pp. 187-188 The Role of Oxygen in Aerobic Cellular Respiration, p. 188	Q questions 36-38, p. 190 Section 5.3 Review: 3, 6-8, p. 194 Unit 3 Review: 8, 9, p. 198; 31-33, 40, p. 199
20–C2.3k distinguish, in general terms, between aerobic and anaerobic respiration and fermentation in plants, animals, and other organisms	Section 5.3 Three Pathways for Energy Release, pp. 182-183 Examining Aerobic Cellular Respiration, p. 183 The Role of Oxygen in Aerobic Cellular Respiration, p. 188 Anaerobic Cellular Respiration Uses a Different Final Electron-Acceptor, pp. 189-190 Fermentation, pp. 190-193	Q questions 29, 30, p. 183; 39-41, p. 191 Section 5.3 Review: 2, 9-11, p. 194 Unit 3 Review: 28-30, 35, 37, 38, p. 199
20–C2.4k summarize and explain the role of ATP in cell metabolism ■ *active transport* ■ *cytoplasmic streaming* ■ *phagocytosis* ■ *biochemical synthesis* ■ *muscle contraction* ■ *heat production*	Section 5.1 ATP and Cellular Activity, p. 163	Q questions 3-4, p. 163 Web Link: ATP and implanted devices, p. 163 Section 5.1 Review: 4-6, p. 168 Unit 3 Review: 3, 4, p. 198; 42(a), p. 199
Outcomes for Science, Technology, and Society (Emphasis on Social and Environmental Contexts)		

20–C2.1sts explain that science and technology are developed to meet societal needs and expand human capability
 	
■ *research applications of cellular biochemistry in health and industry, e.g.,*
  ■ *aerobic and anaerobic fitness*
  ■ *methane gas production from organic waste*
  ■ *alcohol fermentation*
  ■ *bread-making*
  ■ *yogurt*
	Ethanol Fermentation and Fuel Production, pp. 191-193
	Connections: Energy from Manure, p. 192
	Ethanol Production, p. 193
	Career Focus: Ask a Research Scientist, pp. 196-197
		Web Link: Pyruvate dehydrogenase complex deficiency, p. 189
		Web Link: Bacteria in your mouth, p. 190
		Connections: 1-2, p. 192
		Web Link: First Nation Ethanol Development Corporation, p. 194
		Career Focus: 1, 2, p. 197

	Student Textbook	Assessment Options
20–C2.2sts explain that science and technology have both intended and unintended consequences for humans and the environment ■ *discuss how pollutants such as cyanide and hydrogen sulfide are unintended byproducts of industrial processes and their metabolic effects on aerobic organisms*	Career Focus: Ask a Research Scientist, pp. 196-197 Thought Lab 5.3: The Effects of Metabolic Toxins on Cellular Respiration, p. 189	Career Focus: 3, p. 197 Thought Lab 5.3: Procedure 1-3; Analysis 1, p. 189
Skill Outcomes (Focus on Scientific Inquiry)		
Initiating and Planning		
20–C2.1s ask questions about observed relationships and plan investigations of questions, ideas, problems, and issues, e.g., by ■ *identifying factors affecting the rate of cellular respiration* ■ *designing an experiment to demonstrate that heat is a byproduct of respiration* ■ *predicting and hypothesizing the effect of oxic and anoxic conditions on the rate of cellular respiration in a unicellular organism, i.e., yeast, bacteria*	Investigation 5.D: Oxygen Consumption and Heat Production in Germinating Seeds, pp. 185-186 Three Pathways for Energy Release, pp. 182-183	Investigation 5.D: Part 1: Analysis 1, p. 185 Investigation 5.D: Part 2: Exp. Plan 1-3; Data and Obs. 4-5, p. 185
Performing and Recording		
20–C2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ using experimental methods to demonstrate, quantitatively, the oxygen consumption of germinating seeds. ■ measuring temperature change over time of germinating and non-germinating seeds ■ investigating and integrating, from print and electronic sources, information on the action of metabolic toxins, such as hydrogen sulfide and cyanide, on cellular respiration	Investigation 5.D: Oxygen Consumption and Heat Production in Germinating Seeds, pp. 185-186 Thought Lab 5.3: The Effects of Metabolic Toxins on Cellular Respiration, p. 189	Investigation 5.D: Part 1: Procedure 1-8, pp. 184-185 Investigation 5.D: Part 2: Data and Obs. 4-5, p. 185 Thought Lab 5.3: Procedure 1-3; Analysis 1, p. 189
Analyzing and Interpreting		
20–C2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ *evaluating reliability, accuracy, and validity of sources used to collect information on metabolic toxins and cellular respiration* ■ *interpreting data on the oxygen consumption of an animal and relate this to metabolic rate* ■ *interpret data that illustrate the effect of oxic and anoxic conditions on cellular respiration*	Investigation 5.D: Oxygen Consumption and Heat Production in Germinating Seeds, pp. 185-186 Thought Lab 5.3: The Effects of Metabolic Toxins on Cellular Respiration, p. 189 Three Pathways for Energy Release, pp. 182-183	Unit 3 Review: 45, p. 199 Investigation 5.D: Part 1: Conclusion 3, p. 185 Thought Lab 5.3: Analysis 2, p. 189
Communication and Teamwork		
20–C2.4s work as members of a team in addressing problems, and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *creating a concept map or flow chart to illustrate how carbon, hydrogen, and oxygen atoms in glucose are ultimately released as carbon dioxide and water*	Investigation 5.D: Oxygen Consumption and Heat Production in Germinating Seeds, pp. 185-186 Thought Lab 5.3: The Effects of Metabolic Toxins on Cellular Respiration, p. 189	Investigation 5.D: Part 2: Exp. Plan 1-3, p. 185 Thought Lab 5.3: Procedure 4, p. 189

CHAPTER 6 HOMEOSTASIS, BODY SYSTEMS, AND DIGESTION

Curriculum Correlation

Human Systems, General Outcome 1: Students will explain how the human digestive and respiratory systems exchange energy and matter with the environment.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–D1.1k identify the principal structures of the digestive and respiratory systems, i.e., ■ mouth, esophagus, stomach, sphincters, small and large intestines, liver, pancreas, gall bladder	Launch Lab: Visualizing the Human Body, p. 205 Section 6.2: The Digestive System, pp. 217-224	Launch Lab: Procedure 1-2; Analysis 2, p. 205 Try This: Digestive tract, p. 218 Q questions 12, 13, p. 218; 16, p. 219; 21, p. 223 Try This: Surface area of small intestine, p. 223 Section 6.2 Review: 1, 2, p. 231 Chapter 6 Review: 11, p. 240 Unit 4 Review: 1, p. 356; 46, p. 358 BLM 6.4.2 Chapter 6 Test
■ nasal passages, pharynx, larynx, epiglottis, trachea, bronchi, bronchioles, alveoli, diaphragm, rib muscles, pleural membranes	See Chapter 7	See Chapter 7
20–D1.2k describe the chemical nature of carbohydrates, fats and proteins and their enzymes, i.e., carbohydrases, proteases, and lipases	Section 6.1: The Molecules of Living Systems, pp. 206-211 Section 6.2 Digestion and Absorption in the Small Intestine, pp. 224-225 Carbohydrate Digestion and Absorption, p. 226 Protein Digestion and Absorption, pp. 226-227 Fat Digestion and Absorption, pp. 227-228	Q questions 1-3, p. 207; 4, p. 208; 5, 6, p. 209; 7, 8, p. 211 Section 6.1 Review: 1-6, p. 216 Chapter 6 Review: 1-5, p. 240 Unit 4 Review: 9, p. 356 BLM 6.4.2 Chapter 6 Test
20–D1.3k explain enzyme action and factors influencing their action	Section 6.1: Vitamins and Minerals, pp. 211-214 Enzymes, pp. 214-216 Thought Lab 6.3: Enzymes and Diet, p. 238 BLM 6.2.8: Digestion of Lipids (Alternative Investigation)	Q questions 9, 10, p. 214; 11, p. 215 Section 6.1 Review: 7-10, p. 216 Section 6.2 Review: 4, p. 231 Thought Lab 6.3: Procedure 2; Analysis 1; Ext. 2, p. 238 Chapter 6 Review: 17, p. 241 BLM 6.2.8: Digestion of Lipids (Alternative Investigation) Unit 4 Review: 25, 26, p. 357 BLM 6.4.2 Chapter 6 Test
20–D1.4k describe the chemical and physical processing of matter through the digestive system into the bloodstream	Section 6.2: Digestion Begins: The Mouth and the Esophagus, pp. 218-219 Figure 6.15, p. 219 Storing, Digesting, and Pushing Food: The Stomach, p. 220 Thought Lab 6.2: An Accident and an Opportunity, p. 221 Digesting and Absorbing Nutrients: The Small Intestine, pp. 222-230 Completing Nutrient Absorption and Elimination: The Large Intestine, pp. 230-231	Q questions 14, 15, p. 219; 17-19, p. 220 Thought Lab 6.2: Analysis 1-6, p. 221 Q question 20, p. 223; 22, p. 224; 23, p. 226; 24, p. 227; 25, 26, p. 228; 27, p. 230 Section 6.2 Review: 3, 5, 6, p. 231 Chapter 6 Review: 6-10, 13-15, p. 240; 16, 24, p. 241 Unit 4 Review: 2, p. 356; 34-36, p. 357; 53, p. 358 BLM 6.4.2 Chapter 6 Test

	Student Textbook	Assessment Options
20–D1.5k explain how gases and heat are exchanged between the human organism and its environment, i.e., mechanism of breathing, gas exchange, removal of foreign material	See Chapter 7	See Chapter 7
Outcomes for Science, Technology and Society (Emphasis on science and technology)		
20–D1.1sts explain that the goal of technology is to provide solutions to practical problems by **(ST1)** ■ *discussing and evaluating the role of food additives and/or food treatment to solve the problems of food spoilage, e.g., antioxidants, irradiation technology* ■ *explaining the biological basis of nutritional deficiencies, including that of anorexia nervosa, and the technological means available to restore equilibrium of body systems* ■ *identifying specific pathologies of the digestive and respiratory systems and the technology used to treat the conditions*	Thought Lab 6.3: Enzymes and Diet, p. 238 Thought Lab 6.1: How Do You Take Your Macromolecules?, p. 210 Connections: Sorting Out Nutritional Supplements, p. 232 Psychological, Social, and Cultural Dimensions of Digestion-Related Conditions, pp. 235-237 Section 6.3: Ulcers, pp. 233-234 Inflammatory Bowel Disease, p. 234 Disorders of the Accessory Organs, p. 235	Thought Lab 6.3: Procedure 1, 2, p. 238 Thought Lab 6.1: Analysis 1-4; Ext. 5, p. 210 Web Link: Processed foods, p. 237 Web Link: Lactose intolerance, p. 226 Q question 28, p. 233; 32, p. 236; 33, p. 237 Section 6.3 Review: 4, p. 238 Chapter 6 Review: 18, 19, p. 241 Unit 4 Review: 10, p. 356 Web Link: *Helicobacter pylori*, p. 234 Q questions 29-31, p.235 Web Link: Pancreatitis, p. 235 Section 6.3: 1-3, 5, p. 238 Chapter 6 Review: 12, p. 240; 22, p. 241
20–D1.2sts explain that the products of technology are devices, systems and processes that meet given needs; however, these products cannot solve all problems by **(ST7)** ■ *assessing the physiological effects of smoking and the limitations of technologies available to deal with these conditions or diseases*	Thought Lab 6.3: Enzymes and Diet, p. 238 See Chapter 7	Web Link: Gastric bypass surgery, p. 236 Thought Lab 6.3: Ext. 2, p. 238 Chapter 6 Review: 20, 21, 23, 25, p. 241 Unit 4 Review: 61, 62, p. 359 See Chapter 7
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
20–D1.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ *designing an investigation to examine food energy through calorimetry* **(IP–NS1, 2, 3, 4) [ICT C7–4.1]**	Investigation 6.B: Optimum pH for Two Protease Enzymes, pp. 228-229 Connections: Sorting Out Nutritional Supplements, p. 232	Investigation 6.B: Ext. 6, p. 229 Connections: 1-4, p. 232 Unit 4 Review: 50, 61, 56, 57, p. 358
Performing and Recording		
20–D1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ observing, through dissection or computer simulations, the respiratory and digestive systems of a representative mammal and identifying the major structural components **(PR–NS1, 2, 3, 4, 5) [ICT F1–4.2]** ■ performing experiments, using qualitative tests to detect the presence of carbohydrates, proteins and lipid**s (PR–NS2, 3, 4, 5)** ■ *designing and performing an experiment to investigate the influence of enzyme concentration, temperature or pH on activity of enzymes, e.g., pepsin, pancreatin* ■ *designing and performing an experiment to examine the mechanics of breathing, e.g., lung volume, breathing rate*	Appendix F: The Dissection of a Fetal Pig: Part 2: The Digestive System, pp. 763-765 Investigation 6.A: Testing for Macromolecules, pp. 212-213 Investigation 6.B: Optimum pH for Two Protease Enzymes, pp. 228-229 BLM 6.2.8: Digestion of Lipids (Alternative Investigation) See Chapter 7	Appendix F: Part 2, pp. 763-765 Investigation 6.A: Procedure Parts 1-4, pp. 212-213 Section 6.1 Review: 6, p. 216 Investigation 6.B: Procedure 1-7; Ext. 6, p. 229 BLM 6.2.8: Digestion of Lipids (Alternative Investigation) See Chapter 7

	Student Textbook	Assessment Options
Analyzing and Interpreting		
20–D1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by	Thought Lab 6.2: An Accident and an Opportunity, p. 221	Thought Lab 6.2: Analysis 1-7, p. 221 Try This: Surface area of small intestine, p. 223 Chapter 6 Review: 19, 24, 25, p. 241 Unit 4 Review: 53, p. 358
■ performing, recording, analyzing, drawing conclusions and assessing validity of data from the investigation on calorimetry, enzyme action and mechanics of breathing **(PR–NS1, 2, 3, 4, 5) (AI–NS2, 3, 4, 6) [ICT P2–4.1]**	Investigation 6.B: Optimum pH for Two Protease Enzymes, pp. 228-229 BLM 6.2.8: Digestion of Lipids (Alternative Investigation)	Investigation 6.B: Analysis 1-2; Conclusion 3-4; Ext. 5, p. 229 BLM 6.2.8: Digestion of Lipids (Alternative Investigation)
Communication and Teamwork		
20–D1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by	Launch Lab: Visualizing the Human Body, p. 205	Launch Lab: Analysis 1, p. 205
■ working cooperatively to collect and communicating results using appropriate terminology, SI units and symbols **(CT–NS1, 2) [ICT P2–4.1]**	Investigation 6.A: Testing for Macromolecules, pp. 212-213 BLM 6.2.8: Digestion of Lipids (Alternative Investigation)	Investigation 6.A: Procedure Parts 1-4, pp. 212-213 BLM 6.2.8: Digestion of Lipids (Alternative Investigation)

CHAPTER 7 THE RESPIRATORY SYSTEM

Curriculum Correlation

Human Systems, General Outcome 1: Students will explain how the human digestive and respiratory systems exchange energy and matter with the environment.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–D1.1k identify the principal structures of the digestive and respiratory systems, i.e., ■ mouth, esophagus, stomach, sphincters, small and large intestines, liver, pancreas, gall bladder ■ nasal passages, pharynx, larynx, epiglottis, trachea, bronchi, bronchioles, alveoli, diaphragm, rib muscles, pleural membranes'	See Chapter 6 Section 7.1: The Respiratory Tract, pp. 245-247	See Chapter 6 Try This: Find your larynx and trachea, p. 245 Q questions 3, 4, p. 246; 5, p. 247 Section 7.1 Review: 4, 5, 8-13, p. 248 Section 7.2 Review: 1, 2, p. 254 Section 7.3 Review: 1, p. 262 Chapter 7 Review: 1, p. 264 BLM 7.4.1 Chapter 7 Test Unit Review: 3, 4, p. 356
20–D1.2k describe the chemical nature of carbohydrates, fats and proteins and their enzymes, i.e., carbohydrases, proteases, and lipases	See Chapter 6	See Chapter 6
20–D1.3k explain enzyme action and factors influencing their action	See Chapter 6	See Chapter 6
20–D1.4k describe the chemical and physical processing of matter through the digestive system into the bloodstream	See Chapter 6	See Chapter 6
20–D1.5k explain how gases and heat are exchanged between the human organism and its environment, i.e., mechanism of breathing, gas exchange, removal of foreign material	Launch Lab: Modelling Your Lungs, p. 243 Section 7.1: Stages in Respiration, pp. 244-245 Section 7.2: Breathing and Respiration, pp. 249-254	Launch Lab: Analysis 1-3, p. 243 Try This: Cellular respiration vs. respiration, p. 244 Q questions 1, 2, p. 245 Web Link: Laws of physical science, p. 246 Section 7.1 Review: 1-3, 7, 14, p. 248 Q question 6, p. 250; 7, 8, p. 252 Section 7.2 Review: 1, 3, 5-8, 10, 11, p. 254 Section 7.3 Review: 10, 12, p. 262 Chapter 7 Review: 2-4, 7, 9, 12, 14, p. 264; 16, 20, p. 265 Unit 4 Review: 11, 12, p. 356 BLM 7.4.1 Chapter 7 Test

	Student Textbook	Assessment Options
Outcomes for Science, Technology and Society (Emphasis on science and technology)		
20–D1.1sts explain that the goal of technology is to provide solutions to practical problems by **(ST1)**		Section 7.1 Review: 6, p. 248
■ *discussing and evaluating the role of food additives and/or food treatment to solve the problems of food spoilage, e.g., antioxidants, irradiation technology*	See Chapter 6	See Chapter 6
■ *explaining the biological basis of nutritional deficiencies, including that of anorexia nervosa, and the technological means available to restore equilibrium of body systems*	See Chapter 6	See Chapter 6
■ *identifying specific pathologies of the digestive and respiratory systems and the technology used to treat the conditions*	Investigation 7.A: Measuring Respiratory Volumes, p. 251 Section 7.3: Respiratory Health, pp. 256-262 Thought Lab 7.2: You Diagnose It, p. 261	Try This: Pneumothorax, p. 250 Investigation 7.A: Application 6, p. 251 Section 7.2 Review: 9, p. 254 Web Link: Respiratory infections, p. 256 Q question 9, p. 256; 10, 11, p. 258 Web Link: Asthma, p. 258 Web Link: Cancer, p. 259 Q question 12, p. 259 Thought Lab 7.2: Procedure 2, p. 261 Section 7.3 Review: 1-5, 7, 10, 12, p. 262 Chapter 7 Review: 5, 6, p. 264; 17, 18, 21, p. 265
20–D1.2sts explain that the products of technology are devices, systems and processes that meet given needs; however, these products cannot solve all problems by **(ST7)**		
■ *assessing the physiological effects of smoking and the limitations of technologies available to deal with these conditions or diseases*	Investigation 7.A: Measuring Respiratory Volumes, p. 251 Connections: Traditional Healing in Modern Times, p. 255 Thought Lab 7.1: Smoking and the Respiratory System, p. 260 Thought Lab 7.2: You Diagnose It, p. 261	Investigation 7.A: Application 7, p. 251 Connections: 1-3, p. 255 Thought Lab 7.1: Procedure questions; Analysis 1-3, p. 260 Thought Lab 7.2: Analysis 3, p. 261 Section 7.3 Review: 6, 8, 9, 11, p. 262 Chapter 7 Review: 8, p. 264; 20, p. 265
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
20–D1.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by	Launch Lab: Modelling Your Lungs, p. 243 Investigation 7.A: Measuring Respiratory Volumes, p. 251 Investigation 7.B: Carbon Dioxide and the Rate of Respiration, p. 253 Thought Lab 7.2: You Diagnose It, p. 261	Launch Lab: Procedure 1, p. 243 Investigation 7.A: Ext. 5, p. 251 Investigation 7.B: Ext. 3, p. 253 Thought Lab 7.2: Analysis 2, p. 261 Chapter 7 Review: 11, 15, p. 264; 18, 19, p. 265
■ *designing an investigation to examine food energy through calorimetry* **(IP–NS1, 2, 3, 4) [ICT C7–4.1]**		

	Student Textbook	Assessment Options
Performing and Recording		
20–D1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by		Chapter 7 Review: 10, p. 264
■ observing, through dissection or computer simulations, the respiratory and digestive systems of a representative mammal and identifying the major structural components **(PR–NS1, 2, 3, 4, 5) [ICT F1–4.2]**	Appendix F: The Dissection of a Fetal Pig: Part 4: The Respiratory System, pp. 766-767	Appendix F: Part 4, pp. 766-767 Unit 4 Review: 4, p. 356
■ performing experiments, using qualitative tests to detect the presence of carbohydrates, proteins and lipids **(PR–NS2, 3, 4, 5)**	See Chapter 6	See Chapter 6
■ *designing and performing an experiment to investigate the influence of enzyme concentration, temperature or pH on activity of enzymes, e.g., pepsin, pancreatin*	See Chapter 6	See Chapter 6
■ *designing and performing an experiment to examine the mechanics of breathing, e.g., lung volume, breathing rate*	Investigation 7.A: Measuring Respiratory Volumes, p. 251 Investigation 7.B: Carbon Dioxide and the Rate of Respiration, p. 253	Investigation 7.A: Procedure 1-7; Ext. 5, p. 251 Investigation 7.B: Procedure 1-6; Ext. 3, p. 253 Section 7.2 Review: 4, p. 254
Analyzing and Interpreting		
20–D1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by	Thought Lab 7.2: You Diagnose It, p. 261	Thought Lab 7.2: Analysis 2, p. 261
■ *performing, recording, analyzing, drawing conclusions and assessing validity of data from the investigation on calorimetry, enzyme action and mechanics of breathing* **(PR–NS1, 2, 3, 4, 5) (AI–NS2, 3, 4, 6) [ICT P2–4.1]**	Investigation 7.A: Measuring Respiratory Volumes, p. 251 Investigation 7.B: Carbon Dioxide and the Rate of Respiration, p. 253	Investigation 7.A: Analysis 1-2; Conclusion 3-4, p. 251 Investigation 7.B: Analysis 1; Conclusion 2, p. 253 Unit Review: 56, p. 358
Communication and Teamwork		
20–D1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by	Launch Lab: Modelling Your Lungs, p. 243	Launch Lab: Procedure 1, p. 243
■ *working cooperatively to collect and communicating results using appropriate terminology, SI units and symbols* **(CT–NS1, 2) [ICT P2–4.1]**	Investigation 7.A: Measuring Respiratory Volumes, p. 251 Investigation 7.B: Carbon Dioxide and the Rate of Respiration, p. 253 Thought Lab 7.1: Smoking and the Respiratory System, p. 260 Thought Lab 7.2: You Diagnose It, p. 261	Investigation 7.A: Extension 4, p. 251 Investigation 7.B: Extension 3, p. 253 Thought Lab 7.1: Procedure, p. 260 Thought Lab 7.2: Procedure 2, p. 261

