

Grade 10 Science Curriculum Guide: Life Science Cluster (10)

<p>Big Understandings</p> <ul style="list-style-type: none"> • The growth and survival of organisms depend upon the physical and biological conditions of the environment. • Body Tissues and organs are made up of different kinds of cells. • The human body and other organisms function as systems. 		
<p>Content Standards Students will understand:</p> <p>A. Classifying Life Forms Students will understand that there are similarities within the diversity of all living things.</p>	<p>B. Ecology Students will understand how living things depend on one another and on non-living aspects of the environment.</p>	<p>C. Cells Students will understand that cells are the basic units of life.</p>
<p>Performance Indicators Students will be able to:</p> <ol style="list-style-type: none"> 1. Explain the role of DNA in resolving questions of relationships and evolutionary change. 2. Describe similarities and differences among organisms within each level of the taxonomic system for classifying organisms. 3. Analyze the basic characteristics of living things, including their need for food, water, and gases and the ability to reproduce. 	<ol style="list-style-type: none"> 1. Illustrate the cycles of matter in the environment and explain their interrelationships 2. Compare the process of photosynthesis and respiration and describe the factors that effect them. 3. Analyze the factors that affect population size. 4. Analyze the impact of human and other activities on the type and pace of change in ecosystems 	<ol style="list-style-type: none"> 1. Relate the parts of a cell to its function 2. Illustrate how cells replicate and transmit information including the roles of DNA and RNA. 3. Discuss the function of the important “molecules of Life” –proteins, carbohydrates, lipids and nucleic acids. 4. Explain how the human body protects itself against disease and how the body might lose that ability 5. Analyze and debate basic principles of genetic engineering: how it is done, its uses and some ethical implications.
<p>Knowledge / Skills</p> <p>Distinguish characteristics of each taxonomic level Compare and contrast the kingdoms of life Discuss the methods of modern classification and the use of DNA analysis in taxonomy Contrast living and non-living entities based upon observed characteristics Analyze a theory scientists use to explain the origin of life Examine the phenotypic results of gene mutation or chromosomal alterations Compare and contrast reproduction by mitosis and meiosis Discuss implications of genetic variability and bottleneck effects on populations Describe how artificial selection and natural selection can cause rapid changes in a species Explore scientific evidence supporting evolution by natural selection Examine evidence of changes on earth based upon scientific evidence (fossil record, geological timeline, etc.) Compare and contrast fertilization and development among species</p>	<p>Knowledge / Skills</p> <p>Differentiate organisms, populations, & communities in ecosystems Predict species interactions based upon observations Evaluate relationships between biotic and a biotic components Deduce factors that affect population size and predict types of population growth Use of a dichotomous key Examine the rate and effects of human population growth on the biosphere Illustrate the cycles of matter in the environment Understand relationship between cell respiration and photosynthesis Examine the effects of humans on ecosystems and formulate solutions to reduce impacts</p>	<p>Knowledge / Skills</p> <p>Differentiate between the structure and function of the various macromolecules, lipids, proteins, carbs & nucleic acids To review and apply microscopic technique in the study of cells Identifying cell structures of cell specimens Using stains to help identify cell organelles "Form follows function" Investigating how the function of an organelle is related to it's form. Compare and contrast plant and animal cells Identifying stages of mitosis Demonstrating the role of nucleic acids in protein synthesis and how their structure is related their function Be able to solve simple genetics problems and apply them to human genetics Have an understanding of DNA technology applications in paternity suits, solving crimes and organ transplants Describe how the body detects and repels harmful pathogens such as viruses and bacteria</p>
<p>Assessment</p> <ul style="list-style-type: none"> • Organism Research and Taxonomic Comparison – RP • Classification Dichotomous Key Lab – SR 	<p>Assessment</p> <ul style="list-style-type: none"> • Human Impact Impact – RP • Leaf Identification Test – SR • Ecology/Species Interaction Quiz – SR • Species Interrelationship Activity – SR 	<p>Assessment</p> <ul style="list-style-type: none"> • Macromolecule Matrix – SR • Cell Observation Laboratory – RP • Plant/Animal Comparison – SR • Cell Organelle Identification Quiz – SR

