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CLEVELAND
METROPOLITAN
SCHOOL DISTRICT

SUBJECT: PHYSICAL SCIENCE GRADE: 9

EARLY 1ST QUARTER

Course Content: Universe

Topic: The universe and galaxies are introduced, building upon the previous knowledge about space and the solar system in the earlier grades.

- **History of the universe:** The Big Bang Model is a broadly accepted theory for the origin and evolution of our universe.
- **Galaxy formation**: A galaxy is a group of billions of individual stars.
- **Stars:**
  - Formation; stages of evolution
  - Fusion in stars

Course Content : Energy and Waves

Topic: Major concepts about energy and waves are further developed. Conceptual knowledge will move from qualitative understandings of energy and waves to ones that are more quantitative using mathematical formulas, manipulations and graphical representations**.**

- **Conservation of energy:** Energy content learned in middle school, specifically conservation of energy and the basic differences between kinetic and potential energy, is elaborated on and quantified.
  - Quantifying kinetic energy
  - Quantifying gravitational potential energy
  - Energy is relative

LATE 1ST QUARTER

Course Content : Energy and Waves

Topic: Major concepts about energy and waves are further developed. Conceptual knowledge will move from qualitative understandings of energy and waves to ones that are more quantitative using mathematical formulas, manipulations and graphical representations.

- **Transfer and transformation of energy:** (including work, $W = F\Delta x$.)
- **Waves:** waves transmit energy from one place to another, can transfer energy between objects. Refraction, reflection, diffraction, absorption, superposition are addressed from the perspective of waves and expanded to include other types of energy that travel in waves.
  - Refraction, reflection, diffraction, absorption, superposition
  - Radiant energy and the electromagnetic spectrum
  - Doppler shift
- **Thermal energy:** Processes of heat transfer, including conduction, convection and radiation, are studied. The role of thermal energy during heating, cooling and phase changes is explored conceptually and graphically. Rates of thermal energy transfer and thermal equilibrium are introduced.

DATA ENHANCEMENT

- This link provides interactive actives for various topics for physical science; http://www.nasa.gov/
- This link provides various technology lesson plans and instructional resources for physical science. http://www.discoveryeducation.com/search/page/9-12/science/-/-/index.cfm?campaign=flyout_teachers_912_science
- Investigate the star life cycle with interactive media or gain an overview of astronomical spectroscopy in studies of stellar spectra. http://sunshine.chpc.utah.edu/labs/star_life/starlife_main.html
- "Energy: Misconceptions and Models" is a downloadable document from the U.K. Department for Education that gives strategies for teaching different models of energy and addressing misconceptions about energy. https://www.education.gov.uk/schools/toolsandinitiatives/nationalstrategies

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA
Writing Standards: W.9-10.1, W.9-10.7
Language Standards: L.9-10.6

MATH
HSN-Q.A.1, **HSA**-CED.A.4
Expressions & Equations: 8.A.4
Functions: 8.B.5

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness & self-management skills to achieve school & life success.

- Demonstrate control of impulse behaviors.
- Establish routines such as daily schedules that fit into & establish school culture
- Introduce vocabulary terms that would be used throughout school year: etiquette, manners, respect,
- Develop self-awareness & self-management skills to achieve school & life success
- State your expectations about high school & tell how you plan to make your high school years a positive experience.
- Become aware of the requirements for high school graduation & processes for accumulating & tracking credits each year.
- Describe what motivates & hinders your efforts as a learner.
- Describe your personal strengths & areas needing development.
- Analyze how personal qualities influence choices & successes
- Explain how participating in school activities can help you get comfortable in your new school more quickly..
- Describe coping strategies you know for handling stress.
- Demonstrate knowledge of specific vocabulary that was introduced early first quarter

Strand: Use social-awareness & interpersonal skills to establish & maintain positive relationships & caring communities.

- Define ways that your friends from middle school can support each other in going off to a good start in high school.
- Aim to know the names of most of your new classmates.
- Get to know key adults in the school & establish good relationships with them.
- Negotiate school rules & expectations with your classmates & develop ways of holding each other accountable for doing the right thing.
- Learn which school clubs & other activities are available for deepening interests & making new friends.

Strand: Demonstrate decision-making skills & responsible behaviors in personal, school, & community contexts.

- Describe responsible behaviors for working cooperatively in teams, in school & in the workplace.
- Develop & adhere to a schedule which prioritizes school work.
- Assess when there is a need to involve an adult in a school issue that you cannot resolve alone (e.g., having the wrong roster)
- Recognize signs of danger & know how to report information to school staff.
- Identify social norms & safety considerations that guide behavior.
- Identify the reasons for school & societal rules.
- Demonstrate appropriate school & classroom behavior.
- Decide which clubs & activities would be a good match for your skills & interests.
- Discuss & demonstrate understanding of the expectations set forth by the Student Handbook: Student Rights & Responsibilities.
- Determine the extent to which your own decisions & behavior contribute to stress & come up with a plan for changing that decision. (e.g., the decision to procrastinate, the decision to gossip).
- Demonstrate the ability to respect the rights of self & others.
- Evaluate how honesty, respect, fairness, & compassion enable one to take the needs of others into account when making decisions.
- Make positive choices when interacting with classmates.
- Describe causes & consequences of conflicts
- Identify problems & conflicts commonly experienced by peers
- Restrict use of social media to appropriate, manageable & legal levels.

SUBJECT: PHYSICAL SCIENCE GRADE: 9

EARLY 2ND QUARTER

Course Content: Energy and Waves

Topic: Major concepts about energy and waves are further developed. Conceptual knowledge will move from qualitative understandings of energy and waves to ones that are more quantitative using mathematical formulas, manipulations and graphical representations.

- **Electricity**: Circuits are explained by the flow of electrons, and current, voltage and resistance are introduced conceptually to explain what was observed in middle school. The differences between electrical conductors and insulators can be explained by how freely the electrons flow throughout the material due to how firmly electrons are held by the nucleus.
  - Movement of electrons
  - Current
  - Electric potential (voltage)
  - Resistors and transfer of energy

LATE 2ND QUARTER

Course Content: Study of Matter

Topic: Matter was introduced in the elementary grades and the learning progression continued through middle school to include differences in the physical properties of solids, liquids and gases, elements, compounds, mixtures, molecules, kinetic and potential energy and the particulate nature of matter. Content in the chemistry syllabus (e.g., electron configuration, molecular shapes, bond angles) will be developed from concepts in this course.

- **Classification of matter**
  - Heterogeneous vs. homogeneous
  - Properties of matter
  - States of matter and its changes
- **Atoms**
  Content introduced in middle school, where the atom was introduced as a small, indestructible sphere, is further developed in the physical science. →**EQ3**
  - Models of the atom (components)
  - Ions (cations and anions)
  - Isotopes

DATA ENHANCEMENT

- This link provides interactive actives for various topics for physical science; http://www.nasa.gov/
- This link provides various technology lesson plans and instructional resources for physical science. http://www.discoveryeducation.com/search/page/9-12/science/-/-/index.cfm?campaign=flyout_teachers_912_science
- "Energy: Misconceptions and Models" is a downloadable document from the U.K. Department for Education that gives strategies for teaching different models of energy and addressing misconceptions about energy. https://www.education.gov.uk/schools/toolsandinitiatives/nationalstrategies
- This is a website that provides short video clips for introducing topics or further research for students http://science.howstuffworks.com/

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA
Writing Standards: W.9-10.1, W.9-10.7
Language Standards: L.9-10.6

MATH
HSN-Q.A.1, **HSA**-CED.A.4
Expressions & Equations: 8.A.4

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness & self-management skills to achieve school & life success.

- Describe strategies you used in the past to adapt to new situations.
- Demonstrate control of impulse behaviors.
- Establish routines such as daily schedules that fit into and establish school culture
- Introduce vocabulary terms that would be used throughout school year: etiquette, manners, respect,
- Develop self-awareness and self-management skills to achieve school and life success
- State your expectations about high school & tell how you plan to make your high school years a positive experience.
- Become aware of the requirements for high school graduation & processes for accumulating and tracking credits each year.
- Describe what motivates & hinders your efforts as a learner.
- Describe your personal strengths & areas needing development.
- Analyze how personal qualities influence choices and successes

Strand: Use social-awareness & interpersonal skills to establish & maintain positive relationships & caring communities.

- Define ways that your friends from middle school can support each other in going off to a good start in high school.
- Aim to know the names of most of your new classmates.
- Get to know key adults in the school and establish good relationships with them.
- Negotiate school rules and expectations with your classmates and develop ways of holding each other accountable for doing the right thing.
- Learn which school clubs and other activities are available for deepening interests and making new friends.
- Differentiate among passive, assertive and aggressive responses to peer pressure.
- Evaluate the effectiveness of various strategies for dealing with negative peer pressure.
- Analyze the support of people in your life who have helped you resist negative influences.

