# Pre-AP Biology Instructional Planning Guide Teacher Sample

The goal of the instructional planning guide is to help you create a roadmap of the key instructional activities and assessments you will use to design your course in alignment with the Pre-AP course framework and instructional principles. This sample illustrates one way in which you might use the guide. Pre-AP National Faculty and educators with experience teaching Pre-AP provided ideas for additional activities and resources that they might use alongside Pre-AP model lessons and formative assessment to build their full course.

**Using and Customizing Your Own Instructional Planning Guide:**

* When planning additional lessons, consider how they support the Pre-AP course framework, areas of focus,
and shared principles. These three elements represent the key ingredients of aligning to Pre-AP.
* Take time to capture your reflections as you move through the course.

## Unit 1 Ecological Systems

| **Pacing in Minutes** | **Date(s)** | **Key Concepts** | **Materials/Resources/Tasks***Pre-AP Model Lessons, Additional Lessons, Labs, Textbooks, Performance Tasks, Assessments* | **Learning Objectives** | **Essential Knowledge** | **NGSS****Standards** | **Reflections on Areas of Focus & Shared Principles** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ~60 |  | ECO 1: Cycling of Matter in the Biosphere | Properties of water mini-lab (15 min)1.1 Launch Lesson - Important Elements in Organisms (45 min)*Reinforcement/Practice*: Quizizz chemistry review and properties of water (free online interactive quiz platform) | Introductory prior knowledge students elicit from middle school life science | HS-ESS2-5HS-ESS2-6 |  |
| ~90 |  | ECO 1: Cycling of Matter in the Biosphere | 1.2: Modeling the Water and Carbon Cycles (90 min)*Reinforcement/Practice***:**Edpuzzle fossil fuel formation (free online platform that embeds questions into videos to check for understanding) | ECO 1.1(a)ECO 1.1(b)ECO 1.2(a)ECO 1.2(b) | ECO 1.1.1aECO 1.1.1bECO 1.1.1cECO 1.1.1dECO 1.2.1a | HS-LS1-7HS-LS2-3-5HS-ESS2-5HS-ESS2-6 |  |
| <45 |  | ECO 1: Cycling of Matter in the Biosphere | 1.3: Analyzing Nitrogen Fertilizer Use on U.S. Corn Crops*Reinforcement/Practice*:Khan Academy rate of change practice | ECO 1.2(c)ECO 1.2(d) | ECO 1.2.1b ECO 1.2.1c | HS-LS2-3HS-LS2-4HS-LS1-7 |  |
| ~90 |  | ECO 1: Cycling of Matter in the Biosphere | 1.4: Exploring and Modeling the Nitrogen Cycle*Reinforcement/Practice*:Quizizz cycles of matter reviewEdpuzzle eutrophication | ECO 1.2(c)ECO 1.2(d) | ECO 1.2.1b ECO 1.2.1c | HS-LS2-3HS-LS2-4HS-LS1-7 |  |
| ~45 |  | ECO 1: Cycling of Matter in the Biosphere | **Practice Performance Task**Termites, Guardians of the Soil | ECO 1.1(a) ECO 1.2(a)ECO 1.2(c) | ECO 1.1.1aECO 1.2.1aECO 1.2.1b | HS-LS1-7HS-LS2-3HS-LS2-5HS-ESS2-5HS-ESS2-6 |  |
| ~45–60 |  | ECO 2: Population Dynamics | 1.5: Launch Lesson - Modeling Yellowstone’s Food Web (45-60 min)*Reinforcement/Practice:*Quizizz food chains, webs, energy pyramids and biomagnificationWolf reintroduction article—students read, answer reflection questions, and pose further research questions | ECO 2.3(a)ECO 2.3(b) | ECO 2.3.1aECO 2.3.1bECO 2.3.1c | HS-LS2-3HS-LS2-4 |  |
| ~135 |  | ECO 2: Population Dynamics | 1.6: Population Field Studies Simulations Lab – Quadrat and Mark – Recapture Sampling*Reinforcement/Practice:*Khan Academy writing and solving proportions | ECO 2.1(b) | ECO 2.1.1aECO 2.1.1bECO 2.1.1cECO 2.1.1d | HS-LS2-1HS-LS2-2HS-LS2-6HS-LS2-8 |  |
| 60 |  | ECO 2: Population Dynamics | Oh Deer! game (adapted from Project Wild Oh Deer! game)—student groups graph data from game and estimate carrying capacity) (30 min)Pear Deck: population dynamics (interactive lecture with embedded checks for understanding) (15 min)Pre-AP Sample Questions in small groups (15 min)*Reinforcement/Practice*:Quizlet vocabulary review for population dynamics terms | ECO 2.1(a)ECO 2.1(b)ECO 2.1(c)ECO 2.2(a)ECO 2.2(b)ECO 2.2(c)ECO 2.3(b) | ECO 2.1.1aECO 2.1.1bECO 2.1.1cECO 2.1.1dECO 2.2.1aECO 2.2.1bECO 2.2.1cECO 2.2.1dECO 2.2.2aECO 2.2.2b | HS-LS2-1HS-LS2-2HS-LS2-4HS-LS2-6HS-LS2-8 |  |
