

Chapter 1: Science Practices

These maths and science practices skills activities are integrated throughout chapters 2-14 where required.

Chapter 2: Cell Specialization and Organization

Date	Duration Time / No. of periods	Activity number(s)	Notes	Lab / Practical activity	Formative or Summative Assessment
	0.5	29	Anchoring Phenomenon: Frogsicle How does the wood frog survive freezing in winter?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions? Explain two mechanisms that the wood frog uses to survive freezing.
	0.5	30	KQ: How are the cells or organisms organized so that they work together in a coordinated way? Vocab: organelle, cell, tissue, organ, organ system		
	1	31	KQ: What are the distinguishing features of living organisms, prokaryotic cells, and eukaryotic cells? Vocab: prokaryotic, eukaryotic, organelles, DNA, enzymes, cell theory		<ul style="list-style-type: none"> How do prokaryotic and eukaryotic cells differ?
	1	32	KQ: What are the important features of a light microscope, and how do you calculate the magnification of the image they produce? Vocab: microscope, light microscope, magnification, resolution	Use the equations provided to perform calculations to determine magnification and actual object size. Understand the components of a basic light microscope.	<ul style="list-style-type: none"> What is the difference between magnification and resolution? Explain why it is important to start at the lowest magnification.
	1	33	KQ: What techniques are used to prepare and view cells under a light microscope? Vocab: slide, stain, viable stain, non-viable stain	Investigation 2.1: Preparing an onion slide	<ul style="list-style-type: none"> How does using different stains build a picture of cell structure? What is the difference between a viable and non-viable stain?

	1	34	<p>KQ: What are the general and specific features of a plant cell?</p> <p>Vocab: organelle, eukaryotic cell, chloroplast, mitochondrion, vacuole, endoplasmic reticulum (ER), nucleus, ribosome, Golgi apparatus, amyloplast, cytoplasm, cellulose cell wall, plasma membrane, amyloplast</p>		<ul style="list-style-type: none"> Using the TEM images, identify organelles in a plant cell.
	1	35	<p>KQ: What are the general and specific features of animal cells? How are they different from plant cells?</p> <p>Vocab: organelle, chloroplast, mitochondrion, vacuole, ER, nucleus, ribosome, Golgi apparatus, cytoplasm, cell wall, plasma membrane, smooth ER, rough ER, lysosome, centrioles, microvilli</p>		<ul style="list-style-type: none"> Using the TEM images, identify organelles in an animal cell. Why are animal cells more irregular in shape than plant cells?
	1	36	<p>KQ: What features of cells can be identified using electron microscopes?</p> <p>Vocab: organelle</p>		<ul style="list-style-type: none"> Using the TEM images, identify organelles and describe their function
	1	37	<p>KQ: What are the key components of plasma membranes?</p> <p>Vocab: plasma membrane, fluid mosaic model, phospholipid, hydrophilic, hydrophobic, proteins, lipid layer, glycolipid, channel protein, carrier protein, glycoprotein</p>	Use the cut out model to build a three-dimensional paper model of the plasma membrane.	<ul style="list-style-type: none"> Explain how the properties of a phospholipid influence the formation of the double layer plasma membrane. What is the function / role of the plasma membrane?
	1	38	<p>KQ: What is diffusion, and what are the factors that affect the rate of diffusion of a particle from one point to another?</p> <p>Vocab: diffusion, facilitated diffusion, concentration gradient</p>	Investigation 2.2: Simple diffusion across a membrane	<ul style="list-style-type: none"> Use the model to describe the movement of glucose down its concentration gradient.
	1	39	<p>KQ: How is the movement of water affected by separating solutions containing high and low solute concentrations with a partially permeable membrane?</p> <p>Vocab: osmosis, osmotic potential, solvent, solute, solution, osmolarity, partially permeable membrane.</p>	<p>If time allows students could carry out the simple osmosis experiment themselves.</p> <p>Investigation 2.3: Estimating osmolarity</p>	<ul style="list-style-type: none"> Correctly define osmosis. Describe the role of the partially permeable membrane in the osmosis experiment described.

	1	40 17	<p>KQ: How does the surface area to volume ratio of a cell affect how substances diffuse into the cell's center?</p> <p>Vocab: diffusion, surface area, volume, surface area to volume ratio</p>	<p>Carry out calculations to determine the surface area, volume and surface area-volume ratio of cells of different sizes. Graph the results.</p>	<ul style="list-style-type: none"> Explain how the surface area to volume ratio affects diffusion in a cell.
	1	41	<p>KQ: How does the shape of a cell affect its surface area to volume ratio, and how does this affect how substances diffuse into it?</p>	<p>Investigation 2.4: How cell shapes affect diffusion</p> <p>Draw a diagram (model) to show how far the indicator has diffused into the different shaped cells.</p>	<ul style="list-style-type: none"> Use the model (drawing) produced by students to describe how cell shape influences diffusion of the indicator.
	1	42 23	<p>KQ: What is the effect of increasing temperature on the permeability of cellular membranes?</p> <p>Vocab: diffusion</p>	<p>Investigation 2.5: Effect of temperature on membrane permeability</p>	<ul style="list-style-type: none"> How did temperature affect the permeability of the beetroot cells? At the end of the investigation the absorbance of the water in the test tube was measured. What is this a measure of?
	0.5	43	<p>KQ: What is active transport, and how does it transport molecules and ions across a cellular membrane?</p> <p>Vocab: active transport, ATP, transport protein</p>		<ul style="list-style-type: none"> Why does active transport require energy to proceed? List the differences between passive transport and active transport.
	0.5	44	<p>KQ: How do ion pumps transport ions and molecules across cellular membranes?</p> <p>Vocab: active transport, ion pump, sodium-potassium pump, cotransport, carrier protein</p> <p>This activity can be provided for students wanting extension on active transport</p>		<ul style="list-style-type: none"> EXTENSION Provide a detailed summary of the mechanisms of the sodium-potassium pump and cotransport. Explain how co-transport is used to move glucose across into the
	0.5	45	<p>KQ: How does cell specialization allow plant cells to carry out specialist functions?</p> <p>Vocab: specialized cell, plant cell</p>		
	0.5	46	<p>KQ: How does cell modification allow animal cells to carry out specialist functions?</p> <p>Vocab: specialized cell, animal cell</p>		

	1	47	<p>KQ: What does DNA do in the cell, and what does it look like when extracted from the cell?</p> <p>Vocab: DNA, protein, double helix</p>	<p>Investigation 2.6: Extracting DNA</p>	
	1	48	<p>KQ: What is the structure and function of nucleotides and what are the three components that make them up?</p> <p>Vocab: DNA, RNA, nucleotide, adenine, guanine, cytosine, thymine, uracil, purine, pyrimidine, ribose sugar, deoxyribose sugar</p>		<ul style="list-style-type: none"> List the nucleotide bases found in RNA. List the nucleotide bases found in DNA.
	1	49	<p>KQ: What is the difference between DNA and RNA, and what are their functions in the cell?</p> <p>Vocab: DNA, RNA, nucleotides, 5' end, 3' end, messenger RNA, transfer RNA, ribosomal RNA</p>	Label a diagram of DNA.	
	1	50	<p>KQ: How does the base pairing rule determine the way nucleotides join together to form DNA?</p> <p>Vocab: DNA, base-pairing rule, Chargaff's rule, nucleotide, adenine, guanine, cytosine, thymine</p>	Build a paper model of DNA	<ul style="list-style-type: none"> Explain the base pairing rule. Explain Chargaff's rule. How did it help determine the structure of DNA?
	1	51	<p>KQ: What are genes? What is the relationship between genes and proteins?</p> <p>Vocab: gene, gene expression, DNA, transcription, translation, protein</p>		<ul style="list-style-type: none"> Summarize the overall process of gene expression
	0.5	52	<p>KQ: How did scientists discover which three letter triplets coded for which amino acids found in proteins?</p> <p>Vocab: genetic code, codon, triplet</p>		<ul style="list-style-type: none"> How can there be so many different kind of proteins?
	0.5	53	<p>KQ: How does the sequence of amino acids in a protein determine a protein's shape and function?</p> <p>Vocab: protein, polypeptide chain, peptide bond, R-group</p>	Use the diagram (model) on the page to understand the general structure of an amino acid.	<ul style="list-style-type: none"> Describe the basic structure of an amino acid. Explain the role of the R-group in conferring different properties to an amino acid.