Strand: Demonstrate decision-making skills & responsible behaviors in personal, school, & community contexts.

- Develop and adhere to a schedule which prioritizes school work.
- Assess when there is a need to involve an adult in a school issue that you cannot resolve alone (e.g., having the wrong roster)
- Recognize signs of danger and know how to report information to school staff.
- Identify social norms and safety considerations that guide behavior.
- Identify the reasons for school and societal rules.
- Demonstrate appropriate school and classroom behavior.
- Decide which clubs and activities would be a good match for your skills and interests.
- Discuss and demonstrate understanding of the expectations set forth by the Student Handbook: Student Rights and Responsibilities.
- Evaluate strategies for resisting pressures to engage in unsafe or unethical activities.
- Demonstrate personal responsibility in making ethical decisions.

SUBJECT: PHYSICAL SCIENCE **GRADE: 9**

EARLY 3RD QUARTER

Course Content: Study of Matter

Matter was introduced in the elementary grades and the learning progression continued through middle school to include differences in the physical properties of solids, liquids and gases, elements, compounds, mixtures, molecules, kinetic and potential energy and the particulate nature of matter. Content in the chemistry syllabus (e.g., electron configuration, molecular shapes, bond angles) will be developed from concepts in this course.

- **Atoms:** Content introduced in middle school, where the atom was introduced as a small, indestructible sphere, is further developed in the physical science. ←**LQ2**
  - Models of the atom (components)
  - Ions (cations and anions)
  - Isotopes
- **Periodic trends of the elements:** The properties of metals and nonmetals and their positions on the periodic table, is further expanded in this course
  - Periodic law
  - Representative groups

LATE 3RD QUARTER

Course Content: Study of Matter

Matter was introduced in the elementary grades and the learning progression continued through middle school to include differences in the physical properties of solids, liquids and gases, elements, compounds, mixtures, molecules, kinetic and potential energy and the particulate nature of matter. Content in the chemistry syllabus (e.g., electron configuration, molecular shapes, bond angles) will be developed from concepts in this course.

- **Bonding and compounds:** The chemical joining of atoms is studied in more detail. Atoms may be bonded together by losing, gaining or sharing electrons to form molecules or three- dimensional lattices.
  - Bonding (ionic and covalent)
  - Nomenclature
- **Reactions of matter:** Conservation of matter is expressed by writing balanced chemical equations. Reactants and products can be identified from an equation and simple equations can be written and balanced given either the formulas of the reactants and products or a word description of the reaction.
  - Chemical reactions
  - Nuclear reactions

DATA ENHANCEMENT

- This link provides interactive actives for various topics for physical science; http://www.nasa.gov/
- This link provides various technology lesson plans and instructional resources for physical science. http://www.discoveryeducation.com/search/page/9-12/science/-/-/index.cfm?campaign=flyout_teachers_912_science

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA
Writing Standards: W.9-10.1, W.9-10.7
Language Standards: L.9-10.6

MATH
HSN-Q.A.1, **HSA**-CED.A.4
Expressions & Equations: 8.A.4

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness & self-management skills to achieve school & life success.

- Analyze your progress in adjusting to high school and state where there have been obstacles.
- Think about ways you overcame obstacles in the past and how you can apply those strategies now.
- Explain your awareness or lack of awareness of school and community resources that can provide supports to students.
- Name adults you have not considered approaching as yet but who could be resourceful to you in overcoming challenges
- Identify a goal that is related to something you aspire to be or do when you are grown. It might be a career goal or a humanistic goal around improving society.
- Describe what contributed to your interest in that area.
- Begin to develop a short term plan for finding out what you need to do now to reach that goal.

Strand: Use social-awareness & interpersonal skills to establish & maintain positive relationships & caring communities.

- Evaluate strategies for preventing and resolving interpersonal problems that might be contributing to any problems you might be experiencing in adjusting to high school.
- Define strategies for advocating for yourself in ways that encourage people to want to assist you.
- Evaluate the role that patience and gratitude play in seeking and receiving support.
- Determine who you will need to establish relationships with in order to research your goal area to gain a better understanding.
- Develop interview questions to be used in finding out information from people who can talk to you about your goal area.
- Enlist the help of your friends in practicing your interview questions.
- Develop strategies for building confidence and overcoming shyness to seek out people to interview.

Strand: Demonstrate decision-making skills & responsible behaviors in personal, school, & community contexts.

- Identify the obstacles you are having in adjusting to high school.
- Develop a plan to eliminate obstacles and foster personal success
- Explain how you decide that it is time to seek help.
- Evaluate which school and community resources would be most useful in providing support when needed.
- Decide early decisions that you will need to make in pursing the goal that you chose.
- Demonstrate positive interactions in the people you solicit for support in researching your goal so they will want to keep helping you.
- Determine how word choice, voice inflection and attitude contribute to a successful interview.

TEACHER NOTES

SUBJECT: PHYSICAL SCIENCE GRADE: 9

EARLY 4TH QUARTER	LATE 4TH QUARTER
Course Content: Forces and Motion Major concepts of motion and forces are further developed. Speed has been dealt with conceptually, mathematically and graphically. Mathematics (including graphing) is used when describing these phenomena, moving from qualitative understanding to one that is more quantitative. For the physical science course, all motion is limited to objects moving in a straight line either horizontally, vertically, up an incline or down an incline, that can be characterized in a single step .Motions of two objects may be compared or addressed simultaneously. • **Forces:** Force is a vector quantity, having both magnitude and direction***. The opportunity to measure force in the lab must be provided*** o Force diagrams o Types of forces (gravity, friction, normal, tension) o Field model for forces at a distance	**Course Content: Forces and Motion** Major concepts of motion and forces are further developed. Speed has been dealt with conceptually, mathematically and graphically. Mathematics (including graphing) is used when describing these phenomena, moving from qualitative understanding to one that is more quantitative. For the physical science course, all motion is limited to objects moving in a straight line either horizontally, vertically, up an incline or down an incline, that can be characterized in a single step .Motions of two objects may be compared or addressed simultaneously. • **Motion:** The relative nature of motion will be addressed conceptually, not mathematically. o Introduction to one-dimensional vectors o Displacement, velocity (constant, average and instantaneous) and acceleration o Interpreting position vs. time and velocity vs. time graphs • **Dynamics** (how forces affect motion) o Objects at rest o Objects moving with constant velocity o Accelerating objects

DATA ENHANCEMENT

- This link provides interactive activities for various topics for physical science; http://www.nasa.gov/
- This link provides various technology lesson plans and instructional resources for physical science. http://www.discoveryeducation.com/search/page/9-12/science/-/-/index.cfm?campaign=flyout_teachers_912_science

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA
Writing Standards: W.9-10.1, W.9-10.7
Language Standards: L.9-10.6

MATH
HSN-Q.A.1, **HSA**-CED.A.4
Functions: 8.B.5

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness & self-management skills to achieve school & life success.	Strand: Use social-awareness & interpersonal skills to establish & maintain positive relationships & caring communities.	Strand: Demonstrate decision-making skills & responsible behaviors in personal, school, & community contexts.
• Keep a journal that describes your deepening understanding of the process for obtaining the goal you are researching. • Compare what will be needed to meet the goal to the qualities you used in meeting goals in the past. • Prepare a presentation highlighting what you learned about the goal and what you will need to do over the remaining years of high school to meet that goal as an adult.	• Evaluate the effects of requesting support from others. • Chart how courteous behaviors motivate people to want to engage with you. • Make note of which strategies are most successful in opening the doors of the people you need to speak to in doing your research. • Thank the people who assisted you and develop strategies for keeping in touch with them. • Begin to build a pool of people you can list as resources on applications for jobs and various other opportunities. • Celebrate the success of completing this project with your friends while acknowledging them for strides they made as well. • Compare note with your friends about what it took to make a successful transition to high school. Pledge to support each other over the remaining years.	• Analyze how present decision making will affect the likelihood of that goal or aspiration being met in the future. • Make a list of new skills you will need to acquire and decide how you might go about acquiring them. • Continue to analyze how present decision making will affect the likelihood of that goal or aspiration being met in the future. • Develop a plan for acquiring the skills necessary to meet your goal. • Decide how the lesson learned during 9th grade will contribute to your success in 10th grade.