| ~45 |  | ECO 1, ECO 2 | **Learning Checkpoint 1***This learning checkpoint can assess any of the learning objectives from its associated Key Concepts.* |  |  |  |
| <45 |  | ECO 3: Defining Ecological Communities | Learning checkpoint reflections and review of most missed questions. (15 min)1.7: Launch Lesson: Comparing Biomes Using HHMI’s BiomeViewer (30 min)*Reinforcement/Practice*:Biodiversity reading with background on ecosystem services (included terrestrial and aquatic biomes) | ECO 3.1(a)ECO 3.1(b)ECO 3.2(a)ECO 3.2(b) | ECO 3.1.1aECO 3.1.1b ECO 3.1.1cECO 3.2.1aECO 3.2.1bECO 3.2.2aECO 3.2.2bECO 3.2.2c | HS-LS2-2HS-LS2-6 |  |
| <45 |  | ECO 4: Ecological Community Dynamics | Pear Deck: competition and niche partitioning(15 min)1.8: Launch Lesson: Examining Coral Bleaching Effects (30 min) | ECO 4.1(a)ECO 4.1(b)ECO 4.1(c)ECO 4.2(a) ECO 4.2(b) | ECO 4.1.1cECO 4.1.1dECO 4.2.1a | HS-LS4-2HS-LS4-3 |  |
| ~90 |  | ECO 4: Ecological Community Dynamics | Symbiosis brainstorm and video (15 min)1.9: Modeling the Importance of Keystone Species (~75 min) | ECO 4.1(c)ECO 4.2(a) ECO 4.2(b) | ECO 4.1.1aECO 4.1.1bECO 4.2.1aECO 4.2.1bECO 4.2.1c | HS-LS4-2HS-LS4-3 |  |
| <60 |  | ECO 5: Changes in Ecological Communities | 1.10: Launch Lesson – Invasive Species – Brown Tree Snakes in Guam*Reinforcement/Practice:*Research on invasive Species in our area—students choose from a list of species and research impact, origin, and methods of removal | ECO 5.2(a)ECO 5.2(b)ECO 5.2(c) | ECO 5.2.1aECO 5.2.1b | HS-LS4-6HS-ESS3-4 |  |
| 45 |  | ECO 5: Changes in Ecological Communities | Succession on our campus (30 min)Succession climax community predictions by climate (10 min)Brainstorm: What happens after a mass extinction event? (5 min)*Reinforcement/Practice:*Reading: The Rise of Mammals—students read, answer reflection questions, and pose research questions regarding current extinctions | ECO 5.1(a)ECO 5.1(b) | ECO 5.1.1aECO 5.1.1b ECO 5.1.1c | HS-LS2-5HS-LS2-6 |  |
| ~60 |  | ECO 5: Changes in Ecological Communities | 1.11 Predicting Changes in Arctic Ecological Communities | ECO 5.2(a)ECO 5.2(b) | ECO 5.2.1aECO 5.2.1b | HS-LS2-7HS-LS4-6HS-ESS3-4 |  |
| ~60 |  | ECO 5: Changes in Ecological Communities | 1.12 Understanding Beavers as Ecosystem Engineers | ECO 5.1(a)ECO 5.1(c) | ECO 5.1.1d | HS-LS2-5HS-LS2-6 |  |
| ~45 |  | ECO 3–5 | **Performance Task**Exploring Species Interactions in the Great Barrier ReefCirculate and note patterns and address before end of class. Scoring guidelines provided to student to review before the following day. | ECO 2.2(a)ECO 2.3(a)ECO 3.2(a)ECO 4.2(a)ECO 4.2(b)ECO 5.1(a) ECO 5.1(b)ECO 5.2(b)  | ECO 2.2.1bECO 2.3.1aECO 2.3.1bECO 2.3.1cECO 3.2.2aECO 4.2.1aECO 4.2.1bECO 4.2.1cECO 5.1.1aECO 5.2.1aECO 5.2.1b | HS-LS2-2HS-LS2-3HS-LS4-2HS-LS4-3HS-LS2-5HS-LS2-6 |  |
| ~45 |  | ECO 3–5 | **Learning Checkpoint 2***This learning checkpoint can assess any of the learning objectives from its associated Key Concepts.* |  |  |  |
| 45 |  |  | **Assessment Reflections*** Collaborative performance task scoring and revisions (teacher has already identified class trends). Students will be assessed on accuracy of self-scores and quality of revisions.
* Collaborative learning checkpoint rationales. Before gaining access to rationales provided on the platform, students are provided the correct answers and work together to write rationales providing specific evidence from the question for why their answer was incorrect and why the correct answer is the best one.
 |  |  |  |  |