	1	54	<p>KQ: How does modeling help us understand the structure of a protein?</p> <p>Vocab: primary structure, secondary structure, tertiary structure, quaternary structure, denature, hydrogen bonding, disulfide bond</p>	<p>Investigation 2.7: Modeling protein structure</p>	<ul style="list-style-type: none"> • How does denaturation affect protein structure?
	1	55	<p>KQ: What kinds of proteins are found in the body and what are their numerous roles?</p> <p>Vocab: protein function</p>	<p>Use the cut outs to match examples of proteins to their functions and pictograms.</p>	<ul style="list-style-type: none"> • What key roles do proteins have?
	0.5	56	<p>KQ: How do anabolic and catabolic reactions build or break down molecules in the body?</p> <p>Vocab: enzyme, catabolic reaction, anabolic reaction, metabolism</p>		<ul style="list-style-type: none"> • Use diagrams to explain the difference between a catabolic reaction and an anabolic reaction. Provide examples of each type of reaction.
	0.5	57	<p>KQ: What are enzymes and what role do they play in biological reactions?</p> <p>Vocab: enzyme, catalyst, active site, induced fit model</p>		<ul style="list-style-type: none"> • Explain the induced fit model of enzyme activity.
	1	58 17 & 18	<p>KQ: What conditions are optimal for enzymes, and what happens to their structure and function outside of these conditions?</p> <p>Vocab: enzyme, catalyst, optimal conditions, denature, amylase</p>	<p>Investigation 2.8: Effect of temperature on enzyme activity</p>	<ul style="list-style-type: none"> • What do enzymes do? • Is life possible without enzymes? Defend your answer.
	1	59 6, 23 & 24	<p>KQ: How does the germination stage of mung beans affect the activity of catalase, as measured by the breakdown of hydrogen peroxide?</p> <p>Vocab: enzyme, catalase</p>	<p>Use second hand data to determine the effect of germination age on catalase activity.</p>	
	1	60	<p>KQ: How do the muscular and skeletal systems work together to make the body move?</p> <p>Vocab: organ system, body system, extension, flexion, muscular system, skeletal system</p>	<p>Investigation 2.9: Forearm movements</p>	
	1	61	<p>KQ: How do the circulatory and respiratory systems interact to provide the body's tissues with oxygen and remove carbon dioxide?</p> <p>Vocab: circulatory system, respiratory system, gas exchange</p>		<ul style="list-style-type: none"> • Describe how the circulatory and respiratory systems work together to accomplish gas exchange. • How do the circulatory and respiratory systems react to exercise? Why are the changes necessary?

	1	62	<p>KQ: How do the circulatory and digestive systems interact to provide the body's tissues with nutrients?</p> <p>Vocab: circulatory system, digestive system, nutrients</p>		<ul style="list-style-type: none"> Describe how the circulatory and digestive systems work together to deliver nutrients throughout the body.
		63	<p>KQ: What are the different parts of the plant organ system?</p> <p>Vocab: organ system, shoot system, root system</p>		<ul style="list-style-type: none"> Identify the different organ systems in plants, including their components.
	1	64	<p>KQ: How do the shoot and root systems of plants interact to balance water uptake and loss, so that the plant can maintain the essential functions of life?</p> <p>Vocab: vascular bundle, phloem, xylem, gas exchange, transpiration, stomata</p>		<ul style="list-style-type: none"> Explain why it is important for plants to balance water loss and gas exchange.
	1	65	<p>Review Your Understanding Anchoring Phenomenon revisited Frogsicle</p>		<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: How does the wood frog survive freezing in winter?</p>
	1	66	<p>Summing Up</p>		<p>Summative Assessment PE HS-LS1-2, PE HS-LS1-2</p>

Chapter 3: Feedback Mechanisms

Date	Duration Time / No. of periods	Activity number(s)	Notes	Lab / Practical activity	Formative or Summative Assessment
	0.5	67	Anchoring Phenomenon: Hot Dog How do mammals manage to maintain stable conditions in their bodies, despite facing a wide range of external conditions?		<ul style="list-style-type: none"> • What do your students already know about the topic? • Are there any gaps or misconceptions? • How do you warm up or cool down?
	0.5	68	KQ: How do organisms maintain a constant internal environment despite changes in their external environment? Vocab: homeostasis, receptor, effector, control center		<ul style="list-style-type: none"> • Understand the role of receptors, effectors and a control centre in maintaining homeostasis. • Why is the analogy (model) of a heat pump a good way to explain homeostasis?
	0.5	69	KQ: How do the body's organ systems work together to maintain homeostasis? Vocab: homeostasis		<ul style="list-style-type: none"> • Can you define homeostasis? • What would happen to an organism if homeostasis was not maintained? Can you think of any examples where homeostasis is not maintained? Select an organ system and describe how it helps to support homeostasis
	1.5	70 71	KQ: How do negative feedback mechanisms detect changes in the internal environment away from normal and then act to return the internal environment to a steady state? KQ: How do positive feedback mechanisms work to amplify a physiological response in order to achieve a particular outcome? Vocab: negative feedback mechanism, positive feedback mechanism		<ul style="list-style-type: none"> • Use a table to compare and contrast negative feedback and positive feedback • Is homeostasis typically maintained by negative or positive feedback mechanisms? Explain your answer.
	0.5	72	KQ: What are the two major ways that organisms obtain heat to enable their body metabolism to function effectively? Vocab: ectotherm, endotherm		<ul style="list-style-type: none"> • Describe the differences between ectotherms and endotherms. • What is an advantage and a disadvantage of ectothermy? • What is an advantage and a disadvantage of endothermy?

	1.5	73	<p>KQ: How does the process of thermoregulation function in both endotherms and ectotherms?</p> <p>Vocab: thermoregulation, homeotherm, poikilotherm</p>	<p>Investigation 3.1: Exploring insulation</p>	<ul style="list-style-type: none"> Define thermoregulation. Explain the differences in body temperature between homeotherms and poikilotherms.
	0.5	74	<p>KQ: What role does the hypothalamus play in regulating body temperature in humans?</p>		<ul style="list-style-type: none"> What type of feedback mechanism controls thermoregulation in humans?
	1.5	75 17 & 18	<p>KQ: How does body shape influence how quickly heat is lost from the body's surface?</p>	<p>Investigation 3.2: Investigating body shape and temperature regulation</p>	
	1	76	<p>KQ: How is a constant blood glucose level maintained in the body?</p> <p>Vocab: diabetes mellitus, Type 1 diabetes, insulin, glucagon, blood sugar</p>		<ul style="list-style-type: none"> What type of feedback mechanism controls blood glucose (sugar) levels. Why are insulin and glucagon antagonistic hormones?
	1	77	<p>KQ: What is type 2 diabetes, and how does it differ from type 1 diabetes?</p> <p>Vocab: Type 2 diabetes</p>		<ul style="list-style-type: none"> Make a chart to compare Type 1 and Type 2 diabetes?
	1	78	<p>KQ: How do the circulatory and respiratory systems function to maintain homeostasis during exercise?</p> <p>Vocab: circulatory system, respiratory system</p>		<ul style="list-style-type: none"> Describe how blood flow patterns change in response to exercise. How do the circulatory and respiratory systems respond to exercise to maintain homeostasis?
	1	79 17 & 18	<p>KQ: What effect does exercise have on breathing and heart rate?</p>	<p>Investigation 3.3: Investigating effect of exercise on heart rate</p> <p>Inv 3.4: Investigating effect of exercise on breathing rate</p>	<p>PE HS-LS1-3</p>
	0.5	80	<p>KQ: How does the process of transpiration help maintain water homeostasis in plants?</p> <p>Vocab: water balance, transpiration, stomata</p>		<ul style="list-style-type: none"> What is transpiration? Draw a simple diagram to show the role of the stomata in increasing/decreasing transpiration losses.
	2	81 16 - 18	<p>KQ: What effects do physical factors in the environment, such as humidity, temperature, light level, and air movement, have on transpiration rate in plants?</p> <p>Vocab: transpiration rate, potometer</p>	<p>Investigation 3.5: Investigating plant transpiration</p>	<ul style="list-style-type: none"> How do different physical factors affect transpiration rate in plants? does the rate of transpiration respond to different physical factors to maintain homeostasis?