TEACHER NOTES

SUBJECT: BIOLOGY **GRADE: 10**

EARLY 1ST QUARTER	LATE 1ST QUARTER
Course Content: Diversity and Interdependence of Life ***Topic:*** This topic focuses on the study of diversity and similarity at the molecular level of organisms. Additionally the effects of physical/chemical constraints on all biological relationships and systems are investigated. • Classification systems are frameworks created by scientists for describing the vast diversity of organisms indicating the degree of relatedness between organisms.	**Course Content: Diversity and Interdependence of Life** ***Topic:*** This topic focuses on the study of diversity and similarity at the molecular level of organisms. Additionally the effects of physical/chemical constraints on all biological relationships and systems are investigated. • **Ecosystems** o Homeostasis ▪ Carrying capacity ▪ Equilibrium and disequilibrium ***Note 1:*** *Exponential growth equation in simplest form, change in population size N per unit time t is a product of r (the per capita reproductive rate) and N (population size.* ***Note 2:*** *Carrying capacity is defined as the population equilibrium sized when births and deaths are equal; hence dN/dt = zero.* ***Note 3:*** *Constructing food webs/food chains to show interactions between organisms within ecosystems was covered in upper elementary school & middle school; constructing them as a way to demonstrate content knowledge is not appropriate for this grade. Students may use these diagrams to help explain real-world relationships or events within an ecosystem, but not to identify simple trophic levels, consumers, producers, predator-prey & symbiotic relations.*

DATA ENHANCEMENT

- Use technology and mathematics to improve investigations and communications
- Construct a model to exemplify biomagnification in an ecosystem such as mercury in Lake Erie. Include a quantification of the distribution and buildup of the potentially damaging molecule that was introduced into the ecosystem. Within the model, predict and explain why the consequences occur at each trophic level as the relative concentration of the chemical increases. Include in your justification the changes in the number of organisms at each trophic level, matter cycling and energy transfer from one level to another.
- Mathematical graphing and algebraic knowledge (at the high school level) must be used to explain concepts of carrying capacity and homeostasis within biomes. Use real-time data to investigate population changes that occur locally or regionally. Mathematical models can include exponential growth model and the logistic growth model. The simplest version of the logistic growth model is *dN/dt = rN (K-N/K)*; the only new variable added to the exponential model is K for carrying capacity.
- Examine wildlife populations in Ohio like bald eagles, beavers or white-tailed deer. The Ohio Department of Natural Resources provides population data over the years. Examine the factors that have impacted the carrying capacity. http://www.dnr.state.oh.us/Home/wild_resourcessubhomepage/ResearchandSurveys/WildlifePopulationStatusLandingPage/tabid/19230/Default.aspx
- The Southern Nevada Regional Professional Development Center provides a tutorial, which explains the links between classification systems and evolution. http://rpdp.net/sciencetips_v2/L12D1.htm

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA
Writing Standards: W.9-10.1c, W.9-10.4
Speaking and Listening Standards: SL.9-10.4
Reading Standards: RST.9-10.2, RST.9-10.3, RST.9-10.4

SOCIAL STUDIES
World Geography-Environment and Society: 6.
There are costs and benefits of using renewable, nonrenewable, and flow resources (e.g., availability, sustainability, environmental impact, expense).

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness and self-management skills to achieve school and life success.	Strand: Use social-awareness and interpersonal skills to establish and maintain positive relationships and caring communities.	Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.
• Identify attitudes and behaviors that lead to successful learning and proper etiquette. • Assess which attitudes and behaviors presented challenges during 9th grade and how you plan to combat them going into 10th grade. • Display a positive interest in learning. • Recognize personal qualities and external supports. • Analyze how making use of school and community supports and opportunities can contribute to school and life success. • Analyze factors that create stress or motivate successful performance. • Create positive group dynamics.	• Commit to using greater discretion in identifying friends and developing friendships. • Assess the extent to which the summer months shifted priorities in friends who are no longer as focused on school and success. • Develop skills for separating yourself from people who are not interested in seeing you succeed. • Practice strategies to use constructively in social and other media (Facebook, email, Twitter, etc…)	• Determine how you will decide to divide the labor when needing to accomplish a group task. • Develop processes for holding people responsible for their load of the work.

EARLY 2ND QUARTER	LATE 2ND QUARTER
Course Content: Cells ***Topic:*** This topic focuses on the cell as a system itself (single-celled organism) and as part of larger systems (multicellular organism), sometimes as part of a multicellular organism, always as part of an ecosystem. The cell is a system that conducts a variety of functions associated with life. Details of cellular processes such as photosynthesis, chemosynthesis, cellular respiration, cell division and differentiation are studied at this grade level. Additionally, cellular organelles studied are cytoskeleton, Golgi complex and endoplasmic reticulum. • **Cell structure and function:** There are specialized parts for the transport of materials, energy transformation, protein building, waste disposal, information feedback and movement. In addition to these basic cellular functions, most cells in multicellular organisms perform some specific functions that others do not. o Structure, function and interrelatedness of cell organelles o Eukaryotic cells and prokaryotic cells ***Note:*** *The concept of the cell and its parts as a functioning system is more important than memorizing parts of the cell.*	**Course Content: Cells** ***Topic:*** This topic focuses on the cell as a system itself (single-celled organism) and as part of larger systems (multicellular organism), sometimes as part of a multicellular organism, always as part of an ecosystem. The cell is a system that conducts a variety of functions associated with life. Details of cellular processes such as photosynthesis, chemosynthesis, cellular respiration, cell division and differentiation are studied at this grade level. Additionally, cellular organelles studied are cytoskeleton, Golgi complex and endoplasmic reticulum. • **Cellular processes:** Cell functions are regulated. Complex interactions among the different kinds of molecules in the cell cause distinct cycles of activities, such as growth and division. Most cells function within a narrow range of temperature and pH. o Characteristics of life regulated by cellular processes o Photosynthesis, chemosynthesis, cellular respiration o Cell division and differentiation ***Note:*** *The idea that protein molecules assembled by cells conduct the work that goes on inside and outside the cells in an organism can be learned without going into the biochemical details. It is sufficient for students to know that the molecules involved are different configurations of a few amino acids and that the different shapes of the molecules influence what they do.*

DATA ENHANCEMENT

- Investigate the effect of different chemicals on the growth of algal colonies. Use mathematics to explain why even under ideal situations the colonies cannot continue exponential growth.
- Plan and design an investigation to determine the factors that affect the activity of enzymes on their substrates.
- Research and provide a written explanation of how unicellular organisms are used for industrial purposes.
- Surface area to volume ratio of a cell (introduction to mitosis as well) http://www.biologyjunction.com/cell_size.htm
- Diffusion Lab http://biologycorner.com/worksheets/diffusionlab.html
- Potato Osmosis Lab http://www.biologyjunction.com/potato_osmosis_bi_lab.htm
- Properties of Life Lab http://serendip.brynmawr.edu/sci_edu/waldron/pdf/IsYeastAliveProtocol.pdf
- Developing and testing hypothesis lab http://www.lessoncorner.com/l/amfroehle/VitruvianManDataCollection
- chromatography lab http://www.biologyjunction.com/chromatography_plant_pigments.htm
- Resources for Biology Activities http://www.biologyjunction.com/biology_projects.htm

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA

Reading Standards: RST.9-10.2, RST.9-10.3, RST.9-10.4

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.

- Interpret and evaluate the importance of personal roles and responsibilities in the overall school climate.
- Analyze the purpose and impact of classroom and school wide activities, policies, and routines.
- Determine how you will decide to divide the labor when needing to accomplish a group task.
- Develop processes for holding people responsible for their load of the work.

TEACHER NOTES

SUBJECT: BIOLOGY **GRADE: 10**

EARLY 3RD QUARTER	LATE 3RD QUARTER
Course Content: Heredity ***Topic:*** This topic focuses on the explanation of genetic patterns of inheritance. Mendel's laws of inheritance (introduced in grade 8) are interwoven with current knowledge of DNA and chromosome structure and function to build toward basic knowledge of modern genetics. • **Cellular genetics** • **Structure and function of DNA in cells** • **Genetic mechanisms and inheritance** ***Note:*** *It is imperative that the technological developments that lead to the current knowledge of heredity be included in the study of heredity.*	**Course Content: Heredity** ***Topic:*** This topic focuses on the explanation of genetic patterns of inheritance. Mendel's laws of inheritance (introduced in grade 8) are interwoven with current knowledge of DNA and chromosome structure and function to build toward basic knowledge of modern genetics. • **Mutations** • **Modern genetics** ***Note:*** *It is imperative that the technological developments that lead to the current knowledge of heredity be included in the study of heredity.*

DATA ENHANCEMENT

- DNA Learning Center features an interactive site that provides detailed background knowledge on how genomes are developed and used for research. http://www.dnai.org/c/index.html?m=3
- Develop a timeline from Mendel's, Darwin's and Wallace's work to the present day.
- Design and implement an investigation to test the effect of low doses of different common chemicals (e.g., boric acid, acetone or vinegar) on the development of a plant from seed to adult. Represent the data in a way that demonstrates the relationship, if any, between the chemical and changes in the development pattern. Explain how the investigation is similar to or different from the processes that occur in the natural environment.
- Dihybrid crosses can be used to explore linkage groups.
- Modern genetics techniques, such as cloning must be explored in this unit.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA
Reading Standards: RST.9-10.2, RST.9-10.3, RST.9-10.4
Reading for Literature Standards: RL.9-10.1

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness and self-management skills to achieve school and life success.	Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.
• Keep a journal of lessons learned in working on group projects to guide you in future group work. • Reflect on examples of success as the project develops.	• Determine how you will decide to divide the labor when needing to accomplish a group task. • Develop processes for holding people responsible for their load of the work.