[add or remove rows as needed]

### Reflections

What went well in this unit?

When were students most engaged during this unit?

How have students grown? What opportunities for growth stand out at this time?

What needs modification or differentiation next time?

## Unit 2 Evolution

| **Pacing in Minutes** | **Date(s)** | **Key Concepts** | **Materials/Resources/Tasks***Pre-AP Model Lessons, Additional Lessons, Labs, Textbooks, Performance Tasks, Assessments* | **Learning Objectives** | **Essential Knowledge** | **NGSS Standards** | **Reflections on Areas of Focus & Shared Principles** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ~45 |  | EVO 1: Patterns of Evolution | 2.1: Launch Lesson: Examining Evidence of Evolution | EVO 1.1(a)EVO 1.1(b) | EVO 1.1.1EVO 1.1.2aEVO 1.1.2b | HS-LS4-1 |  |
| ~45 |  | EVO 1: Patterns of Evolution | Student generated class definition of evolution and list of student generated questions about evolution. (15 min)Edpuzzle *Stated Clearly* video, What is the Evidence For Evolution? (15 min)Students research 3 questions from class list (15 min) | EVO 1.1(a)EVO 1.1(b) | EVO 1.1.1EVO 1.1.2aEVO 1.1.2b | HS LS4-1 |  |
| ~60 |  | EVO 1: Patterns of Evolution | 2.2: Examining Anatomical Evidence from Fossils – *Spinosaurus* | EVO 1.1(a) | EVO 1.1.2a | HS LS4-1 |  |
| ~45 |  | EVO 1: Patterns of Evolution | NOVA Labs: Evolution Lab Video Intro with guided questions for students. (10 min)NOVA Labs: Evolution Lab Build a Tree activity—students complete, submit screenshots, and discuss guiding questions (35 min) | EVO 1.2(a)EVO 1.2(b) | EVO 1.2.1aEVO 1.2.1b | HS LS4-1 |  |
| ~45 |  | EVO 2: Mechanisms of Evolution | WebQuest: student-led research into the changing nature of scientific knowledge about principles and theories associated with evolution. | EVO 2.1(a) | EVO 2.1.1aEVO 2.1.1b |  |  |
| ~45 |  | EVO 2: Mechanisms of Evolution | 2.3: Launch Lesson: Variation in Asian Ladybugs | EVO 2.2(a) | EVO 2.2.1a | HS-LS4-2 |  |
| ~180 |  | EVO 2: Mechanisms of Evolution | 2.4: Modeling Natural Selection Lab*Reinforcement/Practice:*Edpuzzle *Stated Clearly* video, What is Natural Selection? | EVO 2.2(a)EVO 2.2(b)EVO 2.2(c)EVO 2.2(d) | EVO 2.2.1aEVO 2.2.1bEVO 2.2.1cEVO 2.2.1dEVO 2.2.1eEVO 2.2.2a | HS LS4-2HS LS4-3HS LS4-4  |  |
| ~45 |  | EVO 2: Mechanisms of Evolution | **Practice Performance Task**Tusklessness in African Elephants | EVO 2.2(a)EVO 2.2(b)EVO 2.2(c)EVO 2.2(d) | EVO 2.2.1aEVO 2.2.1bEVO 2.2.1cEVO 2.2.1dEVO 2.2.1eEVO 2.2.2a | HS LS4-2HS LS4-3HS LS4-4 |  |
| ~60 |  | EVO 1, EVO 2 | **Learning Checkpoint 1***This learning checkpoint can assess any of the learning objectives from its associated Key Concepts.*Review of most missed Learning Checkpoint questions. (15 min) |  |  |  |
| ~70 |  | EVO 3: Speciation | 2.5 Launch Lesson: Introduction to the Process of Speciation – Salamander Evolution (45 min)HHMI BioInteractive video: *The Origin of Species: Lizards in an Evolutionary Tree.* Students collaborate on guided questions before and after the video about speciation. (25 min) | EVO 3.1(a)EVO 3.1(b) | EVO 3.1.1aEVO 3.1.1bEVO 3.1.1cEVO 3.1.1d | HS LS4-5 |  |
| ~45 |  | EVO 3: Speciation | HHMI BioInteractive: *Vertebrate Declines and the Sixth Mass Extinction*  | EVO 3.2(a)EVO 3.2(b)EVO 3.2(c) | EVO 3.2.1aEVO 3.2.1bEVO 3.2.1cEVO 3.2.1d | HS LS4-5 |  |
| ~65 |  | EVO 3 | **Performance Task**The Flashy Guppy Data Analysis (45 min)Circulate and note patterns and address before end of class. Scoring guidelines provided to students to review before the following day.**Pre-AP Sample Questions** *think/pair/share*Students generate claims for correct answers using evidence from the text and reasoning that includes scientific principles from this unit. (20 min) | EVO 2.2(a)EVO 2.2(b) EVO 2.2(c)EVO 2.2(d) | EVO 2.2.1aEVO 2.2.1bEVO 2.2.1cEVO 2.2.1dEVO 2.2.1eEVO 2.2.2a | HS LS4-2HS LS4-3HS LS4-4 |  |
| ~45 |  | EVO 3 | **Learning Checkpoint 2***This learning checkpoint can assess any of the learning objectives from its associated Key Concepts.* |  |  |  |
| 45 |  |  | **Assessment Reflections*** Collaborative performance task scoring and revisions (teacher has already identified class trends). Students will be assessed on accuracy of scoring and quality of revisions.
* Collaborative learning checkpoint rationales. Before gaining access to rationales provided on the platform, students are provided the correct answers and work together to write rationales providing specific evidence from the question for why their answer was incorrect and why the correct answer is the best one.
 |  |  |  |  |

[add or remove rows as needed]

### Reflections

What went well in this unit?

When were students most engaged during this unit?

How have students grown? What opportunities for growth stand out at this time?

What needs modification or differentiation next time?