	1	82	Review Your Understanding Anchoring Phenomenon revisited Hot Dog		Can students fully explain the Key Question for the chapter anchoring phenomenon: How do mammals manage to maintain stable conditions in their bodies, despite facing a wide range of external conditions?
	1	83	Summing Up		Summative Assessment

Chapter 4: Growth and Development

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	1	84	Anchoring Phenomenon: The Power to Rebuild How can the axolotl have such superpowers of regeneration, with the ability to regrow amputated limbs, damaged spinal cords, and even parts of its brain?		<ul style="list-style-type: none"> • What do your students already know about the topic? • Are there any gaps or misconceptions? • Have you ever scraped your knee? How did it heal? • What is so extraordinary about the axolotl?
	1	85	KQ: How do multicellular organisms develop from a single cell to produce genetically identical copies? Vocab: mitosis, cell division, zygote		<ul style="list-style-type: none"> • How are growth and development different?
	0.5	86	KQ: How is the DNA in a cell copied before mitosis can take place? Vocab: replication, semi-conservative, chromosome, anti-parallel,		<ul style="list-style-type: none"> • Explain what makes DNA replication semi-conservative.
	0.5	87	KQ: How does DNA unwind for replication happen and what enzymes are involved? Vocab: base pair, replication fork, parent strand, daughter strand, enzymes		<ul style="list-style-type: none"> • Describe the stages of DNA replication. • What role do enzymes play in DNA replication?
	1	88	KQ: How do we know that DNA replication is semi-conservative? Vocab: semi conservative, Meselson and Stahl, heavy DNA, light DNA, isotope	Model semi-conservative replication	<ul style="list-style-type: none"> • How did Meselson and Stahls experiments prove that DNA replication is semi-conservative?
	0.5	89	KQ: What are the three primary functions of mitosis? Vocab: mitosis, cell division, growth, repair, asexual reproduction		<ul style="list-style-type: none"> • Describe the three main purposes of mitosis.
	1	90	KQ: What are the phases of the eukaryotic cell cycle, and what specific cellular events occur in each phase? Vocab: cell cycle, interphase, G1, S, G2, cytokinesis		<ul style="list-style-type: none"> • Describe the stages of the cell cycle, and the primary activities at each stage. • Describe what happens to the nuclear material and nuclear membrane during mitosis.

	1	91	<p>KQ: Mitosis is an important part of the eukaryotic cell cycle in which the replicated chromosomes are separated and the cell divides, producing two new cells.</p> <p>Vocab: 2N, somatic cells, meristem</p>		<ul style="list-style-type: none"> • Use a model to explain why daughter cells produced by mitosis are identical to the parent cell. • Describe cytokinesis.
	1	92	<p>KQ: What happens in the different stages of mitosis leading up to the formation of two daughter cells, and is it different for plant and animal cells?</p> <p>Vocab: prophase, metaphase, anaphase, telophase, centrosomes, spindle, cleavage furrow, cell plate</p>		<ul style="list-style-type: none"> • Use a model describe what occurs in each stage of mitosis.
	1.5	93	<p>KQ: How can I model the stages of mitosis to help to visualize and understand the process?</p>	Investigation 4.1: Modeling mitosis	<ul style="list-style-type: none"> • Make a model to show the correct sequence and stages of mitosis.
	2	94	<p>KQ: How do many different cell types arise during development of the embryo?</p> <p>Vocab: cellular differentiation, stem cells</p>		<ul style="list-style-type: none"> • What is a stem cell? • How can the zygote give rise to some many different cell types?
		95	<p>KQ: How do stem cells, which are undifferentiated, develop into many different cell types, and how do related cell types come together to form tissues such as blood</p> <p>Vocab: totipotent, pluripotent, multipotent</p>		<ul style="list-style-type: none"> • Can stem cells become ANY kind of cell? Explain.
	1	96	<p>KQ: How do different tissue types work together to meet the body's needs efficiently?</p> <p>Vocab: tissue</p>		<ul style="list-style-type: none"> • What are the four kinds of tissues? What is the function of each tissue type?
	1	97	<p>Review Your Understanding Anchoring Phenomenon revisited The Power to Rebuild</p>		<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: How can the axolotl have such superpowers of regeneration, with the ability to regrow amputated limbs, damaged spinal cords, and even parts of its brain?</p>
	1	98 5	Summing Up		<p>Summative Assessment PE HS-LS1-4</p>

Chapter 5: Energy in Living Systems

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	1	99	Anchoring Phenomenon: Mouse Trap Under what conditions can an animal survive in a sealed system?		<ul style="list-style-type: none"> • What do your students already know about the topic? • Are there any gaps or misconceptions? • What did Joseph Priestley's experiments show?
	0.5	100	KQ: How does the ATP produced from cellular respiration provide the energy needed to perform essential life functions? Vocab: cellular respiration, mitochondrion, adenosine triphosphate (ATP)		<ul style="list-style-type: none"> • Where does the energy for metabolism come from? • How is ATP utilized by organisms?
	0.5	101	KQ: How does hydrolysis of the phosphate group in ATP release energy which can be used by the cell? Vocab: adenosine triphosphate (ATP), adenosine diphosphate (ADP) hydrolysis		<ul style="list-style-type: none"> • Use models to understand the structure of ATP. • How does ATP provide energy to the cell?
	1	102	KQ: How does photosynthesis convert sunlight, carbon dioxide, and water into glucose and oxygen? Vocab: photosynthesis, chloroplast, chlorophyll, carbon fixation, light-dependent phase (LDP), light-independent phase (LID)		<ul style="list-style-type: none"> • Where does photosynthesis occur? • Use models and word equations to explain photosynthesis. • Use models and word equations to construct a chemical equation for photosynthesis.
	0.5	103	KQ: How does the structure of a chloroplast relate to its photosynthetic function? Vocab: chloroplast, thylakoid, grana (granum), stroma, chlorophyll		<ul style="list-style-type: none"> • Identify the structures of a chloroplast and relate them to the process of photosynthesis.