TEACHER NOTES

SUBJECT: BIOLOGY **GRADE: 10**

EARLY 4TH QUARTER	LATE 4TH QUARTER
Course Content: Evolution ***Topic:*** Biological evolution explains the natural origins for the diversity of life. Emphasis shifts from thinking in terms of selection of individuals with a particular trait to changing proportions of a trait in populations. The study of evolution must include Modern Synthesis, the unification of genetics and evolution and historical perspectives of evolutionary theory. The study of evolution must include gene flow, mutation, speciation, natural selection, genetic drift, sexual selection and Hardy Weinberg's law. • **Mechanisms** o Natural selection o Mutation o Genetic drift o Gene flow (immigration, emigration) o Sexual selection o History of life on Earth **Populations evolve over time.** Evolution is the consequence of the interactions of: 1. The potential for a population to increase its numbers; 2. The genetic variability of offspring due to mutation and recombination of genes; 3. A finite supply of the resources required for life; and 4. The differential survival and reproduction of individuals with the specific phenotype.	**Course Content: Evolution** ***Topic:*** Biological evolution explains the natural origins for the diversity of life. Emphasis shifts from thinking in terms of selection of individuals with a particular trait to changing proportions of a trait in populations. The study of evolution must include Modern Synthesis, the unification of genetics and evolution and historical perspectives of evolutionary theory. The study of evolution must include gene flow, mutation, speciation, natural selection, genetic drift, sexual selection and Hardy Weinberg's law. • **Diversity of Life** o Speciation and biological classification based on molecular evidence o Variation of organisms within a species due to population genetics and gene frequency **Populations evolve over time.** Evolution is the consequence of the interactions of: 1. The potential for a population to increase its numbers; 2. The genetic variability of offspring due to mutation and recombination of genes; 3. A finite supply of the resources required for life; and 4. The differential survival and reproduction of individuals with the specific phenotype.

DATA ENHANCEMENT

- Manipulate variables (e.g., distribution of traits, number of organisms and change in environmental conditions) in a simulation that represents natural selection in terms of how changes in environmental conditions can result in selective pressure on a population of organisms. Analyze the data to determine the relationship, if any, between the environmental changes and the population. Explain how each part of the simulation is similar to or different from the process of natural selection.
- Additional evolution resources: http://www.indiana.edu/~ensiweb/
- Natural selection simulation activities and virtual labs: http://phet.colorado.edu/en/simulation/natural-selection
- Peppered moth simulation activity: http://www.biologycorner.com/worksheets/pepperedmoth.html

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA
Reading Standards: RST.9-10.2, RST.9-10.4

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness and self-management skills to achieve school and life success. • Keep a journal of lessons learned in working on group projects to guide you in future group work. • Reflect on examples of success as the project develops.	**Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.** • Determine how you will decide to divide the labor when needing to accomplish a group task. • Develop processes for holding people responsible for their load of the work.

TEACHER NOTES

SUBJECT: CHEMISTRY **GRADE: 11**

EARLY 1ST QUARTER

Course Content: Structure and Properties of Matter

Topic: *Quantifying Matter*

Scientific protocols for quantifying the properties of matter accurately and precisely are studied.

- Using metric measuring systems, significant digits or figures, scientific notation, error analysis and dimensional analysis are vital to scientific communication.
- The mass of one mole of a substance is equal to its formula mass in grams. The formula mass for a substance can be used in conjunction with Avogadro's number and the density of a substance to convert between mass, moles, volume and number of particles of a sample.

Topic: *Atomic Structure*

This includes properties and locations of protons, neutrons and electrons, atomic number, mass number, cations and anions, isotopes and the strong nuclear force that hold the nucleus together. The historical development of the atom and the positions of electrons are explored in more detail

- **Evolution of atomic models/theory**
- **Electrons**
- **Electron configurations**

Note: *Quantum numbers and equations of de Broglie, Schrödinger and Plank are beyond the scope of this course.*

LATE 1ST QUARTER

Course Content: Structure and Properties of Matter

Topic: *The Periodic Table*

In the physical science syllabus, elements are placed in order of increasing atomic number in the periodic table such that elements with similar properties are placed in the same column. How the periodic table is divided into groups, families, periods, metals, nonmetals and metalloids also was in the physical science syllabus. In chemistry, with more information about the electron configuration of elements, similarities in the configuration of the valence electrons for a particular group can be observed.

- **Properties**
- **Trends**

The electron configuration of an atom can be written from the position on the periodic table. The repeating pattern in the electron configurations for elements on the periodic table explain many of the **trends** in the **properties** observed. Atomic theory and bonding must be used to explain trends in properties across periods or down columns including atomic radii, ionic radii, first ionization energies, electronegativities and whether the element is a solid or gas at room temperature.

DATA ENHANCEMENT

- Atoms and Molecules is a program produced by Annenberg that deals with teaching the very first steps of chemistry. It introduces the basic building blocks – the atoms – which, through their properties, periodicity and binding, form molecules.
- The Periodic Table of Data is an interactive periodic table. Students can select the properties they wish to view.
- "Alkali metals" Discover the explosive results when water and alkali metals come together - and the science behind the reaction. Video.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA

Integration of Knowledge and Ideas 11.7

Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem

MATH

Measurement

Select appropriate units to measure angles, circumference, surface area, mass and volume; using :U.S. customary units; e.g., degrees, square feet, pounds, and other units as appropriate. Metric units; e.g., square meters, kilograms and other units as appropriate. Convert units of length, area, volume, mass and time within the same measurement system. Use problem solving techniques and technology as needed to solve problems involving length, weight, perimeter, area, volume, time and temperature.

Algebra

Use a variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas.

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness and self-management skills to achieve school and life success.

- Display a positive interest in learning.
- Recognize personal qualities and external supports.
- Analyze how making use of school and community supports and opportunities can contribute to school and life success.
- Analyze factors that create stress or motivate successful performance.
- Create positive group dynamics.

Strand: Use social-awareness and interpersonal skills to establish and maintain positive relationships and caring communities.

- Seek ways to interact with or engage in projects with people whose cultures or ethnicities are unlike yours.

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TEACHER NOTES

2ND QUARTER

Course Content: Structure and Properties of Matter

Topic: *Intermolecular Chemical Bonding*

In this course, electron configurations, electronegativity values and energy considerations will be applied to bonding and the properties of materials with different types of bonding.

- **Ionic**
- **Polar/covalent**

Types of intermolecular attractions include London dispersion forces (present between all molecules), dipole-dipole forces (present between polar molecules) and hydrogen bonding (a special case of dipole-dipole where hydrogen is bonded to a highly electronegative atom such as fluorine, oxygen or nitrogen), each with its own characteristic relative strength.

Topic: *Representing compounds*

Using the periodic table, formulas of ionic compounds containing specific elements can be predicted.

- **Formula Writing**
- **Nomenclature**
- **Models and shapes (Lewis structures, ball and stick, molecular geometries**)

Ionic compounds made up of elements from groups 1, 2, 17, hydrogen and oxygen and polyatomic ions if given the formula and charge of the polyatomic ion can be predicted. Given the formula, a compound can be named using conventional systems that include Greek prefixes and Roman numerals where appropriate. Given the name of an ionic or covalent substance, formulas can be written.

Many different models can be used to represent compounds including chemical formulas, Lewis structures, and ball and stick models with valence shell electron pair repulsion (VSEPR) theory to predict the three-dimensional electron pair and molecular geometry of compounds.

Note1*: Lewis structures and molecular geometries will only be constructed for the following combination of elements: hydrogen, carbon, nitrogen, oxygen, phosphorus, sulfur and the halogens.*

Note 2: *Organic nomenclature is reserved for more advanced courses.*

DATA ENHANCEMENT

- Alkali metals" Discover the explosive results when water and alkali metals come together - and the science behind the reaction. Video.
- Masterminding Molecules seeks to develop logic and reinforce the principles of fair testing. It introduces the importance of concepts such as size, polarity and drug-like properties in the discovery of new medicines.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

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SUBJECT: CHEMISTRY **GRADE: 11**

EARLY 3RD QUARTER

Course Content: Structure and Properties of Matter

Topic: *Phases of Matter*

Plasmas and Bose-Einstein condensates are included with the continued study of phases of matter in relation to the spacing of the particles, motion of the particles and strength of attraction between the particles that make up the substance.