## Unit 3 Cellular Systems

| **Pacing in Minutes** | **Date(s)** | **Key Concepts** | **Materials/Resources/Tasks***Pre-AP Model Lessons, Additional Lessons, Labs, Textbooks, Performance Tasks, Assessments* | **Learning Objectives** | **Essential Knowledge** | **NGSS Standards** | **Reflections on Areas of Focus & Shared Principles** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ~90  |  | CELLS 1: The Chemistry of Life | Pear Deck: macromolecules (45 min)Foldables: macromolecules (45 min) | CELLS 1.1(a) | CELLS 1.1.1aCELLS 1.1.1bCELLS 1.2.1aCELLS 1.2.1b CELLS 1.2.1c CELLS 1.2.1d | HS-LS1-1 |  |
| ~45 |  | CELLS 1: The Chemistry of Life | Video: digestion (5 min)Graphic organizer: students group cards with terms, molecular structures, and functions using connecting words between groupings, then peer review and revise. (30 min)Quizlet Live: macromolecules (10 min) | CELLS 1.1(a) | CELLS 1.1.1aCELLS 1.1.1bCELLS 1.2.1aCELLS 1.2.1b CELLS 1.2.1c CELLS 1.2.1dCELLS 1.4.1b | HS-LS1-1 |  |
| ~70 |  | CELLS 1: The Chemistry of Life | Introductory video on proteins, with guiding questions to elicit prior knowledge (10 min)Student-generated models of protein structure—student groups use random provided materials to create protein models including primary, secondary, tertiary, and quaternary structure. Students must include labels for listed terms and create a key of structures corresponding to their materials. Using the video as a reference, they peer review and revise. (60 min) | CELLS 1.1(a) | CELLS 1.1.1aCELLS 1.1.1bCELLS 1.2.1c | HS LS1-1 |  |
| ~60–75 |  | CELLS 1: The Chemistry of Life | 3.1: Simulation of Enzymatic and Cellular Reactions*Reinforcement/Practice:*Edpuzzle: protein structure and function | CELLS 1.2(a) CELLS 1.3(a)CELLS 1.3(b) | CELLS 1.2.1c CELLS 1.3.1aCELLS 1.3.1bCELLS 1.3.1c | HS-LS1-1HS-LS1-6 |  |
| ~180 |  | CELLS 1: The Chemistry of Life | 3.2: Guided Inquiry Investigation – Enzyme Catalysis Lab | CELLS 1.2(a)CELLS 1.3(a)CELLS 1.3(b) | CELLS 1.2.1c CELLS 1.3.1aCELLS 1.3.1bCELLS 1.3.1c | HS-LS1-1HS-LS1-6 |  |
| ~45 |  | CELLS 1: The Chemistry of Life | **Practice Performance Task** Cellulase | CELLS 1.1(a) CELLS 1.2(a) CELLS 1.3(a) | CELLS 1.1.1 CELLS 1.1.1bCELLS 1.2.1 CELLS 1.2.1aCELLS 1.2.1bCELLS 1.2.1cCELLS 1.3.1aCELLS 1.3.1bCELLS 1.3.1cCELLS 1.4.2 | HS-LS1-1 |  |
| ~45 |  | CELLS 1: The Chemistry of Life | Pear Deck: ATP and energy needs (20 min)Khan Academy: metabolism and thermoregulation—students complete reading and quiz on each, and submit screenshots (25 min) | CELLS 1.4(a)CELLS 1.4(b)CELLS 1.4(c) | CELLS 1.4.1a | HS LS1-6HS LS1-7 |  |
| ~100 |  | CELLS 2: Cell Structure and Function | Video: *Inner Life of a Cell* is used to help elicit student knowledge of cellular systems from middle school. (Show twice. First play: music only, no narration or subtitles. Ask students what they think is happening. Second play: provide the narration or subtitles, or inform students of processes.) (10 min)3.3: Launch Lesson – Modeling Cellular Systems (90 min)*Reinforcement/practice*:Quizizz: cell structure and function | CELLS 1.2(a) CELLS 2.1(a) CELLS 2.2(a) CELLS 2.3(a) | CELLS 1.2.1aCELLS 1.2.1bCELLS 1.2.1cCELLS 1.2.1dCELLS 2.1.1aCELLS 2.1.1bCELLS 2.2.1aCELLS 2.2.1bCELLS 2.3.1aCELLS 2.3.1b | HS-LS1-1HS-LS1-2 |  |
| ~90–120 |  | CELLS 2: Cell Structure and Function | 3.4: Cell Membrane Bubble Investigation Lab (60–90 min) Students collaboratively generate Flipgrid videos on differences between plant and animal cellular structures, then collaborate with another group to build a consensus on the characteristics of the structures. (30 min) | CELLS 2.1(a) | CELLS 2.1.1aCELLS 2.1.1b CELLS 2.3.2aCELLS 2.3.2b |  |  |
| ~80 |  | CELLS 2: Cell Structure and Function | Student-generated models of membranes—student groups use random provided materials to create membrane models with listed components and a key of structures corresponding to their materials. Students engage in a gallery walk and provide peer-to-peer critique and feedback. (60 min)Student-generated questions regarding cell membrane structure and function. List compiled for reinforcement assignment. (15 min)*Reinforcement/practice:*Edpuzzle: cell membrane structure and functionStudents research 3 questions from class list | CELLS 3.1(a)CELLS 3.1(b) | CELLS 3.1.1aCELLS 3.1.1bCELLS 3.1.1c | HS-LS1-2 |   |