	0.5	104	<p>KQ: What are the two main reactions in photosynthesis?</p> <p>Vocab: light-dependent phase (LDP), light-independent phase (LID) triose phosphate</p>		<ul style="list-style-type: none"> Describe the light dependent and light independent phases of photosynthesis. Identify the location where each occurs. What is the importance of triose phosphate? <p>Summative assessment PE HS-LS1-5</p>
	1	105 17, 18 & 23	<p>KQ: How does light intensity affect photosynthesis rate?</p>	<p>Investigation 5.1: Measuring bubble production in <i>Cabomba</i></p>	<p>Summative Assessment PE HS-LS1-5</p>
	0.5	106	<p>KQ: How do living organisms use glucose to produce a wide range of other molecules?</p> <p>Vocab: glucose, isotopes, isomers</p>		<ul style="list-style-type: none"> Describe three ways that glucose may be used. <p>Summative Assessment PE HS-LS1-6</p>
	0.5	107	<p>KQ: How is the stored energy in glucose used to power the chemical reactions which occur in living organisms?</p> <p>Vocab: heterotrophs, photosynthesis, cellular respiration, glucose</p>		<ul style="list-style-type: none"> Explain how the energy stored in glucose used to provide the energy for cellular respiration. <p>Summative Assessment PE HS-LS1-5</p>
	1	108	<p>KQ: How is energy released from glucose during the process of cellular respiration?</p> <p>Vocab: cellular respiration, glycolysis, Kreb’s cycle, electron transport chain, aerobic respiration, lactic acid fermentation, alcoholic fermentation, anaerobic respiration</p>		<ul style="list-style-type: none"> Compare the different pathways for ATP production and account for the differences in ATP yield for each. <p>Summative Assessment PE HS-LS1-7</p>
	1	109	<p>KQ: How does aerobic cellular respiration convert the chemical energy in glucose into usable energy (ATP), carbon dioxide, and water?</p> <p>Vocab: glycolysis, krebs cycle, electron transport system (ETS), cristae, carbohydrate, mitochondrion</p>		<ul style="list-style-type: none"> Use a model to describe the location and steps of cellular respiration. <p>Summative Assessment PE HS-LS1-7</p>
	1	110	<p>KQ: How can a respirometer be used to measure the rate of cellular respiration in germinating seeds?</p> <p>Vocab: respirometer</p>	<p>Investigation 5.2: Measuring respiration in germinating seeds</p>	<ul style="list-style-type: none"> What evidence is there that germinating seeds are carrying cellular respiration?

	1	111	Review Your Understanding Anchoring Phenomenon revisited Mouse Trap		Can students fully explain the Key Question for the chapter anchoring phenomenon: Under what conditions can an animal survive in a sealed system?
	1	112	Summing Up	Investigation 5.3: Modeling photosynthesis and cellular respiration.	Summative Assessment PE HS-LS1-5, PE HS-LS1-7

Chapter 6: Interdependence in Ecosystems

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	0.5	113	Anchoring Phenomenon: A Plague of Mice What causes explosive population growth?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions? What is a plague?
	0.5	114	KQ: What are the components of an ecosystem? How are these components linked through nutrient cycles and energy flow? Vocab: ecosystem, biotic factor, abiotic factor		<ul style="list-style-type: none"> Distinguish between abiotic and biotic factors. Provide examples of each.
	0.5	115	KQ: How do we define habitat? How does the tolerance range of an organism determine Vocab: habitat, tolerance range	Calculate population density for several packs of dingoes and determine a correlation between density and habitat	<ul style="list-style-type: none"> Use a model to explain the relationship between tolerance range and a species distribution in its habitat.
	0.5	116	KQ: What is an organism's niche? How is it influenced by interactions with other species? Vocab: ecological niche (fundamental and realized), competition		<ul style="list-style-type: none"> Distinguish between fundamental and realized niche.
	1	117	KQ: How does the amount of resources in a habitat influence an organism's population density?		<ul style="list-style-type: none"> Describe the realized niche for one of the packs of dingoes
	1	118	KQ: What are population density and population distribution? Why do these vary between different species of organisms? Vocab: population distribution (random, clumped / aggregated, uniform), mutualism, parasitism, predation, herbivory, competition		<ul style="list-style-type: none"> Distinguish between population density and population distribution. Use models to explain random, clumped, and uniform distribution patterns.
	1	119	KQ: How do interactions such as predation, competition, and parasitism between species influence the size and distribution of their populations? Vocab: mutualism, parasitism, predation, herbivory, competition		<ul style="list-style-type: none"> List and describe the types of interactions between species.

	0.5	120	<p>KQ: Why does competition within and between species occur?</p> <p>Vocab: competition, interspecific competition, intraspecific competition</p>		<ul style="list-style-type: none"> Define competition
	1	121	<p>KQ: Why does intraspecific competition occur? How does intraspecific competition regulate population size?</p> <p>Vocab: intraspecific competition, territory, home range</p>		<ul style="list-style-type: none"> How does intraspecific competition limit population size? Provide examples of intraspecific competition. What is the difference between a home range and a territory?
	1	122	<p>KQ: Why does interspecific competition occur, and how does it affect the species involved?</p> <p>Vocab: interspecific competition</p>		<ul style="list-style-type: none"> Why is interspecific competition less intense than intraspecific competition? How has the introduction of the American gray squirrel affected the distribution of the European red squirrel in the UK?
	0.5	123	<p>KQ: How can competition between species with similar resources be reduced?</p> <p>Vocab: interspecific competition</p>		<ul style="list-style-type: none"> Provide an example to explain how species in the same habitat reduce interspecific competition.
	1	124	<p>KQ: Are the populations of predators and prey related and how do they change over time?</p>	Plot interacting predator and prey populations on the same graph	<ul style="list-style-type: none"> Use models (graphs) to explain the relationship between predator and prey numbers.
	0.5	125	<p>KQ: What does the carrying capacity of an environment mean, and what environmental factors affect an environment's carrying capacity?</p> <p>Vocab: carrying capacity, limiting factors, density dependent factors, density independent factors</p>		<ul style="list-style-type: none"> What is the relationship between limiting factors and carrying capacity?
	0.5	126	<p>KQ: How does the environment influence predator-prey interactions?</p>		
	2	127 17 & 18	<p>KQ: How does competition for resources limit population growth?</p>	Investigation 6.1: Investigating Carrying Capacity	Summative Assessment PE HS-LS2-1, PE HS-LS2-2
	0.5	128	<p>KQ: How is home range size influenced by the resources offered by the ecosystem?</p> <p>Vocab: home range</p>		

	2	129	<p>KQ: What happens if there are no limits to populations growth? Why does this not normally happen?</p> <p>Vocab: population growth, exponential growth, logistic growth,</p>	<p>Investigation 6.2: Creating a model of logistic growth</p>	<p>Summative Assessment PE HS-LS2-1, PE HS-LS2-2</p>
	1	130 8 & 17	<p>KQ: How does a microbial population grow over time? Can growth be modeled or the population predicted?</p> <p>Vocab: exponential growth</p>		<ul style="list-style-type: none"> • What is binary fission?
	1	131 9 & 17	<p>KQ: How is a spectrophotometer used to measure the growth of microbial populations over time?</p> <p>Vocab: spectrophotometer</p>		<ul style="list-style-type: none"> • How do nutrient levels affect bacterial growth?
	1.5	132	<p>KQ: How does changing the starting position of populations affect the way a population grows?</p>	<p>Investigation 6.3: Density independent growth</p> <p>Investigation 6.4: Density dependent growth</p> <p>Investigation 6.5: Density dependent growth</p>	<p>Summative Assessment PE HS-LS2-1, PE HS-LS2-2</p>
	0.5	133	<p>KQ: How do populations fluctuate when a predator is dependent on a single prey species?</p>		<ul style="list-style-type: none"> • Describe the relationship between the number of lynx and the number of hares.
	1	134	<p>Review Your Understanding Anchoring Phenomenon revisited A Plague of Mice</p>		<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: What causes explosive population growth?</p>
	1	135	<p>Summing Up</p>		<p>Covered elsewhere in the chapter</p>