Note: *The advancement of technology makes it possible to extend the boundaries of current knowledge and understanding. Consequently, Bose-Einstein condensates were only recently created in the laboratory (1995), although predicted more than 80 years ago. Detailed instruction of Bose-Einstein condensates or plasmas is not required at this grade level. This information is strictly for recognition that new discoveries are continually occurring, extending the realm of current understanding in science.*

Topic: *Intermolecular Chemical Bonding*

Forces, called intermolecular attractions, are addressed in more detail in chemistry. Intermolecular attractions are generally weak when compared to intramolecular bonds, but span a wide range of strengths.

- **Types and strengths**
- **Implications for properties of substances**
  - Melting and boiling point
  - Solubility
  - Vapor pressure

Note: *The configuration of atoms in a molecule determines the strength of the forces (bonds or intermolecular forces) between the particles and therefore the physical properties (e.g., melting point, boiling point, solubility, vapor pressure) of a material.*

LATE 3RD QUARTER

Course Content: Interactions of Matter

Topic: *Chemical Reactions*

In this course, more complex reactions will be studied, classified and represented with chemical equations and three- dimensional models.

- **Types of reactions**: Classifying reactions into types can be a helpful organizational tool in recognizing patterns of what may happen when two substances are mixed.
- **Kinetics:** For chemical systems, potential energy is in the form of chemical energy and kinetic energy is in the form of thermal energy.
- **Energy:** Organic molecules release energy when undergoing combustion reactions and are used to meet the energy needs of society and to provide the energy needs of biological organisms .
- **Equilibrium:** If given a graph showing the concentration of the reactants and products over the time of reaction, the equilibrium concentrations and the time at which equilibrium was established can be determined**.**
- **Acids/Bases:** the structural features of molecules are explored to further understand acids and bases.

Note 1: *Identification of reactions involving oxidation and reduction as well as indicating what substance is being oxidized and what is being reduced are appropriate in this course. However, balancing complex oxidation/reduction reactions will be reserved for more advanced study.*

Note 2:*Teachers should be aware that the common reaction classifications that are often used in high school chemistry courses often lead to misconceptions because they are not based on the actual chemistry, but on surface features that may be similar from one system to another (e.g., exchanging partners), even though the underlying chemistry is not the same. However, they may be useful in making predictions about what may happen when two substances are mixed.*

DATA ENHANCEMENT

- Laboratory experiences (3-D or virtual) with different types of chemical reactions must be provided.
- Chem4Kids, University of Colorado at Boulder, and Scientific American have articles and websites devoted to providing more information about Bose-Einstein condensates.
- "Ultra Cold Atoms" is an interview with a scientist who studies Bose-Einstein condensates. He describes the process needed to form Bose-Einstein condensates and the unusual properties of super-cooled matter.
- "How Low Can You Go" is an interactive simulation of the process by which substances can be cooled to absolute zero.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA

Integration of Knowledge and Ideas 11.7

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MATH

Algebra

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TEACHER NOTES

4TH QUARTER

Course Content: Interactions of Matter

Topic: *Stoichiometry*

A stoichiometric calculation involves the conversion from the amount of one substance in a chemical reaction to the amount of another substance. The coefficients of the balanced equation indicate the ratios of the substances involved in the reaction in terms of both particles and moles.

- **Molar calculations**
- **Solutions**
- **Limiting reagents**

Note 1: *The concept of limiting reagents is treated conceptually and not mathematically.*
Note 2: *Molality and Normality are concepts reserved for more advanced study.*

Topic: *Gas laws*

The kinetic-molecular theory can be used to explain the macroscopic properties of gases (pressure, temperature and volume) through the motion and interactions of its particles. When one of the three properties is kept constant, the relationship between the other two properties can be quantified, described and explained using the kinetic-molecular theory.

- **Pressure, volume and temperature**
- **Ideal gas law**
- **Radioisotopes**
- **Nuclear energy**

DATA ENHANCEMENT

- Teaching Entropy Analysis in the First Year Chemistry Class and Beyond is an article that appeared in the Journal of Chemistry Education that discusses scientifically accurate ways to teach entropy to high school students. The sections from the beginning of the article to the bottom of page 1586, ending at *Advanced Students* is appropriate for the level of this chemistry course.
- Indicators in Chemistry is a video that shows how the content of acids and bases can be integrated into a technological design activity.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

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TEACHER NOTES

SUBJECT: ENVIRONMENTAL SCIENCE GRADES: 11/12

1ST QUARTER

Course Content: **Earth Systems: Interconnected Spheres of Earth**

Topic: The focus for this topic is on the connections and interactions between Earth's spheres (the hydrosphere, atmosphere, biosphere and lithosphere). Both natural and human-made interactions must be studied. This includes an understanding of causes and effects of climate, global climate and changes in climate through Earth's history, geologic events that impact Earth's spheres, biogeochemical cycles and patterns, the effect of abiotic and biotic factors within an ecosystem, and the understanding that each of Earth's spheres is part of the dynamic Earth system. Ground water and surface water velocities and patterns are included as the movement of water can be a mode of transmission of contamination. This builds upon previous hydrologic cycle studies in earlier grades. Geomorphology and topography are helpful in determining flow patterns and pathways for contamination.

- **Biosphere**
  - Evolution and adaptation in populations
  - Biodiversity
  - Ecosystems (equilibrium, species interactions, stability)
  - Population dynamics

Course Content: Earth's Resources

Topic: This topic explores the availability of Earth's resources, extraction of the resources, contamination problems, remediation techniques and the storage/disposal of the resources or by-products. Conservation, protection and sustainability of Earth's resources also are included.

- **Wildlife and wilderness**
  - Wildlife and wilderness management
  - Endangered species

DATA ENHANCEMENT

- The connections and interactions of energy and matter between Earth's spheres must be researched and investigated using actual data.
- See Instructional Strategies and Resources in the model curriculum for links and support, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design.
- To understand the effects that certain contaminants may have on the environment, scientific investigations and research must be conducted on a local, national and global level.
- Water, air, land, and biotic field and lab sampling/testing equipment and methods must be utilized with real-world application. Quantifiable field and/or lab data must be used to analyze and draw conclusions regarding air, water or land quality
- Comparative analysis of scientific field or lab data should be used to quantify the environmental quality or conditions. Local data also can be compared to national and international data.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA: CCR Standards for Science and Technology

Reading Standards

- Key Ideas and Details: Standards 1-3
- Craft and Structure: Standards 4-6
- Integration of Knowledge and Ideas: Standards 7-9
- Range of Reading and Level of Text Complexity: Standard 10

Writing Standards

- Text Types and Purposes: Standard 1 (a-e), Standard 2 (a-e)
- Production and Distribution of Writing: Standards 4-6
- Research to Build Present Knowledge: Standards 7-9
- Range of Writing: Standard 10

MATH

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate mathematic tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

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Note: The → (arrow) denotes an on-going content/standard statement.

2ND QUARTER

Course Content: **Earth Systems: Interconnected Spheres of Earth**

Topic: The focus for this topic is on the connections and interactions between Earth's spheres (the hydrosphere, atmosphere, biosphere and lithosphere). Both natural and human-made interactions must be studied. This includes an understanding of causes and effects of climate, global climate and changes in climate through Earth's history, geologic events that impact Earth's spheres, biogeochemical cycles and patterns, the effect of abiotic and biotic factors within an ecosystem, and the understanding that each of Earth's spheres is part of the dynamic Earth system. Ground water and surface water velocities and patterns are included as the movement of water can be a mode of transmission of contamination. This builds upon previous hydrologic cycle studies in earlier grades. Geomorphology and topography are helpful in determining flow patterns and pathways for contamination.

EARLY 2nd QUARTER

- **Atmosphere**
  - Atmospheric properties and currents
- **Lithosphere**
  - Geologic events and processes

LATE 2nd QUARTER

- **Hydrosphere**
  - Oceanic currents and patterns (as they relate to climate)
  - Surface and ground water flow patterns and movement
  - Cryosphere

Course Content: **Earth's Resources**

Topic: This topic explores the availability of Earth's resources, extraction of the resources, contamination problems, remediation techniques and the storage/disposal of the resources or by-products. Conservation, protection and sustainability of Earth's resources also are included.