CHAPTER 8 CIRCULATION AND IMMUNITY

Curriculum Correlation

Human Systems General Outcome 2: Students will explain the role of the circulatory and defense systems in maintaining an internal equilibrium.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–D2.1k identify the principal structures of the heart and associated blood vessels, i.e., atria, ventricles, septa, valves, aorta, vena cavae, pulmonary arteries and veins, sinoatrial node	Section 8.1: Major Components of the Circulatory System, pp. 268-269 The Structure of the Heart, pp. 269-270 Investigation 8.A: Identifying Structures of the Circulatory System, pp. 272-273	Q questions 1, 2, p. 269; 3, 4, p. 270 Investigation 8.A: Procedure 2-6, p. 273 Section 8.1 Review: 1, 6, p. 281 Chapter 8 Review: 2, p. 302 BLM 8.4.1 Chapter 8 Test Unit 4 Review: 5, 13, 14, p. 356
20–D2.2k describe the action of the heart and the general circulation of the blood through coronary, pulmonary and systemic pathways	Section 8.1: The Beating Heart, pp. 272-274 Blood Pressure, p. 274 Cardiac Output and Stroke Volume, pp. 275-276 Pathways of the Circulatory System, pp. 276-277	Q questions 9, 10, p. 274; 11, p. 275; 12, 13, p. 277 Section 8.1 Review: 4, 5, p. 281 Chapter 8 Review: 3, p. 302 BLM 8.4.1 Chapter 8 Test Unit 4 Review: 14, p. 356
20–D2.3k describe the structure and function of blood vessels; i.e., arteries, veins, and capillaries	Launch Lab: Watching Blood Flow, p. 268 Section 8.1: The Structure of Blood Vessels, pp. 270-271 Investigation 8.A: Identifying Structures of the Circulatory System, pp. 272-273	Launch Lab: Analysis 1-3, p. 268 Q questions 5-8, p. 272 Investigation 8.A: Procedure 2-6; Analysis 1, p. 273 Section 8.1 Review: 2, 3, p. 281 Chapter 8 Review: 1, 17, p. 302 BLM 8.4.1 Chapter 8 Test Unit 4 Review: 15-17, p. 356
20–D2.4k describe the main components of blood and their role in transport and in resisting the influence of pathogens; i.e., erythrocytes, leucocytes, platelets, plasma	Section 8.2: The Formed Portion of Blood, pp. 282-284 Plasma, p. 284 The Functions of Blood, pp. 284-287 Investigation 8.C: Identifying Blood Cells, p. 285	Q questions 14-16, p. 284 Investigation 8.C: Procedure 1-7, p. 285 Section 8.2 Review: 1, 2, p. 291 Chapter 8 Review: 6, p. 302 BLM 8.4.1 Chapter 8 Test Unit 4 Review: 19, p. 356
20–D2.5k explain the role of the circulatory system at the capillary level in aiding the digestive, excretory, respiratory and motor systems' exchange of energy and matter with the environment	Section 8.2: The Functions of Blood, pp. 284-287 Circulation and the Action of Capillaries, pp. 287-288	Q questions 17, 18, p. 287; 19, 20, p. 288 Section 8.2 Review: 3, 4, 5(b), p. 291 BLM 8.4.1 Chapter 8 Test Unit 4 Review: 28, 32, p. 357; 47, p. 358
20–D2.6k explain the role of blood in regulating body temperature	Section 8.2: Homeostatic Regulation, p. 286	Q question 18, p. 287; 20, p. 288 BLM 8.4.1 Chapter 8 Test Unit 4 Review: 32, p. 357
20–D2.7k describe and explain, in general terms, the function of the lymphatic system	Section 8.3: The Lymphatic System and Immunity, pp. 292-293	Q questions 21, 22, p. 293 Section 8.3 Review: 1-3, p. 300 Chapter 8 Review: 9, p. 302 BLM 8.4.1 Chapter 8 Test Unit 4 Review: 38-42, p. 357

	Student Textbook	Assessment Options
20–D2.8k list the main cellular and non-cellular components of the human defense system and describe their role, i.e., skin, macrophage, helper T cell, B cell, killer T cell, suppressor T cell, memory T cell	Section 8.3: The Defence System, pp. 293-295 Thought Lab 8.3: Barriers of Defence, p. 298	Q questions 23-25, p. 295 Thought Lab 8.3: Procedure 1, p. 298 Section 8.3 Review: 4-6, 9, p. 300 Chapter 8 Review: 8, 10, 11, 18-20, p. 302; 27, p. 303 BLM 8.4.1 Chapter 8 Test Unit 4 Review: 43-45, p. 357
Outcomes for Science, Technology and Society (Emphasis on social and environmental contexts)		
20–D2.1sts explain how Canadian society supports scientific research and technological development that helps achieve a sustainable society, economy and environment by **(STS4a)**		
■ *evaluating the effects that the needs, interests and financial support of society have on preventing the spread of disease-causing organisms, e.g.,* Staphylococcus, *smallpox virus, E. coli and the human immunodeficiency virus (HIV)*	Thought Lab 8.2: Keeping the Blood Supply Safe, p. 289	Thought Lab 8.2: Analysis 2; Extension 6, p. 289
■ *identifying specific pathologies of the circulatory and defense systems, the technology used to treat the conditions and the reasons society supports the development of such technologies*	Cardiovascular Disorders and Treatments, pp. 277-280 Thought Lab 8.1: Cardiovascular Health, Technology, and Society, p. 280 Blood Disorders, pp. 288-291 Blood Types, pp. 296-297 Immune System Disorders, pp. 298-299	Web Link: Artificial pacemaker, p. 275 Thought Lab 8.1: Procedure 1, 2; Analysis 1, p. 280 Section 8.1 Review: 7, p. 281 Web Link: Leukemia, p. 291 Section 8.2 Review: 5(a), p. 291 Q question 27, p. 297 Web Link: Hemolytic disease, p. 297 Web Link: Peanut allergies, p. 299 Section 8.3 Review: 8, 10, 11, p. 300 Chapter 8 Review: 5, 22, p. 302; 30, p. 303 Unit 4 Review: 62, p. 359
■ *assessing the physiological effect of drugs such as alcohol and nicotine on the circulatory system and why habitual use of these drugs is a societal concern*	Homeostatic Regulation, pp. 286-287	Thought Lab 8.1: Procedure 3; Analysis 1-3; Extension 4, p. 280
20–D2.2sts explain that decisions regarding the application of scientific and technological developments involve a variety of perspectives, including social, cultural, environmental, ethical and economic considerations by **(STS4b)**	Thought Lab 8.2: Keeping the Blood Supply Safe, p. 289 Connections: The Tomorrow Project, p. 290 Thought Lab 8.1: Cardiovascular Health, Technology, and Society, p. 280	Web Link: High altitude training, p. 286 Thought Lab 8.2: Procedure 2; Analysis 3, 5, p. 289 Connections: 1, p. 290 Thought Lab 8.1: Procedure 2, Analysis 1; Extension 4, p. 280
■ *evaluating the ethical implications of organ transplants in terms of the needs, interests and financial support of society on scientific and technological research in this field, e.g., societal and scientific definitions of death*		
■ *analyzing the considerations associated with technological advances that assist in the maintenance of internal equilibrium with respect to* *- pathogens, e.g., vaccinations/inoculations* *- defective hearts, e.g., artificial valves, artificial hearts, xenotransplantation, stem cell culture* *-delivery of prescription drugs to sites of action*		Web Link: Leukemia, p. 291 Chapter 8 Review: 16, p. 302
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
20–D2.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by		Chapter 8 Review: 14, 15, 22, p. 302; 23, p. 303
■ *designing procedures to investigate factors affecting heart rate and blood pressure, e.g., physical activity, emotion, gender and chemicals such as caffeine* **(IP–NS4) [ICT C7–4.1]**	Investigation 8.B: Factors Affecting Heart Rate and Blood Pressure, p. 278 Investigation 8.B: Exp. Plan 1-6, p. 278	Chapter 8 Review: 12, p. 302 Unit 4 Review: 59, p. 359

	Student Textbook	Assessment Options
Performing and Recording		
20–D2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by		
■ measuring blood pressure and observing blood flow in capillaries in a living organism or through demonstration in a virtual lab, e.g., *human, goldfish* **(PR–NS2, 3)**	Launch Lab: Watching Blood Flow, p. 268 Investigation 8.B: Factors Affecting Heart Rate and Blood Pressure, p. 278	Launch Lab: Procedure 1; Analysis 3, p. 268 Investigation 8.B: Data and Obs. 7, Ext, 7; p. 278 Chapter 8 Review: 24, p. 303 Unit 4 Review: 18, p. 356
■ determining the morphology and abundance of cellular components in a prepared human blood slide **(PR–NS2, 3)**	Investigation 8.C: Identifying Blood Cells, p. 285	Investigation 8.C: Procedure 1-7; Analysis 2; Conclusion 3, 4, p. 285
■ selecting and integrating information from various sources to observe the principal features of a mammalian circulatory system and the direction of blood flow and identifying structures from drawings, e.g., *valves, chambers* **(PR–NS1) [ICT C1–4.1]**	Launch Lab: Watching Blood Flow, p. 268 Appendix F: The Dissection of a Fetal Pig, Part 3: The Circulatory System, pp. 765-766 Pathways of the Circulatory System, pp. 276-277	Launch Lab: Procedure 1; Analysis 6, p. 268 Appendix F: Procedure Part 3: A, B; Analysis 1, 2, p. 766
■ researching and designing a simulation or model of the functioning of the main components of the human immune system **(PR–NS1) (PR–ST2) [ICT C6–4.2]**	Thought Lab 8.3: Barriers of Defence, p. 298	Thought Lab 8.3: Procedure 2, 3; Analysis 2, 3, p. 298 Chapter 8 Review: 19, p. 302
■ *compiling and displaying information on blood pressure, heart rate and blood composition and researching statistical data* **(PR–NS1, 4) [ICT P4–4.3]**	Blood Pressure, p. 274 Investigation 8.B: Factors Affecting Heart Rate and Blood Pressure, p. 278	Q question 11, p. 275 Try This: Heart rate, p. 277 Investigation 8.B: Extension 6, p. 278 Chapter 8 Review: 21, p. 302
■ *carrying out a heart dissection to identify the major parts and to determine the directional flow of blood through the organ* **(IP–NS4)**	Investigation 8.A: Identifying Structures of the Circulatory System, pp. 272-273 Appendix F: The Dissection of a Fetal Pig, Part 3: The Circulatory System, B: Examining the Organs of the Circulatory System, p. 766	Investigation 8.A: Procedure 1-6; Analysis 2, p. 273 Appendix F: Procedure Part 3, B 5-7; Analysis 1, p. 766
Analyzing and Interpreting		
20–D2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by		Section 8.3 Review: 9, p. 300 Unit 4 Review: 47, 49, p. 358 Chapter 8 Review, 13, p. 302 Try This: Heart rate, p. 277
■ *determining the relationship between blood pressure and exercise from patterns and trends in data* **(AI–NS2) [ICT C6–4.3]**	Cardiovascular Fitness, pp. 275-276	
■ *investigating lifestyle behaviour, physical fitness and heart rate recovery using statistical theoretical data and account for discrepancies* **(AI–NS2, 3)**	Cardiovascular Disorders and Treatments, pp. 277-280 Thought Lab 8.1: Cardiovascular Health, Technology, and Society, p. 280	Thought Lab 8.1: Procedure 3; Analysis 2, 3; Extension 4, p. 280
■ *identifying the limitations and evaluate the dependability of devices used to measure blood pressure* **(AI–NS4)**	Investigation 8.B: Factors Affecting Heart Rate and Blood Pressure, p. 278	Investigation 8.B: Extension 7, p. 278
■ *analyzing the heart-lung machine* **(AI–ST2) [ICT C7–4.1, 4.2]**	Thought Lab 8.1: Cardiovascular Health, Technology, and Society, p. 280	Thought Lab 8.1: Procedure 2, p. 280
■ *exploring solutions to practical problems associated with the circulatory system, e.g., heart transplant, artificial blood, blood doping to enhance athletic performance* **(AI–ST2) [ICT C1–4.1, 4.2]**	Investigation 8.B: Factors Affecting Heart Rate and Blood Pressure, p. 278 Thought Lab 8.2: Keeping the Blood Supply Safe, p. 289	Investigation 8.B: Extension 6, p. 278 Thought Lab 8.2: Procedure 2; Analysis 5, p. 289 Chapter 8 Review: 16, p. 302; 28, 30, p. 303

	Student Textbook	Assessment Options
Communication and Teamwork		
20–D2.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively with team members to measure and record blood pressure, heart rate or any other factor relating to the circulatory system* **(CT–NS1, 2) [ICT P4–4.3]**	Connections: The Tomorrow Project, p. 290 Thought Lab 8.3: Barriers of Defence, p. 298 Investigation 8.B: Factors Affecting Heart Rate and Blood Pressure, p. 278	Connections: 1, p. 290 Thought Lab 8.3: Procedure 2-4; Analysis 1, p. 298 Investigation 8.B: Exp. Plan 1-6; Data and Obs. 7; Conclusion 4; Extension 7, p. 278

CHAPTER 9 EXCRETION AND THE INTERACTION OF SYSTEMS

Curriculum Correlation

Human Systems, General Outcome 3: Students will explain the role of the excretory system in maintaining an internal equilibrium in humans through the exchange of energy and matter with the environment.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–D3.1k identify the principal structures of the excretory system, i.e., kidneys, ureters, urinary bladder, urethra	Section 9.1: The Organs of the Excretory System, pp. 306-307 Investigation 9.A: Identifying Structures of the Excretory System, p. 309	Q questions 4-5, p. 307 Figure 9.1 question, p. 307 Investigation 9.A: Analysis 1-2, p. 309 Section 9.1 Review: 1, 2, 4, p. 310 Chapter 9 Review: 1, p. 328 BLM 9.4.1 Chapter 9 Test Unit 4 Review: 6, p. 356
20–D3.2k explain the structure and function of the nephron in maintaining normal body fluid composition, i.e., water, pH, ions	Section 9.1: The Kidneys: The Body's Blood Cleansers, pp. 307-310 An Overview of the Nephron and its Three Functional Regions, p. 308 Section 9.2: Urine Formation in the Nephron, pp. 311-315	Q questions 6, 7, p. 310 Section 9.1 Review: 4, 5, 6, p. 310 Q questions 8, 9, p. 312; 10, p. 313; 11, p. 314 Section 9.2 Review: 1, 2, 4, p. 315 Section 9.3 Review: 1, 4(a) Chapter 9 Review: 3-7, 11, p. 328; 13, 15, 18, p. 329 BLM 9.4.1 Chapter 9 Test Unit 4 Review: 20-22, p. 356; 23, 30, 31, p. 357
20–D3.3k describe the function of the kidney in excreting metabolic wastes and expelling them into the environment	Section 9.1: The Problem of Wastes, p. 306 The Solution to Wastes: Excretion, p. 306	Q questions 1-3, p. 306 Section 9.1 Review: 3, 7, p. 310 Section 9.2 Review: 4, p. 315 Chapter 9 Review: 2, 12, p. 328 BLM 9.4.1 Chapter 9 Test Unit 4 Review: 22(b), p. 357
Outcomes for Science, Technology and Society (Emphasis on the nature of science)		
20–D3.1sts explain that the goal of science is knowledge about the natural world by **(NS1)**		
■ *examining how lifestyle factors contribute to hypertension and affect kidney function, e.g.,* ■ *drugs such as alcohol and nicotine* ■ *sedentary lifestyle* ■ *dietary excesses or deficiencies* ■ *stress*	The Kidney-Coronary Connection, pp. 323-325	Section 9.3 Review: 2(b), p. 326 Chapter 9 Review: 14, p. 329
■ *explaining how our understanding of nephron function is applied to renal and peritoneal dialysis*	Hemodialyis and Peritoneal Dialysis, pp. 319-321	Chapter 9 Review: 17, 20, p. 329
■ *identifying specific pathologies of the excretory system and the scientific knowledge connected with the treatment* ■ *identifying the physiological complexities and challenges of organ transplant*	Disorders of the Excretory System, pp. 318-319 Problems with Kidney Function, pp. 319-321 Kidneys Transplants, pp. 321-323 Connections: Metabonomics, p. 324	Q questions 16, 17, p. 321 Connections: 2, p. 324 Section 9.3 Review: 3, 10, 11, p. 326 Q questions 18, 19, p. 323 Chapter 9 Review: 8, p. 328; 16, 21, p. 329 Unit 4 Review: 62, p. 359

	Student Textbook	Assessment Options
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
20–D3.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ predicting how blood pressure affects urine formation, composition and volume **(IP–NS1) [ICT C6–4.1]**	The Kidney-Coronary Connection, pp. 323-325	Section 9.3 Review: 5, 9, p. 326 Chapter 9 Review: 19, p. 329 Unit 4 Review: 60, p. 359 Section 9.3 Review: 8, p. 326
Performing and Recording		
20–D3.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ r*esearching and creating a flow chart to describe how humans maintain homeostasis with respect to water and ions, e.g.,* **(PR–NS1) [ICT C7–4.1, 4.2]** ■ *water uptake is high, e.g., tea, carbonated soft drink* ■ *action of diuretic compounds, e.g., caffeine, ethanol* ■ *sodium intake is excessive, e.g., anchovy pizza* ■ *performing a kidney dissection to identify major parts of the organ* **(IP–NS4)**	Section 9.3: Regulating Reabsorption of Water, p. 316 Reabsorption of Salts, p. 317 Maintaining Blood pH, p. 317 Investigation 9.A: Identifying Structures of the Excretory System, p. 309	Section 9.2 Review: 5, p. 315 Q questions 12, 13, p. 316 Try This: Aldosterone, p. 317 Q questions 14, 15, p. 318 Section 9.3 Review: 2, 4(b), 7, 9, p. 326 Chapter 9 Review: 9, 10, p. 328; 14, p. 329 Investigation 9.A: Procedure 1-5; Analysis 1-2, p. 309
Analyzing and Interpreting		
20–D3.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ observing the principal features of a mammalian excretory system and identifying structures from drawings obtained from various print and electronic sources **(AI–NS1) [ICT C1–4.1]** ■ collecting and interpreting data in analysis of simulated urine, identifying limitations of data, comparing to theoretical values, and producing a generalization **(PR–NS1, 2, 3, 4, 5) (AI–NS2, 4, 6) [ICT C6–4.4]** ■ making analogies between kidney function and renal dialysis, and contrasting hemodialysis with peritoneal dialysis **(AI–ST2);** and, e.g. by ■ *assessing technological solutions to kidney failure, e.g., peritoneal dialysis, hemodialysis and kidney transplant and identifying the potential strengths and weaknesses of each* **(AI–ST2) [ICT C2–4.1, 4.2]**	Investigation 9.A: Identifying Structures of the Excretory System, p. 309 Launch Lab: Dehydration and Urine Colour, p. 305 Upsetting the Balance of the Excretory System, p. 318 Investigation 9.B: Urinalysis, pp. 320-321 Connections: Metabonomics, p. 324 Hemodialyis and Peritoneal Dialysis, pp. 319-321 Figure 9.10, p. 322 Kidney Transplants, pp. 321-323	Investigation 9.A: Identifying Structures of the Excretory System, p. 309 Investigation 9.A: Analysis 1-2, p. 309 Chapter 9 Review: 1, 12, p. 328 Launch Lab: Procedure 1-4; Analysis 1-2, p. 305 Investigation 9.B: Analysis 1-2; Conc. 3-5; Ext. 6-7, p. 321 Connections: 1, p. 324 Section 9.3 Review: 6, 10, p. 326 Chapter 9 Review: 15, p. 329 Unit 4 Review: 48, p. 358 Chapter 9 Review: 17, 20, p. 329 Unit 4 Review: 63, p. 359
Communication and Teamwork		
20–D3.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively with team members to assess and record simulated urine composition* **(CT–NS1, 2) [ICT C6–4.3, C7–4.2]**	Investigation 9.B: Urinalysis, pp. 320-321	Investigation 9.B: Procedure 1-3 (Tests 1-4), pp. 320-321

CHAPTER 10 THE MUSCULAR SYSTEM AND HOMEOSTASIS

Curriculum Correlation

Human Systems: General Outcome 4: Students will explain the role of the motor system in the function of other body systems.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
20–D4.1k explain how the motor system supports body functions, i.e., circulatory, respiratory, digestive, excretory and locomotory	Section 10.1: Movement and Muscle Tissue, pp. 332-333 The Cooperation of Skeletal Muscles, p. 333 Section 10.2: Homeostasis, Muscles, and Other Body Systems, pp. 348-249	Q questions 1, 2, p. 333; 3, p. 336 Try This: The Diaphragm, p. 336 Section 10.1 Review: 1-3, 8-10, p. 342 Section 10.2 Review: 10, 12, p. 350 Chapter 10 Review: 2, 9, 10, p. 352; 25, p. 353 BLM 10.3.1 Chapter 10 Test Unit 4 Review: 7, 8, p. 356; 37, p. 357
20–D4.2k describe, in general, the action of actin and myosin in muscle contraction and heat	Section 10.1: Skeletal Muscle Consists of Bundles and Fibres, pp. 335-336 The Mechanism of Muscle Fibre Contractions, pp. 336-339 Energy for Muscle Contraction, p. 339	Q question 4, p. 336; 5, 6, p. 338; 7, p. 339; 8-10, p. 341 Section 10.1 Review: 4, 5, 7, p. 342 Section 10.2 Review: 4, 5, p. 350 Chapter 10 Review: 4-6, 11, 13, 14, 16, p. 352; 24, p. 353 BLM 10.3.1 Chapter 10 Test Unit 4 Review: 24, 27, p. 357; 52, 54, p. 358
Outcomes for Science, Technology and Society (Emphasis on the nature of science)		
20–D4.1sts explain that concepts, models and theories are often used in interpreting and explaining observations, and in predicting future observations by (NS6a) ■ *analyzing the effects of exercise on the muscle fiber* ■ *describing the relationship between fitness and efficiency of muscle action* ■ *assessing the physiological effects on the motor system of drugs such as steroids, creatine phosphate, energy-enhancing drugs*	Career Focus: Ask an Athletic Therapist, pp. 354-355 Exercise and Muscle Contraction, p. 344 Thought Lab 10.2: Injuries Related to Athletics, p. 345 The Value of Exercise, pp. 347-348 Connections: How Much Does It Cost to Be The Best?, p. 343	Try This: *Rigor mortis*, p. 340 Career Focus: 1, p. 355 Thought Lab 10.2: Analysis 1-2, p. 345 Q question 14, p. 346; 15, p. 347; 16, 17, p. 348 Unit 4 Review: 55, p. 358; 58, p. 359 Section 10.2: 6, 9, p. 350 Chapter 10 Review: 8, p. 352; 22, 23, p. 353 Web Link: Diet supplements, p. 342 Connections: 1, 2, p. 343
20–D4.2sts explain that the goal of technology is to provide solutions to practical problems by (ST1) ■ *identifying specific pathologies of the motor system and the technology used to treat the conditions*	Career Focus: Ask an Athletic Therapist, pp. 354-355 Complications of the Muscular System, p. 344	Chapter 10 Review: 19, p. 352 Career Focus: 2, 3, p. 355 Q question 12, p. 344; 13, p. 346 Section 10.2 Review: 1, 2, 13, p. 350 Chapter 10 Review: 21, p. 353 Unit 4 Review: 62, p. 359
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
20–D4.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ designing an investigation to determine the relationship between muscle activity and energy **(IP–NS1, 2, 3, 4) [ICT C7–4.1]**	The Mechanism of Muscle Fibre Contractions, pp. 336-339 Energy for Muscle Contraction, pp. 339-342	Try This: Heat generation, p. 341 Chapter 10 Review: 18, p. 352 Section 10.1 Review: 9, p. 342 Chapter 10 Review: 5, 12, p. 352