Chapter 7: Energy Flow and Nutrient Cycles

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	0.5	136	Anchoring Phenomenon: Eat or be Eaten How did energy and matter move through ecosystems when dinosaurs were the dominant species?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions? Use a model to show how energy moved through the ecosystems when dinosaurs roamed the Earth.
	0.5	137	KQ: Where does the energy needed for essential life processes come from? Vocab: photosynthesis, cellular respiration		<ul style="list-style-type: none"> What is the ultimate source of energy in ecosystems?
	1	138	KQ: What are the differences in how matter cycles through aerobic systems and through anaerobic systems? Vocab: aerobic, anaerobic		<ul style="list-style-type: none"> How are aerobic and anaerobic systems different? <p>Summative Assessment PE HS-LS2-3</p>
	0.5	139	KQ: How do producers (autotrophs) make their own food? Vocab: producer, autotroph, photosynthesis		<ul style="list-style-type: none"> How do matter and energy move differently through an ecosystem?
	0.5	140	KQ: How do consumers (heterotrophs) obtain their food? Vocab: consumer, heterotroph, decomposer, herbivore, omnivore, carnivore, detritivore		<ul style="list-style-type: none"> Distinguish between different types of heterotrophs. How do producers and consumers differ in how they obtain food (energy).
	0.5	141	KQ: How do food chains model the feeding relationships between organisms? Vocab: food chain, trophic level, producer, consumer		<ul style="list-style-type: none"> In a food chain, what does the direction of the arrow indicate? What are trophic levels? Why do food chains typically have a maximum of six links?
	1	142	KQ: How can we show the complex feeding relationships between all the organisms in a community? Vocab: food web		<ul style="list-style-type: none"> What does a food web show?

	1.5	143	<p>KQ: How can we use information from food chains to construct a food web?</p> <p>Vocab: trophic level, food chain, food web</p>	Given the information provided, transcribe multiple food chains and a food web	<ul style="list-style-type: none"> Compare and contrast food chains and food webs.
	0.5	144	<p>KQ: What is the difference in energy inputs and outputs in producers and consumers?</p> <p>Vocab: gross primary production, net primary production</p>		<ul style="list-style-type: none"> What are the possible destinations of “lost” energy?
	1	145	<p>KQ: How does energy flow through an ecosystem?</p> <p>Vocab: trophic level, trophic efficiency, ten percent rule</p>		<ul style="list-style-type: none"> Use the ten percent rule to explain why all the energy available in one trophic level is not available to the organisms in the next level. <p>Summative Assessment PE HS-LS2-4</p>
	1	146	<p>KQ: How can the number of organisms, amount of energy, or amount of biomass at each trophic level be represented in an ecosystem?</p> <p>Vocab: pyramid of numbers, pyramid of biomass, pyramid of energy</p>		<ul style="list-style-type: none"> A pyramid of numbers <i>may</i> have an inverted shape. Is it possible for a pyramid of biomass to have an inverted shape? Explain. <p>Summative Assessment PE HS-LS2-4</p>
	1	147	<p>KQ: What patterns do we see in ecological pyramids of real-world examples?</p>	Investigation. 7.1: Exploring biomass pyramids	
	1	148	<p>KQ: How does matter cycle through the biotic and abiotic compartments of Earth's ecosystems?</p> <p>Vocab: biogeochemical cycle, nutrient cycle</p>		<ul style="list-style-type: none"> Identify the spheres matter passes through in a generalized biogeochemical cycle.
		149	<p>KQ: What processes cycle water around the biosphere, atmosphere, hydrosphere, and geosphere?</p> <p>Vocab: water cycle (hydrologic cycle), evaporation, transpiration, condensation, precipitation, infiltration, percolation</p>		<ul style="list-style-type: none"> Draw and label a water cycle.
	1	150	<p>KQ: How does carbon cycle between the atmosphere, biosphere, geosphere, and hydrosphere?</p> <p>Vocab: carbon cycle, sink, photosynthesis, respiration, combustion, decomposition, coal formation, mineralization, dissolving</p>		<ul style="list-style-type: none"> What form is carbon... <ul style="list-style-type: none"> in the atmosphere? in living organisms? in non-living “geologic” deposits? <p>Summative Assessment PE HS-LS2-5</p>

	1.5	151	KQ: How can a simple model be used to represent the carbon cycle?	Investigation 7.2: A model of the carbon cycle	Summative Assessment PE HS-LS2-5
	1.5	152	KQ: How does oxygen cycle through an ecosystem? Vocab: oxygen cycle		<ul style="list-style-type: none"> Name 2 biologic processes that move oxygen. Name 2 chemical or geologic processes that move oxygen.
		153	KQ: What role do the processes of photosynthesis and respiration play in carbon cycling? Vocab: oxygen		<ul style="list-style-type: none"> What is the relationship between photosynthesis and cellular respiration in the carbon cycle? <p>Summative Assessment PE HS-LS2-5</p>
	1	154	KQ: How is nitrogen conserved as it moves through an ecosystem? Vocab: nitrogen fixation, legumes, denitrification, ammonia (NH ₃), nitrates (-NO ₃ ⁻), nitrites (-NO ₂ ⁻)		<ul style="list-style-type: none"> Why is nitrogen fixation so important?
	1	155	Review Your Understanding Anchoring Phenomenon revisited Eat or be Eaten		Can students fully explain the Key Question for the chapter anchoring phenomenon: How did energy and matter move through ecosystems when dinosaurs were the dominant species?
	1	156	Summing Up		Summative Assessment PE HS-LS2-4

Chapter 8: The Dynamic Ecosystem

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	0.5	157	Anchoring Phenomenon: A Mammoth Task How could bringing back the mammoth help restore a lost ecosystem?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions?
	1	158	KQ: How do ecosystems respond to short-term and cyclical changes, but remain relatively stable in the long term? Vocab: ecosystem, ecosystem dynamics, ecosystem stability		<ul style="list-style-type: none"> Distinguish between ecosystem stability and ecosystem dynamics
	0.5	159	KQ: How is the resilience of a ecosystem affected by its biodiversity, health, and the frequency with which it is disturbed? Vocab: ecosystem resilience, disturbance		<ul style="list-style-type: none"> Why is it important to understand the resilience of an ecosystem?
	0.5	160	KQ: How are resilient ecosystems able to recover from moderate fluctuations? Vocab: ecosystem resilience		<ul style="list-style-type: none"> What is the relationship between the balsam fir and spruce budworm?
	1	161	KQ: What are keystone species? Vocab: keystone species		<ul style="list-style-type: none"> Explain the significance of a keystone species.
	1	162	KQ: Can there be such severe disturbances to ecosystems that they never return to their original state? Vocab: Mount St Helens		<ul style="list-style-type: none"> Is the northern flank of Mt St Helens likely to become reforested? Explain
	1	163	KQ: What effects will the long term warming of the Earth's atmosphere have on sea levels and land temperatures? Vocab: climate change, anthropogenic climate change		<ul style="list-style-type: none"> Describe the effect of sea level rising on the Florida Everglades.