<ul style="list-style-type: none"> • "Is it living?" Essay – SR • Genetic Disorder Short Investigation – RP • Greenland Lemming Natural Selection – SR • Evolution quiz and exam – B • Evidence of evolution packet – SR • Evaluation of Evidence of Life Theories – SC • Darwin's Theory of Evolution Essay - SR 	<ul style="list-style-type: none"> • Stages of Succession Identification Activity – SR • Cycles Collage / Diagram – Model • Cycle Quizzes – SR • Photosynthesis/Respiration Comparison – SR • Ecology Exam – B • Peroxidase Enzyme Lab - SI 	<ul style="list-style-type: none"> • Cell Organelle Function Quiz – SR • Cell Structure as it Relates to Function – SR • Mitosis Flipbook – SR • Hybrid/Co dominance Problems – SR • Genetics Test – B • Cell Structure and Function Test – B • Pedigree worksheet – SR • DNA investigation kits - PC, SR • Blood typing laboratory – SR • Cell City Analogy – SR • Replication/Transcription/Translation Exam – B • 3D cell – Model • Pathogen "Wanted" poster – RP • Genetic Manipulation Persuasive Essay – RP •
<p>Resources</p> <ul style="list-style-type: none"> • Classification of Life Kit • Internet/Media center • Libby Hill Game Preserve • Characteristics of Life Activity • BDOL 17, 18 • 1000 mm of time (internet resources) • Internet/Media center • Immunology and Evolution Experiment Kit • Evolution video • Evolution of birds video • Bioterror video • Gattaca Discussion & Questions 	<p>Resources</p> <ul style="list-style-type: none"> • BDOL Ch 1, 3-5 • Project Wild • Internet, Infotrack, Infonet, media center • Libby Hill Game Preserve • Living Together (Symbiosis) Video • Population Dot Video • CNN Human Population Impact Video • Maine Tree Guide 	<p>Resources</p> <ul style="list-style-type: none"> • BDOL Ch 7, 8, 9 • DNA model kit • Genetics BioKit • Blood Typing Kit • Oxygen/Carbon Dioxide sensors • Vernier Data Recorders • EME Kayotypes and Genetic Disorders software • EME Intro to Genetics Disorders • Cracking the Code video • Standard Deviant's Biology video
<p>Instructional Strategies</p> <p>Application of characteristics of kingdom/phyla/class with unknowns</p> <p>Use of Graphic organizer to compare/contrast kingdoms</p> <p>Identification of live/specimens</p> <ul style="list-style-type: none"> • Lecture • Role-playing/scenarios • Manipulative <p>REEBOP genetic exercise</p>	<p>Instructional Strategies</p> <p>Provide local opportunities to visit a local ecosystem</p> <p>Reinforce that much natural change happens slowly</p> <p>Uses of technology to show human-caused changes in ecosystems</p> <p>Application of knowledge in authentic scenarios</p>	<p>Instructional Strategies</p> <p>Role-playing</p> <p>Construction of 3D cell</p> <p>Cell manipulatives</p> <p>Use of microscopes</p> <p>Use of graphic organizers</p> <p>Application of knowledge in authentic scenarios</p> <p>Gel Electrophoresis</p>

Grades 11 Science Curriculum Guide: Physical Science Cluster (11)