	Student Textbook	Assessment Options
Performing and Recording		
20–D4.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ observing types of muscle under magnification **(PR–NS3)** ■ *designing and constructing a model of a muscle fiber* **(PR–ST2) [ICT C7–4.1]**	Launch Lab: Working in Pairs, p. 331 Thought Lab 10.2: Injuries Related to Athletics, p. 345 Investigation 10.A: Observing Muscle Tissue, pp. 334-335 Thought Lab 10.1: Designing a Muscle Fibre Model, p. 339	Launch Lab: Procedure 1-2; Analysis 1-2, p. 331 Thought Lab 10.2: Procedure 2, p. 345 Chapter 10 Review: 22, p. 353 Investigation 10.A: Procedure Parts 1, 2, p. 335 Chapter 10 Review: 1, p. 352 Thought Lab 10.1: Procedure 1-4, p. 339 Section 10.1 Review: 7, p. 342 Chapter 10 Review: 3, 17, p. 352
Analyzing and Interpreting		
20–D4.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by	Investigation 10.A: Observing Muscle Tissue, pp. 334-335 Thought Lab 10.2: Injuries Related to Athletics, p. 345	Investigation 10.A: Analysis 1-4; Conc. 5-7, p. 335 Thought Lab 10.2: Analysis 2, p. 345 Section 10.2 Review: 8, p. 350 Chapter 10 Review: 13, 14, p. 352; 20, p. 353 Unit 4 Review: 52, p. 358
■ *obtaining and interpreting data to demonstrate a direct correlation between energy use by muscle cells and heat production* **(PR–NS1, 2, 3, 4) (AI–NS2)**	Launch Lab: Working in Pairs, p. 331	Try This: Heat generation, p. 341 Launch Lab: Analysis 3, p. 331
■ *evaluating dependability of technologies used for temperature measurement, assessment or analysis and identifying limitations of such measurements* **(AI–NS3, 4)**	Launch Lab: Working in Pairs, p. 331	Try This: Heat generation, p. 341 Launch Lab: Analysis 3, p. 331
Communication and Teamwork		
20–D4.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by	Thought Lab 10.1: Designing a Muscle Fibre Model, p. 339 Thought Lab 10.2: Injuries Related to Athletics, p. 345	Thought Lab 10.1: Procedure 1-3; Analysis 1, p. 339 Thought Lab 10.2: Analysis 1, p. 345
■ *working cooperatively with team members to measure body temperature* **(CT–NS1)**	Launch Lab: Working in Pairs, p. 331	Launch Lab: Procedure 1-2, Analysis 3, p. 331
■ *using appropriate SI notation, fundamental and derived units* **(CT–NS2)**	Investigation 10.A: Observing Muscle Tissue, pp. 334-335	Investigation 10.A: Procedure Part 2: 2, 4-7, pp. 334-335

CHAPTER 11 THE CONTINUANCE OF HUMAN LIFE

Curriculum Correlation

General Outcome 1: Students will explain how the nervous system controls physiological processes.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–A1.1k describe the structure and function of a neuron and myelin sheath, explaining the formation and transmission of an action potential and the transmission of a signal across a synapse or neuromuscular junction and the main chemicals and transmitters involved, i.e., norepinephrine, acetylcholine and cholinesterase	**Section 11.1: Cells of the Nervous System, p. 368** **The Structure of a Neuron, p. 370** **The Nerve Impulse, p. 372** **Investigation 11.B: Modelling Resting Action Potential, p. 374** **Membrane Potential, p. 375** **Nerve Impulse, p. 377** **Signal Transmission Across a Synapse, p. 378** **Neural Transmitters in Action, p. 380** **Investigation 11.C: Examining Neural Tissue, p. 381** **Thought Lab 11.1: The Effect of Drugs on Neurons and Synapses, p. 383** **Section 11.2: The Autonomic System, p. 397**	**Chapter 11 Questions for Comprehension: 4–6, p. 370** **7, 8, p. 372** **9, 10, p. 374** **11–13, p. 377** **14–16, p. 380** **17, 18, p. 382** **30–32, p. 399** **Investigation 11.B: Analysis, Conclusions, p. 375** **Investigation 11.C: Analysis 2-6, p. 381** **Thought Lab 11.1: Analysis, p. 383** **Section 11.1 Review: 1–8, p. 384** **Chapter 11 Review: 1, 6, 8, 10, 13–17, 19–21, 23, pp. 402–403** **Chapter 11 Test** Unit 5 Review: 1, 2, 5, 7, 36–38, pp. 468–470

	Student Textbook	Assessment Options
30–A1.2k identify the principal structures of the central and peripheral nervous systems and explain their functions in regulating the voluntary (somatic) and involuntary (autonomic) systems of the human organism, i.e., cerebral hemispheres and lobes, cerebellum, pons, medulla oblongata, hypothalamus, spinal cord, sympathetic and parasympathetic nervous systems, and the sensory–somatic nervous system	**Section 11.1: Organization of the Nervous System, p. 367** **Section 11.2:** **The Spinal Cord, p. 385** **The Brain, p. 386** **The Structure and Function of the Cerebrum, p. 389** **Mapping Brain Functions, p. 392** **Imaging Techniques Used to Study the Brain, p. 392** **Investigation 11.D: The Brain, Parts 1 & 2, p. 393–394** **Section 11.3:** **The Somatic System, p. 396** **The Autonomic System, p. 397** Throughout Section 12.1, p. 406–409 Section 12.2: The Photoreceptors: Rods and Cones, p. 414	**Chapter 11 Questions for Comprehension:** **1–3, p. 367** **19–22, p. 389** **23–25, p.392** **28, 29, p. 399** **30–32, p. 399** **Investigation 11.D, Parts 1 & 2: Analysis, pp. 393–394** **Sect 11.1 Review: 1, p. 384** **Section 11.2 Review: 1–7, p. 395** **Section 11.3 Review: 1–5, p. 399** **Chapter 11 Review: 1–5, 7–9, 11, 18, 19, 22, 24, pp. 402–403** **Chapter 11 Test** Chapter 12 Questions for Comprehension: 1–2, p. 406 3–4, p. 407 5–6, p. 409 15, p. 416 17, p. 416 22, p. 424 25, p. 425 Section 12.1 Review: 1–5, p. 409 Chapter 12 Review 1–2, 4–7, 11, 13, 17, 18, p. 432 Chapter 12 Test Unit 5 Review: 3–7, 16, 23, 35, 46, pp. 468–471
30–A1.3k describe the composition and function of a simple reflex arc and the organization of neurons into nerves	**Section 11.1: Cells of the Nervous System, p. 368** **The Reflex Arc, p. 369** **Investigation 11.A: Move Fast! Reflex Responses, p. 371**	**Chapter 11 Questions for Comprehension: 4–6, p. 370** **Investigation 11.A: Analysis, p. 371** **Chapter 11 Test** Unit 5 Review: 3, 6, p. 468
30–A1.4k describe the structure and function of the human eye, i.e., cornea, lens, sclera, choroid, retina, rods and cones, pupil, iris, and optic nerve	Section 12.1: Sensory Receptors, p. 407 Throughout Section 12.2, pp. 410–418 Investigation 12.A: Dissection of an Eye, p. 417 Investigation 12.B: Distinguishing Sights and Sounds, Part 1 Distinguishing Shades of Colour, p. 422	Chapter 12 Questions for Comprehension: 7–9, p. 412 10–12, p. 414 13–17, p. 416 Investigation 12.A: Analysis, Conclusion, Application, p. 417 Investigation 12.B, Part 1: Analysis, Conclusion, p. 422 Section 12.1 Review: 1(b), p. 409 Section 12.2 Review: 1–7, p. 418 Chapter 12 Review: 3, 8–12, 14, 16–17, 21, 22, 23–25, 27, 31, pp. 432-433 Chapter 12 Test Unit 5 Review: 8, 9, 12–14, 44, p. 468-471

	Student Textbook	Assessment Options
30–A1.5k describe the structure and function of the human ear, i.e., pinna, auditory canal, tympanum, ossicles, cochlea, organ of Corti, auditory nerve, semicircular canals and Eustachian tube	Section 12.3: Hearing and Balance, p. 419 Capturing Sound, p. 419 Frequencies of Sound, p. 421 Hearing Loss, p. 423 The Perception of Sound, p. 424 Investigation 12.B: Distinguishing Sights and Sounds, Part 2: Distinguishing Sound Frequencies, p. 422–423	Chapter 12 Questions for Comprehension: 18–20, p. 421 21–22, p. 424 23–25, p. 425 Investigation 12.B, Part 2: Analysis, Conclusion, Extension, p. 423 Section 12.3 Review: 1–5, p. 429 Chapter 12 Review: 6, 15, 17–20, p. 432 Chapter 12 Test Unit 5 Review: 10, 11, p. 468
30–A1.6k explain other ways that human organisms sense their environment and their spatial orientation in it, e.g., *skin receptors, olfactory receptors, proprioceptors, taste receptors.*	Throughout Section 12.1, p. 406–409 Section 12.3: Hearing and Balance, p. 419 Taste, p. 425 Smell, p. 426 Touch, p. 427 Sensation and Homeostasis, p. 427 Summary, p. 429 Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428	Chapter 12 Questions for Comprehension: 5–6, p. 409 26, p. 426 27–30, p 427 Investigation 12.C: Analysis, Conclusion, p. 428 Section 12.1 Review: 1 (a), 2–5, p. 409 Chapter 12 Review: 13, 15, 29 pp. 432–433 Chapter 12 Test Unit 5 Review: 8, 31, 35, pp. 468–470
Outcomes for Science, Technology, and Society (Emphasis on the nature of Science)		
30–A1.1sts explain that scientific knowledge and theories develop through hypotheses, collection of evidence through experimentation and the ability to provide explanations by ■ *discussing the biological basis of neurological diseases and how this relates to its treatment, e.g., Alzheimer's disease, Parkinson's disease*	**Section 11.1: The Nerve Impulse, p. 377** **Neurotransmitters in Action, p. 380** **Section 11.2: Imaging Techniques Used to Study the Brain, p. 392** **The Somatic System, p. 396** **Investigation 11.D: The Brain, Parts 1 & 2, pp. 393–394** **Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, p. 400**	**Investigation 11.D, Parts 1 & 2: Analysis, pp. 389–390** **Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, questions 1–4, p. 400** **Chapter 11 Review: 12, 18, 20, pp. 402–403** Unit 5 Review: 36, 45, 47, 48, pp. 470–471
■ *evaluating the impact of photoperiod (light wavelength and duration) on the human organism*	e.g., Investigation 12.B, Distinguishing Sights and Sounds Part 1: Distinguishing Shades of Colour, p. 422	Chapter 12 Questions for Comprehension: e.g., 8, p. 412 e.g., Investigation 12.B, Part 1: Analysis, Conclusions, p. 422 e.g., Chapter 12 Review: 8, 11, p. 432 e.g., Unit 5 Review: 14, p. 468

	Student Textbook	Assessment Options
30–A1.2sts explain that scientific investigation includes the process of analyzing evidence and providing explanations based on scientific theories and concepts by ■ *analyzing experimental evidence on the influence of anesthetics, drugs and chemicals, natural and synthetic, on the functioning of the nervous system and their relationship to addiction theories*	**Thought Lab 11.1: The Effect of Drugs on Neurons and Synapses, p. 383**	**Thought Lab 11.1: Analysis, p. 383** **Section 11.1 Review: 8, p. 384** **Section 11.3 Review: 5, p. 399** Unit 5 Review: 49, p. 471
■ *analyzing the contribution of technological developments and physiological knowledge to longevity and quality of life*	**Section 11.2: Imaging Techniques Used to Study the Brain, p. 392** **Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, p. 400** Section 12.1: Sensory Receptors, p. 407 Section 12.2: Focussing, p. 412 Conditions Affecting the Cornea and Lens, p. 412 Section 12.3: Hearing Loss, p. 423	**Section 11.2 Review: 7, p. 391** **Chapter 11 Questions for Comprehension: 26, 27, p. 394** **Chapter 11 Connections: Social and Environmental Contexts, 1–4, p. 400** Chapter 12 Review: 23, 31, p. 433 Unit 5 Review: 31–35, 41–51 , pp. 469-471
30–A1.3sts explain that the goal of technology is to provide solutions to practical problems by ■ *investigating the technologies available to correct eye and ear defects*	Section 12.1: Sensory Receptors, p. 407 Section 12.2: Photoreceptors, p. 414 Focussing, p. 412 Conditions Affecting the Cornea and Lens, p. 412 Preventing Vision Loss, p. 418 Investigation 12.B: Distinguishing Sights and Sounds, pp. 422-423 Section 12.3: Hearing Loss, p. 423	Chapter 12 Questions for Comprehension 9, p. 412 11, p. 414 21, p. 424 Investigation 12.B, Extension, p. 423 Section 12.2 Review: 5, 6, p. 418 Chapter 12 Review: 24, p. 431
■ *investigating the biological basis of neurotoxin action and their antidotes, e.g., snake venom, box jellyfish, botulin, reserpine* (Rauwolfia serpentina)	Chapter 12 Connections: Nature of Science: Pain Relievers or Deadly Neurotoxins? p. 430	**Chapter 11 Review: 24, p. 403** Chapter 12 Connections: Nature of Science, 1–3, p. 430 Chapter 12 Review: 31, p. 433
■ *discussing how advances in science have contributed to technologies that increase access to the world beyond normal sensory limits.*	Section 12.1: Sensory Receptors, p. 407	Section 12.2 Review: 2, 6, p. 418 Chapter 12 Review: 22, 23, 31, pp. 432–433
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
30–A1.1s ask questions about observed relationships, and plan investigations of questions, ideas, problems and issues by ■ designing an experiment to investigate heat, cold, pressure and touch receptors	Chapter 12 Launch Lab: Sense It, p. 405 Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428	Chapter 12 Launch Lab: Analysis, p. 405 Investigation 12.C: Analysis, Conclusion, p. 428

	Student Textbook	Assessment Options
Performing and Recording		
30–A1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ designing and performing an experiment to investigate the physiology of reflex arcs	**Investigation 11.A: Move Fast! Reflex Responses, p. 371**	**Investigation 11.A: Analysis, p. 371**
■ performing experiments to measure the ability to discriminate objects visually and to hear a range of sounds	**Chapter 11 Launch Lab: You, Robot?, p. 365** Investigation 12.B: Distinguishing Sights and Sounds Parts 1–2, pp. 422–423	**Chapter 11 Launch Lab: Analysis, p. 365** Investigation 12.B, Parts 1–2: Analysis, Conclusion, Extension, pp. 422–423 Unit 5 Review: 40, p. 470
■ using a microscope and prepared slides to observe neurons and neuromuscular junctions	**Investigation 11.C: Examining Neural Tissue, p. 381**	**Investigation 11.C: Analysis, p. 381**
■ observing the principal features of a mammalian brain, ear and eye, using models, computer simulations or dissections, and identifying the major visible structures of those organs	**Investigation 11.D: The Brain, Parts 1 & 2, pp. 393–394** Section 12.2: Photoreceptors, p. 410 Focussing, p. 412 The Photoreceptors: the Rods and Cones, p. 414 Investigation 12.A: Dissection of an Eye, p. 417 Section 12.3: Capturing Sound, p. 419	**Investigation 11.D, Parts 1 & 2: Analysis, pp. 393–394** Investigation 12.A: Analysis, Conclusions and Application, p. 417
■ *investigating and integrating, from library and electronic sources, information on the impact of photoperiod and wavelength on humans*	Investigation 12.B, Distinguishing Sights and Sounds, Part 1: Distinguishing Shades of Colour, p. 422	Investigation 12.B, Part 1: Analysis, Conclusion, p. 422 Chapter 12 Review: 8, 11, 16, p. 432 Unit 5 Review: 9, 14, p. 468
■ *compiling and displaying, in appropriate format, data collected for investigations on auditory range, reflex arcs and/or stimulus strength versus force of muscle contraction*	**Investigation 11.A: Move Fast! Reflex Responses, p. 371**	**Investigation 11.A: Analysis, p. 371** Unit 5 Review: 36, 37, 40, p. 470
Analyzing and Interpreting		
30–A1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ *interpreting patterns and trends in data on strength of stimuli versus force of muscle contraction*	**Investigation 11.A: Move Fast! Reflex Responses, p. 371** Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428	**Investigation 11.A: Analysis, p. 371** **Chapter 11 Review: 17, p. 403** Investigation 12.C: Analysis, Conclusion, p. 428 Unit 5 Review: 36, 37, p. 470
■ *providing a statement that explains the blind spot*	Section 12.2: Visual Interpretation, p. 416 Summary, p. 418	Chapter 12 Questions for Comprehension: 16, p. 416 Chapter 12 Review: 10, p. 432
■ *explaining how data supports or refutes a hypothesis or prediction on strength of stimulus versus force of muscle contraction*	**Investigation 11.A: Move Fast! Reflex Responses, p. 371**	**Investigation 11.A: Analysis, p. 371** Unit 5 Review: 36, 37, p. 470
■ *analyzing a hearing aid as a device that simulates a sensory function*	Investigation 12.B: Distinguishing Sights and Sounds, pp. 422-423 Section 12.3: Hearing Loss, p. 423	Investigation 12.B: Extension, p. 423

	Student Textbook	Assessment Options
■ *posing new questions, e.g., why some people are more tolerant to pain than others*	**Investigation 11.A: Move Fast! Reflex Responses, p. 371** Throughout Section 12.1, pp. 406–409	**Investigation 11.A: Applications, 4, p. 371** **Chapter 11 Review: 23, p. 403** Chapter 12 Review: 28, p. 433 Unit 5 Review: 34, p. 469
■ *collecting and analyzing class data on colour charts*	Investigation 12.B, Distinguishing Sights and Sounds, Part 1: Distinguishing Shades of Colour, p. 422	Investigation 12.B, Part 1: Analysis, Conclusion, p.422
■ *analyzing data to show the interrelationship between taste and smell receptors*	Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428	Investigation 12.C: Analysis, Conclusion, p. 428
Communication and Teamwork		
30–A1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively with group members to investigate neurological disorders such as Alzheimer's disease and Parkinson's disease*	**Thought Lab 11.1: The Effect of Drugs on Neurons and Synapses, p. 383** **Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, 1–4, p. 400** e.g., Investigation 12.B, Distinguishing Sights and Sounds, Part 1–2, p. 422 e.g., Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428	**Thought Lab 11.1: Analysis, p. 383** **Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, 1–4, p. 400** **Chapter 11 Review: 18, p. 403** e.g., Investigation 12.B, Analysis, Conclusion, Extension, p. 422 e.g., Investigation 12.C: Analysis, Conclusion; p. 428 Unit 5 Review: 48, 50, p. 471

CHAPTER 12 SENSORY RECEPTION

Curriculum Correlation

General Outcome 1: Students will explain how the nervous system controls physiological processes.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–A1.1k describe the structure and function of a neuron and myelin sheath, explaining the formation and transmission of an action potential and the transmission of a signal across a synapse or neuromuscular junction and the main chemicals and transmitters involved, i.e., norepinephrine, acetylcholine and cholinesterase	Section 11.1: Cells of the Nervous System, p. 368 The Structure of a Neuron, p. 370 The Nerve Impulse, p. 372 Investigation 11.B: Modelling Resting Action Potential, p. 374 Membrane Potential, p. 375 Nerve Impulse, p. 377 Signal Transmission Across a Synapse, p. 378 Neural Transmitters in Action, p. 380 Investigation 11.C: Examining Neural Tissue, p. 381 Thought Lab 11.1: The Effect of Drugs on Neurons and Synapses, p. 383 Section 11.2: The Autonomic System, p. 397	Chapter 11 Questions for Comprehension: 4–6, p. 370 7, 8, p. 372 9, 10, p. 374 11–13, p. 377 14–16, p. 380 17, 18, p. 382 30–32, p. 399 Investigation 11.B: Analysis, Conclusions, p. 375 Investigation 11.C: Analysis 2-6, p. 381 Thought Lab 11.1: Analysis, p. 383 Section 11.1 Review: 1–8, p. 384 Chapter 11 Review: 1, 6, 8, 10, 13–17, 19–21, 23, pp. 402–403 Chapter 11 Test Unit 5 Review: 1, 2, 5, 7, 36–38, pp. 468–470