	2	164	<p>KQ: What impact does human activity, either deliberate or accidental, have on ecosystems?</p> <p>Vocab: persistent, biomagnification</p>	<p>Investigation 8.1: Pathways for toxins in food webs</p>	<ul style="list-style-type: none"> Explain why the herring gull eggs have such high levels of DDE. <p>Summative Assessment PE HS-LS2-7</p>
	1	165	<p>KQ: What effects do damming have on ecosystems?</p> <p>Vocab: dam</p>		<ul style="list-style-type: none"> Use a pyramid diagram to explain the impact of a dam. What effect has damming had on the Colorado River?
	1	166	<p>KQ: What impact do alien species have on ecosystems into which they are brought, either as introduced or invasive species?</p> <p>Vocab: alien species, invasive species</p>		<ul style="list-style-type: none"> Identify an invasive species in your area. What affect has it had on the ecosystem?
	2	167	<p>KQ: What is the impact of unsustainable fishing on fish stocks?</p> <p>Vocab: overfishing, ghost fishing</p>	<p>Investigation 8.2: A model of human impacts on fish stocks</p>	<p>Summative Assessment PE HS-LS2-7</p>
	1	168	<p>KQ: Could fish farming be a solution to overfishing?</p> <p>Vocab: overfishing</p>		<p>Summative Assessment PE HS-LS2-7</p>
	1	169	<p>KQ: How does deforestation impact species survival?</p> <p>Vocab: deforestation</p>		<p>Summative Assessment PE HS-LS2-7</p>
	1	170	<p>Vocab: conservation, biodiversity</p>		<p>Summative Assessment PE HS-LS2-7, PE HS-ETS1-3</p>
	1	171	<p>Review Your Understanding Anchoring Phenomenon revisited A Mammoth Task</p>		<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: How could bringing back the mammoth help restore a lost ecosystem?</p> <p>Summative Assessment PE HS-LS2-6</p>
	1	172	<p>Summing Up</p>		<p>Summative Assessment PE HS-LS2-6</p>

Chapter 9: Social Behavior

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	1	173	Anchoring Phenomenon: Internet or Anternet? What is the purpose of social group behavior?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions?
	0.5	174	KQ: What are the advantages and disadvantages of different types of animal social groupings? Vocab: social groups, solitary animal, social group, non-social group		<ul style="list-style-type: none"> Compare and contrast the benefits of living in a social group versus living alone
	0.5	175	KQ: How do schooling, flocking, and herding enhance survival? Vocab: school, flock, herd		<ul style="list-style-type: none"> What protective advantages do schooling, flocking, and herding provide the individual?
	1	176	KQ: Why do animals migrate? Vocab: migration, V formation		<ul style="list-style-type: none"> Is migration a <i>social</i> activity? Explain. Summative Assessment PE HS-LS2-8
	0.5	177	KQ: How are social groups organized? Vocab: social groups, eusocial, presocial		<ul style="list-style-type: none"> What is the difference between eusocial and presocial groups?
	0.5	178	KQ: How can social behavioral adaptations in animals improve survival? Vocab: kin selection, altruism		Summative Assessment PE HS-LS2-8
	0.5	179	KQ: What are some examples of cooperative behavior? Vocab: kin selection, altruism, cooperative behavior		<ul style="list-style-type: none"> Describe an example of cooperative behavior between species.
	0.5	180	KQ: How is cooperative defense used to enhance the survival of individuals in a group? Vocab: cooperative defense		<ul style="list-style-type: none"> What are the benefits of cooperative attack?
		181 17 & 18	KQ: How can working together in attack help increase the chance of success? Vocab: cooperative attack		<ul style="list-style-type: none"> What are the benefits of cooperative defense?

		182	<p>KQ: How can cooperative behavior increase the chances of obtaining enough food?</p> <p>Vocab: cooperative food gathering</p>		<ul style="list-style-type: none"> Share one example of how animals use cooperative behavior to obtain food. <p>Are the</p>
	1	183	<p>Review Your Understanding</p> <p>Anchoring Phenomenon revisited</p> <p>Internet or Anترنت?</p>		<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: What is the purpose of social group behavior?</p>
	1	184 17 &18	<p>Summing Up</p>		<p>Summative Assessment</p> <p>PE HS-LS2-8</p>

Chapter 10: Inheritance of Traits

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	1	185	Anchoring Phenomenon: Stand Out From the Crowd What is albinism, and how common is it?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions? What environmental conditions are more likely to affect an albino organism than one with typical pigmentation?
	1	186	KQ: What are genes and what are they made of? Vocab: chromatin, chromosome, gene, histone protein, nucleosome		<ul style="list-style-type: none"> How is DNA able to fit into a cell?
	1	187	KQ: How do we know that DNA is the heritable material responsible for the characteristics we see in organisms? Vocab: RNase, Protease, DNase, phage,		Summative Assessment PE HS-LS3-1
	0.5	188	KQ: Does the way in which DNA is packed affect gene expression? Vocab: gene expression, histone modification, DNA methylation		<ul style="list-style-type: none"> Does DNA methylation alter the sequence of DNA? Explain.
	0.5	189	KQ: How are primary mRNA molecules modified in the nucleus before being translated into proteins, and how are proteins modified after translation? Vocab: post-transcriptional modification, post translational modification		<ul style="list-style-type: none"> Produce a table or diagram to compare the differences between post-transcriptional modification and post translational modification.
	1	190	KQ: How much of an organism's DNA actually codes for protein, and what is the function of the non protein-coding DNA? Vocab: intron, exon, splicing		<ul style="list-style-type: none"> What is the role, if any, of non-coding DNA?
	1	191	KQ: How do variations in the way genes are expressed cause significant differences between cells or organisms, even if their DNA is identical? Vocab: gene expression		

	1	192	Review Your Understanding Anchoring Phenomenon revisited Stand Out From the Crowd		Can students fully explain the Key Question for the chapter anchoring phenomenon: What is albinism, and how common is it?
	1	193	Summing Up		Covered elsewhere in the chapter.

Chapter 10: Variation of Traits

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	1	194	Anchoring Phenomenon: Stand Out From the Crowd Anyone for Chocolate?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions? How can two black Labrador dogs produce puppies of different colors?
	0.5	195	KQ: What are traits, and how are they inherited and passed from one generation to the next? Vocab: trait, gene, Gregor Mendel		<ul style="list-style-type: none"> HOW are traits passed through a family?
	0.5	196	KQ: What are alleles, and what determines whether a trait will be passed to an organism's offspring? Vocab: allele, trait, homologous chromosome, heterozygous, homozygous, dominant, recessive		<ul style="list-style-type: none"> Draw diagrams to illustrate homologous chromosomes that are: 1) homozygous recessive, 2) homozygous dominant, and 3) heterozygous
	0.5	197	KQ: Why is variation in a population or species important, and what strategies do both sexually and asexually reproducing species have to increase variation? Vocab: variation, phenotype, sexual reproduction, asexual reproduction		<ul style="list-style-type: none"> Why is phenotypic variation important? Contrast variation produced by sexual reproduction and asexual reproduction.
	0.5	198	KQ: What are some of the ways in which variation arises? Vocab: mutations, sexual reproduction, phenotype, environmental factors		Summative Assessment PE HS-LS3-2
	1	199 8 & 24	KQ: What is continuous and discontinuous variation, and what is the difference between quantitative and qualitative traits? Vocab: quantitative trait, qualitative trait	Investigation 11.1: Phenotypic variation in your class	<ul style="list-style-type: none"> Why should the data be graphed in a histogram?