<p>Big Understandings</p> <ul style="list-style-type: none"> Matter is made up of tiny particles called atoms. Atoms are in constant, random motion. When a substance goes through a chemical change, the atoms are rearranged and a different substance with new properties is produced. Energy cannot be created or destroyed, only changed from one form to another (Law of Conservation). Motion can be described mathematically. 		
<p>Content Standards Students will understand:</p> <p>E. Structure of Matter Students will understand the structure of matter and the changes it can undergo.</p> <p>Note: Highlighted indicators are items for common assessments</p>	<p>H. Energy Student will understand concepts of energy.</p> <p>Note: Highlighted indicators are items for common assessments</p>	<p>I. Motion Students will understand the motion of objects and how forces can change that motion.</p> <p>Note: Highlighted indicators are items for common assessments</p>
<p>Performance Indicators Students will be able to:</p> <ol style="list-style-type: none"> Trace the development of models of the atom to the present and describe how each model reflects the scientific understanding of their time. <p>2. Analyze how matter is affected by changes in temperature, pressure and volume.</p> <ol style="list-style-type: none"> Describe the characteristics and behavior of acids and bases. Describe an application of the Law of Conservation of Matter. Describe how atoms are joined by chemical bonding. <p>6. Compare the physical and chemical characteristics of elements.</p> <p>7. Describe nuclear reactions including fusion, fission, and decay, their occurrences in nature, and how they can be used by humans</p>	<p>Performance Indicators Students will be able to:</p> <p>1. Analyze the evidence that leads scientists to conclude that light behaves somewhat like a wave and somewhat like a particle</p> <ol style="list-style-type: none"> Examine and describe how light is reflected and refracted by mirrors of lenses Explain or demonstrate how sound waves travel <p>4. Analyze the relationship between the kinetic and potential energy of a falling object.</p> <p>5. Use mathematics to describe the work and power in a system.</p> <ol style="list-style-type: none"> Describe the relationship between matter and energy and how matter releases energy through the processes of nuclear fission and fusion. Use mathematics to describe and predict electrical and magnetic activity Compare and contrast how conductors, semiconductors, and superconductors work and describe their present and potential uses Demonstrate an understanding that energy can be found in chemical bonds and can be used when it is released from those bonds 	<p>Performance Indicators Students will be able to:</p> <ol style="list-style-type: none"> Use mathematics to describe the law of conservation of momentum. Explain some current theories of gravitational force <p>3. Use Newton's Laws to describe the motion of objects qualitatively and quantitatively.</p> <ol style="list-style-type: none"> Describe how forces affect fluids Explain the relationship between temperature, heat and molecular motion Describe how forces within and between atoms affect their behavior and the properties of matter
<p>Knowledge / Skills</p> <ul style="list-style-type: none"> Rutherford's Nuclear atom Main parts of atom – relative mass $\frac{PV}{T} = \frac{P'V'}{T'}$ Write and balance equations Types of bonds Periodic table Energy from nuclear reactions 	<p>Knowledge / Skills</p> <ul style="list-style-type: none"> Conservation of energy $W=F \cdot S$ $P=W/T$ simple machines $KE = \frac{Mv^2}{2}$ $PE = mgh$ Momentum = $M \cdot v$ or $F \cdot T$ 	<p>Knowledge / Skills</p> <ul style="list-style-type: none"> Graph Distance as a function of time Graph Velocity as a function of time Find s,v,t,a from above graphs Acceleration due to gravity Universal gravitation $F=ma$ Open/closed systems

<ul style="list-style-type: none"> Radioactive Decay Lab Fossils 		<ul style="list-style-type: none"> Phase changers affected by T&P Liquids don't move into a vacuum, gases do. Using a syringe to measure volume of fluids Operation of a partial vacuum system How attenuation and compression of fluids affect density
<p>Assessment</p> <ul style="list-style-type: none"> Temp Rising - LAD Heating Up - LAD MEA #6, #10, #2 Periodic Table, PVT, Nuclear fission 	<ul style="list-style-type: none"> Nothing by Net – LAD MEA Released Items 4,12,16,28 	<ul style="list-style-type: none"> Vectors and motion MEA #21 Velocity and time MEA #4 Distance and time MEA #3 LAD Formal Lab reports Quizzes Fountain/Torilolli comparison
<p>Resources</p> <ul style="list-style-type: none"> Modern Chemistry, published by HRW Small Scale Chemistry Chemistry Physics, Hewitt 	<ul style="list-style-type: none"> Modern Physics Conceptual Physics, Hewitt Interactive Physics software “Logger Pro” software and hardware 	<ul style="list-style-type: none"> Use computers Modern Physics Conceptual Physics, Hewitt Interactive Physics software Logger Pro software and hardware Lab materials
<p>Instructional Strategies</p> <ul style="list-style-type: none"> Provide a variety of lab activities for students to explore chemical reactions Reinforce connections among chemical reactions, equations and math relationships Make connections between the properties of substances and their subatomic particles Demonstrate relation among P,V,T 	<ul style="list-style-type: none"> Provide opportunities for students to explore work, power, machines Review theories about conservation of energy Explore measurement of work, power, KE, PE Examine Interchange of KE + PE 	<ul style="list-style-type: none"> Reinforce relationship among distance, velocity, acceleration and time Provide opportunities for students to explore vectors by making maps Have students measure g and compare it to $9.8 \frac{m}{sec^2}$ Provide opportunities for students to predict the effect of a Force on a body's acceleration or velocity Series of lab investigations Fountain model project Explore phase changes of solid liquid gas. ↔ Class discussion ↔
	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">