	Student Textbook	Assessment Options
30–A1.2k identify the principal structures of the central and peripheral nervous systems and explain their functions in regulating the voluntary (somatic) and involuntary (autonomic) systems of the human organism, i.e., cerebral hemispheres and lobes, cerebellum, pons, medulla oblongata, hypothalamus, spinal cord, sympathetic and parasympathetic nervous systems, and the sensory–somatic nervous system	Section 11.1: Organization of the Nervous System, p. 367 Section 11.2: The Spinal Cord, p. 385 The Brain, p. 386 The Structure and Function of the Cerebrum, p. 389 Mapping Brain Functions, p. 392 Imaging Techniques Used to Study the Brain, p. 392 Investigation 11.D: The Brain, Parts 1 & 2, p. 393–394 Section 11.3: The Somatic System, p. 396 The Autonomic System, p. 397 **Throughout Section 12.1, p. 406–409** **Section 12.2: The Photoreceptors: Rods and Cones, p. 414**	Chapter 11 Questions for Comprehension: 1–3, p. 367 19–22, p. 389 23–25, p.392 28, 29, p. 399 30–32, p. 399 Investigation 11.D, Parts 1 & 2: Analysis, pp. 393–394 Sect 11.1 Review: 1, p. 384 Section 11.2 Review: 1–7, p. 395 Section 11.3 Review: 1–5, p. 399 Chapter 11 Review: 1–5, 7–9, 11, 18, 19, 22, 24, pp. 402–403 Chapter 11 Test **Chapter 12 Questions for Comprehension:** **1–2, p. 406** **3–4, p. 407** **5–6, p. 409** **15, p. 416** **17, p. 416** **22, p. 424** **25, p. 425** **Section 12.1 Review: 1–5, p. 409** **Chapter 12 Review 1–2, 4–7, 11, 13, 17, 18, p. 432** **Chapter 12 Test** Unit 5 Review: 3–7, 16, 23, 35, 46, pp. 468–471
30–A1.3k describe the composition and function of a simple reflex arc and the organization of neurons into nerves	Section 11.1: Cells of the Nervous System, p. 368 The Reflex Arc, p. 369 Investigation 11.A: Move Fast! Reflex Responses, p. 371	Chapter 11 Questions for Comprehension: 4–6, p. 370 Investigation 11.A: Analysis, p. 371 Chapter 11 Test Unit 5 Review: 3, 6, p. 468
30–A1.4k describe the structure and function of the human eye, i.e., cornea, lens, sclera, choroid, retina, rods and cones, pupil, iris, and optic nerve	**Section 12.1:** **Sensory Receptors, p. 407** **Throughout Section 12.2, pp. 410–418** **Investigation 12.A: Dissection of an Eye, p. 417** **Investigation 12.B: Distinguishing Sights and Sounds, Part 1 Distinguishing Shades of Colour, p. 422**	**Chapter 12 Questions for Comprehension:** **7–9, p. 412** **10–12, p. 414** **13–17, p. 416** **Investigation 12.A: Analysis, Conclusion, Application, p. 417** **Investigation 12.B, Part 1: Analysis, Conclusion, p. 422** **Section 12.1 Review: 1(b), p. 409** **Section 12.2 Review: 1–7, p. 418** **Chapter 12 Review: 3, 8–12, 14, 16–17, 21, 22, 23–25, 27, 31, pp. 432-433** **Chapter 12 Test** Unit 5 Review: 8, 9, 12–14, 44, p. 468-471

	Student Textbook	Assessment Options
30–A1.5k describe the structure and function of the human ear, i.e., pinna, auditory canal, tympanum, ossicles, cochlea, organ of Corti, auditory nerve, semicircular canals and Eustachian tube	**Section 12.3: Hearing and Balance, p. 419** **Capturing Sound, p. 419** **Frequencies of Sound, p. 421** **Hearing Loss, p. 423** **The Perception of Sound, p. 424** **Investigation 12.B: Distinguishing Sights and Sounds, Part 2: Distinguishing Sound Frequencies, p. 422–423**	**Chapter 12 Questions for Comprehension: 18–20, p. 421** **21–22, p. 424** **23–25, p. 425** **Investigation 12.B, Part 2: Analysis, Conclusion, Extension, p. 423** **Section 12.3 Review: 1–5, p. 429** **Chapter 12 Review: 6, 15, 17–20, p. 432** **Chapter 12 Test** Unit 5 Review: 10, 11, p. 468
30–A1.6k explain other ways that human organisms sense their environment and their spatial orientation in it, e.g., *skin receptors, olfactory receptors, proprioceptors, taste receptors.*	**Throughout Section 12.1, p. 406–409** **Section 12.3:** **Hearing and Balance, p. 419** **Taste, p. 425** **Smell, p. 426** **Touch, p. 427** **Sensation and Homeostasis, p. 427** **Summary, p. 429** **Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428**	**Chapter 12 Questions for Comprehension: 5–6, p. 409** **26, p. 426** **27–30, p 427** **Investigation 12.C: Analysis, Conclusion, p. 428** **Section 12.1 Review: 1 (a), 2–5, p. 409** **Chapter 12 Review: 13, 15, 29 pp. 432–433** **Chapter 12 Test** Unit 5 Review: 8, 31, 35, pp. 468–470
Outcomes for Science, Technology, and Society (Emphasis on the nature of Science)		
30–A1.1sts explain that scientific knowledge and theories develop through hypotheses, collection of evidence through experimentation and the ability to provide explanations by ■ *discussing the biological basis of neurological diseases and how this relates to its treatment, e.g., Alzheimer's disease, Parkinson's disease*	Section 11.1: The Nerve Impulse, p. 377 Neurotransmitters in Action, p. 380 Section 11.2: Imaging Techniques Used to Study the Brain, p. 392 The Somatic System, p. 396 Investigation 11.D: The Brain, Parts 1 & 2, pp. 393–394 Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, p. 400	Investigation 11.D, Parts 1 & 2: Analysis, pp. 389–390 Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, questions 1–4, p. 400 Chapter 11 Review: 12, 18, 20, pp. 402–403 Unit 5 Review: 36, 45, 47, 48, pp. 470–471
■ *evaluating the impact of photoperiod (light wavelength and duration) on the human organism*	**e.g., Investigation 12.B, Distinguishing Sights and Sounds Part 1: Distinguishing Shades of Colour, p. 422**	**e.g., Chapter 12 Questions for Comprehension: e.g., 8, p. 412** **e.g., Investigation 12.B, Part 1: Analysis, Conclusions, p. 422** **e.g., Chapter 12 Review: 8, 11, p. 432** e.g., Unit 5 Review: 14, p. 468

	Student Textbook	Assessment Options
30–A1.2sts explain that scientific investigation includes the process of analyzing evidence and providing explanations based on scientific theories and concepts by ■ *analyzing experimental evidence on the influence of anesthetics, drugs and chemicals, natural and synthetic, on the functioning of the nervous system and their relationship to addiction theories*	Thought Lab 11.1: The Effect of Drugs on Neurons and Synapses, p. 383	Thought Lab 11.1: Analysis, p. 383 Section 11.1 Review: 8, p. 384 Section 11.3 Review: 5, p. 399 Unit 5 Review: 49, p. 471
■ *analyzing the contribution of technological developments and physiological knowledge to longevity and quality of life*	Section 11.2: Imaging Techniques Used to Study the Brain, p. 392 Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, p. 400 **Section 12.1: Sensory Receptors, p. 407** **Section 12.2: Focussing, p. 412** **Conditions Affecting the Cornea and Lens, p. 412** **Section 12.3: Hearing Loss, p. 423**	Section 11.2 Review: 7, p. 391 Chapter 11 Questions for Comprehension: 26, 27, p. 394 Chapter 11 Connections: Social and Environmental Contexts, 1–4, p. 400 **Chapter 12 Review: 23, 31, p. 433** Unit 5 Review: 31–35, 41–51 , pp. 469-471
30–A1.3sts explain that the goal of technology is to provide solutions to practical problems by ■ *investigating the technologies available to correct eye and ear defects*	**Section 12.1: Sensory Receptors, p. 407** **Section 12.2:** **Photoreceptors, p. 414** **Focussing, p. 412** **Conditions Affecting the Cornea and Lens, p. 412** **Preventing Vision Loss, p. 418** **Investigation 12.B: Distinguishing Sights and Sounds, pp. 422-423** **Section 12.3: Hearing Loss, p. 423**	**Chapter 12 Questions for Comprehension** **9, p. 412** **11, p. 414** **21, p. 424** **Investigation 12.B, Extension, p. 423** **Section 12.2 Review: 5, 6, p. 418** **Chapter 12 Review: 24, p. 431**
■ *investigating the biological basis of neurotoxin action and their antidotes, e.g., snake venom, box jellyfish, botulin, reserpine* (Rauwolfia serpentina)	**Chapter 12 Connections: Nature of Science: Pain Relievers or Deadly Neurotoxins? p. 430**	Chapter 11 Review: 24, p. 403 **Chapter 12 Connections: Nature of Science, 1–3, p. 430** **Chapter 12 Review: 31, p. 433**
■ *discussing how advances in science have contributed to technologies that increase access to the world beyond normal sensory limits.*	**Section 12.1: Sensory Receptors, p. 407**	**Section 12.2 Review: 2, 6, p. 418** **Chapter 12 Review: 22, 23, 31, pp. 432–433**
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
30–A1.1s ask questions about observed relationships, and plan investigations of questions, ideas, problems and issues by ■ designing an experiment to investigate heat, cold, pressure and touch receptors	**Chapter 12 Launch Lab: Sense It, p. 405** **Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428**	**Chapter 12 Launch Lab: Analysis, p. 405** **Investigation 12.C: Analysis, Conclusion, p. 428**

	Student Textbook	Assessment Options
Performing and Recording		
30–A1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ designing and performing an experiment to investigate the physiology of reflex arcs	Investigation 11.A: Move Fast! Reflex Responses, p. 371	Investigation 11.A: Analysis, p. 371
■ performing experiments to measure the ability to discriminate objects visually and to hear a range of sounds	Chapter 11 Launch Lab: You, Robot?, p. 365 **Investigation 12.B: Distinguishing Sights and Sounds Parts 1–2, pp. 422–423**	Chapter 11 Launch Lab: Analysis, p. 365 **Investigation 12.B, Parts 1–2: Analysis, Conclusion, Extension, pp. 422–423** Unit 5 Review: 40, p. 470
■ using a microscope and prepared slides to observe neurons and neuromuscular junctions	Investigation 11.C: Examining Neural Tissue, p. 381	Investigation 11.C: Analysis, p. 381
■ observing the principal features of a mammalian brain, ear and eye, using models, computer simulations or dissections, and identifying the major visible structures of those organs	Investigation 11.D: The Brain, Parts 1 & 2, pp. 393–394 **Section 12.2: Photoreceptors, p. 410** **Focussing, p. 412** **The Photoreceptors: the Rods and Cones, p. 414** **Investigation 12.A: Dissection of an Eye, p. 417** **Section 12.3: Capturing Sound, p. 419**	Investigation 11.D, Parts 1 & 2: Analysis, pp. 393–394 **Investigation 12.A: Analysis, Conclusions and Application, p. 417**
■ *investigating and integrating, from library and electronic sources, information on the impact of photoperiod and wavelength on humans*	**Investigation 12.B, Distinguishing Sights and Sounds, Part 1: Distinguishing Shades of Colour, p. 422**	**Investigation 12.B, Part 1: Analysis, Conclusion, p. 422** **Chapter 12 Review: 8, 11, 16, p. 432** Unit 5 Review: 9, 14, p. 468
■ *compiling and displaying, in appropriate format, data collected for investigations on auditory range, reflex arcs and/or stimulus strength versus force of muscle contraction*	Investigation 11.A: Move Fast! Reflex Responses, p. 371	Investigation 11.A: Analysis, p. 371 Unit 5 Review: 36, 37, 40, p. 470
Analyzing and Interpreting		
30–A1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ *interpreting patterns and trends in data on strength of stimuli versus force of muscle contraction*	Investigation 11.A: Move Fast! Reflex Responses, p. 371 **Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428**	Investigation 11.A: Analysis, p. 371 Chapter 11 Review: 17, p. 403 **Investigation 12.C: Analysis, Conclusion, p. 428** **Unit 5 Review: 36, 37, p. 470**
■ *providing a statement that explains the blind spot*	**Section 12.2: Visual Interpretation, p. 416** **Summary, p. 418**	**Chapter 12 Questions for Comprehension: 16, p. 416** **Chapter 12 Review: 10, p. 432**
■ *explaining how data supports or refutes a hypothesis or prediction on strength of stimulus versus force of muscle contraction*	Investigation 11.A: Move Fast! Reflex Responses, p. 371	Investigation 11.A: Analysis, p. 371 Unit 5 Review: 36, 37, p. 470
■ *analyzing a hearing aid as a device that simulates a sensory function*	**Investigation 12.B: Distinguishing Sights and Sounds, pp. 422-423** **Section 12.3: Hearing Loss, p. 423**	**Investigation 12.B: Extension, p. 423**

	Student Textbook	Assessment Options
■ *posing new questions, e.g., why some people are more tolerant to pain than others*	Investigation 11.A: Move Fast! Reflex Responses, p. 371 **Throughout Section 12.1, pp. 406–409**	Investigation 11.A: Applications, 4, p. 371 Chapter 11 Review: 23, p. 403 **Chapter 12 Review: 28, p. 433** Unit 5 Review: 34, p. 469
■ *collecting and analyzing class data on colour charts*	**Investigation 12.B, Distinguishing Sights and Sounds, Part 1: Distinguishing Shades of Colour, p. 422**	**Investigation 12.B, Part 1: Analysis, Conclusion, p.422**
■ *analyzing data to show the interrelationship between taste and smell receptors*	**Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428**	**Investigation 12.C: Analysis, Conclusion, p. 428**
Communication and Teamwork		
30–A1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively with group members to investigate neurological disorders such as Alzheimer's disease and Parkinson's disease*	Thought Lab 11.1: The Effect of Drugs on Neurons and Synapses, p. 383 Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, 1–4, p. 400 **e.g., Investigation 12.B, Distinguishing Sights and Sounds, Part 1–2, p. 422** **e.g., Investigation 12.C: Feel, Taste, or Smell: Design Your Own Investigation, p. 428**	Thought Lab 11.1: Analysis, p. 383 Chapter 11 Connections: Social and Environmental Contexts: Neurological Disorders, 1–4, p. 400 Chapter 11 Review: 18, p. 403 **e.g., Investigation 12.B, Analysis, Conclusion, Extension, p. 422** **e.g., Investigation 12.C: Analysis, Conclusion; p. 428** Unit 5 Review: 48, 50, p. 471

CHAPTER 13 HORMONAL REGULATION OF HOMEOSTASIS

Curriculum Correlation

General Outcome 2: Students will explain how the endocrine system contributes to homeostasis.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–A2.1k identify the principal endocrine glands of the human organism, i.e., the hypothalamus/pituitary complex, thyroid and adrenal glands, islet cells of the pancreas	Throughout Section 13.1, pp. 436–442 Throughout Section 13.2, pp. 444–450 Throughout Section 13.3, pp. 451–455 Section 13.4: The Hormones of the Pancreas, p. 456 Career Focus: Ask an Endocrinologist, p. 466	Questions for Comprehension: 4–5, p. 439 7–9, p. 441 12, p. 442 15–17, p. 449 19, p. 453 25, p. 457 Section 13.1 Review: 3, p. 442 Section 13.2 Review: 3, p. 450 Chapter 13 Review: 2, 4, 5, 8, 16–18, 25 (a, c), pp. 464–465 Chapter 13 Test Career Focus, 2, p.467 Unit 5 Review: 21, 25, 30, p. 469
30–A2.2k describe the hormones of the principal endocrine glands, i.e., thyroid-stimulating hormone (TSH)/thyroxine, adrenocorticotropic hormone (ACTH)/cortisol, glucagon/insulin, human growth hormone (hGH), antidiuretic hormone (ADH), epinephrine, norepinephrine, aldosterone	Throughout Section 13.1, pp. 436–442 Throughout Section 13.2, pp. 444–450 Throughout Section 13.3, pp. 451–455 Section 13.4: The Hormones of the Pancreas, p. 456	Questions for Comprehension: 2, p. 437 6, p. 439 7–9, p. 441 10–12, p. 442 13, 14, p. 446 16, p. 449 19, p. 453 21, 22, p. 454 23, p. 455 25, 26, p. 457 Section 13.1 Review: 3, 5, p. 442 Section 13.2 Review: 1, 3, 6, 7, p. 450 Section 13.3 Review: 5, 6, p. 455 Section 13.4 Review: 1–5, p. 462 Chapter 13 Review: 2–7, 9, 10, 12–14, 17–22, 24, 25 (b, d, f), 27, 30, pp. 464–465 Chapter 13 Test Unit 5 Review: 21, 22, 27, 29, 30, p. 469

	Student Textbook	Assessment Options
30–A2.3k explain the metabolic roles hormones may play in homeostasis, i.e., thyroxine in metabolism, insulin, glucagon, and cortisol in blood sugar regulation, hGH in growth, ADH in water regulation, aldosterone in sodium ion regulation	Throughout Section 13.1, pp. 436–442 Throughout Section 13.2, pp. 444–450 Throughout Section 13.3, pp. 451–455 Section 13.4: The Effects of Glucose Imbalance, p. 457 Summary, p. 462	Questions for Comprehension: 10, 12, p. 442 13, p. 446 15, 16, p. 449 19, p. 453 21, 22, p. 454 23, p. 455 26, p. 457 Section 13.1 Review: 1–4, p. 442 Section 13.2 Review: 1, 3, p. 450 Section 13.4 Review: 1, 2, 5, p. 462 Chapter 13 Review: 1–3, 5–7, 9, 10, 14, 24, 25 (e, f), 30, pp. 464–465 Chapter 13 Test Unit 5 Review: 18, 28, 30, 31, 41, pp. 469–470
30–A2.4k explain how the endocrine system allows human organisms to sense their internal environment and respond appropriately, e.g., *calcium metabolism, osmotic pressure of blood*	Section 13.3: Coritsol, p. 454 The Adrenal Medulla: Regulating the Short-Term Stress Response, p. 452 Aldosterone, p. 454 Summary, p. 455	Questions for Comprehension: 18, 19, p. 453 22, p. 454 23, p. 455 Chapter 13 Test
30–A2.5k compare the endocrine and nervous control systems and explain how they act together, i.e., stress and the adrenal gland	Throughout Section 13.1, pp. 436–442 Section 13.3: The Adrenal Medulla: Regulating the Short-Term Stress Response, p. 452 Summary, p. 455	Questions for Comprehension: 1, 3, p. 437 18–20, p. 453 Section 13.1 Review: 2, p. 442 Section 13.3 Review: 1, 4, 6, 7, p. 455 Chapter 13 Review: 1, 12–14, 18–19, p. 464 Chapter 13 Test Unit 5 Review: 15, 17, 23, 31, pp. 468–469

	Student Textbook	Assessment Options
30–A2.6k describe, using an example, the physiological consequences of hormone imbalances, i.e., diabetes mellitus, and e.g., gigantism, goiter, cretinism, Graves' disease, diabetes insipidus.	Section 13.2: Human Growth Hormone, p. 444 The Thyroid Gland: A Metabolic Thermostat, p. 446 Summary, p. 449 Connections: Social and Environmental Contexts: Light up Your Life! p. 443 Section 13.3: Cortisol, p. 454 Aldosterone, p. 454 Summary, p. 455 Section 13.4: The Hormones of the Pancreas, p. 456 The Effects of Glucose Imbalance, p. 457 Causes of Diabetes, p. 458 Career Focus: Ask an Endocrinologist, p. 466	Questions for Comprehension: 15–17, p. 449 20, p. 453 22, p. 454 23, 24, p. 455 27–29, p. 458 30, 31, p. 455 Connections: Social and Environmental Contexts: questions 1, 2, p. 443 Section 13.2 Review: 2, 4, 6, 7, p. 450 Section 13.3 Review: 3, p. 455 Section 13.4 Review: 3, 4, 5, 6 (d), p. 462 Chapter 13 Review: 11, 15, 17–19, 20–22, 24, 29, pp. 464–465 Chapter 13 Test Career Focus, 3, p. 467 Unit 5 Review: 20, 24, 26, 31, 32, 50, 51, pp. 469–471
Outcomes for Science, Technology, and Society (Emphasis on societal and environmental concerns)		
30–A2.1sts explain that science and technology are developed to meet societal needs and expand human capability by ■ *comparing the function of technological control systems with electrochemical control systems in organisms, e.g., computer control systems for car emissions*	e.g., Investigation 13.A: Evaluating Potential Uses for Human Growth Hormone, p. 447	e.g., Investigation 13.A: Opinions and Recommendations, p. 447 e.g., Chapter 13 Review: 22, 23, p. 465
■ *assessing the impact of research into biochemical control systems on human performance*	Section 13.1: From Hypothesis to Evidence, p. 438 Human Growth Hormone, p. 444 Connections: Social and Environmental Contexts: Light up Your Life! p. 443 Investigation 13.A: Evaluating Potential Uses for Human Growth Hormone, p. 447 Section 13.4: Towards a Cure for Diabetes, p. 459 Investigation 13.B Analyzing Endocrine Disorders, pp. 460–461	Questions for Comprehension: 4–6, p. 439 14, p. 446 32, 33, p. 462 Connections: Social and Environmental Contexts: 1, 2, p. 443 Investigation 13.A: Opinions and Recommendations, 3, 4, p. 447 Section 13.2 Review: 6, 7, p. 450 Section 13.3 Review: 5, p. 455 Investigation 13.B, Application: 6, p. 461 Section 13.4 Review: 3, 4, p. 462 Chapter 13 Review: 4, 16, 27, pp. 464–465 Unit 5 Review: 47, 49, p. 471

	Student Textbook	Assessment Options
■ *describing the current treatment technology for type 1 diabetes*	Section 13.4: Towards a Cure for Diabetes, p. 459 Thought Lab 13.1: Blood Glucose Regulation and Homeostasis, p. 458 Career Focus: Ask an Endocrinologist, p. 466	Questions for Comprehension: 32, 33, p. 462 Thought Lab 13.1: Analysis, p. 458 Section 13.4 Review: 4, p. 462 Career Focus, 2, 3, p, 467 Chapter 13 Review: 24, p. 465 Unit 5 Review: 24, p. 469
30–A2.2sts explain that science and technology have both intended and unintended consequences for humans and the environment by ■ *explaining the relationship among ultraviolet light, ozone depletion and pigment deposition within skin cells*	e.g., Throughout Section 13.1, pp. 436–442 e.g., Section 13.3: Cortisol, p. 454 e.g., Investigation 13.A: Evaluating Potential Uses for Human Growth Hormone, p. 447 e.g., Connections: Social and Environmental Contexts: Light up Your Life! p. 443	e.g., Questions for Comprehension: 6, p. 439 14, p. 446 32, 33, p. 462 e.g., Investigation 13.A: Opinions and Recommendations, p. 447 e.g., Connections: Social and Environmental Contexts, 1, 2, p. 443 e.g., Section 13.2 Review: 5, 6, 7, p. 450 e.g., Section 13.3 Review: 5, p. 455 e.g., Section 13.4 Review: 4, p. 462 e.g., Chapter 13 Review: 27, 28, p. 465 e.g., Unit 5 Review: 45, 47, 49, p. 471
■ *evaluating the use of biotechnology to solve practical problems, e.g., hormone synthesis for diabetes, dwarfism, milk yield in cows*	Section 13.1: From Hypothesis to Evidence, p. 438 Connections: Social and Environmental Contexts: Light up Your Life! p. 443 Section 13.3: Coritsol, p. 454, Aldosterone, p. 454 Summary, p. 455 Career Focus: Ask an Endocrinologist, p. 466	Connections: Social and Environmental Contexts, 2, p. 443 Section 13.2 Review: 6, p. 449 Section 13.3 Review: 5, p. 455 Career Focus, 2, p. 467 Chapter 13 Review: 28, p. 467
■ *evaluating the use of hormone therapy in the treatment of humans, e.g., growth hormone and aging, steroids and human performance.*	Investigation 13.A: Evaluating Potential Uses for Human Growth Hormone, p. 447 Career Focus: Ask an Endocrinologist, p. 466	Questions for Comprehension: 14, p. 449 Investigation 13.A: Opinions and Recommendations, p. 447 Career Focus, 3, p. 467