| ~60 |  | CELLS 2: Cell Structure and Function | Student groups work on a triple Venn diagram (bacteria/plant/animal cells), then peer review and revise. (15 min)Specialized cells videoPre-viewing and post-viewing questions (15 min)Microscope lab: plant versus animal cells (30 min) | CELLS 2.3(a) CELLS 2.3(b) | CELLS 2.3.1CELLS 2.3.2 | HS-LS1-2 |  |
| ~45–60 |  | CELLS 3: Cell Transport and Homeostasis | 3.5: Launch Lesson – Introduction to the Role of Water in Cells | CELLS 3.2(c) ECO 1.1(a)ECO 1.1(b)  | CELLS 3.2.1 CELLS 6.1.1cECO 1.1.1a | HS-LS1-2HS-ESS2-5 |  |
| ~90 |  | CELLS 3: Cell Transport and Homeostasis | 3.6: Argument-Driven Inquiry Into Tonicity Lab | CELLS 3.2(a)CELLS 3.2(b)CELLS 3.2(c)  | CELLS 3.2.1a | HS LS1-2HS LS1-3 |  |
| ~60  |  | CELLS 3: Cell Transport and Homeostasis | WebQuest: cell transport and tonicity (30 min)Graphic organizer: cell transport and tonicity (30 min) | CELLS 3.1(a)CELLS 3.2(a)CELLS 3.2(b)CELLS 3.2(c) | CELLS 3.2.1aCELLS 3.2.1bCELLS 3.2.1c | HS LS1-2HS LS1-3 |  |
| 45 |  | CELLS 3: Cell Transport and Homeostasis | Cell size and surface area student-driven inquiry: pre-lab question probing why cells are smallSurface-area-to-volume practice problems for just-in-time skill refreshment on area and volume calculations Agar cube diffusion lab with pH indicator | CELLS 3.1(a)CELLS 3.3(a) | CELLS 3.3.1aCELLS 3.3.1b | HS LS1-2HS LS1-3 |  |
| ~60 |  | CELLS 4: Organisms Maintaining Homeostasis | Pre-AP Sample Item Extended Reading—*Getting Fresh: How Fish Transition from One Type of Water to the Other*Students read the passage then watch a video on how salmon rely on multiple body systems in order to maintain osmoregulation. Whole-group discussion on how this is similar and different from osmoregulation in humans. Students then answer the three questions associated with the passage. | CELLS 3.2(b)CELLS 4.1(a)CELLS 4.1(b) | CELLS 3.2.1aCELLS 3.2.1bCELLS 4.1.1a | HS LS1-2HS LS1-3 |  |
| ~45 |  | CELLS 4: Organisms Maintaining Homeostasis | Stomata printing microscope investigation—students connect their understanding of the need for gas exchange to cycling of matter and prime cellular energy conversions (30 min)Video: tropisms with pre- and post-viewing questions (15 min) | CELLS 4.2(a) CELLS 4.2(b) | CELLS 4.1.1bCELLS 4.2.1a | HS LS1-3 |  |
| ~90 |  | CELLS 4: Organisms Maintaining Homeostasis | Argument-driven inquiry on taxis investigation: pill bugs in wet and dry chambers (students engage in a CER-style investigation technique to investigate the phenomenon of animal taxis) | CELLS 4.2(a)CELLS 4.2(b) | CELLS 4.2.1b | HS LS1-3 |  |
| ~75 |  | CELLS 1–4 | **Learning Checkpoint 1** *This learning checkpoint can assess any of the learning objectives from its associated key concepts.*Learning Checkpoint reflections and review of most missed questions (15 min) |  |  |  |
| ~60 |  | CELLS 5: Cell Growth and Division | 3.7: Launch Lesson – Modeling the Cell Cycle | CELLS 5.1(a)CELLS 5.1(b) CELLS 5.2(a)CELLS 5.2(c)  | CELLS 5.1.1aCELLS 5.1.1bCELLS 5.2.1aCELLS 5.1.1bCELLS 5.1.1c | HS-LS1-4 |  |
| ~45–60 |  | CELLS 5: Cell Growth and Division | 3.8: Modeling Mitosis | CELLS 5.1(a)CELLS 5.1(b)CELLS 5.2(c) | CELLS 5.1.1aCELLS 5.2.1bCELLS 5.2.1c | HS-LS1-4 |  |
| ~90 |  | CELLS 5: Cell Growth and Division | HHMI Biointeractive: *The Eukaryotic Cell Cycle and Cancer* (45 min)Microscope lab: onion root tips (45 min) | CELLS 5.3(a) CELLS 5.3(b) | CELLS 5.3.1aCELLS 5.3.1bCELLS 5.3.1c | HS-LS1-4 |  |
| ~60–45 |  | CELLS 5: Cell Growth and Division | Analytical reading: introduction to viruses (30 min)* Article with guiding questions
* Review of characteristics of life in comparison to viral characteristics
* Student-generated arguments—students make claim that viruses are alive or not alive, using evidence from article and/or other sources and reasoning that includes scientific principles from characteristics of life, then peer review and revise

