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MSAD #54 Science Curriculum

Content Area: Science
Unit: Unifying Themes

Grade: Grade 10
MLR Span: 9-12

MLR Content Standard: **A: Unifying Themes**
Students apply the principles of systems, models, constancy and change, and scale in science and technology.

*Assessment

Unifying Themes:	MLR Performance Indicators 9-12	MSAD #54 Objectives	Instructional Resources/Activities
A1 Systems	1.Students apply an understanding of systems to explain and analyze man-made and natural phenomena.	Students will:	
	a.Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem.	a1.trace the path of energy and matter in an ecosystem	a1.Ecosystem Energy Transfer activity
	b.Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system.	b1.Describe the impact of human influences on ecosystems.	b1.No small change activity

A2 Models	2.Students evaluate the effectiveness of a model by comparing its predictions to actual observations from the physical setting, the living environment, and the technological world.	Students will	
A3 Constancy and Change	3.Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances.	Students will: 3. explain the relationship between natural selection and evolution	3.Adaptation lab
A4 Scale	4.Students apply understanding of scale to explain phemomena in physical, biological, and technological systems. a.Describe how large changes of scale may change how physical and biological	Students will:	

	systems work and provide examples. b.Mathematically represent large magnitudes of scale.		

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MSAD #54 Science Curriculum

Content Area: Science
Unit: Skills & Traits

Grade: Grade 10
MLR Span: 9-12

MLR Content Standard: **B. The Skills and Traits of Scientific Inquiry And Technological Design**
Students plan, conduct, analyze data from and communicate results of in-depth scientific investigations; and they use a systematic process, tools, equipment, and a variety of materials to create a technological design and produce a solution or product to meet a specified need.

Skills and Traits	MLR Performance Indicators 9-12	MSAD #54 Objectives	Instructional Resources/Activities
B1 Skills and Traits of Scientific Inquiry	1. Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a.Identify questions, concepts, and testable hypotheses that guide scientific investigations. b.Design and safely conduct methodical scientific investigations, including experiments with controls. c.Use statistics to summarize, describe, analyze, and interpret results. d.Formulate and revise scientific investigations and models using logic	Students will:	

	and evidence. e.Use a variety of tools and technologies to improve investigations and communications. f.Recognize and analyze alternative explanations and models using scientific criteria. g.Communicate and defend scientific ideas.		
B2 Skills and Traits of Technological Design	2. Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a.Identify new problems or a current design in need of improvement. b.Generate alternative design solutions. c.Select the design that best meets established criteria. d.Use models and simulations as prototypes in the design planning	Students will	

	process. e.Implement the proposed design solution. f.Evaluate the solution to a design problem and the consequences of that solution. g.Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations.		

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MSAD #54 Science Curriculum

Content Area: Science | Grade: Grade 10
Unit: Scientific & Technological Enterprise | MLR Span: 9-12

MLR Content Standard: **C. The Scientific and Technological Enterprise**
Students understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts science and technology have on society and the environment.

Scientific & Technological Enterprise	MLR Performance Indicators 9-12	MSAD #54 Objectives	Instructional Resources/Activities
C1 Understandings of Inquiry	1.Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a.Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b.Describe how scientists defend their evidence and explanations using logical arguments and verifiable results.	Students will	
C2 Understandings About Science and Technology	2.Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems.	Students will	

	a.Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b.Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. c.Provide examples that illustrate how technological solutions to problems sometimes lead to new problems or new fields of inquiry.	a1.explain how technology has lead to advances in biology though the discoveries of Hooke, Mendel, Darwin, and Watson and Crick.	a1.Timeline activity to describe advancement in biology (in cells, evolution or DNA etc.)
C3 Science, Technology, and Society	3.Students describe the role of science and technology in creating and solving contemporary issues and challenges. a.Explain how science and technology influence the carrying capacity and sustainability of the planet. b.Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c.Explain how ethical,	Students will 3.identify the importance of science and technology in today's changing world	3. No small change activity

	societal, political, economic, religious, and cultural factors influence the development and use of science and technology.		
C4 History and Nature of Science	4.Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a.Describe and provide examples of the ethical traditions in science including peer review, truthful reporting, and making results public. b.Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c.Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d.Provide examples of criteria that distinguish scientific explanations form pseudoscientific ones.	Students will c1.evaluate the applications and benefits of genetic engineering.	c1.DNA choice/ Pro Or Con activity

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MSAD #54 Science Curriculum

Content Area: Science
Unit: Physical Setting

Grade: Grade 10
MLR Span: 9-12

MLR Content Standard: **D. The Physical Setting**
Students understand the universal nature of matter, energy, force, and motion and identify how these relationships are exhibited in Earth Systems, in the solar system, and throughout the universe.

Physical Setting	MLR Performance Indicators 9-12	MSAD #54 Objectives	Instructional Resources/Activities
D1 Universe and Solar System	1. Students explain the physical formation and changing nature of our universe and solar system, and how our past and present knowledge of the universe and solar system developed. a.Explain why the unit of light years can be used to describe distances to objects in the universe and use light years to describe distances. b.Explain the role of gravity in forming and maintaining planets, stars, and the solar system. c.Outline the age, origin, and process of formation of the universe as currently understood by science. d.Describe the major events that have led to our current understanding of the	Students will	

	universe and the current technologies used to further our understanding.		
D2 Earth	2.Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. a.Describe and analyze the effect of solar radiation, ocean currents, and atmospheric conditions on the Earth's surface and the habitability of Earth. b.Describe Earth's internal energy sources and their role in plate tectonics. c.Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d.Describe and analyze the effects of human influences on Earth Systems.	Students will a1-d1.describe the composition of the atmosphere. a1-d1.explain how the atmosphere is heated and include the role of land and surface water. a1-d1.describe the Earths system of water cycling. a1-d1.explain what causes Earth's major wind and pressure systems. a1-d1.describe typical daily weather patterns around lows and fronts. a1-d1. describe the most important storm systems and forms of severe weather. a1-d1.describe what determines climate. a1-d1.explain how latitude, oceans and other factors affect the climate of a region. a1-d1.classify climate systems. a1-d1.describe climate distribution over the United States.	