EARLY 2nd QUARTER

- **Air and air pollution**
  - Primary and secondary contaminants
  - Greenhouse gases
  - Clean Air Act
- **Soil and land**
  - Desertification
  - Mass wasting and erosion
  - Sediment contamination
  - Land use & management (including food production, agriculture, zoning)
  - Solid and hazardous waste

LATE 2nd QUARTER

- **Water and water pollution**
  - Potable water and water quality
  - Hypoxia, eutrophication
  - Clean Water Act
  - Point source and non-point source contamination

Note: *Relating Earth's resources to a global scale & using technology to collect global resource data for comparative classroom study is recommended. In addition, it is important to connect the industry & the scientific community to the classroom to increase the depth of understanding. Critical thinking and problem-solving skills are important in evaluating resource use, management & conservation. New discoveries & research are important parts of this topic.*

DATA ENHANCEMENT

- The connections and interactions of energy and matter between Earth's spheres must be researched and investigated using actual data.
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ACADEMIC CONNECTIONS (MULTIPLE AREAS)

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3RD QUARTER

Course Content: Earth Systems: Interconnected Spheres of Earth

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EARLY 2nd QUARTER

- **Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere**
  - Energy transformations on global, regional and local scales
  - Biogeochemical cycles
  - Ecosystems
  - Climate and weather

LATE 2nd QUARTER

-not continued to late quarter-

Course Content: Earth's Resources

Topic: This topic explores the availability of Earth's resources, extraction of the resources, contamination problems, remediation techniques and the storage/disposal of the resources or by-products. Conservation, protection and sustainability of Earth's resources also are included

- **Energy resources:** *Renewable and nonrenewable energy resources topics investigate the effectiveness, risk and efficiency for differing types of energy resources at a local, state, national and global level.*
  - Renewable and nonrenewable energy sources and efficiency
  - Alternate energy sources and efficiency
  - Resource availability
  - Mining and resource extraction

Note: *Relating Earth's resources to a global scale & using technology to collect global resource data for comparative classroom study is recommended. In addition, it is important to connect the industry & the scientific community to the classroom to increase the depth of understanding. Critical thinking and problem-solving skills are important in evaluating resource use, management & conservation. New discoveries & research are important parts of this topic.*

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4TH QUARTER

Course Content: Global Environmental Problems and Issues

Topic: This topic is a culminating section that incorporates the previous topics and applies them to a global or international scale. Case studies, developing and using models, collecting and analyzing water and/or air quality data, conducting or researching population studies and methods of connecting to the real world must be emphasized for this topic.

- Human population
- Potable water quality, use and availability
- Climate change
- Sustainability
- Species depletion and extinction
- Air quality
- Food production and availability
- Deforestation and loss of biodiversity
- Waste management (solid and hazardous)

Note: *This topic provides opportunity for students to demonstrate knowledge & mastery of environmental science through project or problem based learning activities.*

DATA ENHANCEMENT

- The connections and interactions of energy and matter between Earth's spheres must be researched and investigated using actual data.
- See Instructional Strategies and Resources in the model curriculum for links and support, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design.
- To understand the effects that certain contaminants may have on the environment, scientific investigations and research must be conducted on a local, national and global level.
- Water, air, land, and biotic field and lab sampling/testing equipment and methods must be utilized with real-world application. Quantifiable field and/or lab data must be used to analyze and draw conclusions regarding air, water or land quality
- Comparative analysis of scientific field or lab data should be used to quantify the environmental quality or conditions. Local data also can be compared to national and international data.
- Case studies, developing and using models, collecting and analyzing water and/or air quality data, conducting or researching population studies and methods of connecting to the real world must be emphasized for this topic.
- Technology can be used for comparative studies to share local data internationally so that specific, quantifiable data can be compared and used in understanding the impact of some of the environmental problems that exist on a global scale.
- Researching and investigating environmental factors on a global level contributes to the depth of understanding by applying the environmental science concepts to problem solving and design.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA: CCR Standards for Science and Technology

Reading Standards

- Key Ideas and Details: Standards 1-3
- Craft and Structure: Standards 4-6
- Integration of Knowledge and Ideas: Standards 7-9
- Range of Reading and Level of Text Complexity: Standard 10

Writing Standards

- Text Types and Purposes: Standard 1 (a-e), Standard 2 (a-e)
- Production and Distribution of Writing: Standards 4-6
- Research to Build Present Knowledge: Standards 7-9
- Range of Writing: Standard 10

MATH

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate mathematic tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness and self-management skills to achieve school and life success.

- Display a positive interest in learning.
- Recognize personal qualities and external supports.
- Analyze how making use of school and community supports and opportunities can contribute to school and life success.
- Analyze factors that create stress or motivate successful performance.
- Create positive group dynamics.

Strand: Use social-awareness and interpersonal skills to establish and maintain positive relationships and caring communities.

- Seek ways to interact with or engage in projects with people whose cultures or ethnicities are unlike yours.

Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.

- Describe responsible behaviors for working cooperatively in teams, in school and in the workplace.

SUBJECT: PHYSICAL GEOLOGY GRADES: 11/12

EARLY 1ST QUARTER

Course Content: Minerals

Topic: The emphasis is to relate the chemical and physical components of minerals to the properties of the minerals. This requires extensive mineral testing, investigations, experimentation, observation, use of technology and models/modeling. The focus must be learning the ways to research, test and evaluate minerals, not in memorization of mineral names or types.

- **Atoms and elements**
- **Chemical bonding** (ionic, covalent, metallic)
- **Crystallinity** (crystal structure)
- **Criteria of a mineral** (crystalline solid, occurs in nature, inorganic, defined chemical composition)
- **Properties of minerals** (hardness, luster, cleavage, streak, crystal shape. fluorescence, flammability, density/specific gravity, malleability)

LATE 1ST QUARTER

Course Content: Igneous, Metamorphic and Sedimentary Rocks

Topic: Geologic, topographic, seismic and aerial maps must be used to locate and recognize igneous, metamorphic and sedimentary structures and features. Technological advances permit the investigation of intrusive structures and the interior of Earth. Connections between the minerals present within each type of rock and the environment formed are important. The processes and environmental conditions that lead to fossil fuel formation must include the fossil fuels found in Ohio, nationally and globally. (*Note*: this links to the energy resources section Q4) → **EQ2**

- ***Igneous***
  - Mafic and felsic rocks and minerals
  - Intrusive (igneous structures: dikes, sills, batholiths, pegmatites)
  - Earth's interior (inner core, outer core, lower mantle, upper mantle, Mohorovicic discontinuity, crust)
  - Magnetic reversals and Earth's magnetic field
  - Thermal energy within the Earth
  - Extrusive (volcanic activity, volcanoes: cinder cones, composite, shield)
  - Bowen's Reaction Series (continuous and discontinuous branches) Use to develop an understanding of the relationship of cooling temperature, formation of specific igneous minerals and the resulting igneous environment. The focus is on knowing how to use Bowen's Reaction Series, not to memorize it.

DATA ENHANCEMENT

- See Instructional Strategies and Resources in the model curriculum for links and support, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design.
- Use mineral data to help interpret the environmental conditions that existed during the formation of the mineral.
- Extensive mineral testing, investigations, experimentation, observation, use of technology and models/modeling.
- Virtual demonstrations and simulations of cooling magma and crystallization of the igneous minerals found on the Bowen's Reaction Series can be helpful in conceptualizing the chart.
- The magnetic properties of Earth must be examined through the study of real data and evidence.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

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SUBJECT: PHYSICAL GEOLOGY GRADES: 11/12

EARLY 2ND QUARTER	LATE 2ND QUARTER

Course Content : Igneous, Metamorphic and Sedimentary Rocks

Topic: Geologic, topographic, seismic and aerial maps must be used to locate and recognize igneous, metamorphic and sedimentary structures and features. Technological advances permit the investigation of intrusive structures and the interior of Earth. Connections between the minerals present within each type of rock and the environment formed are important. The processes and environmental conditions that lead to fossil fuel formation must include the fossil fuels found in Ohio, nationally and globally. (***Note*:** this links to the energy resources section Q4) **←LQ1, → LQ2**

- **Metamorphic**
  - Pressure, stress, temperature and compressional forces
  - Foliated (regional), non-foliated (contact)
  - Parent rock and degrees of metamorphism
  - Metamorphic zones (where metamorphic rocks are found)
- **Sedimentary**
  The ocean: While the ocean is included within the sedimentary topic, it can be incorporated into other topics. Features found in the ocean must include all types of environments (igneous, metamorphic or sedimentary). **←LQ1, → LQ2**
  - Tides (daily, neap and spring)
  - Currents (deep and shallow, rip and longshore)
  - Thermal energy and water density
  - Waves
  - Ocean features (ridges, trenches, island systems, abyssal zone, shelves, slopes, reefs, island arcs)