NOVA Labs: Virus Wars (30–45 min) | CELLS 6.1(a)CELLS 6.1(c) | CELLS 6.1.1a CELLS 6.1.1bCELLS 6.1.1d |  |  |
| ~45–60 |  | CELLS 6: Photosynthesis | 3.9: Launch Lesson – Exploring Photosynthesis Through Atmospheric Carbon Dioxide Concentrations | CELLS 6.1(a)CELLS 6.1(b) | CELLS 6.1.1aCELLS 6.1.1b | HS-LS1-5 |  |
| ~60 |  | CELLS 6: Photosynthesis | 3.10: Modeling-Based Guided Inquiry – Introduction to Photosynthesis and Light Energy | CELLS 7.1(a)CELLS 7.1(b)CELLS 7.1(c) | CELLS 7.1.1a | HS-LS1-5 |  |
| ~45–60 |  | CELLS 7: Cellular Respiration and Fermentation | 3.11: Model-Based Guided Inquiry Activity – Comparing Cellular Respiration and Photosynthesis*Reinforcement/practice:*Quizizz: photosynthesis and respiration | CELLS 7.1(a)CELLS 7.1(b)CELLS 7.1(c) | CELLS 7.1.1a | HS LS1-7HS-LS2-3HS-LS2-5HS-ESS2-6 |  |
| ~45–60 |  | CELLS 7: Cellular Respiration and Fermentation | Day 1: Set up biochambers and make predictionsOne chamber with plant only, one with plant and invertebrate, one with invertebrate only. Oxygen and carbon dioxide levels are measured over time. (15 min to set up and ongoing)Day 2: Biochamber data collection and analysis Student-generated arguments and peer review of claims about their data (30–45 min) | CELLS 7.1(a)CELLS 7.1(b)CELLS 7.1(c)CELLS 7.2(a) CELLS 7.2(b) | CELLS 7.1.1aCELLS 7.1.1b CELLS 7.1.1cCELLS 7.1.1dCELLS 7.1.1eCELLS 7.2.1aCELLS 7.2.1b | HS LS1-7HS-LS2-3HS-LS2-5HS-ESS2-6 |  |
| ~90–105 |  | CELLS 7: Cellular Respiration and Fermentation | Student-driven inquiry investigation into yeast fermentation (45–60 min)Student-generated graphic organizers: photosynthesis/respiration/fermentation (includes small group comparison and whole-group debrief) (45 min) | CELLS 2.2(a) CELLS 2.3(a) CELLS 3.2(c) CELLS 6.1(b) | CELLS 2.2.1CELLS 2.3.2CELLS 3.2.1CELLS 6.1.1 | HS LS1-5HS LS1-7HS-LS2-3HS-ESS2-6 |  |
| ~45 |  | CELLS 2, 3, 6 | **Performance Task***Elodea* ExperimentCirculate and note patterns and address before end of class. Scoring guidelines provided to students to review before the following day. | CELLS 7.1(a)CELLS 7.1(b)CELLS 7.1(c)CELLS 7.2(a) CELLS 7.2(b) | CELLS 7.1.1aCELLS 7.1.1b CELLS 7.1.1cCELLS 7.1.1dCELLS 7.1.1eCELLS 7.2.1aCELLS 7.2.1b | HS-LS1-2HS-LS1-5 |  |
| ~45 |  | CELLS 5–7 | **Learning Checkpoint 2***This learning checkpoint can assess any of the learning objectives from its associated key concepts.* |  |  |  |
| 45 |  |  | **Assessment Reflections*** Collaborative performance task scoring and revisions (teacher has already identified class trends). Students will be assessed on accuracy of scoring and quality of revisions.
* Collaborative learning checkpoint rationales. Before gaining access to rationales provided on the platform, students are provided the correct answers and work together to write rationales providing specific evidence from the question for why their answer was incorrect and why the correct answer is the best one.
 |  |  |  |  |