	Student Textbook	Assessment Options
Skill Outcomes (Focus on decision making)		
Initiating and Planning		
30–A2.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by formulating a hypothesis, from published data, on an environmental factor that can be detected and responded to by humans, e.g., *ultraviolet light and pigment deposition, diet and thyroid function*	Launch Lab: Modern Stress! p. 435 Throughout Section 13.1, pp. 434–442 Connections: Social and Environmental Contexts: Light up Your Life! p. 443 Investigation 13.A: Evaluating Potential Uses for Human Growth Hormone, p. 447 Investigation 13.B: Analyzing Endocrine Disorders, pp. 460–461	Launch Lab: Analysis, Extension, p. 435 Connections: Social and Environmental Contexts, 1, 2, p. 443 Investigation 13.A: Opinions and Recommendations, p. 447 Investigation 13.B: Analysis, Application, pp. 460–461
Performing and Recording		
30–A2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ *researching Seasonal Affective Disorder (SAD) or General Adaptation Syndrome and identifying the main hormonal and nervous components*	Investigation 13.A: Evaluating Potential Uses for Human Growth Hormone, p. 447 Investigation 13.B: Analyzing Endocrine Disorders, pp. 460–461 Thought Lab 13.1: Blood Glucose Regulation and Homeostasis, p. 458 Connections: Social and Environmental Contexts: Light up Your Life! p. 443	Investigation 13.A: Opinions and Recommendations, p. 447 Investigation 13.B: Analysis, Application, p. 461 Thought Lab 13.1: Analysis, p. 458 Connections: Social and Environmental Contexts, 1, 2, p. 443
Analyzing and Interpreting		
30–A2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ inferring the role of ADH and aldosterone in the maintenance of water and ions using the analysis and interpretation of data on blood and urine composition	Section 13.1: Regulating the Regulators, p. 441 Investigation 13.B: Analyzing Endocrine Disorders, pp. 460–461	Investigation 13.B: Analysis, Application, p. 461
■ inferring the role of insulin in the regulation of blood sugar by performing an experiment to investigate the presence of reducing sugars in simulated urine and comparing the results with normal urinalysis data; and/or investigating the role of insulin in the regulation of blood sugar using a computer simulation	Thought Lab 13.1: Blood Glucose Regulation and Homeostasis, p. 458 Investigation 13.B: Analyzing Endocrine Disorders, pp. 460–461	Thought Lab 13.1: Analysis, p. 458 Investigation 13.B: Analysis, Application, p. 461 Section 13.4 Review: 5, p. 462 Chapter 13 Review: 30, p. 465 Unit 5 Review: 42, 43, pp. 470–471

	Student Textbook	Assessment Options
Communication and Teamwork		
30–A2.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *evaluating individual and group processes used in planning and carrying out group investigations of hormone therapy or use of biotechnology to solve practical problems*	Investigation 13.A: Evaluating Potential Uses for Human Growth Hormone, p. 447 Investigation 13.B: Analyzing Endocrine Disorders, pp. 460–461	Investigation 13.A: Opinions and Recommendations, p. 447 Investigation 13.B: Analysis, Application, p. 461

CHAPTER 14 THE CONTINUANCE OF HUMAN LIFE

Curriculum Correlation

General Outcome 1: Students will explain how survival of the human species is ensured through reproduction.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–B1.1k identify the structures in the female reproductive system and describe their functions, i.e., ovaries, Fallopian tubes, uterus, cervix, vagina, endometrium, fimbriae	**Launch Lab: Inside Story, p. 477** **Section 14.1: Structures and Functions of the Female Reproductive System, p. 481** *The Ovaries, p. 482* **The Uterus and Vagina, p. 482**	**Launch Lab, Analysis, p. 477** **Questions for Comprehension: 7–10, p. 484** **Section 14.1 Review: 1, 2, 4, 6, p. 485** **Chapter 14 Review: 1, 2 (b, d–f), 3, 8, p. 504** **Chapter 14 Test** Unit 6 Review: 1, 2, 7, 8, p. 540
30–B1.2k identify the structures in the male reproductive system and describe their functions, i.e., testes, seminiferous tubules, interstitial cells, Sertoli cells, epididymides, vasa (ductus) deferentia, Cowper's glands, seminal vesicles, prostate gland, ejaculatory duct, urethra, penis	**Launch Lab: Inside Story, p. 477** **Section 14.1: Structures and Functions of the Male Reproductive System, p. 478** **The Testes, p. 479** **The Penis, p. 480** **Seminal Fluid, p. 481**	**Launch Lab, Analysis, p. 477** **Questions for Comprehension: 2–6, p. 481** **Section 14.1 Review: 1–3, 5, 8, p. 485** **Chapter 14 Review: 1, 2 (a, c), 3, 4, p. 504** **Chapter 14 Test** Unit 6 Review: 1, 2, 6–9, p. 540
30–B1.3k distinguish egg and sperm from their supporting structures, i.e., seminiferous tubules, interstitial cells, Sertoli cells, follicle, corpus luteum	**Section 14.1: Differences between Sperm Cells and Egg Cells, p. 484**	**Questions for Comprehension: 2–4, 6, p. 481** **Section 14.1 Review: 7, 485** **Chapter 14 Review: 3, 4, 11, 18, pp. 504–505** **Chapter 14 Test** Unit 6 Review: 3, 6–8, 16–18, 26, 34, pp. 540–541
30–B1.4k describe the chromosomal factors and hormonal influence in the formation of the gonads and reproductive organs in the female and male embryo and fetus, i.e., Y chromosome and role of testosterone	**Section 14.3: Hormonal Regulation of the Reproductive System (Section Opener), p. 492**	**Questions for Comprehension: 18, p. 492** **Chapter 14 Test** Unit 6 Review: 3, 25, 30, pp. 540–541
30–B1.5k explain how sexually transmitted diseases can interfere with fertility and reproduction, e.g., *chlamydia, gonorrhea, human papilloma virus*	**Throughout Section 14.2, pp. 486–490** **Thought Lab 14.1: STIs: What To Know and How To Know It, p. 491**	**Questions for Comprehension:** **11–13, p. 487** **14–16, p. 488** **17, p. 490** **Thought Lab 14.1** **Analysis, Extension, p. 491** **Section 14.2 Review: 1–6, p. 491** **Chapter 14 Review: 5–6, 17, 19, pp. 504–505** **Chapter 14 Test** Unit 6 Review: 19, p. 541

	Student Textbook	Assessment Options
Outcomes for Science, Technology, and Society (Emphasis on social and environmental contexts)		
30–B1.1sts explain that decisions regarding the use of scientific and technological developments involve a variety of perspectives, including social, cultural, environmental, ethical and economic considerations by ■ *evaluating the implications of reproductive technology for human biology* ■ discussing society's expectations of the scientific community with respect to reproductive technology	**e.g., Thought Lab 14.4: Therapy Options for Menopause, p. 499** **Career Focus: Ask a Sexual and Reproductive Health Coordinator, p. 538** **e.g., Thought Lab 14.1: STIs: What To Know and How To Know It, p. 491** **Career Focus: Ask a Sexual and Reproductive Health Coordinator, p. 538**	**e.g., Thought Lab, p. 499** **Career Focus, 1–3, p. 538** **e.g., Thought Lab 14.1: STIs: What To Know and How To Know It, p. 491** **Section 14.2 Review: 6, p. 491** **Career Focus, 1–3, p. 538** Unit 6 Review: 44, p. 542
■ *discussing the impact of sexually transmitted diseases on an individual, considering the physiological damage they cause*	**Section 14.2: Controlling the Spread of STIs in Canada, p. 490** **Thought Lab 14.1: STIs: What To Know and How To Know It, p. 491** Career Focus: Ask a Sexual and Reproductive Health Coordinator, p. 538	**Thought Lab 14.1: Analysis, Extension, p. 491** **Section 14.2 Review: 1–6, p. 491** Career Focus, 2, p. 538
Skill Outcomes (Focus on decision making)		
Initiating and Planning		
30–B1.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ *identifying ethical concerns about, e.g.,* ■ *reproductive technologies* ■ *infertility* ■ *spread of STDs.*	**Thought Lab 14.1: STIs: What To Know and How To Know It, p. 491**	**Thought Lab 14.1: Analysis, Extension, p. 491**
Performing and Recording		
30–B1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ observing the principal features of the human reproductive system using models or computer simulations, and identifying the major structures from drawings	**Throughout Section 14.1, pp. 478–485** **Investigation 14.A: Examining Gonads and Gametes, p. 483**	**Investigation 14.A: Analysis, Conclusion, p. 483** **Section 14.1 Review: 6, p. 485** Unit 6 Review: 7, p. 540
■ using a microscope to observe prepared slides of ovaries and testes so as to distinguish eggs and sperm from their supporting structures, i.e., follicle, corpus luteum, seminiferous tubules, interstitial cells, Sertoli cells	**Investigation 14.A: Examining Gonads and Gametes, p. 483**	**Investigation 14.A: Analysis, Conclusion, p. 483**

	Student Textbook	Assessment Options
Analyzing and Interpreting		
30–B1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ evaluating practical solutions to decreased fertility, i.e., low sperm count, difficulty in egg production, hormonal imbalance by ■ *evaluating information collected from library and electronic sources on the implications of reproductive technologies, e.g., surrogate mothers, sperm banks, cloning*	**Investigation 14.B: The Menstrual Cycle, p. 500** **Connections—Endocrine Disruptors in the Environment, p. 501**	**Investigation 14.B: The Menstrual Cycle, Analysis, p. 500** **Section 14.1 Review: 8, p. 485** **Chapter 14 Review: 16, p. 504** Unit 6 Review: 39, p. 542
Communication and Teamwork		
30–B1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ working cooperatively as a team to research the physiological and physical damage to reproductive organs caused by exposure to sexually transmitted disease organisms and, using appropriate multimedia, present the findings to the class	**Thought Lab 14.1: STIs: What To Know and How To Know It, p. 491**	**Thought Lab 14.1: Analysis, Extension, p. 491**

General Outcome 2: Students will explain how human reproduction is regulated by chemical control systems

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–B2.1k describe the role of hormones (gonadotropic-releasing hormone (GnRH), FSH, LH, estrogen, progesterone, testosterone, inhibin) in the regulation of primary and secondary sex characteristics in females and males	**Section 14.1: The Male and Female Reproductive Systems (Section Opener), p. 478** **Section 14.3: Hormonal Regulation of the Reproductive System (Section Opener), p. 492**	**Questions for Comprehension: 1, p. 478** **Section 14.3 Review: 1, p. 502** **Chapter 14 Test** Unit 6 Review: 10, p. 540
30–B2.2k identify the principal reproductive hormones in the female and explain their interactions in the maintenance of the menstrual cycle, i.e., estrogen, progesterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH)	**Section 14.3: Sex Hormones and the Female Reproductive System, p. 495** **Hormonal Regulation of the Female Reproductive System, p. 495** **The Ovarian Cycle, p. 496** **The Uterine Cycle, p. 498** **Aging and the Menstrual Cycle, p. 498** **Thought Lab 14.3: Development of the Corpus Luteum, p. 497** **Investigation 14.B: The Menstrual Cycle, p. 500** **Connections: Social and Environmental Contexts: Endocrine Disruptors in the Environment, p. 501**	**Questions for Comprehension: 20, p. 495 21–24, p. 498** **Thought Lab 14.3: Analysis, Extension, p. 497** **Investigation 14.B: Analysis, Conclusion, p. 500** **Connections, p. 501** **Section 14.3 Review: 3, 4, 6, p. 502** **Chapter 14 Review: 7–10, 12, 13, 15, 16, 20, pp. 504–505** **Chapter 14 Test** Unit 6 Review: 5, 11, 21, 23, 24, 28, 43, pp. 540–542

	Student Textbook	Assessment Options
30–B2.3k identify the principal reproductive hormones in the male and explain their interactions in the maintenance and functioning of the male reproductive system, i.e., testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH)	**Section 14.3: Sex Hormones and the Male Reproductive System, p. 492** **Maturation of the Male Reproductive System, p. 493** **Hormonal Regulation of the Male Reproductive System, p. 493** **Aging and the Male Reproductive System, p. 495** **Thought Lab 14.2: Testosterone and Male Development, p. 494** **Connections: Social and Environmental Contexts: Endocrine Disruptors in the Environment, p. 501**	**Questions for Comprehension: 19, p. 495** **Thought Lab 14.2: Testosterone and Male Development, Analysis, p. 494** **Connections, p. 501** **Section 14.3 Review: 2, 3, 5, 8, p. 502** **Chapter 14 Review: 12, 14, 21, pp. 504–505** **Chapter 14 Test** Unit 6 Review: 12, 37, 43, pp. 540–542
Outcomes for Science, Technology, and Society (Emphasis on social and environmental contexts)		
30–B2.1sts explain how science and technology are influenced and supported by society and have influenced, and been influenced by, historical development and societal needs by ■ *researching and assessing the effects of the medical use of reproductive hormones on humans*	Section 15.3 Hormone Treatments, p. 531 e.g., Career Focus: Ask a Sexual and Reproductive Health Coordinator, p. 538	Section 15.3 Review: 2, p. 534 e.g., Career Focus, 1–3, p. 539 Chapter 15 Review: 22, p. 536 Unit 6 Review: 22, 49, 50 p. 541–543
■ *researching and assessing the implications for humans of producing and using reproductive hormones in domestic animals, e.g., cattle and horses*	**e.g., Thought Lab 14.2: Testosterone and Male Development, p. 494** **e.g., Thought Lab 14.4: Therapy Options for Menopause, p. 499** e.g., Connections (Social and Environmental Contexts): Stem Cells, p. 527	**e.g., Thought Lab 14.2, Analysis, p. 494** **e.g., Thought Lab 14.4, Analysis, p. 499** e.g., Connections, Questions, p. 527
30–B2.2sts explain why decisions regarding the use of scientific and technological developments involve a variety of perspectives, including social, cultural, environmental, ethical and economic considerations by ■ *explaining how reproductive hormone homeostasis is disrupted by the natural aging process and whether available technologies should be used to restore balance; e.g., hormone treatment for menopause and andropause*	**Section 14.3: Aging and the Menstrual Cycle, p. 498** **Thought Lab 14.4: Therapy Options for Menopause, p. 499** Career Focus: Ask a Sexual and Reproductive Health Coordinator, p. 538	**Thought Lab 14.4: Analysis, p. 499** Career Focus, 1–3, p. 538
Skill Outcomes (Focus on decision making)		
Initiating and Planning		
30–B2.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues, e.g., by ■ *designing an investigation to determine at which point during the menstrual cycle a female is most fertile*	**Investigation 14.B: The Menstrual Cycle, p. 500**	**Investigation 14.B: Analysis, Conclusion, p. 500**

	Student Textbook	Assessment Options
Performing and Recording		
30–B2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ graphing the changes in estrogen, progesterone, LH and FSH levels in the blood of a female through a single menstrual cycle	**Investigation 14.B: The Menstrual Cycle, p. 500**	**Investigation 14.B: Analysis, Conclusion, p. 500** **Section 14.3 Review: 4, p. 502** **Chapter 14 Review: 10, p. 504**
■ using models, diagrams or computer simulations, identifying the follicle and corpus luteum within the ovary	**Thought Lab 14.3: Development of the Corpus Luteum, p. 497** **Investigation 14.B: The Menstrual Cycle, p. 500**	**Thought Lab 14.3: Analysis, Extension p. 497** **Investigation 14.B: Analysis, Conclusion, p. 500**
Analyzing and Interpreting		
30–B2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ analyzing blood hormone data and physiological events for a single menstrual cycle, inferring the roles of female sex hormones	**Investigation 14.B: The Menstrual Cycle, p. 500**	**Investigation 14.B: Analysis, Conclusion, p. 500** **Section 14.3 Review: 4, p. 502** **Chapter 14 Review: 10, p. 504**
■ analyzing blood hormone data and physiological events, inferring the roles of male sex hormones	**Thought Lab 14.2: Testosterone and Male Development, p. 494**	**Thought Lab 14.2: Analysis, p. 494** **Section 14.3 Review: 5, p. 502**
■ *researching and assessing the effects of the medical use of reproductive hormones, e.g., menopause, andropause, infertility*	**Aging and the Menstrual Cycle, p. 498** **Thought Lab 14.4: Therapy Options for Menopause, p. 499** Thought Lab 15.2: Evaluating Reproductive Technologies, p. 533	**Thought Lab 14.4: Analysis, p. 499** Thought Lab 15.2, p. 533 Section 15.3 Review: 2, p. 534
Communication and Teamwork		
30–B2.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ selecting and using appropriate numerical and graphical modes of representation to communicate information on changing reproductive hormone levels in the blood	**Thought Lab 14.2: Testosterone and Male Development, p. 494** **Investigation 14.B: The Menstrual Cycle, p. 500**	**Thought Lab 14.2: Analysis, p. 494** **Investigation 14.B: Analysis, Conclusion, p. 500** **Section 14.3 Review: 4, 7, p. 502** **Chapter 14 Review: 10, 16, p. 504** Unit 6 Review: 46–51, p. 543
■ *working cooperatively with team members to investigate the value of producing and using reproductive hormones in domestic animals and, using the appropriate multimedia, present the information to the class*	**e.g., Thought Lab 14.2: Testosterone and Male Development, p. 494** **e.g., Thought Lab 14.4: Therapy Options for Menopause, p. 499** e.g., Connections (Social and Environmental Contexts): Stem Cells, Section 15.2, p. 527	**e.g., Thought Lab 14.2, Analysis, p. 494** **e.g., Thought Lab 14.4, Analysis, p. 499** e.g., Connections, Questions, p. 527

General Outcome 3 [selected correlation]: *Students will* explain how cell differentiation and development in the human organism are regulated by a combination of genetic, endocrine and environmental factors.

	Student Textbook	Assessment Options
Skill Outcomes		
Analyzing and Interpreting		
30–B3.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ observing the changes during embryo development, using preserved material such as chicken embryos, prepared slides, models or computer simulations, and extrapolating these events to the development of a human	Investigation 15.A: Comparing Embryonic Structures, p. 519	Investigation 15.A: Analysis, p. 519
■ evaluating, from published data, the effectiveness and safety of various reproductive technologies	Thought Lab 15.2: Evaluating Reproductive Technologies, p. 533	Thought Lab 15.2, p. 533
■ interpreting hormonal data from published investigations, e.g., *pregnancy testing*	Section 14.3: The Ovarian Cycle, p. 496 The Uterine Cycle, p. 498 *Aging and the Menstrual Cycle, p. 498* Thought Lab 14.2: Testosterone and Male Development, p. 494 Thought Lab 14.4: Therapy Options for Menopause, p. 495 *Investigation 14.B: The Menstrual Cycle, p. 500*	Thought Lab 14.2, p. 494 Thought Lab 14.4, p. 495 *Investigation 14.B: Analysis, Conclusion, p. 500* Chapter 14 Review: 10, 16, p. 504 Unit 6 Review: 46–51, p. 543
■ *analyzing the stages of embryo development*	Chapter 15 Launch Lab: Visualizing Early Human Development, p. 507 Investigation 15.A: Comparing Embryonic Structures, p. 519	Chapter 15 Launch Lab: Analysis, p. 507 Investigation 15.A: Analysis, p. 519

CHAPTER 15 HUMAN DEVELOPMENT

Curriculum Correlation

General Outcome 2: *Students will* explain how human reproduction is regulated by chemical control systems.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–B2.1k describe the role of hormones in the regulation of primary and secondary sex characteristics in females and males	Section 14.1: The Male and Female Reproductive Systems (Section Opener), p. 478 Section 14.3: Hormonal Regulation of the Reproductive System (Section Opener), p. 492	Questions for Comprehension: 1, p. 478 Section 14.3 Review: 1, p. 502 Chapter 14 Test Unit 6 Review: 10, p. 540
30–B2.2k identify the principal reproductive hormones in the female and explain their interactions in the maintenance of the menstrual cycle, i.e., estrogen, progesterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH)	Section 14.3: Sex Hormones and the Female Reproductive System, p. 495 Hormonal Regulation of the Female Reproductive System, p. 495 The Ovarian Cycle, p. 496 The Uterine Cycle, p. 498 Aging and the Menstrual Cycle, p. 498 Thought Lab 14.3: Development of the Corpus Luteum, p. 497 Investigation 14.B: The Menstrual Cycle, p. 500 Connections: Social and Environmental Contexts: Endocrine Disruptors in the Environment, Section 14.3, p. 501	Questions for Comprehension: 20, p. 495 21–24, p. 498 Thought Lab 14.3: Analysis, Extension, p. 497 Investigation 14.B: Analysis, Conclusion, p. 500 Connections, p. 501 Section 14.3 Review: 3, 4, 6, p. 502 Chapter 14 Review: 7–10, 12, 13, 15, 16, 20, p. 504–505 Chapter 14 Test Unit 6 Review: 5, 11, 21, 23, 24, 28, 43, p. 540–542
30–B2.3k identify the principal reproductive hormones in the male and explain their interactions in the maintenance and functioning of the male reproductive system, i.e., testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH)	Section 14.3: Sex Hormones and the Male Reproductive System, p. 492 Maturation of the Male Reproductive System, p. 493 Hormonal Regulation of the Male Reproductive System, p. 493 Aging and the Male Reproductive System, p. 495 Thought Lab 14.2: Testosterone and Male Development, p. 494 Connections: Social and Environmental Contexts: Endocrine Disruptors in the Environment, Section 14.3, p. 501	Questions for Comprehension: 19, p. 495 Thought Lab 14.2: Testosterone and Male Development, Analysis, p. 494 Connections, Section 14.3, p. 501 Section 14.3 Review: 2, 3, 5, 8, p. 502 Chapter 14 Review: 12, 14, 21, pp. 504–505 Chapter 14 Test Unit 6 Review: 12, 37, 43, pp. 540–542