- **Sedimentary**
  Passive and active continental margins
  - Division of sedimentary rocks and minerals (chemical, clastic/physical, organic)
  - Depositional environments
  - Streams (channels, streambeds, floodplains, cross-bedding, alluvial fans, deltas)
  - Transgressing and regressing sea levels

DATA ENHANCEMENT

- See Instructional Strategies and Resources in the model curriculum for links and support, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design.
- Using models (3-D or virtual) with real-time data to simulate waves, tides, currents, feature formation and changing sea levels to explore and investigate the ocean fully is recommended.
- Technological advances must be used to illustrate the physical features of the Earth, including the ocean floor.
- Interpreting geologic history using maps of local cross-sections of bedrock can be related to the geologic history of Ohio, the United States and the Earth.
- The analysis of data and evidence found in the variety of dating techniques (both absolute and relative), the complexity of the fossil record, and the impact that improving technology has had on the interpretation and continued updating of what is known about the history of Earth must be investigated.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

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SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness and self-management skills to achieve school and life success.	Strand: Use social-awareness and interpersonal skills to establish and maintain positive relationships and caring communities.	Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.
• Display a positive interest in learning. • Recognize personal qualities and external supports. • Analyze how making use of school and community supports and opportunities can contribute to school and life success. • Analyze factors that create stress or motivate successful performance. • Create positive group dynamics.	• Seek ways to interact with or engage in projects with people whose cultures or ethnicities are unlike yours.	• Describe responsible behaviors for working cooperatively in teams, in school and in the workplace.

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SUBJECT: PHYSICAL GEOLOGY GRADES: 11/12

EARLY 3RD QUARTER

Course Content : Earth's History

Topic: The long-term history of Earth and the analysis of the evidence from the geologic record (including fossil evidence) must be investigated. The emphasis for this unit is to explore the geologic record and the immensity of the geologic record.

- The geologic rock record
  - Relative and absolute age
  - Principles to determine relative age
    - Original horizontality
    - Superposition
    - Cross-cutting relationships
  - Absolute age
    - Radiometric dating (isotopes, radioactive decay)
    - Correct uses of radiometric dating
  - Combining relative and absolute age data
  - The geologic time scale
    - Comprehending geologic time
    - Climate changes evident through the rock record
    - Fossil record

LATE 3RD QUARTER

Course Content : Plate Tectonics

Topic: Earth's interior and plate tectonics is investigated at greater depth using models, simulations, actual seismic data, real-time data, satellite data and remote sensing. Relationships between energy, tectonic activity levels and earthquake or volcano predictions, and calculations to obtain the magnitude, focus and epicenter of an earthquake must be included.

- **Internal Earth**
  - Seismic waves
    - S and P waves
    - Velocities, reflection, refraction of waves
  - Structure of Earth *(**Note:** specific layers were part of grade 8)*
    - Asthenosphere
    - Lithosphere
    - Mohorovicic boundary (Moho)
    - Composition of each of the layers of Earth
    - Gravity, magnetism and isostasy
    - Thermal energy (geothermal gradient and heat flow)
- **Historical review** *(**Note:** this would include a review of continental drift and sea-floor spreading found in grade 8)*
  - Paleomagnetism and magnetic anomalies
  - Paleoclimatology
- **Plate motion** *(**Note:** introduced in grade 8)*
  - Causes and evidence of plate motion
  - Measuring plate motion
  - Characteristics of oceanic and continental plates
  - Relationship of plate movement & geologic events & features
  - Mantle plumes

DATA ENHANCEMENT

- See Instructional Strategies and Resources in the model curriculum for links and support, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. →
- Using actual sections of the geologic record to interpret, compare and analyze can demonstrate the changes that have occurred in Ohio, in North America and globally.
- The analysis of data and evidence found in the variety of dating techniques (both absolute and relative), the complexity of the fossil record, and the impact that improving technology has had on the interpretation and continued updating of what is known about the history of Earth must be investigated.
- Geologic principles must be tested and experienced through modeling, virtually, field studies, research and in-depth investigation
- Evidence and data analysis is the key in understanding Earth's interior and plate tectonics.

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA: CCR Standards for Science and Technology

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SOCIAL EMOTIONAL LEARNING

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Strand: Develop self-awareness and self-management skills to achieve school and life success.

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- Recognize personal qualities and external supports.
- Analyze how making use of school and community supports and opportunities can contribute to school and life success.
- Analyze factors that create stress or motivate successful performance.
- Create positive group dynamics.
- Identify courses you might need to take during your senior year to help you acquire or strengthen the competencies needed for your desired career.

Strand: Use social-awareness and interpersonal skills to establish and maintain positive relationships and caring communities.

- Seek ways to interact with or engage in projects with people whose cultures or ethnicities are unlike yours.

Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.

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SUBJECT: PHYSICAL GEOLOGY GRADES: 11/12

EARLY 4TH QUARTER

Course Content : Glacial Geology

Topic: Tracing and tracking glacial history and present-day data for Ohio, the United States and globally is an emphasis for this unit.

- Glaciers and glaciation
- Evidence of past glaciers (including features formed through erosion or deposition)
- Glacial deposition and erosion (including features formed through erosion or deposition)
- Data from ice cores
  - Historical changes (glacial ages, amounts, locations, particulate matter, correlation to fossil evidence)
  - Evidence of climate changes throughout Earth's history
- Glacial distribution and causes of glaciation
- Types of glaciers – continental (ice sheets, ice caps), alpine/valley (piedmont, valley, cirque, ice caps)
- Glacial structure, formation and movement

LATE 4TH QUARTER

Course Content : Earth's Resources

Topic: Renewable and nonrenewable energy resources topics investigate the effectiveness and efficiency for differing types of energy resources at a local, state, national and global level. Feasibility, availability and environmental cost are included in the extraction, storage, use and disposal of both abiotic and biotic resources. In addition, it is important to connect industry and the scientific community to the classroom to increase the depth of understanding.

- **Energy resources**
  - Renewable and nonrenewable energy sources and efficiency
  - Alternate energy sources and efficiency
  - Resource availability
  - Mining and resource extraction
- **Air**
  - Primary and secondary contaminants
  - Greenhouse gases
- **Water**
  - Potable water and water quality
  - Hypoxia, eutrophication
- **Soil and sediment**
  - Desertification
  - Mass wasting and erosion
  - Sediment Contamination

Note 1: *Critical thinking and problem-solving skills are important in evaluating resource use and conservation.*

Note 2: *This topic provides opportunity for students to demonstrate knowledge & mastery of physical geology through project or problem based learning activities.*

DATA ENHANCEMENT

- See Instructional Strategies and Resources in the model curriculum for links and support, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design.
- Scientific data found in the analysis of the geologic record, ice cores and surficial geology should be used to provide the evidence for changes that have occurred over the history of Earth and are observable in the present day.
- New discoveries, mapping projects, research, contemporary science and technological advances must be included in the study of glacial geology
- Modeling (3-D or virtual), simulations and real-world data must be used to investigate energy resources and exploration. The emphasis must be on current, actual data, contemporary science and technological advances in the field of energy resources.
- Relating Earth's resources (energy, air, water, soil) to a global scale and using technology to collect global resource data for comparative classroom study is recommended

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA: CCR Standards for Science and Technology

Reading Standards

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Strand: Use social-awareness and interpersonal skills to establish and maintain positive relationships and caring communities.

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- Describe responsible behaviors for working cooperatively in teams, in school and in the workplace.

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SUBJECT: PHYSICS **GRADES: 11/12**

EARLY 1ST QUARTER

Course Content : Motion

Topic: Acceleration vs. time graphs are introduced and more complex graphs are considered that have both positive and negative displacement values and involve motion that occurs in stages (e.g., an object accelerates then moves with constant velocity). Symbols representing acceleration are added to motion diagrams and mathematical analysis of motion becomes increasingly more complex.

