

	Asking questions and defining problems	Developing and using models	Planning and carrying out investigations	Analyzing and interpreting data	Using mathematics and computational thinking	Constructing Explanations	Engaging in argument from evidence
Name of lesson							
DNA Sentences		x		x			
DNA Extraction			x				
GMO Speed Dating	x			x		x	x
Micropipetting				x	x		
Plasmid modeling	x	x				x	
pGLO transformation	x	x	x	x	x	x	x
Plant Tissue Culture	x	x	x	x		x	x
Biomass to Sugars	x	x	x	x	x	x	x
Corn Fermentation in a Bag	x	x	x	x	x	x	x
Ethanol: Corn Mash, Nutrient Testing, and Distillation	x	x	x	x	x	x	x
Explore an Ear of Corn		x	x				
Leaf Collar Method	x	x	x	x		x	x
Corn Field Math				x	x		

	HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.	HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.	HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.	HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintain complex organisms.	HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.	HS-LS1-6 construct and revise an explanation based on evidence for how carbon, hydrogen and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.	HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
DNA sentences	x	x					
DNA Extraction							
GMO Speed Dating							
Micropipetting							
Plasmid modeling	x	x					
pGLO transformation	x	x					
Plant Tissue Culture				x			
Biomass to Sugars							
Corn Fermentation in a Bag							
Ethanol: Corn Mash, Nutrient Testing, and Distillation							
Explore an Ear of Corn							
Leaf Collar Method		x					
Corn Field Math							

	HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.	HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.	HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.	HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.	HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.	HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.	HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.	HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
DNA sentences								
DNA Extraction								
GMO Speed Dating							x	
Micropipetting								
Plasmid modeling						x		
pGLO transformation		x						
Plant Tissue Culture		x				x		
Biomass to Sugars								
Corn Fermentation in a Bag			x			x		
Ethanol: Corn Mash, Nutrient Testing, and Distillation			x			x		
Explore an Ear of Corn								
Leaf Collar Method								
Corn Field Math								

	HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.	HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.	HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
DNA sentences	x		
DNA Extraction			
GMO Speed Dating			
Micropipetting			
Plasmid modeling	x	x	
pGLO transformation	x	x	x
Plant Tissue Culture	x	x	
Biomass to Sugars			
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Corn Field Math			

	HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.	HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.	HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.	HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.	HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
DNA sentences						
DNA Extraction						
GMO Speed Dating						x
Micropipetting						
Plasmid modeling		x		x		
pGLO transformation		x		x	x	
Plant Tissue Culture						x
Biomass to Sugars						
Corn Fermentation in a Bag						
Ethanol: Corn Mash, Nutrient Testing, and Distillation						
Explore an Ear of Corn						
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	HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	HS-PS1-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.	HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.	HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.	HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	HS-PS1-8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
DNA sentences								
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GMO Speed Dating								
Micropipetting								
Plasmid modeling								
pGLO transformation		x						
Plant Tissue Culture								
Biomass to Sugars								
Corn Fermentation in a Bag		x						
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	HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.	HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).	HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
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	HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.	HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
DNA sentences		X		
DNA Extraction				
GMO Speed Dating	X	X	X	
Micropipetting				
Plasmid modeling	X	X	X	
pGLO transformation		X	X	
Plant Tissue Culture	X	X		
Biomass to Sugars		X	X	
Corn Fermentation in a Bag		X	X	
Ethanol: Corn Mash, Nutrient Testing, and Distillation		X	X	
Explore an Ear of Corn				
Leaf Collar Method				
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