Grade 9 Science Curriculum Guide: Earth and Space Sciences Cluster (9)

<p>Big Understandings</p> <ul style="list-style-type: none"> • Environmental and physical conditions on earth continue to change over time. • The universe is all encompassing; it includes galaxies, stars, meteors, comets, and asteroids. • Distances in the Universe can be measured indirectly. 		
<p>Content Standards Students will understand:</p> <p>D. Continuity and Change Students will understand the basis for all life and that all living things change over time.</p>	<p>F. The Earth Students will gain knowledge about the earth and the processes that change it.</p>	<p>G. The Universe Students will gain knowledge about the universe and how humans have learned about it, and about the principles upon which it operates.</p>
<p>Performance Indicators Students will be able to:</p> <ol style="list-style-type: none"> 1. Explain how mutations can be caused by gene mutation or chromosomal alteration and describe the possible results of such mutations on individuals or populations . 2. Describe why the offspring of sexually reproducing species have different survival rates than those of asexually reproducing species under a variety of conditions. Describe the advantages and disadvantages of each. 3. Explain and document the importance of relatively short-term changes on a species' survival 4. Describe how genetic manipulation can cause unusually rapid changes in species 5. Compare and contrast fertilization, zygote formation and embryo development in human and other species. 6. Analyze a theory scientists use to explain the origin of life 7. Explain both the evidence used to develop the geologic time scale and why an awareness of geologic time is important to an understanding of the process of change in the universe as well as on earth. 	<ol style="list-style-type: none"> 1. Describe how air pressure, temperature and moisture interact to cause changes to the weather. 2. Analyze potential effects of changes in the earth's oceans and atmosphere 3. Describe the impact of plate movement and erosion on the rock cycle 4. Describe ways that scientists measure long periods of time and determine the age of very old objects 5. Demonstrate how rocks and minerals are used to determine geologic history 6. Analyze the changes in continental position and the evidence that supports the concept of tectonic plates 	<ol style="list-style-type: none"> 1. Describe how scientists gather data about the universe 2. Research current explanations for phenomena such as black holes and quasars 3. Explain how astronomers measure interstellar distances
<p>Knowledge / Skills</p>	<p>Knowledge / Skills</p> <ul style="list-style-type: none"> • Affect of T & P or phase changes • Affect of T on volume of liquid & gas • Measuring Mass & Volume • Affect of T on liquid & gas 	<p>Knowledge / Skills</p> <ul style="list-style-type: none"> Evaluation websites Triangulation method Parallax method Life cycle star Methods to gather Data in astronomy
<p>Assessment</p> <ul style="list-style-type: none"> • 	<p>Assessment</p> <ul style="list-style-type: none"> • MSP • Quizzes • Formal Lab reports • Worksheet 	<p>Assessment</p> <ul style="list-style-type: none"> LAD – black holes Oral report Worksheets
<p>Resources</p> <ul style="list-style-type: none"> • 	<p>Resources</p> <ul style="list-style-type: none"> Lab materials 	<p>Resources</p> <ul style="list-style-type: none"> Internet

		Lab materials
<u>Instructional Strategies</u>	<u>Instructional Strategies</u>	<u>Instructional Strategies</u>
<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Series of lab investigations 	<ul style="list-style-type: none"> • Internet research • Investigations • Lecture • Discussion • Oral Presentation • Project assignments • Class discussion

Grades 9-12 Science Curriculum Guide: Nature and Implications of Science Cluster (9-12)