- **Graph interpretations** (Motion Graphs) →**LQ1**
  - Position vs. time
  - Velocity vs. time
  - Acceleration vs. time
- **Problem solving → LQ1**
  - Using graphs (average velocity, instantaneous velocity, acceleration, displacement, change in velocity)
  - Uniform acceleration including free fall (initial velocity, final velocity, time, displacement, acceleration, average velocity)
- **Projectiles → LQ1,**
  - Independence of horizontal and vertical motion
  - Problem-solving involving horizontally launched projectiles: *Limited to solving for the range, time, initial height, initial velocity or final velocity of horizontally launched projectiles with negligible air resistance.*

Note 1*: Motion must be explored through investigation and experimentation* →**LQ1**

Note 2*: While it is not inappropriate to explore more complex projectile problems, it must not be done at the expense of other parts of the curriculum.* →**LQ1**

LATE 1ST QUARTER

Course Content : Motion ←EQ1

See early 1st quarter

Course Content : Forces, momentum and motion

Topic: Newton's laws of motion are applied to mathematically describe and predict the effects of forces on more complex systems of objects and to analyze objects in free fall that experience significant air resistance. Gravitational forces are studied as a universal phenomenon and gravitational field strength is quantified. Elastic forces and a more detailed look at friction are included. At the atomic level, "contact" forces are actually due to the forces between the charged particles of the objects that appear to be touching. These electric forces are responsible for friction forces, normal forces and other "contact" forces. Air resistance and drag are explained using the particle nature of matter. Projectile motion is introduced and circular motion is quantified. The vector properties of momentum and impulse are introduced and used to analyze elastic and inelastic collisions between objects. → **LQ2**

- **Newton's laws applied to complex problems**
- **Gravitational force and fields**
- **Elastic forces**
- **Friction force** (static and kinetic)
- **Air resistance and drag**
- **Forces in two dimensions**
  - Adding vector forces o Motion down inclines
  - Centripetal forces and circular motion
- **Momentum, impulse and conservation of momentum**

Note*: Analysis of experimental data collected in laboratory investigations must be used to study forces and momentum.*

DATA ENHANCEMENT

- Motion detectors and computer graphing applications can be used to collect and organize data.
- Computer simulations and video analysis can be used to analyze motion with greater precision.
- Computers and probes can be used to collect and analyze data**.**

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA: CCR Standards for Science and Technology

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2ND QUARTER

Course Content: Forces, momentum and motion

Topic: Newton's laws of motion are applied to mathematically describe and predict the effects of forces on more complex systems of objects and to analyze objects in free fall that experience significant air resistance. Gravitational forces are studied as a universal phenomenon and gravitational field strength is quantified. Elastic forces and a more detailed look at friction are included. At the atomic level, "contact" forces are actually due to the forces between the charged particles of the objects that appear to be touching. These electric forces are responsible for friction forces, normal forces and other "contact" forces. Air resistance & drag are explained using the particle nature of matter. Projectile motion is introduced and circular motion is quantified. The vector properties of momentum & impulse are introduced and used to analyze elastic and inelastic collisions between objects. ← **LQ1,** → **LQ2**

- **Newton's laws applied to complex problems**
- **Gravitational force and fields**
- **Elastic forces**
- **Friction force (static and kinetic)**
- **Air resistance and drag**
- **Forces in two dimensions**
  - Adding vector forces o Motion down inclines
  - Centripetal forces and circular motion
- **Momentum, impulse and conservation of momentum**

Note*: Analysis of experimental data collected in laboratory investigations must be used to study forces and momentum.*

DATA ENHANCEMENT

- Motion detectors and computer graphing applications can be used to collect and organize data.
- Computer simulations and video analysis can be used to analyze motion with greater precision.
- Computers and probes can be used to collect and analyze data**.**

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

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TEACHER NOTES

SUBJECT: PHYSICS **GRADES: 11/12**

EARLY 3RD QUARTER

Course Content: Energy

Topic: The concept of gravitational potential energy is understood from the perspective of a field, elastic potential energy is introduced and quantified, nuclear processes are explored further, the concept of mass-energy equivalence is introduced, the concept of work is expanded, power is introduced, and the principle of conservation of energy is applied to increasingly complex situations.

- **Gravitational potential energy ←Q2**
- **Energy in springs →LQ3**
- **Nuclear energy**
- **Work and power**
- **Conservation of energy**

Note: *Energy must be explored by analyzing data gathered in scientific investigations.*

LATE 3RD QUARTER

Course Content: Waves

Topic: Conservation of energy is applied to waves and the measurable properties of waves (wavelength, frequency, amplitude) are used to mathematically describe the behavior of waves (index of refraction, law of reflection, single- and double-slit diffraction).

- **Wave properties**
  - Conservation of energy
  - Reflection
  - Refraction
  - Interference
  - Diffraction
- **Light phenomena**
  - Ray diagrams (propagation of light)
  - Law of reflection (equal angles)
  - Snell's law
  - Diffraction patterns
  - Wave – particle duality of light **→Q4**

Note 1: *Waves must be explored experimentally in the laboratory. This may include, but is not limited to, water waves, waves in springs, the interaction of light with mirrors, lenses, barriers with one or two slits, and diffraction gratings*

Note 2: *The wavelet model of wave propagation and interactions is not addressed in this course.*

DATA ENHANCEMENT

- Motion detectors and computer graphing applications can be used to collect and organize data.
- Computer simulations and video analysis can be used to analyze with greater precision.
- Computers and probes can be used to collect and analyze data

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

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- Look for and express regularity in repeated reasoning.

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness and self-management skills to achieve school and life success.

- Display a positive interest in learning.
- Recognize personal qualities and external supports.
- Analyze how making use of school and community supports and opportunities can contribute to school and life success.
- Analyze factors that create stress or motivate successful performance.
- Create positive group dynamics.
- Identify courses you might need to take during your senior year to help you acquire or strengthen the competencies needed for your desired career.

Strand: Use social-awareness and interpersonal skills to establish and maintain positive relationships and caring communities.

- Seek ways to interact with or engage in projects with people whose cultures or ethnicities are unlike yours.

Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.

- Describe responsible behaviors for working cooperatively in teams, in school and in the workplace.

TEACHER NOTES

Note: The → (arrow) denotes an on-going content/standard statement.

SUBJECT: PHYSICS **GRADES: 11/12**

4TH QUARTER

Course Content: Electricity and Magnetism

Topic: In earlier grades, the following concepts were addressed: conceptual treatment of electric and magnetic potential energy; the relative number of subatomic particles present in charged and neutral objects; attraction and repulsion between electrical charges and magnetic poles; the concept of fields to conceptually explain forces at a distance; the concepts of current, potential difference (voltage) and resistance to explain circuits conceptually; and connections between electricity and magnetism as observed in electromagnets, motors and generators. In this course, the details of electrical and magnetic forces and energy are further explored and can be used as further examples of energy and forces affecting motion. →**LQ4**

- **Charging objects** (friction, contact and induction) ←**LQ1, Q2**
- **Coulomb's law:** *Fe = ke q1 q2) / r2*
- **Electric fields and electric potential energy:** E = Fe / q.
- **DC circuits**
  - Ohm's law
  - Series circuits
  - Parallel circuits
  - Mixed circuits
  - Applying conservation of charge and energy (junction and loop rules)
- **Magnetic fields and energy** ←**LQ3**
- **Electromagnetic interactions** ←**LQ3**

Note 1*: The interactions between electricity and magnetism must be explored in the laboratory setting. Experiments with the inner workings of motors, generators and electromagnets must be conducted.*

Note 2: *Field line diagrams are excluded from this course.*

Note 3: *In this course, the concepts of magnetic fields and magnetic potential energy will not be addressed mathematically*

DATA ENHANCEMENT

- Computer graphing applications can be used to collect and organize data.
- Computer simulations and video analysis can be used to analyze with greater precision.
- Probes can be used to collect and analyze data
- Measuring and analyzing of current, voltage and resistance in parallel, series and mixed circuits with traditional laboratory equipment and through computer simulations.
- Current technologies using these principles of electricity and magnetism must be explored

ACADEMIC CONNECTIONS (MULTIPLE AREAS)

ELA: CCR Standards for Science and Technology

Reading Standards

- Key Ideas and Details: Standards 1-3
- Craft and Structure: Standards 4-6
- Integration of Knowledge and Ideas: Standards 7-9
- Range of Reading and Level of Text Complexity: Standard 10

Writing Standards

- Text Types and Purposes: Standard 1 (a-e), Standard 2 (a-e)
- Production and Distribution of Writing: Standards 4-6
- Research to Build Present Knowledge: Standards 7-9
- Range of Writing: Standard 10

MATH

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate mathematic tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

SOCIAL EMOTIONAL LEARNING

When incorporating Scope and Sequence, utilize social and emotional learning 5 core competencies to ensure a positive learning community and high academic achievement.

Strand: Develop self-awareness and self-management skills to achieve school and life success.	**Strand: Use social-awareness and interpersonal skills to establish and maintain positive relationships and caring communities.**	**Strand: Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.**
• Display a positive interest in learning. • Recognize personal qualities and external supports. • Analyze how making use of school and community supports and opportunities can contribute to school and life success. • Analyze factors that create stress or motivate successful performance. • Create positive group dynamics.	• Seek ways to interact with or engage in projects with people whose cultures or ethnicities are unlike yours.	• Describe responsible behaviors for working cooperatively in teams, in school and in the workplace.

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CLEVELAND
METROPOLITAN
SCHOOL DISTRICT