[add or remove rows as needed]

### Reflections

What went well in this unit?

When were students most engaged during this unit?

How have students grown? What opportunities for growth stand out at this time?

What needs modification or differentiation next time?

## Unit 4 Genetics

| **Pacing in Minutes** | **Date(s)** | **Key Concepts** | **Materials/Resources/Tasks***Pre-AP Model Lessons, Additional Lessons, Labs, Textbooks, Performance Tasks, Assessments* | **Learning Objectives** | **Essential Knowledge** | **State Standards** | **Reflections on Areas of Focus & Shared Principles** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| <90 |  | GEN 1: Structure of DNA | 4.1: Launch Lesson – Investigating the Building Blocks of DNAModeling activity where students use knowledge of Chargaff's ratios to develop a model of DNA with pop beads (30 min) | GEN 1.1(a) GEN 1.2(b) | GEN 1.1.1aGEN 1.1.1bGEN 1.1.1cGEN 1.2.1a |  |  |
| 75 |  | GEN 1: Structure of DNA | WebQuest: race to discover DNA—students study the work of key scientists who developed models and theories for defining our genetic material. This includes students investigating the scientists’ research questions, data collected, and the assumptions they made that led to the construction, testing, and eventual acceptance of DNA modeled as a double helix.Peer-to-peer review of WebQuest with whole-class debrief on the theory-building that led to the discovery of DNA | GEN 1.1(a) | GEN 1.1.1aGEN 1.1.1bGEN 1.1.1c |  |  |
| <45 |  | GEN 2: DNA Synthesis | 4.2: Launch Lesson – Introduction to DNA Synthesis | GEN 1.2(a)GEN 2.1(a)GEN 2.1(b)GEN 2.1(c) | GEN 1.2.1bGEN 2.1.1aGEB 2.1.1b | HS-LS1-6 |  |
| ~90 |  | GEN 2: DNA Synthesis | Pear Deck: DNA structure and replication (15 min)Edpuzzle: DNA structure and replication (includes differences in prokaryotic and eukaryotic DNA and replication) (15 min)Students return to the DNA model they generated in the first lesson of this unit to model the process of replication. Student groups use provided materials to create models, including labels for listed terms and a key of structures corresponding to their materials. Using Pear Deck as a reference, students peer review and revise models as needed. (60 min) | GEN 2.1(a)GEN 2.1(b)GEN 2.1(c) | GEN 2.1.1aGEB 2.1.1b | HS LS3-1 |  |
| ~150 |  | GEN 2: DNA Synthesis | 4.3: DNA Extraction Lab (~120 min)Analytical reading: the native Japanese plant, *Paris japonica*, has the largest genome yet recorded. Students relate their DNA extraction lab to understandings of polyploidy in plants from the article to diploidy in human genomes. (30 min) | GEN 2.1(a)GEN 2.1(b)GEN 2.1(c) | GEN 2.1.1aGEB 2.1.1b | HS LS3-1 |  |
| 90 |  | GEN 3: Protein Synthesis | Understanding genotype versus phenotype (lesson modified from HHMI Biointeractive, incorporating DNA -> RNA -> Protein graphic organizers and parts of the HHMI lessons *Molecular Genetics of Color Mutations in Rock Pocket Mice* and *Biochemistry and Cell Signaling Pathway of the Mc1r Gene*)*Reinforcement/Practice:*Quizizz: DNA structure, replication, and protein synthesis  | GEN 3.1(a)GEN 3.2(a)GEN 3.3(a)GEN 3.3(b)GEN 3.3(c)GEN 3.3(d)GEN 3.4(b)GEN 3.4(c) | GEN 3.1.1aGEN 3.2.1aGEN 3.2.1bGEN 3.2.1cGEN 3.3.1aGEN 3.3.1bGEN 3.3.1cGEN 3.4.1b | HS-LS3-1HS-LS3-2 |  |
| ~60 |  | GEN 3: Protein Synthesis | 4.4: Launch Lesson – Introduction to Gene Expression—Sickle Cell Anemia Case Study | GEN 3.3(a)GEN 3.3(b) GEN 3.4(a) | GEN 3.3.1aGEN 3.3.1bGEN 3.3.1cGEN 3.4.1aGEN 3.4.1b GEN 3.4.1c | HS-LS1-1HS-LS3-2 |  |
| 60 |  | GEN 3: Protein Synthesis | Pear Deck: DNA mutations (includes student-driven writing of embedded assessment questions) (15 min)Jigsaw mutations activity where students become experts on one mutation and associated changes in phenotype and report to group for feedback (45 min) | GEN 3.4(a)GEN 3.4(b)GEN 3.4(c) | GEN 3.4.1aGEN 3.4.1b GEN 3.4.1c | HS LS3-2 |  |
| 60 |  | GEN 3: Protein Synthesis | Students model albinism with pop beads by mapping each part of the gene expression process from gene to protein. (45 min)Students collaborate on developing a Venn diagram on DNA synthesis and RNA synthesis. (15 min) | GEN 3.1(a)GEN 3.2(a)GEN 3.3(a)GEN 3.3(b)GEN 3.3(c)GEN 3.3(d) | GEN 3.1.1aGEN 3.2.1aGEN 3.2.1bGEN 3.2.1cGEN 3.3.1aGEN 3.3.1bGEN 3.3.1c | HS LS1-1HS LS3-1 |  |
| 60  |  | GEN 3: Protein Synthesis | WebQuest with Learn Genetics website—students are provided with guiding questions that help them synthesize concepts across the structure of DNA, DNA synthesis, and protein synthesis | GEN 2.1(a)GEN 2.1(b)GEN 2.1(c) | GEN 2.1.1aGEB 2.1.1b | HS LS1-1HS LS3-1 |  |
| ~45 |  | GEN 1–3 | **Learning Checkpoint 1***This learning checkpoint can assess any of the learning objectives from its associated Key Concepts.* |  |  |  |
| ~60 |  | GEN 4: Asexual & Sexual Passing of Genes | Learning checkpoint reflections and review of most missed questions (15 min)Analytical extended reading: the New Mexico whip-tail lizard (all-female species)—after this introduction to unique reproduction strategies, students work in pairs to discuss pros and cons of these strategies (45 min) | GEN 4.1(a)GEN 4.1(b) | GEN 4.1.1aGEN 4.1.1bGEN 4.1.1cGEN 4.1.1d | HS LS4-2 |  |