	0.5	200	<p>KQ: What is meiosis, and how does it produce haploid cells for the purposes of sexual reproduction?</p> <p>Vocab: meiosis, , crossing over, variation</p>		<ul style="list-style-type: none"> How does meiosis contribute to variation?
	1.5	201	<p>KQ: What are the important ways of introducing variation into the gametes formed during meiosis?</p> <p>Vocab: independent assortment, crossing over, recombination</p>		<p>Summative Assessment PE HS-LS3-2</p>
	1	202	<p>KQ: How is variation introduced into the gametes formed during meiosis?</p> <p>Vocab: meiosis</p>	<p>Investigation 11.2: Modelling meiosis using popsicle sticks</p>	<ul style="list-style-type: none"> Do the “children” produced have the same genotype and phenotype as the parents? Explain.
	1	203	<p>KQ: What are mutations, and why are they the ultimate source of new alleles, and therefore genetic variation?</p> <p>Vocab: mutation, insertion mutation, substitution mutation, deletion mutation, allele</p>		<p>Summative Assessment PE HS-LS3-2</p>
	1	204	<p>KQ: What types of effects are caused by mutations, and are they always harmful?</p> <p>Vocab: harmful mutation, beneficial mutation, silent mutation.</p>		<ul style="list-style-type: none"> Are mutations helpful or harmful? Explain.
	1.5	205	<p>KQ: How does resistance to antibiotics arise, and how do antibiotic resistant bacteria pass this resistance on to the next generation and to other populations?</p> <p>Vocab: antibiotic resistance</p>	<p>Investigation 11.3: Modeling antibiotic resistance</p>	<ul style="list-style-type: none"> What are the benefits of antibiotic resistance to bacteria?
	1	206	<p>KQ: How do beneficial mutations increase the fitness of the organisms that possess them, and how common are they?</p> <p>Vocab: beneficial mutation, lactose tolerance, malaria resistance, apolipoprotein A1</p>		<ul style="list-style-type: none"> Explain how some mutations can be beneficial.

	1	207	<p>KQ: What are some examples of harmful mutations in humans, and what changes to the DNA are responsible for them?</p> <p>Vocab: harmful mutation, cystic fibrosis (CF), CFTR protein, Huntington’s disease</p>		<ul style="list-style-type: none"> Describe the mutation leading to CF and the effect of the mutation.
	0.5	208	<p>KQ: How is an organism’s phenotype influenced by the effects of the environment during and after development, even though the genotype remains unaffected?</p> <p>Vocab: phenotype, genotype, epigenetics</p>		<ul style="list-style-type: none"> Is phenotype strictly controlled by genotype? Explain
	1	209	<p>KQ: How can the environment affect an organism’s phenotype?</p> <p>Vocab: variation, environmental factors, phenotype</p>		<p>Summative Assessment PE HS-LS3-2</p>
	1.5	210	<p>KQ: How can the environment or experiences of an individual affect the development of following generations?</p> <p>Vocab: epigenetics</p>		<ul style="list-style-type: none"> Can stressful environmental situations in parents have similar effects in their offspring? Explain.
	1	211 *7	<p>KQ: How does the parental genotype affect the outcome of a cross?</p> <p>Vocab: monohybrid cross, dominant, recessive</p>	Complete monohybrid crosses	<p>Summative Assessment PE HS-LS3-3</p>
	1	212	<p>KQ: How can we use a cross to determine an individual’s genotype?</p> <p>Vocab: test cross, dominant, recessive</p>	Complete test crosses	<ul style="list-style-type: none"> Use a test cross to predict an organism’s genotype. <p>Summative Assessment PE HS-LS3-3</p>
	1	213	<p>KQ: How can we use a monohybrid cross to study the inheritance pattern of one gene, and what are the predictable ratios in the offspring from this cross?</p> <p>Vocab: monohybrid cross, dominant, recessive</p>		<ul style="list-style-type: none"> Complete monohybrid crosses to predict outcomes

	1	214 *7	<p>KQ: How can we use dihybrid crosses to study the inheritance pattern of two unlinked genes, and what are their predictable ratios?</p> <p>Vocab: dihybrid cross, F₁, F₂, Punnett square, chi-squared test</p>	Complete dihybrid crosses	<ul style="list-style-type: none"> Complete a dihybrid cross and predict outcomes. <p>Summative Assessment PE HS-LS3-3</p>
	1	215	<p>KQ: How can we use a Punnett square to predict the outcome of dihybrid crosses?</p> <p>Vocab: Punnett square, dihybrid cross</p>	Complete dihybrid crosses	<ul style="list-style-type: none"> Complete a dihybrid cross and predict outcomes.
	1	216	<p>KQ: How do we use the chi-squared test for goodness of fit (χ^2) for testing the outcome of dihybrid crosses against a predicted Mendelian ratio?</p> <p>Vocab: chi-squared test</p>		<ul style="list-style-type: none"> Complete chi-squared tests to predict if outcomes meet expected Mendelian ratios. <p>Summative Assessment PE HS-LS3-3</p>
	1	217	<p>KQ: How do pedigree charts illustrate inheritance patterns over a number of generations and allow us to trace a genetic disorder back to its origin?</p> <p>Vocab: pedigree analysis, pedigree chart</p>	Complete pedigree analysis charts	<ul style="list-style-type: none"> Use a pedigree chart to determine the mode of inheritance for a genetic disorder.
	1	218	<p>Review Your Understanding Anchoring Phenomenon revisited Anyone for chocolate?</p>		<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: Can we get a chocolate Labrador puppy from black parents?</p>
	1	219	Summing Up		<p>Summative Assessment PE HS-LS3-2, PE HS-LS3-3</p>

Chapter 12: Evidence for Evolution

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	1	220	Anchoring Phenomenon: Dinosaur or Bird? How does scientific evidence allow us to continually build ideas of what dinosaurs looked like?		<ul style="list-style-type: none"> • What do your students already know about the topic? • Are there any gaps or misconceptions? • How do we know what dinosaurs looked like?
	1	221	KQ: Where does evidence for evolution come from? Vocab: comparative anatomy, geology, protein homology, developmental evidence, dating techniques, biogeography, fossils, DNA homology		<ul style="list-style-type: none"> • Describe two sources of evidence that support our understanding of evolution.
	1	222	KQ: How are all groups of living organisms related to each other? Vocab: proteobacteria, cyanobacteria, thermophilic bacteria, domain, archaea, bacteria, eukarya		<ul style="list-style-type: none"> • List at least two pieces of evidence for a universal common ancestor
	0.5	223	KQ: How can the fossil record be used as evidence for evolution? Vocab: fossil record, rock strata, relative order, trilobite		<ul style="list-style-type: none"> • Explain how the fossil record is used to establish the order of past events. What limitations are there?
	0.5	224	KQ: How are we able to analyze the fossils within rock strata to order past events in a rock profile, from oldest to most recent? Vocab: fossil record, rock strata, relative order		<ul style="list-style-type: none"> • Rank rock layers by relative age, based on the fossil record.
	0.5	225	KQ: How do transitional fossils provide important links in the fossil record? Vocab: transitional fossil, archaeopteryx		<ul style="list-style-type: none"> • Why are transitional fossils important? • Why is Archaeopteryx an important transitional fossil?
	0.5	226	KQ: What fossil evidence do we have to show the evolution of whales? Vocab: transitional fossil, toothed whale, baleen whale		<ul style="list-style-type: none"> • Outline the importance of transitional fossils in providing information about whale evolution.