Big Understandings			
<p>Content Standards Students will understand:</p> <p>J. Inquiry and Problem Solving Students will apply inquiry and problem-solving approaches in science and technology.</p>	<p>K. Scientific Reasoning Students will learn to formulate and justify ideas and to make informed decisions.</p>	<p>L. Communication Students will communicate effectively in the application of science and technology.</p>	<p>M. Implications of Science and Technology Students will understand the historical, social, economic, environmental, and ethical implications of science and technology.</p>
<p>Performance Indicators Students will be able to:</p> <ol style="list-style-type: none"> 1. Make accurate observations using tools and units of measure. 2. Verify, evaluate, and use results in a purposeful way. This includes analyzing and interpreting data, making predictions based on observed patterns testing solutions against the original problem conditions, and formulating additional questions. 3. Demonstrate the ability to use scientific inquiry and technological method with short term and long term investigations, recognizing that there is more than one way to solve a problem. Demonstrate knowledge of when to try different strategies 4. Design and construct a device to perform a specific function then redesign for improvement 	<ol style="list-style-type: none"> 1. Judge the accuracy of alternative explanations by identifying the evidence necessary to support them 2. Explain why agreement among people does not make an argument valid 3. Develop generalizations based on observations 4. Determine when there is a need to revise studies in order to improve their validity through better sampling, controls or data analysis techniques 5. Produce inductive and deductive arguments to support conjecture 6. Analyze situations where more than one logical conclusion can be drawn 	<ol style="list-style-type: none"> 1. Analyze research or other literature for accuracy in the design and findings of experiments 2. Use journals and self-assessment to describe and analyze scientific and technological experiences and to reflect on problem-solving processes 3. Make and use appropriate symbols, pictures, diagrams, scale drawings, and models to represent and simplify real-life situations and to solve problems 4. Employ graphs, tables, and maps in making arguments and drawing conclusions 5. Critique models, stating how they do an do not effectively represent the real phenomenon 6. Evaluate the communication capabilities of new kinds of media 7. Use computers to organize data, generate models, and do research for problem solving 8. Engage in a debate, on a scientific issue, where both points of view are based on the same set of information 	<ol style="list-style-type: none"> 1. Examine the impact of political decisions on science and technology 2. Demonstrate the importance of resource management, controlling environmental impacts, and maintaining natural ecosystems 3. Evaluate the ethical use or introduction of new scientific or technological developments 4. Analyze the impacts of various scientific and technological developments 5. Examine the historical relationships between prevailing cultural beliefs and breakthroughs in science and technology 6. Research issues that illustrate the effects of technological imbalances and suggest some solutions
<p>Knowledge / Skills</p> <ul style="list-style-type: none"> • Data collection skills • $D = \frac{M}{V}$ Density of solids, liquids and gasses • use of scientific method of inquiry • How to write a formal lab report 	<p>Knowledge / Skills</p> <ul style="list-style-type: none"> • Use of scientific method of inquiry 	<p>Knowledge / Skills</p> <ul style="list-style-type: none"> • 	<p>Knowledge / Skills</p> <ul style="list-style-type: none"> •
<p>Assessment</p> <ul style="list-style-type: none"> • Boat project • Quizzes • Formal/informal lab reports 	<p>Assessment</p> <ul style="list-style-type: none"> • Formal/informal lab reports 	<p>Assessment</p> <ul style="list-style-type: none"> • 	<p>Assessment</p> <ul style="list-style-type: none"> •
<p>Resources</p> <ul style="list-style-type: none"> • Lab materials • Provided by students 	<p>Resources</p> <ul style="list-style-type: none"> • Lab Materials • 	<p>Resources</p> <ul style="list-style-type: none"> • 	<p>Resources</p> <ul style="list-style-type: none"> •
<p>Instructional Strategies</p> <ul style="list-style-type: none"> • Boat project • Series lab investigations • Class discussion 	<p>Instructional Strategies</p> <ul style="list-style-type: none"> • Series of lab investigations • Class discussion 	<p>Instructional Strategies</p> <ul style="list-style-type: none"> • 	<p>Instructional Strategies</p> <ul style="list-style-type: none"> •