| ~60 |  | GEN 4: Asexual & Sexual Passing of Genes | 4.5: Launch Lesson – Introduction to Meiosis Through Modeling | GEN 4.2(a)GEN 4.2(b)GEN 4.2(c) | GEN 4.2.1a 1–3GEN 4.2.1b | HS-LS3-1 |  |
| ~90 |  | GEN 4: Asexual & Sexual Passing of Genes | 4.6: Analyzing Shark Reproduction Strategies | GEN 4.1(a)GEN 4.1(b) | GEN 4.1.1cGEN 4.1.1d | HS LS4-2 |  |
| ~75 |  | GEN 4: Asexual & Sexual Passing of Genes | Introductory video with guiding questions on chromosomal disorders, followed by a whole-class debrief on chromosomal disorders to help introduce the next inquiry-based investigation on disorders (15 min)Disorder Detectives karyotype activity—inquiry-based lesson where students take on the role of cytogeneticists to diagnose the diseases of 15 different patients using fully reusable materials (60 min)*Reinforcement/practice:*Quizizz: mitosis and meiosis | GEN 4.3(a)GEN 4.3(b)GEN 6.1(a) | GEN 4.3.1aGEN 4.3.1bGEN 6.1.1a |  |  |
| ~60 |  | GEN 5: Inheritance Patterns | 4.7: Launch Lesson – Exploring Mendelian Inheritance Patterns | GEN 5.1(a)GEN 5.1(b) | GEN 5.1.1aGEN 5.1.1bGEN 5.1.1cGEN 5.1.1d | HS-LS3-1 |  |
| 60 |  | GEN 5: Inheritance Patterns | Students use the phenomenon of coloring in cows to explore how Mendelian genetics determine the three different phenotypes. (45 min)Quizlet Live: heredity terms and mendelian genetics (15 min)*Reinforcement/Practice:*Khan Academy: monohybrid Punnett squares practice | GEN 5.1(a)GEN 5.1(b) | GEN 5.1.1aGEN 5.1.1bGEN 5.1.1cGEN 5.1.1d | HS LS3-1 |  |
| 90 |  | GEN 5: Inheritance Patterns | Investigation into human color blindness to explore sex-linked inheritance (45 min)Human blood type investigation into co-dominance and non-Mendelian inheritance patterns (45 min)*Reinforcement/Practice:*Khan Academy: non-mendelian genetics and sex-linked traits practice | GEN 5.1(a)GEN 5.1(b) | GEN 5.1.1aGEN 5.1.1bGEN 5.1.1cGEN 5.1.1dGEN 5.1.2aGEN 5.1.2b | HS-LS3-3 |  |
| ~90 |  | GEN 5: Inheritance Patterns | 4.8: Exploring Inheritance Patterns – Albinism | GEN 5.1(a)GEN 5.1(b) GEN 5.2(a)GEN 5.2(b)GEN 5.2(c) | GEN 5.1.1aGEN 5.1.1bGEN 5.1.1cGEN 5.1.1dGEN 5.1.2a GEN 5.1.2b 1-2GEN 5.2.1aGEN 5.2.1b | HS-LS3-1HS-LS3-2HS-LS3-3 |  |
| ~90 |  | GEN 5: Inheritance Patterns | 4.9: Albinism Investigation*Reinforcement/Practice*:Khan Academy: pedigree practice | GEN 5.1(a) GEN 3.4(a)GEN 3.4(b)GEN 3.4(c) | GEN 5.1.1a GEN 3.4.1aGEN 3.4.1bGEN 3.4.1c | HS-LS3-1HS-LS4-2 |  |
| ~45 |  | GEN 5: Inheritance Patterns | **Practice Performance Task**Thalassemia | GEN 3.3(c) GEN 3.4(a)GEN 3.4(b)GEN 3.4(c) | GEN 3.3.1aGEN 3.3.1bGEN 3.3.1cGEN 3.4.1bGEN 3.4.1c | HS LS3-1HS-LS4-2 |  |
| 45 |  | GEN 1–5 | **Pre-AP Sample Questions** think/pair/shareStudent groups generate claims for correct answers using evidence from the text and reasoning that includes scientific principles from this unit. (30 min)Reflections on essential knowledge statements for this unit and study plan developed based on this review (15 min) | May review all the learning objectives and essential knowledge statements in Key Concepts 1–5 |  |  |
| ~45 |  | GEN 6: Biotechnology | 4.10: Launch Lesson – Ethics and Decision Making in Science—Biotechnology | GEN 6.1(c) | GEN 6.1.1bGEN 6.1.1c |  |  |
| 90 |  | GEN 6: Biotechnology | Biotechnology research and presentations—students choose from an extensive list of topics then research and create a video to share with the class | GEN 6.1(b) GEN 6.1(c) | GEN 6.1.1bGEN 6.1.1c |  |  |
| ~75 |  | GEN 6: Biotechnology | 4.11: Gene Editing | GEN 6.1(b)GEN 6.1(c) | GEN 6.1.1aGEN 6.1.1bGEN 6.1.1c |  |  |
| ~70 |  | GEN 3, 5 | **Performance Task**Modeling Pigeon Trait InheritanceCirculate and note patterns and address before end of class. Scoring guidelines provided to students to review before the following day. | GEN 3.2(a)GEN 3.3(c)GEN 3.3(d)GEN 3.4(a)GEN 5.1(a)GEN 5.1(b) | GEN 3.2.1bGEN 3.2.1cGEN 3.3.1aGEN 3.3.1bGEN 3.4.1cGEN 5.1.1aGEN 5.1.1bGEN 5.1.1cGEN 5.1.1dGEN 5.1.2a | HS-LS1-1HS-LS3-2 |  |
| ~45 |  | GEN 4–6 | **Learning Checkpoint 2***This learning checkpoint can assess any of the learning objectives from its associated Key Concepts.* |  |  |  |
| 45 |  |  | **Assessment Reflections*** Collaborative performance task scoring and revisions (teacher has already identified class trends). Students will be assessed on accuracy of scoring and quality of revisions.
* Collaborative learning checkpoint rationales. Before gaining access to rationales provided on the platform, students are provided the correct answers and work together to write rationales providing specific evidence from the question for why their answer was incorrect and why the correct answer is the best one.
 |  |  |  |  |

[add or remove rows as needed]

### Reflections

What went well in this unit?

When were students most engaged during this unit?

How have students grown? What opportunities for growth stand out at this time?

What needs modification or differentiation next time?