	Student Textbook	Assessment Options
Outcomes for Science, Technology, and Society (Emphasis on social and environmental contexts)		
30–B2.1sts explain how science and technology are influenced and supported by society and have influenced, and been influenced by, historical development and societal needs by ■ *researching and assessing the effects of the medical use of reproductive hormones on humans*	Section 15.3 Hormone Treatments, p. 531 e.g., Career Focus: Ask a Sexual and Reproductive Health Coordinator, p. 538	Section 15.3 Review: 2, p. 534 e.g., Career Focus, 1–3, p. 539 Chapter 15 Review: 22, p. 536 Unit 6 Review: 22, 49, 50 pp. 541–543
■ *researching and assessing the implications for humans of producing and using reproductive hormones in domestic animals, e.g., cattle and horses*	e.g., Thought Lab 14.2: Testosterone and Male Development, p. 494 e.g., Thought Lab 14.4: Therapy Options for Menopause, p. 499 e.g., Connections (Social and Environmental Contexts): Stem Cells, Section 15.2, p. 527	e.g., Thought Lab 14.2, Analysis, p. 494 e.g., Thought Lab 14.4, Analysis, p. 499 e.g., Connections, Questions, Section 15.2, p. 527
30–B2.2sts explain why decisions regarding the use of scientific and technological developments involve a variety of perspectives, including social, cultural, environmental, ethical and economic considerations by ■ *explaining how reproductive hormone homeostasis is disrupted by the natural aging process and whether available technologies should be used to restore balance; e.g., hormone treatment for menopause and andropause*	Section 14.3: Aging and the Menstrual Cycle, p. 498 Thought Lab 14.4: Therapy Options for Menopause, p. 499 Career Focus: Ask a Sexual and Reproductive Health Coordinator, p. 538	Thought Lab 14.4: Analysis, p. 499 Career Focus, 1–3, p. 538
Skill Outcomes (Focus on decision making)		
Initiating and Planning		
30–B2.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues, e.g., by ■ designing an investigation to determine at which point during the menstrual cycle a female is most fertile	Investigation 14.B: The Menstrual Cycle, p. 500	Investigation 14.B: Analysis, Conclusion, p. 500
Performing and Recording		
30–B2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ graphing the changes in estrogen, progesterone, LH and FSH levels in the blood of a female through a single menstrual cycle	Investigation 14.B: The Menstrual Cycle, p. 500	Investigation 14.B: Analysis, Conclusion, p. 500 Section 14.3 Review: 4, p. 502 Chapter 14 Review: 10, p. 504

	Student Textbook	Assessment Options
■ using models, diagrams or computer simulations, identifying the follicle and corpus luteum within the ovary	Thought Lab 14.3: Development of the Corpus Luteum, p. 497 Investigation 14.B: The Menstrual Cycle, p. 500	Thought Lab 14.3: Analysis, Extension p. 497 Investigation 14.B: Analysis, Conclusion, p. 500
Analyzing and Interpreting		
30–B2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ analyzing blood hormone data and physiological events for a single menstrual cycle, inferring the roles of female sex hormones	Investigation 14.B: The Menstrual Cycle, p. 500	Investigation 14.B: Analysis, Conclusion, p. 500 Section 14.3 Review: 4, p. 502 Chapter 14 Review: 10, p. 504
■ analyzing blood hormone data and physiological events, inferring the roles of male sex hormones	Thought Lab 14.2: Testosterone and Male Development, p. 494	Thought Lab 14.2: Analysis, p. 494 Section 14.3 Review: 5, p. 502
■ *researching and assessing the effects of the medical use of reproductive hormones, e.g., menopause, andropause, infertility*	Aging and the Menstrual Cycle, p. 498 Thought Lab 14.4: Therapy Options for Menopause, p. 499 Thought Lab 15.2: Evaluating Reproductive Technologies, p. 533	Thought Lab 14.4: Analysis, p. 499 Thought Lab 15.2, p. 533 Section 15.3 Review: 2, p. 534
Communication and Teamwork		
30–B2.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ selecting and using appropriate numerical and graphical modes of representation to communicate information on changing reproductive hormone levels in the blood	Thought Lab 14.2: Testosterone and Male Development, p. 494 Investigation 14.B: The Menstrual Cycle, p. 500	Thought Lab 14.2: Analysis, p. 494 Investigation 14.B: Analysis, Conclusion, p. 500 Section 14.3 Review: 4, 7, p. 502 Chapter 14 Review: 10, 16, p. 504 Unit 6 Review: 46–51, p. 543
■ *working cooperatively with team members to investigate the value of producing and using reproductive hormones in domestic animals and, using the appropriate multimedia, present the information to the class*	e.g., Thought Lab 14.2: Testosterone and Male Development, p. 494 e.g., Thought Lab 14.4: Therapy Options for Menopause, p. 499 e.g., Connections (Social and Environmental Contexts): Stem Cells, Section 15.2, p. 527	e.g., Thought Lab 14.2, Analysis, p. 494 e.g., Thought Lab 14.4, Analysis, p. 499 e.g., Connections, Questions, p. 527

General Outcome 3: S*tudents will* explain how cell differentiation and development in the human organism are regulated by a combination of genetic, endocrine and environmental factors.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–B3.1k trace the processes of fertilization, implantation, and extra-embryonic membrane formation; i.e., amnion, chorion, allantois followed by embryo development, placental and fetal development, parturition and lactation, and the control mechanisms of the above events, i.e., progesterone, LH, human chorionic gonadotropin (hCG), oxytocin, prolactin, prostaglandins	Chapter 15, Launch Lab: Visualizing Early Human Development, p. 507 Throughout Section 15.1, pp. 508–519 Throughout Section 15.2, pp. 520–528 Investigation 15.A: Comparing Embryonic Structures, p. 519	Chapter 15, Launch Lab: Analysis, p. 507 Questions for Comprehension: 1–4, p. 509 5–9, p. 511 10–14, p. 512 15–19, p. 515 20–23, p. 517 24–26, p. 520 27, 28, p. 523 29–32, p. 526 Investigation 15.A, Analysis, p. 519 Section 15.1 Review: 1–10, p. 518 Section 15.2 Review: 1–7, p. 528 Chapter 15 Review: 1–14, 17–22, 24, p. 536 Chapter 15 Test Unit 6 Review: 4, 13–15, 20, 22, 27, 29, 48–51, pp. 540–543
30–B3.2k describe development from fertilization to parturition in the context of the main physiological events that occur in the development of organ systems during each major stage (trimester), i.e., zygote, blastocyst, gastrulation, general morphogenesis	Chapter 15, Launch Lab: Visualizing Early Human Development, p. 507 Section 15.1: Fertilization, p. 508 Cleavage and Implantations, p. 509 Gastrulation and Start of Tissue Formation, p. 511 Neurulation and Organ Formation, p. 512 Investigation 15.A: Comparing Embryonic Structures, p. 519 Section 15.2: Fetal Development and Birth, p. 520 Parturition: Delivery of the Baby, p. 523	Chapter 15, Launch Lab: Analysis, p. 507 Questions for Comprehension: 1–4, p. 509 5–9, p. 511 10–14, p. 512 15–19, p. 515 Section 15.1 Review: 4, 8, 10, p. 518 Investigation 15.A: Analysis, p. 519 Section 15.2 Review: 1, 2, p. 528 Chapter 15 Review: 3, 4, 7, 12, 13, 17–19, 21, 24, 26, pp. 536–537 Chapter 15 Test Unit 6 Review: 4, 13, 20, 27, 29, pp. 540–541
30–B3.3k identify major tissues and organs that arise from morphological development of the ectoderm, mesoderm and endoderm in the embryo, i.e., * ectoderm: nervous system, epidermis * mesoderm: skeleton, muscles, reproductive structures * endoderm: lining of the digestive and respiratory systems, endocrine glands	Section 15.1: Gastrulation and the Start of Tissue Formation, p. 511 Neurulation and Organ Formation, p. 512	Questions for Comprehension: 14, p. 512 15–19, p. 515 Section 15.1 Review: 5, 10, p. 518 Chapter 15 Review: 6, 7, 14, p. 536 Chapter 15 Test Unit 6 Review: 4, 14, p. 540

	Student Textbook	Assessment Options
30–B3.4k describe the influence of environmental factors on embryonic and fetal development of body structures or systems, e.g., maternal lifestyle, teratogens such as alcohol, drugs, viral infections	Section 15.3: The Effects of Teratogens on Development, p. 521 Thought Lab 15.1: Folic Acid and Neural Tube Defects, p. 524	Questions for Comprehension: 27–28, p. 523 Thought Lab 15.1: Analysis, p. 524 Section 15.2 Review: 3, p. 528 Chapter 15 Review: 15–16, p. 536 Chapter 15 Test Unit 6 Review: 44, p. 542
30–B3.5k describe the physiological or mechanical basis of different reproductive technology methods, i.e., conception control, *in vitro* fertilization, infertility reversal.	Throughout Section 15.3, pp. 529–534 Thought Lab 15.2: Evaluating Reproductive Technologies, p. 533	Questions for Comprehension: 33-34, p. 530 35-36, p. 532 Thought Lab 15.2, Analysis, p. 533 Section 15.3 Review: 1–5, p. 534 Chapter 15 Review: 25, p. 537 Chapter 15 Test Unit 6 Review: 35, 39, pp. 541–542
Outcomes for Science, Technology, and Society (Emphasis on social and environmental contexts)		
30–B3.1sts explain that science and technology are developed to meet societal needs and expand human capability by * *analyzing the use of technology to solve problems of immunological incompatibility between fetus and mother and possible solutions to such problems*	e.g., Connections (Social and Environmental Contexts), Stem Cells, Section 15.2, p. 527	e.g., Connections, Section 15.2, p. 527
30–B3.2sts explain why decisions regarding the application of scientific and technological development involve a variety of perspectives including social, cultural, environmental, ethical and economic considerations by * *assessing the effects of conception control technology on population demographics in developed and underdeveloped countries*	Thought Lab 15.2: Evaluating Reproductive Technologies, p. 533 Career Focus: Ask a Sexual and Reproductive Health Coordinator, p. 538	Thought Lab 15.2, Extension, p. 533 Career Focus, 1–3, p. 539
* a*ssessing the use of imaging technologies in monitoring fetal development, e.g., ultrasound, CVS, amniocentesis, fetal heart rate monitor*	Section 15.3: In Vitro Fertilization, p. 530	
* *discussing how knowledge of embryonic/fetal development has influenced the value that society places on human life*	Section 15.3: Social and Ethical Questions, p. 532	
* *discussing the societal impact of chemicals on fetal development, e.g., environmental contaminants such as polychlorinated biphenyls (PCBs), heavy metals, dioxins and furans.*	Thought Lab 15.1: Folic Acid and Neural Tube Defects, p. 524	Thought Lab 15.1: Analysis, p. 524

	Student Textbook	Assessment Options
Skill Outcomes		
Initiating and Planning		
30–B3.1s ask questions about observed relationships, and plan investigations of questions, ideas, problems and issues by * *designing an experiment to investigate hormonal changes during pregnancy*	e.g., Thought Lab 15.1: Folic Acid and Neural Tube Defects, p. 524	e.g., Thought Lab 15.1: Analysis, p. 524 e.g., Section 15.2 Review: 8, p. 528 e.g., Section 15.3: 5, p. 534
Performing and Recording		
30–B3.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by * investigating, using library and electronic sources, the effects of environmental factors on human embryonic and fetal development, e.g., *alcohol, cocaine, cigarette smoke, diet and prescription drugs*	Thought Lab 15.1: Folic Acid and Neural Tube Defects, p. 524	Thought Lab 15.1: Analysis, p. 524
* *investigating, using library and electronic sources, how embryonic cells communicate during development*	e.g., Connections (Social and Environmental Contexts) Stem Cells, Section 15.2, p. 527	e.g., Connections, Section 15.2, p. 527
* *researching the societal impact of technology, e.g., ultrasound, amniocentesis,* in vitro *fertilization, chorionic villi sampling.*	Section 15.3 Social and Ethical Questions, p. 532 Thought Lab 15.2: Evaluating Reproductive Technologies, p. 533	Thought Lab 15.2, Analysis, p. 533
Analyzing and Interpreting		
30–B3.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by * observing the changes during embryo development, using preserved material such as chicken embryos, prepared slides, models or computer simulations, and extrapolating these events to the development of a human	Investigation 15.A: Comparing Embryonic Structures, p. 519	Investigation 15.A: Analysis, p. 519
* evaluating, from published data, the effectiveness and safety of various reproductive technologies	Thought Lab 15.2: Evaluating Reproductive Technologies, p. 533	Thought Lab 15.2, Analysis, p. 533

	Student Textbook	Assessment Options
* interpreting hormonal data from published investigations, e.g., *pregnancy testing*	Section 14.3: The Ovarian Cycle, p. 496 The Uterine Cycle, p. 498 Aging and the Menstrual Cycle, p. 498 Thought Lab 14.2: Testosterone and Male Development, p. 494 Thought Lab 14.4: Therapy Options for Menopause, p. 495 Investigation 14.B: The Menstrual Cycle, p. 500	Thought Lab 14.2, p. 494 Thought Lab 14.4, p. 495 Investigation 14.B: Analysis, Conclusion, p. 500 Chapter 14 Review: 10, 16, p. 504 Unit 6 Review: 46–51, p. 543
* *analyzing the stages of embryo and fetal development*	Chapter 15 Launch Lab: Visualizing Early Human Development, p. 507 Investigation 15.A: Comparing Embryonic Structures, p. 519	Chapter 15 Launch Lab: Analysis, p. 507 Investigation 15.A: Analysis, p. 519
Communication and Teamwork		
30–B3.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by * developing clear and logical arguments, based on published data, to defend a given decision on the effectiveness and safety of available reproductive technologies	Thought Lab 15.2: Evaluating Reproductive Technologies, p. 533	Thought Lab 15.2, p. Analysis, 533

CHAPTER 16 CELLULAR REPRODUCTION

Curriculum Correlation

General Outcome 1: Students will describe the processes of mitosis and meiosis.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–C1.1k define and explain the significance of chromosome number in somatic and sex cells; i.e., haploidy, diploidy and polyploidy	Launch Lab: Cell Division, p. 549 Organization of Genetic Information in a Eukaryotic Cell, p. 551 Chromosome Number, p. 552 Examining Chromosomes: the Karyotype, p. 553 Investigation 16.A: Modelling a Karyotype, p. 554	Launch Lab: Analysis, p. 549 Questions for Comprehension: 5–10, p. 552 11, 12. p. 553 Investigation 16.A: Analysis, Conclusion, p. 554 Section 16.1 Review: 3–7, p. 555 Chapter 16 Review: 2, 5, 10, pp. 582–583 Chapter 16 Test Unit 7 Review: 24, 25, p. 669
30–C1.2k explain, in general terms, the events of the cell cycle, i.e., interphase, chromosomal behaviour in mitosis and cytokinesis	Stages of the Cell Cycle, p. 550 Phases of Mitosis, p. 556 Cytokinesis, p. 558 Mitosis and Cytokinesis in Plant Cells, p. 558 Regulation of the Cell Cycle, p. 560 Investigation 16.B: Observing the Cell Cycle in Plant and Animal Cells, p. 559	Questions for Comprehension: 13, 14, p. 555 15, 16, p. 556 17, 18, p. 558 19, p. 559 Investigation 16.B: Analysis, Conclusion, p. 560 Section 16.1 Review: 3, 6, p. 555 Section 16.2 Review: 1–7, p. 561 Chapter 16 Review: 1, 3, 4, 8, 17, 24, 25, 28, pp. 582–583 Chapter 16 Test
30–C1.3k describe the processes of spermatogenesis and oogenesis and the reduction of chromosomal number in meiosis	The Formation of Gametes, p. 563 Phases of Meiosis, p. 563 Gamete Formation in Animals, p. 568	Questions for Comprehension: 20–22, p. 563 Section 16.3 Review: 1–5, 6 (b-d), 7, 9, 10, p. 572 Chapter 16 Review: 5, 6, 11, 14, 15, 19, pp. 582–583 Chapter 16 Test
30–C1.4k compare the processes of mitosis and meiosis	Investigation 16.C: Modelling to Compare Meiosis and Mitosis, p. 568	Investigation 16.C, p. 568 Chapter 16 Review: 6, 7, 15, pp. 582–583 Chapter 16 Test
30–C1.5k describe the processes of nondisjunction and crossing over and evaluate their significance to organism inheritance and development	Crossing Over, p. 566 Nondisjunction, p. 567 Thought Lab 16.1: Nondisjunction Syndromes, p. 567	Questions for Comprehension: 25, p. 566 26, p. 568 Thought Lab 16.1: Analysis, p. 567 Section 16.3 Review: 6 (a), p. 572 Chapter 16 Review: 13, 20, 26, pp. 582–583 Chapter 16 Test

	Student Textbook	Assessment Options
30–C1.6k compare the formation of fraternal and identical offspring in a single birthing event	Cell Division and the Conception of Twins, p. 570	Questions for Comprehension: 30, p. 571 Section 16.3 Review: 8, p. 572 Chapter 16 Test
30–C1.7k describe the diversity of reproductive strategies by comparing the alternation of generations in a range of organisms; e.g., *protists*, Daphnia, *sea anemone, moss, pine*	Throughout Section 16.4, pp. 573–580 Thought Lab 16.2: Comparing Reproductive Strategies, p. 579	Questions for Comprehension: 31, p. 573 32, 33, p. 574 34–36, p. 575 37, p. 577 Thought Lab 16.2: Analysis, p. 579 Section 16.4 Review: 1–9, p. 580 Chapter 16 Review: 12, 14, 21–23, 27, pp. 582–583 Chapter 16 Test
Outcomes for Science, Technology, and Society (emphasis on social and environmental contexts)		
30–C1.1sts explain that science and technology are developed to meet societal needs and expand human capability by ■ *discussing the role of mitosis and biotechnology in regenerating damaged or missing parts of organisms, e.g., stem cells*	The Reproduction of Somatic Cells, p. 556 Connections—Nature of Science: Regenerating the Sense of Hearing, p. 562	Connections—Nature of Science: 1, 2, p. 562
■ *evaluating how a knowledge of cell division or development of nanotechnology might be applied to the regulation of cancerous growth in plants or animals*		Section 16.2 Review: 5, p. 561 Chapter 16 Review: 17, 26, 28, p. 583 Unit 7 Review: 26, 27, p. 669
■ *discussing and assessing the impact of research in plant and animal reproduction on our understanding of mitosis and meiosis in humans, e.g., cloning, chromosome shortening*	The Reproduction of Somatic Cells, p. 556 Connections—Nature of Science: Regenerating the Sense of Hearing, p. 562	Connections—Nature of Science: 1, 2, p. 562 Chapter 16 Review: 17, 27, p. 583
■ *discussing the types and sources of teratogenic compounds found in the environment and the technological means by which they can be removed or controlled to ensure quality of life for future generations*		Section 16.4 Review: 9, p. 580
Skill Outcomes (Focus on problem solving)		
Initiating and Planning		
30–C1.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ *defining questions related to mitosis and meiosis, e.g., chromosome shortening, conditions/stimuli for meiosis, aging and mitosis, cytokinesis*	Launch Lab: Cell Division, p. 549	Launch Lab: Analysis, p. 549

	Student Textbook	Assessment Options
Performing and Recording		
30–C1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ performing a simulation to demonstrate the behavior of chromosomes during mitosis	Investigation 16.C: Modelling to Compare Meiosis and Mitosis, p. 568	Investigation 16.C: p. 568 Chapter 16 Review: 17, p. 583
■ using a microscope and prepared slides of onion root tip cells to identify the stages of a cell cycle and calculate the duration of each stage	Investigation 16.B: Observing the Cell Cycle in Plant and Animal Cells, p. 559	Investigation 16.B: Analysis, Conclusion, p. 560
■ researching a range of reproductive strategies in organisms and presenting them in the form of charts, tables or diagrams, e.g., *alternation of generation showing sexual and asexual phases such as budding, spore production, binary fission*	Investigation 16.B: Observing the Cell Cycle in Plant and Animal Cells, p. 559 Thought Lab 16.2: Comparing Reproductive Strategies, p. 579	Investigation 16.B: Analysis, Conclusion, p. 560 Thought Lab 16.2: Analysis, p. 579
■ *preparing microscope slides to demonstrate some stages of mitosis and meiosis*	Investigation 16.B: Observing the Cell Cycle in Plant and Animal Cells, p. 559	Investigation 16.B: Analysis, Conclusion, p. 560
Analyzing and Interpreting		
30–C1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ preparing and interpreting models of human karyotypes	Investigation 16.A: Modelling a Karyotype, p. 554	Investigation 16.A: Analysis, Conclusion, p. 554 Section 16.3 Review: p. 572 Unit 7 Review: 25, p. 669
■ *analyzing the similarities and differences of cell division in plants and animals*	Investigation 16.B: Observing the Cell Cycle in Plant and Animal Cells, p. 559 Thought Lab 16.1: Nondisjunction Syndromes, p. 567	Investigation 16.B: Analysis, Conclusion, p. 560 Thought Lab 16.1: Analysis, p. 567 Section 16.4 Review: 5–7, p. 580
Communication and Teamwork		
30–C1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively with team members in the preparation of mitosis slides*	Investigation 16.B: Observing the Cell Cycle in Plant and Animal Cells, p. 559	Investigation 16.B: Analysis, Conclusion, p. 560
■ presenting two contrasting reproductive strategies, emphasizing the differences	Thought Lab 16.2: Comparing Reproductive Strategies, p. 579	Thought Lab 16.2: Analysis, p. 579

CHAPTER 17 PATTERNS AND PROCESSES IN INHERITANCE

Curriculum Correlation

General Outcome 2: Students will explain the basic rules and processes associated with the transmission of genetic characteristics.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–C2.1k describe the evidence for segregation and the independent assortment of genes on different chromosomes, as investigated by Mendel	Section 17.1: Early Theories of Inheritance, p. 586 Developing a Theory of Inheritance: Gregor Mendel's Experiments, p. 587 The Law of Segregation, p. 588 The Law of Independent Assortment, p. 591 Investigation 17.1: Testing the Law of Segregation, p. 592	Questions for Comprehension: 1, 2, p. 587 3, 4, p. 588 5, p. 589 Investigation 17.1, p. 592–593 Section 17.1 Review: 4, p. 598 Chapter 17 Review: 2, p. 620 Chapter 17 Test Unit 7 Review, 4, p. 668
30–C2.2k compare ratios and probabilities of genotypes and phenotypes for dominant/recessive alleles, multiple alleles and incompletely dominant or codominant alleles	Section 17.1: Dominant and Recessive Genes, p. 589 Representing Genetic Crosses, p. 589 Analyzing Genetic Crosses, p. 590 Test Cross, p. 591 The Law of Independent Assortment, p. 591 Incomplete Dominance and Co-dominance, p. 594 Objections to Sutton's Theory, p. 596	Questions for Comprehension: 6–9, p. 590 10–12, p. 593 13–16, p. 595 17, p. 596 Practice Problems: 1, 2, p. 591 3–7, p. 596 Section 17.1 Review: 1, 5–11, p. 598 Chapter 17 Review: 3–10, 14–16, 18, 19, p. 620–621 Chapter 17 Test Unit 7 Review: 5, 10–14, p. 668
30–C2.3k explain the limitations of variability due to gene linkage and the influence of crossing over on assortment of genes on the same chromosome	Section 17.2: Linked Genes and Chromosome Maps, p. 599 Crossing Over and Inheritance, p. 599 Sex-Linked Inheritance, p. 601 Thought Lab 17.1: Mapping Chromosomes, p. 602	Questions for Comprehension: 18, 19, p. 601 Practice Problems 8–10, p. 603 Thought Lab 17.1, p. 602 Section 17.2 Review: 1, p. 609 Chapter 17 Test Unit 7 Review: 7, p. 668
30–C2.4k explain the relationship between variability and the number of genes controlling a trait, e.g., *one pair of genes, as for Rh factor, versus two or more pairs of genes, as for skin colour, height*	Section 17.2: Multiple Alleles, p. 604 Polygenic Inheritance, p. 605 Genes and the Environment, p. 609	Questions for Comprehension: 25, p. 605 26, 27, p. 609 Practice Problems: 11–17, p. 606 Section 17.2 Review: 5, p. 609 Chapter 17 Test