	1	227	<p>KQ: How do homologous structures indicate the evolutionary relationship between groups of organisms?</p> <p>Vocab: homologous structures, pentadactyl limb, adaptive radiation</p>		<ul style="list-style-type: none"> • How does evolution of the pentadactyl limb provide evidence of adaptive radiation?
	1	228	<p>KQ: How can DNA sequencing and comparison, and the use of computer databases be used to locate evidence for evolution?</p> <p>Vocab: DNA sequencing, bioinformatics, phylogenetic tree, common ancestor</p>		<ul style="list-style-type: none"> • How can DNA sequencing be used to determine relatedness?
	1	229	<p>KQ: How can protein homology be used to determine evolutionary patterns?</p> <p>Vocab: common ancestor, Pax-6, hemoglobin, homology</p>		<ul style="list-style-type: none"> • Why is the hemoglobin protein used to determine relatedness?
	1	230	<p>KQ: How do similarities in the development of embryos, including the genetic control of development, provide strong evidence for evolution?</p> <p>Vocab: Carnegie stage, homology</p>		<ul style="list-style-type: none"> • How can the Carnegie stages of embryo development be used to show evolutionary relatedness?
	1	231	<p>Review Your Understanding Anchoring Phenomenon revisited Dinosaur or Bird?</p>		<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: How does scientific evidence allow us to continually build ideas of what dinosaurs looked like?</p>
	1	232	<p>Summing Up</p>		<p>Summative Assessment PE HS-LS4-1</p>

Chapter 13: Natural Selection and Adaptation

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
		233	Anchoring Phenomenon: How does an Elephant Lose its Tusks? How is poaching causing African elephants to be born without tusks?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions? Why does the incidence of tusklessness increase in areas with heavy poaching?
	1	234	KQ: How does natural selection act as a mechanism for evolution? Vocab: evolution, variation, natural selection, Darwin		<ul style="list-style-type: none"> How does natural selection act as a mechanism for evolution?
	1	235	KQ: How do adaptations provide an advantage when selection pressure is applied to a population? Vocab: natural selection	Investigation 13.1: Investigating natural selection	Summative Assessment PE HS-LS4-2
	0.5	236	KQ: What are adaptations, and how are they classified? Vocab: adaptations (morphological, physiological, or behavioral), fitness		<ul style="list-style-type: none"> Describe some diving adaptations in air-breathing animals.
	0.5	237	KQ: Why do unrelated species often evolve similar adaptations to overcome the same environmental challenges? Vocab: convergent evolution		<ul style="list-style-type: none"> Do similar adaptations always indicate evolutionary relatedness? Explain.
	1	238 21	KQ: How did studying Galapagos finch beaks provide evidence for evolution by natural selection? Vocab: natural selection, Galapagos finches, adaptation		<ul style="list-style-type: none"> Explain how studying the beaks of the Galapagos finches provided evidence for evolution by natural selection. Summative Assessment PE HS-LS4-2, PE HS-LS4-3
	1	239	KQ: How does natural selection act upon the coat color of rock pocket mice? Vocab: natural selection, rock pocket mice, adaptation, coat color		Summative Assessment PE HS-LS4-4

	1	240	<p>KQ: How does the change in environmental selection pressure affect the coat color in a deer mouse population?</p> <p>Vocab: natural selection</p>	<p>Investigation 13.2: Investigating natural selection in deer mice</p>	<p>Summative Assessment PE HS-LS4-3</p>
	0.5	241	<p>KQ: How does the application of insecticide act as a strong selection pressure on insects?</p> <p>Vocab: traits, insecticide resistance, selection pressure</p>		<ul style="list-style-type: none"> Describe how insects can become resistance to insecticides.
	1.5	242	<p>KQ: How can we use a computer model to simulate changes in the gene pool due to natural selection?</p> <p>Vocab: selection pressure, gene pool</p>	<p>Investigation 13.3: Investigating gene pool changes</p>	<p>Summative Assessment PE HS-LS4-3</p>
	1	243	<p>KQ: How can we define a species?</p> <p>Vocab: species, biological species concept, phylogenetic species concept</p>		<ul style="list-style-type: none"> Why are dogs all considered <i>one</i> species?
	1	244	<p>KQ: How do isolating mechanisms lead to the formation of new species?</p> <p>Vocab: gene flow, gene pool, geographic reproductive isolating mechanisms (RIMs), sterility</p>		<ul style="list-style-type: none"> How do new species form?
	1	245	<p>KQ: How do populations diverge from their common ancestor and form new species?</p> <p>Vocab: evolution, divergent evolution, adaptive radiation, sequential evolution, phyletic gradualism, punctuated equilibrium</p>		<ul style="list-style-type: none"> How do new species form?
	1	246	<p>KQ: How did adaptive radiation of mammals increase the biodiversity of the group?</p> <p>Vocab: monotreme, marsupial, eutherian (placental)</p>		<ul style="list-style-type: none"> Why have rodents been able to successful fill so many niches?
	0.5	247	<p>KQ: How does the natural process of extinction affect biodiversity?</p> <p>Vocab: extinction, background extinction rate</p>		<ul style="list-style-type: none"> Identify at least 2 reasons for the increased rate of extinction. <p>Summative Assessment PE HS-LS4-5</p>

	1	248	<p>KQ: How has human activity been directly responsible for a number of extinctions?</p> <p>Vocab: extinction</p>	<ul style="list-style-type: none"> How have humans affected extinction rates? <p>Summative Assessment PE HS-LS4-5</p>
	1	249	<p>Review Your Understanding</p> <p>Anchoring Phenomenon revisited</p> <p>How does an Elephant Lose its Tusks?</p>	<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: How is poaching causing African elephants to be born without tusks?</p>
	1	250	<p>Summing Up</p>	<p>Summative Assessment covered elsewhere in the activity</p>

Chapter 14: Biodiversity

Date	Duration Time / No. of periods	Activity number	Notes	Lab / Practical activity	Formative or Summative Assessment
	0.5	251	Anchoring Phenomenon: Can't see the Wood for the Trees How has human activity affected a biodiversity hotspot, and what are some possible solutions for restoring it, or preventing more loss?		<ul style="list-style-type: none"> What do your students already know about the topic? Are there any gaps or misconceptions? How is human activity affecting global biodiversity?
	2.0	252 2&3	KQ: How is biodiversity measured in an ecosystem? Vocab: biodiversity, endemic, species richness, diversity index (<i>H</i> , indices), Simpson's Diversity Index	Investigation 14.1: Investigating biodiversity and human impacts	<ul style="list-style-type: none"> What are the different measures of biodiversity? Summative Assessment PE HS-LS4-6
	0.5	253	KQ: What are the ecosystem services that humans depend upon? Vocab: ecosystem services		<ul style="list-style-type: none"> What are ecosystem services? Explain why they are important.
	1	254	KQ: What and where are Earth's biodiversity hotspots? Vocab: biodiversity hotspot		<ul style="list-style-type: none"> How is human activity affecting biodiversity?
	1	255	KQ: How is human activity affecting biodiversity on Earth? Vocab: biodiversity, climate change, coral bleaching		<ul style="list-style-type: none">
	1	256	KQ: How do <i>ex-situ</i> conservation methods assist critically endangered species? Vocab: <i>Ex-situ</i> conservation, captive breeding, seed banks, gene banks,		<ul style="list-style-type: none"> Describe an example of <i>ex-situ</i> conservation.
	1	257	KQ: How can <i>in-situ</i> (on site) conservation methods manage ecosystems? Vocab: <i>In-situ</i> conservation, genetic diversity, restoration		<ul style="list-style-type: none"> Describe an example of <i>in-situ</i> conservation.

	0.5	258	<p>KQ: How can conservation methods help to maintain genetic diversity?</p> <p>Vocab: conservation genetics, genetic diversity</p>		<ul style="list-style-type: none"> • How can conservation genetics be used to increase genetic diversity?
	0.5	259	<p>KQ: How can the Maasai Mara case study be used to show the need to balance human and environmental needs in conservation?</p> <p>Vocab: conservation genetics, genetic diversity</p>		
	1	260	<p>Review Your Understanding</p> <p>Anchoring Phenomenon revisited</p> <p>Can't see the Wood for the Trees</p>		<p>Can students fully explain the Key Question for the chapter anchoring phenomenon: How has human activity affected a biodiversity hotspot, and what are some possible solutions for restoring it, or preventing more loss?</p>
	1	261	<p>Summing Up</p>		<p>Summative Assessment covered else where in the activity</p>