		a1-d1.explain supporting evidence for the continental drift hypothesis. a1-d1.discuss the failings of the continental drift hypothesis. a1-d1.describe the causes and characteristics of earthquakes. a1-d1.explain how seismic waves affect the Earth's surface.	
D3 Matter and Energy	3.Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. a.Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b.Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c.Explain the essential roles of carbon and water in life processes. d.Describe how light is	c1.describe how elements move through biotic and abiotic parts in an ecosystem.	c1. Nutrient Cycle Activity (Minilab 2.2)

	emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e.Describe factors that affect he rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules). f.Apply an a understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g.Describe nuclear reactions, including fusion and fission, and the energy they release. h.Describe radioactive decay and half-life. i.Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems. j.Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration)		

	useful energy is often lost through radiation or conduction. k.Apply an understanding of energy transformations to solve problems. l.Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions.		
D4 Force and Motion	4.Students understand that the laws of force and motion are the same across the universe. a.Describe the contribution of Newton to our understanding of force an motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation. b.Explain and apply the ideas of relative motion and frame of reference. c.Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies. d.Describe and apply characteristics of	Students will	

	waves including wavelength, frequency, and amplitude. e.Describe and apply an understanding of how waves interact with other waves and with materials including reflection, refraction, and absorption. f.Describe kinetic energy (the energy of motion). Potential energy (dependent on relative position), and energy contained by a field (including electromagnetic waves) and apply these understandings to energy problems.		

MSAD #54 Science Curriculum

Content Area: Science
Unit: The Living Environment

Grade: Grade 10
MLR Span: 9-12

MLR Content Standard: **E. The Living Environment**
Students understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection to create a great diversity of organisms, and that these organisms create interdependent webs through which matter an energy flow. Students understand similarities and differences between humans and other organisms and the interconnections of these interdependent webs.

Living Environment	MLR Performance Indicators 9-12	MSAD #54 Objectives	Instructional Resources/Activities
E1 Biodiversity	1.Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity.	Students will	
	a.Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment.	a1.explain how adaptations of organisms relate to natural selection.	a1.Adaptation lab
	b.Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species.		

	c.Analyze the relatedness among organisms using structural and molecular evidence.		
	d.Analyze the effects of changes in biodiversity and predict possible consequences.	d1.describe how the decline of a single species can affect an entire ecosystem.	d1.No Small change activity
E2 Ecosystems	2. Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change.	Students will	
	a.Explain why ecosystems can be reasonably stable over hundreds of thousands of years, even though populations may fluctuate.	a1. explain why the decline of a single species can affect an entire ecosystem	a1.No Small change activity
	b.Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations.	b1.describe how limiting factors affect the ecosytem stability in the short and long term.	b1.Reindeer on St. Paul Island Activity
	c.Explain the concept of carrying capacity and list factors that determine the amount of life that any	c1.understand the concepts of carrying capacity and limiting factors	c1.Reindeer on St. Paul Island Activity

	environment can support.		
	d.Describe the critical role of photosynthesis and how energy and the chemical elements that make up molecules are transformed in ecosystems and obey basic conservation laws.	d1.describe how elements move through biotic and abiotic parts in an ecosystem.	d1.Nutrient Cycle Activity (Minilab 2.2)
E3 Cells	3.Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals.	Students will	
	a.Describe the similarities and differences in the basic functions of cell membranes and to the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move.	a1.describe the structure and function of the parts of cells.	a1.Organelle Anatomy Activity Cell Identification Lab
	b.Describe the relationship among DNA, protein molecules, and amino	b1.describe the process of protein synthesis	b1.DNA sentence lab

	acids in carrying out the work of cells and how this is similar among all organisms.		
	d.Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis).	d1.explain the importance of mitosis and meiosis.	
	e.Describe ways in which cells can malfunction and put an organism at risk.	e1.understand how changes in DNA affect cells and organisms	
	e.Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment.		
	f.Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions.	f1.describe the importance of the complementary processes of photosynthesis and cellular respiration	
	g.Describe how cells differentiate to form specialized systems for carrying out life functions.		
E4 Heredity and Reproduction	4.Students examine the role of DNA in transferring traits from generation to	Students will	

	generation, in differentiating cells, and in evolving new species.		
	a.Explain some of the effects of the sorting and recombination of genes in sexual reproduction.	a1.explain the importance of genetic variability to the continuation of the species	
	b.Describe genes as segments of DNA that contain instruction for the cells and include information that leads to the differentiation of cells.	b1.relate the concept of the gene to the phenotype	
	c.Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA.		
	d.Describe the possible causes and effects of gene mutations.	d1.summarize the effects of various types of mutations on the species	
E5 Evolution	5.Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution.	Students will	
	a.Describe the premise of biological evolution, citing evidence from the	a1.describe evidence of evolution.	

	fossil record and evidence based on the observation of similarities within the diversity of existing organisms.		
	b.Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation.	b1.summarize Darwin's theory of Evolution by Natural Selection.	
	c.Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage.		
	d.Relate structural and behavioral adaptations of an organism to its survival in the environment.	d1.describe how adaptations lead to the survival of a species in an environment.	