	Student Textbook	Assessment Options
30–C2.5k compare the pattern of inheritance produced by genes on the sex chromosomes to that of genes on autosomes, as investigated by Morgan and others	Section 17.1: Crossing Over and Inheritance, p. 595 Section 17.2: Extending Mendel's Laws, p. 599 Chromosome Mapping, p. 600 Sex-Linked Inheritance, p. 601 Section 17.3: Human Genetics, p. 611 Analyzing a Human Pedigree, p. 611 Autosomal Dominant Inheritance, p. 612 Sex-Linked Traits, p. 613 Thought Lab 17.2: Creating a Pedigree, p. 615 Thought Lab 17.3: Analyzing Pedigrees, p. 617	Questions for Comprehension: 18–21, p. 601 Practice Problems: 18–21, p. 615 Thought Lab 17.2: Analysis, p. 615 Thought Lab 17.3: Analyze, p. 617 Section 17.3 Review: 3–4, p. 617 Chapter 17 Test
Outcomes for Science, Technology, and Society (Emphasis on social and environmental contexts)		
30–C2.1sts explain that decisions regarding the application of scientific and technological development involve a variety of perspectives including social by ■ *evaluating the needs and interests of society and the role of genetic counselling and technology in the identification and treatment of potentially disabling genetic disorders*	Section 17.3: Human Genetic Analysis, p. 614 Connections: Social and Environment Contexts: Biobanks, p. 618	Connections: Social and Environment Contexts, p. 618 Section 17.3 Review: 5, p. 617 Chapter 17 Review: 22, 23, p. 621 Unit 7 Review: 35, 39, 42, 44, 45, p. 670–671
■ *discussing the application of genetic crosses in the development of specific breeds or hybrids*	Section 17.3: Breeding Plants, p. 610 Breeding Animals, p. 611	Questions for Comprehension: 29, p. 611 Section 17.3 Review: 1–2, p. 617 Chapter 17 Review: 12, 14, 18, 19, 25, p. 620–621 Unit 7 Review: 31, 33, p. 670
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
30–C2.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by [bullet] designing a plan for collecting data to demonstrate human inheritance	Thought Lab 17.2: Creating a Pedigree, p. 615	Thought Lab 17.2: Analysis, p. 615
Performing and Recording		
30–C2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ performing an experiment to demonstrate inheritance of a trait controlled by a single pair of genes, e.g., *albino corn*, Brassica (*Wisconsin fast plant*), Drosophila *or* Arabidopsis ■ designing and performing an experiment to demonstrate that an environmental factor can cause a change in the expression of genetic information in an organism	Investigation 17.A: Testing the Law of Segregation, p. 592 Investigation 17.B: Environmental Influences on Gene Expression, p. 608	Investigation 17.A: Analysis, Conclusions p. 592–593 Investigation 17.B: Analysis, Conclusions Extensions, p. 608

	Student Textbook	Assessment Options
Analyzing and Interpreting		
30–C2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ interpreting patterns and trends in data by predicting, quantitatively, the probability of inheritance from monohybrid, dihybrid and sex-linked inheritance by	Launch Lab: Coin Toss, p. 585 Investigation 17.A: Testing the Law of Segregation, p. 592	Launch Lab: Analysis, p. 585 Practice Problems: 9, 10, p. 603 11–13, p. 606 Investigation 17.A: Analysis, Conclusions p. 592–593 Section 17.1 Review: 5, p. 598 Chapter 17: 8–17, p. 620
■ using Punnett squares, interpret patterns and trends in data associated with monohybrid, dihybrid and sex-linked patterns of inheritance	Investigation 17.A: Testing the Law of Segregation, p. 592	Investigation 17.A: Analysis, Conclusions p. 592–593 Practice Problems 9, 10, p. 603 11–13, p. 606 Section 17.2 Review: 2, 3, 5, p. 609 Chapter 17 Review: 5, p. 620 Unit 7 Review: 14, 31, p. 668–670
■ performing, recording and explaining predicted phenotypic ratios versus actual counts in genetic crosses to show a relationship between chance and genetic results	Investigation 17.A: Testing the Law of Segregation, p. 592	Practice Problems: 3–7, p. 596 Investigation 17.A, p. 592–593 Section 17.1 Review 5–9, p. 598 Chapter 17 Review: 2, p. 620 Unit 7 Review: 10–12, 14, p. 668
■ drawing and interpreting pedigree charts from data on human single-allele and multiple-allele inheritance patterns, e.g., *hemophilia, blood types* ■ analyzing crossover data for a single pair of chromosomes to create a chromosome map showing gene arrangement and relative distance	Thought Lab 17.2: Creating a Pedigree, p. 615 Thought Lab 17.3: Analyzing Pedigrees, p. 617 Section 17.1: Analyzing Genetic Crosses, p. 590 Section 17.2: Linked Genes and Chromosome Maps, p. 599 Crossing Over and Inheritance, p. 599 Thought Lab 17.1: Mapping Chromosomes, p. 602	Practice Problems: 18–21, p. 615 Thought Lab 17.2: Analysis, p. 615 Thought Lab 17.3: Analyze, p. 617 Section 17.3 Review: 3, p. 617 Chapter 17 Review: 31, p. 621 Unit 7 Review: 28–30, p. 669–670 Practice Problems: 1, 2, p. 591 Thought Lab 17.1, p. 602 Section 17.1 Review: 6–9, p. 598 Chapter 17 Review: 20, p. 621
■ *providing a concluding statement on assortment of linked genes*	Section 17.1: Summary, p. 597–598 Section 17.2: Linked Genes and Chromosome Maps, p. 599	Section 17.2 Review: 1, p. 609 Chapter 7 Review: 7, p. 620 Unit 7 Review: 9, p. 668

	Student Textbook	Assessment Options
■ *identifying limitations of data associated with phenotypic ratios for small populations in which the ratios may not conform with the theoretical ratios expected*	Thought Lab 17.1: Mapping Chromosomes, Part A, p. 602	Thought Lab 17.1, Part A, p. 602 Section 17.1: 7–9, 11, p. 598 Section 17.2: 4, p. 609 Chapter 17 Review: 16, p. 620 Unit 7 Review: 31, p. 670
Communication and Teamwork		
30–C2.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively with team members to investigate a monohybrid cross, e.g., tongue rolling, attached ear lobes and solve problems as they arise*	Thought Lab 17.2: Creating a Pedigree, p. 615	Thought Lab 17.2: Analysis, p. 615 Chapter 7 Review: 23, p. 621 e.g., Unit 7 Review: 37–39, 45, 48

CHAPTER 18 MOLECULAR GENETICS

Curriculum Correlation

General Outcome 3: Students will explain classical genetics at the molecular level.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–C3.1k summarize the historical events that led to the discovery of the structure of the DNA molecule, as described by Watson and Crick	Section 18.1: Isolating the Material of Heredity, p. 624 The Transforming Principle, p. 624 Hershey and Chase: Evidence in Favour of DNA as the Hereditary Material, p. 624 The Structure of DNA, p. 626 The Chemical Composition of DNA, p. 626 The Three-Dimensional Structure of DNA, p. 627 The Double Helix Structure of DNA, p. 628	Questions for Comprehension: 1–3, p. 625 4, p. 629 Section 18.1 Review: 1, 2, 5, p. 635 Chapter 18 Review: 1, 2, p. 664 Chapter 18 Test Unit 7 Review: 42, p. 671
30–C3.2k describe, in general, how genetic information is contained in the sequence of bases in DNA molecules in chromosomes; how the DNA molecules replicate themselves; and how the genetic information is transcribed into sequences of bases in RNA molecules and is finally translated into sequences of amino acids in proteins	Section 18.1: RNA, p. 629 Genes and the Genome, p. 629 DNA Replication, p. 630 Semi-Conservative Replication, p. 630 Initiation, p. 630 Elongation and Transmission, p. 631 Throughout Section 18.2, pp. 636–642 Thought Lab 18.1: DNA Deductions, p. 629 Investigation 18.A: Modelling DNA Structure and Replication, p. 634 Thought Lab 18.2: Transcription in Reverse, p. 639 Investigation 18.B: Simulating Protein Synthesis, p. 641	Questions for Comprehension: 6, p. 630 7–10, p. 632 13, 14, p. 637 15, 16, p. 640 Practice Problems: 3–5, p. 637 6, 7, p. 638 Thought Lab 18.1: Analysis, p. 629 Investigation 18.A: Analysis, p. 634 Thought Lab 18.2: Analysis, p. 639 Investigation 18.B: Analysis, Conclusion, p. 641 Section 18.1 Review: 6–9, p. 635 Section 18.2 Review: 1–10, p. 642 Chapter 18 Review: 3–10, 16, 17, 21, 23, pp. 664–665 Chapter 18 Test Unit 7 Review: 15–18, 43, 48, pp. 669–67
30–C3.3k explain, in general, how restriction enzymes cut DNA molecules into smaller fragments and how ligases reassemble them	Section 18.3: Restriction Endonucleases and DNA Ligases, p. 648 Investigation 18.A: Modelling DNA Structure and Replication, p. 634	Questions for Comprehension: 23, p. 649 Investigation 18.A: Analysis, p. 634 Section 18.3 Review: 5, p. 651 Chapter 18 Review: 12–13, p. 664 Chapter 18 Test Unit 7 Review: 19, 22, 27, p. 669

	Student Textbook	Assessment Options
30–C3.4k explain, in general, how cells may be transformed by inserting new DNA sequences into their genomes	Section 18.3: Recombinant DNA, p. 647 Sorting and Analyzing DNA, p. 649 Thought Lab 18.4: Recreating the First Chimera, p. 649 Section 18.4 Gathering and Managing Genetic Information, p. 652	Questions for Comprehension: 23, p. 649 Thought Lab 18.4: Analysis, p. 649 Section 18.3 Review: 6, 7, p. 651 Chapter 18 Review: 12, 13, 19, 20, pp. 664–665 Chapter 18 Test Unit 7 Review: 19, 22, 39, 43–47, pp. 669–671
30–C3.5k explain how a random change (mutation) in the sequence of bases provides a source of genetic variability	Section 18.3: Types of Mutations, p. 643 Causes of Mutations, p. 644 Physical Mutagens, p. 645 Chemical Mutagens, p. 645 Mutations and Genetic Variation, p. 645	Questions for Comprehension: 17–19, p. 644 20, p. 645 Section 18.3 Review: 1–4, 6, p. 651 Chapter 18 Review: 11, 26, pp. 664–665 Chapter 18 Test Unit 7 Review: 9 (a), 21, 37, 38, pp. 668–670
30–C3.6k explain how information in nucleic acids contained in the nucleus, mitochondria and chloroplasts gives evidence for the relationships among organisms of different species	Section 18.3: Tracing Ancestry Through Mitochondrial DNA, p. 646 Genetic Variation Within Species, p. 647 Thought Lab 18.3: Investigating Cancer Genes, p. 646	Questions for Comprehension: 21, 22, p. 647 Thought Lab 18.3: Analysis, p. 646 Chapter 18 Review: 22, p. 665 Chapter 18 Test Unit 7 Review: 47, p. 671
Outcomes for Science, Technology, and Society (Emphasis on social and environmental contexts)		
30–C3.1sts explain that science and technology have both intended and unintended consequences for humans and the environment by ■ *discussing the implications for society of corporations being able to patent genes, e.g., gene for Roundup resistance in canola*	Section 18.4: Gathering and Managing Genetic Information, p. 652 Public Benefits of Genetic Research, p. 653 Ownership of Genetic Information, p. 653 Patenting Organisms and Genes, p. 653 Assessing the Risks, p. 657 e.g., Connections: Social and Environmental Contexts: Biotechnology: Assessing Unintended Consequences, p. 662	Connections: Social and Environmental Contexts, p. 662 Section 18.4 Review: 3, 4, p. 661 Chapter 18 Review: 24, 26, 28, p. 665 Unit 7 Review: 44–46, 48, p. 671
■ *assessing the concerns and benefits of genetically modified organisms, e.g., transgenic food organisms, tree cloning for reforestation*	Section 18.4: Public Benefits of Genetic Research, p. 653 Ownership of Genetic Information, p. 653 Biotechnology Products, p. 654 Medicinal Bacteria, p. 654 Transgenic Plants, p. 655 Cloned and Transgenic Animals, p. 655 Assessing the Risks, p. 657 Connections: Social and Environmental Contexts: Biotechnology: Assessing Unintended Consequences, p. 662	Questions for Comprehension: 27, 28, p. 658 Connections: Social and Environmental Contexts, 1, 2, p. 662 Section 18.4 Review: 3, 4, p. 661 Chapter 18 Review: 24, 27, p. 665 Unit 7 Review: 39, 45, 46, 48, pp. 670–671

	Student Textbook	Assessment Options
30–C3.2sts explain that scientific research and technological development help achieve a sustainable society, economy and environment by ■ *discussing the Human Genome Project and the potential of proteomic technologies, in terms of the needs, interests and financial support of society*	Section 18.2: Genomics and Proteomics, p. 640 Section 18.4: Assessing the Risks, p. 657 Connections: Social and Environmental Contexts: Biotechnology: Assessing Unintended Consequences, p. 662 Career Focus: Ask a Cancer Geneticist, p. 666	Questions for Comprehension: 27, 28, p. 658 Connections: Social and Environmental Contexts, 1, 2, p. 662 Section 18.4 Review: 1, p. 661 Chapter 18 Review: 21, 24, p. 665 Unit 7 Review: 43, e.g., 46, p. 671
■ *discussing biotechnology and gene replacement therapy in the treatment of human genetic disorders*	Section 18.4: Medicinal Bacteria, p. 654 The Diagnosis and Treatment of Genetic Disorders, p. 658 Prenatal Diagnosis and Screening, p. 658 Treating Human Genetic Disorders, p. 660	Questions for Comprehension: 27, 28, p. 658 Chapter 18 Review: 28, p. 665 Unit 7 Review: 35, e.g., 44, pp. 670–671
■ *assessing the impact and value of DNA sequencing on the study of genetic relationships and variations in population ecology*	Section 18.4: The Diagnosis and Treatment of Genetic Disorders, p. 658 Treating Human Genetic Diseases, p. 660	Questions for Comprehension: 29, p. 660 Section 18.4 Review: 1, p. 661 Unit 7 Review: 48, p. 671
■ *exploring the application of nanotechnology and its implications for clinical diagnostics, pharmacology, biological research or proteomic programs.*	Section 18.4: Gathering and Managing Genetic Information, p. 652 The Diagnosis and Treatment of Genetic Disorders, p. 658 Prenatal Diagnosis and Screening, p. 658 Treating Human Genetic Disorders, p. 660 Career Focus: Ask a Cancer Geneticist, p. 666	Questions for Comprehension: 24–26, p. 653 29, p. 660 Section 18.4 Review: 2, 5–7, p. 661 Chapter 18 Review: 15, 25, 28, pp. 664–665 Unit 7 Review: 19, 42, 44, 46, 48, pp. 669–671
Skill Outcomes (Focus on problem solving)		
Initiating and Planning		
30–C3.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues, e.g., by ■ *designing an experiment to identify the proteins produced in a cell at a particular point in time or development, e.g., microarrays*	Investigation 18.A: Modelling DNA Structure and Replication, p. 634 Thought Lab 18.4: Recreating the First Chimera, p. 649 Section 18.4: Gathering and Managing Genetic Information, p. 652 Public Benefits of Genetic Research, p. 653	Investigation 18.A, Analysis, p. 634 Thought Lab 18.4, Analysis, p. 649 Chapter 18 Review: 20, p. 665
Performing and Recording		
30–C3.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ constructing models of DNA to demonstrate the general structure and base arrangement	Launch Lab: DNA Extraction, p. 623 Thought Lab 18.1: DNA Deductions, p. 629 Investigation 18.A: Modelling DNA Structure and Replication, p. 634 Thought Lab 18.2: Transcription in Reverse, p. 639	Launch Lab: Analysis, p. 623 Thought Lab 18.1: Analysis, p. 629 Investigation 18.A: Analysis, p. 634 Thought Lab 18.2: Analysis, p. 639
■ performing simulations to demonstrate the replication of DNA and the transcription and translation of its information	Thought Lab 18.2: Transcription in Reverse, p. 639 Investigation 18.B: Simulating Protein Synthesis, p. 641	Thought Lab 18.2: Analysis, p. 639 Investigation 18.B: Analysis, Conclusion, p. 641

	Student Textbook	Assessment Options
■ performing simulations to demonstrate the use of restriction enzymes and ligases	Thought Lab 18.4: Recreating the First Chimera, p. 649	Thought Lab 18.4: Analysis, p. 649
■ *performing an investigation to extract DNA from cells, e.g., green peas or beans, bananas or onions*	Launch Lab: DNA Extraction, p. 623	Launch Lab: Analysis, p. 623
■ *researching gel electrophoresis techniques and their applications in medical diagnostics and forensics*	Section 18.3: Recombinant DNA, p. 647 Sorting and Analyzing DNA, p. 649	Chapter 18 Review: 19, p. 665 Unit 7 Review: 23, p. 669
Analyzing and Interpreting		
30–C3.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ analyzing relationships, from published data, between human activities and changes in genetic information that lead to heritable mutations and cancer	Thought Lab 18.1: DNA Deductions, p. 629 Thought Lab 18.3: Investigating Cancer Genes, p. 646	Thought Lab 18.1: Analysis, p. 629 Thought Lab 18.3: Analysis, p. 646 Section 18.3 Review: 3, p. 651 Unit 7 Review: 38, p. 670
■ *analyzing DNA fingerprints*	Thought Lab 18.5: Reading a DNA Fingerprint, p. 651	Thought Lab 18.5: Analysis, p. 651 Chapter 18 Review: 23, p, 665 Unit 7 Review: 36, p. 670
Communication and Teamwork		
30–C3.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *working cooperatively with team members to investigate the impact of an environmental factor on the expression of a gene and solving problems as they arise*	Investigation 18.A: Modelling DNA Structure and Replication, p. 634 Investigation 18.B: Simulating Protein Synthesis, p. 641 Thought Lab 18.3: Investigating Cancer Genes, p. 646	Investigation 18.A: Analysis, p. 634 Investigation 18.B: Analysis, Conclusion p. 641 Thought Lab 18.3: Analysis, p. 646

CHAPTER 19 GENETIC DIVERSITY IN POPULATIONS

Curriculum Correlation

General Outcome 1: Students will describe a community as a composite of populations in which individuals contribute to a gene pool that can change over time.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–D1.1k describe the Hardy–Weinberg Principle and explain its importance to population gene-pool stability and the significance of non-equilibrium values	Launch Lab: Pick Your Plumage, p. 675 Throughout Section 19.1, p. 676–686	Launch Lab: Analysis, p. 675 Questions for Comprehension: 1, 2, p. 678 Section 19.1 Review: 1, 2, p. 686 Chapter 19 Test
30–D1.2k describe the factors that cause the gene pool diversity to change, i.e., genetic drift, gene flow, non-random mating, bottleneck effect, migration, mutation	Throughout Section 19.2, p. 687–695 Thought Lab 19.1: The Spirit Bear, p. 690 Thought Lab 19.2: Maintaining Genetic Diversity in the Whooping Crane, p. 694	Questions for Comprehension: 8, p. 687 9–11, p. 689 12, 13, p. 691 14–17, p. 692 18, 19, p. 693 20, p. 694 Thought Lab 19.1: Analysis, p. 690 Thought Lab 19.2: Analysis, Extensions, p. 694 Section 19.2 Review: 1–8, p. 695 Chapter 19 Review: 1, 7–8, 15–17, 20, p. 698–699 Chapter 19 Test Unit 8 Review: 3, 5–9, p. 742
30–D1.3k apply quantitatively, the Hardy–Weinberg Principle to observed and published data ■ $p + q = 1$ ■ $p^2 + 2pq + q^2 = 1$	Section 19.1: Introducing the Hardy-Weinberg Principle, p. 678 Minding p and q, p. 682 Expanding the Hardy-Weinberg Equation, p. 683 Investigation 19.A: Applying the Hardy-Weinberg Equation, p. 682 Investigation 19.B: Testing the Hardy-Weinberg Principle, p. 684 Thought Lab 19.1: The Spirit Bear, p. 690	Questions for Comprehension: 3–5, p. 680 6, p. 682 7, p. 683 Practice Problems: 1–5, p. 679 Investigation 19.A: Analysis, Conclusions, p. 682 Investigation 19.B: Analysis, Conclusions, p. 684 Thought Lab 19.1: Analysis, p. 690 Section 19.1 Review: 1–7, p. 686 Chapter 19 Review: 1–6, 10–14, p. 698–699 Chapter 19 Test Unit 8 Review: 1–5, 19–25, 31, p. 742–744
30–D1.4k describe the molecular basis of gene-pool change and the significance of these changes over time, i.e., mutations and natural selection, *e.g., drug-resistant bacteria, herbicide resistant plants*	Section 19.1: The Hardy-Weinberg Principle, p, 676 Expanding the Hardy-Weinberg Equation, p. 683 Section 19.2: Mutations, p. 687 Natural Selection, p. 693 Human Activities and Genetic Diversity, p. 693 Connections—Social and Environmental Contexts: Biotechnology and Gene Pools, p. 696	Questions for Comprehension: 7, p. 681 18, p. 691 19, 20, p. 692 Connections—Social and Environmental Contexts, 1–4, p. 696 Chapter 19 Review: 19, 20, p. 699 Chapter 19 Test Unit 8 Review: 8–10, p. 742

	Student Textbook	Assessment Options
Outcomes for Science, Technology, and Society (Emphasis on social and environmental contexts)		
30–D1.1sts explain that science and technology have both intended and unintended consequences for humans and the environment by ■ *discussing the introduction of exotic species into new ecosystems*	Connections—Social and Environmental Contexts: Biotechnology and Gene Pools, p. 696	Connections—Social and Environmental Contexts, p. 696
■ *discussing the development of ecological reserves to preserve gene-pool diversity*	Thought Lab 19.2: Maintaining Genetic Diversity in the Whooping Crane, p. 694	Thought Lab 19.2: Analysis, Extensions, p. 694
■ *assessing the bottleneck effect characteristic of small populations and strategies to counteract it, e.g., Whooping crane, Swift fox*	Thought Lab 19.2: Maintaining Genetic Diversity in the Whooping Crane, p. 694	Questions for Comprehension: 17, p. 692 Thought Lab 19.2: Analysis, Extensions, p. 694
■ *investigating the role of gene banks in the preservation of endangered species and genotypes, particularly of plants and animals used in agriculture*	Thought Lab 19.2: Maintaining Genetic Diversity in the Whooping Crane, p. 694 e.g., Connections—Social and Environmental Contexts: Biotechnology and Gene Pools, p. 696	Thought Lab 19.2: Analysis, Extensions, p. 694 e.g., Connections—Social and Environmental Contexts, p. 696
■ *assessing habitat loss and the responsibility of society to protect the environment for future generations*	Section 19.2: Human Activities and Genetic Diversity, p. 693	Questions for Comprehension: 20, p. 694 Unit 8 Review: 16, 33, 34, p. 743–745
30–D1.2sts explain how concepts, models and theories are often used in interpreting and explaining phenomena by ■ *assessing the role and importance of models in ecology in explaining scientific phenomena, e.g., Hardy–Weinberg Principle.*	Investigation 19.A: Applying the Hardy-Weinberg Equation, p. 682 Investigation 19.B: Testing the Hardy-Weinberg Principle, p. 684 Thought Lab 19.1: The Spirit Bear, p. 690 Thought Lab 19.2: Maintaining Genetic Diversity in the Whooping Crane, p. 694	Investigation 19.A: Analysis, Conclusions, p. 682 Investigation 19.B: Analysis, Conclusions, p. 684 Thought Lab 19.1: Analysis, p. 690 Thought Lab 19.2: Analysis, Extensions, p. 694
Skill Outcomes (Focus on scientific inquiry)		
Initiating and Planning		
30–D1.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ *identifying a question about the resistance of bacteria to specific antibiotics or plants to specific herbicides*	Section 19.2: Mutations, p. 685 e.g., Thought Lab 19.2: Maintaining Genetic Diversity in the Whooping Crane, p. 692 e.g., Connections—Social and Environmental Contexts: Biotechnology and Gene Pools, p. 696	e.g., Thought Lab 19.2, p. 692 e.g., Connections—Social and Environmental Contexts, p. 696
Performing and Recording		
30–D1.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ *designing and performing an investigation and/or computer simulation to demonstrate population growth and gene-pool change*	Thought Lab 19.2: Maintaining Genetic Diversity in the Whooping Crane, p. 694	Thought Lab 19.2: Analysis, Extensions, p. 694
■ researching, integrating and synthesizing information on a related topic, e.g., *–the development and persistence of deleterious genes in gene pools* *–development of bacterial resistance to antibiotics*	e.g., Thought Lab 19.2: Maintaining Genetic Diversity in the Whooping Crane, p. 692 e.g., Connections—Social and Environmental Contexts: Biotechnology and Gene Pools, p. 696	e.g., Thought Lab 19.2, p. 692 e.g., Connections—Social and Environmental Contexts, p. 696

	Student Textbook	Assessment Options
Analyzing and Interpreting		
30–D1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ *calculating and interpreting problem-solving exercises involving the Hardy–Weinberg Principle*	Investigation 19.A: Applying the Hardy-Weinberg Equation, p. 682 Investigation 19.B: Testing the Hardy-Weinberg Principle, p. 684	Practice Problems: 1–5, p. 681 Section 19.1 Review: 1–7, p. 686 Investigation 19.A: Analysis, Conclusions, p. 682 Investigation 19.B: Analysis, Conclusions, p. 684 Chapter 19 Review: 2–6, 10–14, 18, p. 699 Unit 8 Review: 1, 2, 19–25, 31, p. 742–743
Communication and Teamwork		
30–D1.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *using appropriate notation to show gene frequency and changes in gene frequency over time*	Investigation 19.A: Applying the Hardy-Weinberg Equation, p. 682 Investigation 19.B: Testing the Hardy-Weinberg Principle, p. 684	Investigation 19.A: Analysis, Conclusions, p. 682 Investigation 19.B: Analysis, Conclusions, p. 684

CHAPTER 20 POPULATION GROWTH AND INTERACTIONS

Curriculum Correlation

General Outcome 2: Students will explain the interaction of individuals in populations with each other and members of other populations.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–D2.1k describe the basis of species interactions and symbiotic relationships and their influences on population changes, i.e., ■ predator-prey and producer-consumer relationships	Section 20.2: Producer-Consumer Interactions, p. 717 Defences Against Consumers, p. 720	Questions for Comprehension: 19, 20, p. 720 21, 22, p. 721 Section 20.2 Review: 2, p. 728 Chapter 20 Review: 11,12, p. 738 Chapter 20 Test
■ symbiotic relationships: commensalism, mutualism and parasitism	Launch Lab: Reproductive Strategies and Population Growth, p. 701 Section 20.2: Symbiotic Relationships, p. 721 Mutualism, p. 721 Commensalism, p.722 Parasitism, p. 722	Launch Lab, p. 701 Questions for Comprehension: 23–26, p. 723 Section 20.2 Review: 4, p. 728 Chapter 20 Review: 6, 18, p. 738 Chapter 20 Test
■ interspecific and intraspecific competition	Section 20.2: Intraspecific Competition, p. 715 Interspecific Competition, p. 716 Investigation 20.A: Interspecific and Intraspecific Competition Among Seedlings, p. 722 Thought Lab 20.4: Biological Control or Damage Control? p. 722	Questions for Comprehension: 16–18, p. 717 Investigation 20.A: Analysis, Conclusions p. 718–719 Thought Lab 20. 4: Analysis, Extension, p. 730 Section 20.2 Review: 1, 3, p. 728 Chapter 20 Review: 2, 10, p. 738 Chapter 20 Test Unit 8 Review: 4, 15, p. 742–743
30–D2.2k explain the role of defense mechanisms in predation and competition, e.g., *mimicry, protective coloration, toxins, behaviour*	Section 20.2 Defences Against Consumers, p. 720	Questions for Comprehension: 21, 22, p.721 Section 20.2 Review: 2, 3, p. 728 Chapter 20 Test Unit 8 Review: 14, 15, p. 743
30–D2.3k explain how mixtures of populations that define communities may change over time or remain as a climax community, i.e., primary succession, secondary succession.	Section 20.2: Succession: Community Change over Time, p. 723 Disturbing Events, p. 724 Investigation 20.B: Celebrate the Small Successions, p. 725 Thought Lab 20.3: Testing the Classical Model of Succession, p. 727	Questions for Comprehension: 27, 28, p. 726 Investigation 20.B: Analysis, Conclusions, p. 725 Thought Lab 20.3: Analysis, Extension, p. 727 Section 20.2 Review: 5, 6, p. 728 Chapter 20 Review: 20, p. 739 Chapter 20 Test Unit 8 Review: 17, 33, p. 745

	Student Textbook	Assessment Options
Outcomes for Science, Technology, and Society (Emphasis on social and environmental; contexts)		
30–D2.1sts explain why Canadian society supports scientific research and technological development that helps achieve a sustainable society, economy and environment by ■ *discussing public support of scientific work done on predator-prey relationships as part of wildlife management in national and provincial parks, e.g., introduction of wolves*	Thought Lab 20.4: Biological Control or Damage Control? p. 728 Connections—Social and Environmental Contexts: Helping Hippos and Humans, p. 735 Career Focus—Ask a Science Journalist, p. 740	Questions for Comprehension: 29, p. 729 Thought Lab 20. 4: Analysis, Extension, p. 728 Connections—Social and Environmental Contexts, p. 735 Career Focus:1–3, p. 741 Unit 8 Review: e.g., 34, p. 745
■ *assessing the long-term implications of fire control and prevention on population and ecosystem stability, diversity and productivity*	Thought Lab 20.3: Testing the Classical Model of Succession, p. 727 Connections—Social and Environmental Contexts: Helping Hippos and Humans, p. 736	Thought Lab 20.3: Analysis, Extension, p. 727 Connections—Social and Environmental Contexts, 1–4, p. 736 Unit 8 Review: e.g., 34, p. 745
■ *assessing the impact of parasites on humans and how this impact could be reduced*	Thought Lab 20.4: Biological Control or Damage Control? p. 730	Thought Lab 20. 4: Analysis, Extension, p. 730
Skill Outcomes		
Initiating and Planning		
30–D2.1s ask questions about observed relationships, and plan investigations of questions, ideas, problems and issues by ■ *planning an investigation of species interaction in a national park or wilderness area*	Investigation 20.A: Interspecific and Intraspecific Competition Among Seedlings, p. 718 Thought Lab 20.3: Testing the Classical Model of Succession, p. 727 Thought Lab 20.4: Biological Control or Damage Control? p. 730 e.g. Connections: Social and Environmental Contexts: Helping Hippos and Humans, p. 736 Career Focus: Ask a Science Journalist, p. 740	Investigation 20.A: Analysis, Conclusions p. 718–719 Thought Lab 20.3, p. 727 Thought Lab 20.4, p. 730 e.g. Connections: Social and Environmental Contexts: p. 736 Career Focus:1–3, p. 741 Unit 8 Review: e.g., 34, p. 745
Performing and Recording		
30–D2.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ designing and performing an experiment or simulation to demonstrate interspecific and intraspecific competition	Investigation 20.A: Interspecific and Intraspecific Competition Among Seedlings, p. 718 Investigation 20.B: Celebrate the Small Successions, p. 725 e.g., Thought Lab 20.3: Testing the Classical Model of Succession, p. 727	Investigation 20.A: Analysis, Conclusions p. 718–719 Investigation 20.B: Analysis, Conclusions, p. 725 e.g., Thought Lab 20.3, p. 727
■ designing and performing an experiment to demonstrate succession in a microenvironment and record its pattern of succession over time, e.g., *hay infusion*	Investigation 20.B: Celebrate the Small Successions, p. 725	Investigation 20.B: Analysis, Conclusions, p. 725
■ performing simulations to investigate relationships between predators and their prey, e.g., *computer simulation, role playing*	Section 20.2: Producer-Consumer Interactions, p. 717 Thought Lab 20.4: Biological Control or Damage Control? p. 730	Thought Lab 20.4, p. 730

	Student Textbook	Assessment Options
Analyzing and Interpreting		
30–D2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ summarizing and evaluating a symbiotic relationship	Launch Lab: Reproductive Strategies and Population Growth, p. 701 Section 20.2: Symbiotic Relationships, p. 719	Launch Lab, p. 701 Questions for Comprehension: 23, p. 721 Section 20.2 Review: 4, p. 728 Chapter 20 Review: 6, 17, p. 738 Unit 8 Review: 13, p. 742
■ *researching and analyzing clear cutting versus selective logging practices*	Section 20.2: Disturbing Events, p. 724 Thought Lab 20.3: Testing the Classical Model of Succession, p. 727	Thought Lab 20.3, p. 727 Unit 8 Review: e.g., 16, 32, p. 743–745
Communication and Teamwork		
30–D2.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *researching and presenting practical solutions for reducing the impact of highway fencing on animals in Banff and Jasper National Parks*	Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? p. 712	Thought Lab 20.2: Analysis, p. 712–713
■ *developing, presenting and defending a position on whether organisms should be deliberately introduced into new environments*	Thought Lab 20. 4: Biological Control or Damage Control? p. 730	Thought Lab 20. 4: Analysis, Extension, p. 730 Chapter 20 Review: 19, p. 739
■ *researching and presenting characteristics of interrelationships between organisms for analysis by classmates*	Thought Lab 20. 4: Biological Control or Damage Control? p. 730	Thought Lab 20. 4: Analysis, Extension, p. 730

General Outcome 3: Students will explain, in quantitative terms, the change in populations over time.

	Student Textbook	Assessment Options
Outcomes for Knowledge		
30–D3.1k describe and explain, quantitatively, factors that influence population growth, i.e., ■ mortality, natality, immigration, emigration	Section 20.1: Factors That Affect Distribution Patterns, p. 703 The Rate of Population Growth, p. 706 Section 20.3: Assessing the Significance of Population Change, p. 729 Population Age Structure, p. 731 Earth's Carrying Capacity, p. 734	Questions for Comprehension: 2, 3, p. 705 5–7, p. 707 29, p. 729 30, 31, p. 733 Practice Problems: 1–6, p. 709 Section 20.1 Review: 5, p. 714 Section 20.3 Review: 1, 3, p. 735 Chapter 20 Review: 3, 16, 17, p. 738 Chapter 20 Test
■ change in population size, ΔN = [natality (n) + immigration (i)] – [mortality (m) + emigration (e)]	Section 20.1: Factors That Affect Distribution Patterns, p. 703 The Rate of Population Growth, p. 706 Thought Lab 20.5: Population Growth Rates in Different Countries, p. 732	Practice Problems: 1–6, p. 709 Thought Lab 20.5, p. 732 Section 20.3 Review: 4, p. 735 Chapter 20 Review: 4, 5, 15, p. 738 Chapter 20 Test

	Student Textbook	Assessment Options
30–D3.2k describe the growth of populations in terms of the mathematical relationship among carrying capacity, biotic potential, environmental resistance and the number of individuals in the population, i.e., ■ growth rate, $gr = \frac{\Delta N}{\Delta t}$, where ΔN is change in number and Δt is change in time	Launch Lab: Reproductive Strategies and Population Growth, p. 701 Section 20.1: Population Growth, p. 705 The Rate of Population Growth, p. 706 Factors That Affect Population Growth, p. 707 Thought Lab 20.1: Distribution Patterns and Population Size Estimates, p. 704	Launch Lab: Analysis, p. 701 Questions for Comprehension: 4, p. 706 5–7, p. 707 8–11, p. 709 12–14, p. 710 Practice Problems: 1–3, p. 709 Thought Lab 20.1: Analysis, Extension, p. 704–705 Section 20.1 Review: 2, 7–9, p. 714 Chapter 20 Review: 5, 14, p. 738 Chapter 20 Test Unit 8 Review: 28, p. 744
■ per capita growth rate, $cgr = \frac{\Delta N}{N}$, where ΔN is the change in number over a specified time period, and N is the original number of individuals	Section 20.1: The Rate of Population Growth, p. 706 Factors That Affect Population Growth, p. 707 Biotic Potential, p. 707 Carrying Capacity, p. 709	Questions for Comprehension: 5–7, p. 707 Practice Problems: 4–6, p. 709 Section 20.3 Review: 2, p. 735 Chapter 20 Test Unit 8 Review: 26, 29, 30, p. 744
■ population density, $\Delta p = \frac{N}{A}$, or $\Delta p = \frac{N}{V}$, where N is number of individuals in a given space; i.e., area (A), or volume (V) occupied by a population	Section 20.1: Density and Distribution of Populations, p. 702 Thought Lab 20.1: Distribution Patterns and Population Size Estimates, p. 704 Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? p. 712	Questions for Comprehension: 1, p. 703 2, 3, p. 705 Thought Lab 20.1: Analysis, Extension, p. 704–705 Thought Lab 20.2: Analysis, p. 712–713 Section 20.1 Review: 1–4, p. 714 Chapter 20 Review: 9, 11, p. 738 22, p. 739 Chapter 20 Test Unit 8 Review: 12, 28–30, p. 743-744
30–D3.3k explain the different population growth patterns, i.e., ■ logistic growth pattern (S-shaped curve) and exponential growth pattern (J-shaped curve)	Launch Lab: Reproductive Strategies and Population Growth, p. 701 Section 20.1: Factors That Affect Population Growth, p. 707 Section 20.3: Population Age Structure, p. 731 Thought Lab 20.5: Population Growth Rates in Different Countries, p. 732	Launch Lab: Analysis, p. 701 Questions for Comprehension: 30, 32, p. 733 Thought Lab 20.5: Analysis, p. 732 Section 20.1 Review: 5, 8 p. 714 Section 20.3 Review: 4, p. 735 Chapter 20 Review: 13, p. 738 Chapter 20 Test Unit 8 Review: 18, 30, 35, p. 743–745
■ open and closed populations	Section 20.1: Carrying Capacity, p. 709 Section 20.3: Earth's Carrying Capacity, p. 732	Questions for Comprehension: 12, p. 710 34, p. 733 Chapter 20 Review: 21, p. 739 Chapter 20 Test Unit 8 Review: 34, p. 745
30–D3.4k describe the characteristics and reproductive strategies of *r*-selected and *K*-selected organisms	Section 20.1: Life Strategies, p. 710	Questions for Comprehension: 15, p. 711 Section 20.1 Review: 9, p. 714 Chapter 20 Review: 8, p. 738 Chapter 20 Test Unit 8 Review: 33, p. 745

	Student Textbook	Assessment Options
Outcomes for Science, Technology, and Society (Emphasis on the nature of science)		
30–D3.1sts explain how concepts, models and theories are often used in interpreting and explaining observations and in predicting future observations by ■ *developing appropriate investigative strategies for analyzing biological issues, e.g., risk/benefit analysis, cost/benefit analysis*	Section 20.3: Assessing the Significance of Population Change, p. 729 Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? p. 712 Thought Lab 20.3: Testing the Classical Model of Succession, p. 727	Questions for Comprehension: 29, p. 729 Thought Lab 20.2: Analysis, p. 712–713 Thought Lab 20.3: Analysis, Extension, p. 727 Chapter 20 Review: 19, 21, p. 739
■ *comparing the growth of the human population with that of populations of other species.*	Section 20.3: Growth of the Human Population, p. 731 Population Age Structure, p. 731 Earth's Carrying Capacity, p. 734 Thought Lab 20.5: Population Growth Rates in Different Countries, p. 732 Connections: Social and Environmental Contexts: Helping Hippos and Humans, p. 735	Thought Lab 20.5: Analysis, p. 732 Connections: Social and Environmental Contexts, p. 735 Section 20.3 Review: e.g., 3, p. 735 Unit 8 Review: e.g., 26, 34, p. 744–745
Skill Outcomes		
Initiating and Planning		
30–D3.1s ask questions about observed relationships and plan investigations of questions, ideas, problems and issues by ■ *identifying questions about factors that affect population growth rates*	Launch Lab: Reproductive Strategies and Population Growth, p. 701 Section 20.3: Growth of the Human Population, p. 731 Investigation 20.B: Celebrate the Small Successions, p. 725 Thought Lab 20.1: Distribution Patterns and Population Size Estimates, p. 704	Launch Lab: Analysis, p. 701 Investigation 20.B: Analysis, Conclusions, p. 725 Thought Lab 20.1: Analysis, Extension, p. 704–705 Section 20.1 Review: 6–8, p. 714 Section 20.3 Review: 1, p. 735 Chapter 20 Review: 21, p. 739 Unit 8 Review: 26, 35, p. 744
Performing and Recording		
30–D3.2s conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information by ■ designing and performing an experiment to demonstrate the effect of environmental factors on population growth rate	Thought Lab 20.1: Distribution Patterns and Population Size Estimates, p. 704 Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? p. 712 Investigation 20.A: Interspecific and Intraspecific Competition Among Seedlings, p. 718 Investigation 20.B: Celebrate the Small Successions, p. 725	Thought Lab 20.1: Analysis, Extension, p. 704–705 Thought Lab 20.2: Analysis, p. 712–713 Investigation 20.A, p. 718 Investigation 20.B: Analysis, Conclusions, p. 725
■ *monitoring a paramecium population over time using a microscope and a grid slide*	Investigation 20.B: Celebrate the Small Successions, p. 725	Investigation 20.B: Analysis, Conclusions, p. 725 Chapter 20 Review: 4, p. 738
■ *researching zebra mussel population growth in the Great Lakes*	Launch Lab: Reproductive Strategies and Population Growth, p. 701 Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? p. 712	Launch Lab, p. 701 Thought Lab 20.2, p. 712 Chapter 20 Review: e.g., 22, p. 739
■ *researching the impact of introduced trout species on bull trout* (Salvelinus confluentus) *in Alberta lakes and streams*	Thought Lab 20. 4: Biological Control or Damage Control? p. 730	Thought Lab 20. 4, p. 730 Chapter 20 Review: 19, p. 739

	Student Textbook	Assessment Options
Analyzing and Interpreting		
30–D3.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions by ■ graphing and interpreting population growth of *r*-selected and *K*-selected organisms	Section 20.1: Life Strategies, p. 710 Thought Lab 20.2 What Limits the Growth of Grizzly Bear Populations? p. 712	Questions for Comprehension: 15, p. 711 Practice Problems: 1–6, p. 709 Thought Lab 20.2: Analysis, p. 712–713 Section 20 Review: 8, 9, p. 714 Chapter 20 Review: 22, p. 739 Unit 8 Review: 30, p. 744
■ *comparing and assessing human population growth rates in various countries*	Section 20.3: Growth of the Human Population, p. 731 Thought Lab 20.5: Population Growth Rates in Different Countries, p. 732	Questions for Comprehension: 30, 31, p. 733 Thought Lab 20.5: Analysis, p. 732 Section 20.3 Review: 2, 4, p. 735 Chapter 20 Review: 21, p. 739 Unit 8 Review: 35, p. 745
■ *demonstrating and assessing the effect of environmental factors on population growth curves*	Section 20.3: Growth of Human Population, p. 731 Population Age Structure, p. 731	Section 20.3 Review: 3, p. 745 Chapter 20 Review: 21, p. 739 Unit 8 Review 32, 35, p. 745
■ *calculating and interpreting density, population change and per capita growth rate*	Section 20.1: Density and Distribution of Populations, p. 702 Thought Lab 20.1: Distribution Patterns and Population Size Estimates, p. 704 Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? p. 712	Thought Lab 20.1: Analysis, Extension, p. 704–705 Thought Lab 20.2: Analysis, p. 712–713 Chapter 20 Review: 22, p. 739 Unit 8 Review: 26, 28–30, p. 744
■ *calculating population growth rate under ideal conditions given specific parameters*	Thought Lab 20.1: Distribution Patterns and Population Size Estimates, p. 704 Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? p. 712 Investigation 20.A: Interspecific and Intraspecific Competition Among Seedlings, p. 718 Investigation 20.B: Celebrate the Small Successions, p. 725	Thought Lab 20.1: Analysis, Extension, p. 704–705 Thought Lab 20.2: Analysis, p. 712–713 Investigation 20.A, p. 718 Investigation 20.B: Analysis, Conclusions, p. 725
■ *stating, based on data, a generalization for the growth of a closed population*	Thought Lab 20.1: Distribution Patterns and Population Size Estimates, p. 704 Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? p. 712 Investigation 20.A: Interspecific and Intraspecific Competition Among Seedlings, p. 718 Investigation 20.B: Celebrate the Small Successions, p. 725	Thought Lab 20.1: Analysis, Extension, p. 704–705 Thought Lab 20.2: Analysis, p. 712–713 Investigation 20.A, p. 718 Investigation 20.B: Analysis, Conclusions, p. 725
Communication and Teamwork		
30–D3.4s work as members of a team in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results by ■ *developing, presenting and defending a position on Earth's carrying capacity of* Homo Sapiens	Section 20.1: Carrying Capacity, p. 709 Section 20.3: Earth's Carrying Capacity, p. 732 Connections: Social and Environmental Contexts: Helping Hippos and Humans, p. 735	Questions for Comprehension: 12, p. 710 34, p. 733 Connections: Social and Environmental Contexts, p. 735 Chapter 20 Review: 21, p. 739 Unit 8 Review: 34, p. 745