Randolph Township Schools
Randolph Middle School

Grade 7 Science Curriculum

"Science is a way of life. Science is a perspective. Science is the process that takes us from confusion to understanding in a manner, that's precise, predictive and reliable-a transformation, for those lucky enough to experience it, that is empowering and emotional."

-Brian Greene, Theoretical Physicist

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Randolph Township Schools
Department of Science, Technology, Engineering, & Mathematics
Grade 7 Science

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Randolph Township Schools

Mission Statement

We commit to inspiring and empowering all students in Randolph schools to reach their full potential as unique, responsible and educated members of a global society.

Randolph Township Schools
Affirmative Action Statement

Equality and Equity in Curriculum

The Randolph Township School district ensures that the district's curriculum and instruction are aligned to the state's standards. The curriculum provides equity in instruction, educational programs and provides all students the opportunity to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

RANDOLPH TOWNSHIP BOARD OF EDUCATION
EDUCATIONAL GOALS
VALUES IN EDUCATION

The statements represent the beliefs and values regarding our educational system. Education is the key to self-actualization, which is realized through achievement and self-respect. We believe our entire system must not only represent these values, but also demonstrate them in all that we do as a school system.

We believe:

- The needs of the child come first
- Mutual respect and trust are the cornerstones of a learning community
- The learning community consists of students, educators, parents, administrators, educational support personnel, the community and Board of Education members
- A successful learning community communicates honestly and openly in a non-threatening environment
- Members of our learning community have different needs at different times. There is openness to the challenge of meeting those needs in professional and supportive ways
- Assessment of professionals (i.e., educators, administrators and educational support personnel) is a dynamic process that requires review and revision based on evolving research, practices and experiences
- Development of desired capabilities comes in stages and is achieved through hard work, reflection and ongoing growth

Randolph Township Schools

Department of Science, Technology, Engineering, & Mathematics

Introduction

The Randolph Township School District is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the 21st century. We believe that an education grounded in the fundamental principles of science, technology, engineering, and math (STEM) will provide students with the skills and content necessary to become future leaders and lifelong learners.

A sound STEM education is grounded in the principles of inquiry, rigor, and relevance. Students will be actively engaged in learning as they use real-world STEM skills to construct knowledge. They will have ample opportunities to manipulate materials and solve problems in ways that are developmentally appropriate to their age. They will work in an environment that encourages them to take risks, think critically, build models, observe patterns, and recognize anomalies in those patterns. Students will be encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why". They will develop the ability, confidence, and motivation to succeed academically and personally.

STEM literacy requires understandings and habits of mind that enable students to make sense of how our world works. Scientifically and technologically literate citizens deal sensibly with problems that involve mathematics, evidence, patterns, logical arguments, uncertainty, and problem-solving.

Grade 7 Science

Introduction

The seventh grade science course is the second of three middle school science courses. We believe that all children are entitled to an education that will equip them to become productive citizens of the 21st century. We believe that an education grounded in the fundamental principles of science inquiry and rigor will provide students with the skills and content necessary to become future leaders. Students would be actively engaged in learning as they model real-world scientific behaviors to construct knowledge. This course introduces key concepts and skills that are essential for students as they prepare for the third course of Science. They will have ample opportunities to manipulate materials in ways that are developmentally appropriate to their age. They will work in an environment that encourages them to take risks, think critically, build models, observe patterns, and recognize anomalies in those patterns. Students should be encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why". Scientific literacy requires understandings and habits of mind that enables students to make sense of how the natural and physical worlds work. Scientifically literate citizens deal sensibly with problems that involve evidence, patterns, logical arguments, and uncertainty. The science curriculum has been developed with age-appropriate activities and expectations to achieve these goals.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Curriculum Pacing Chart
Grade 7 Science

SUGGESTED TIME ALLOTMENT	UNIT NUMBER	CONTENT - UNIT OF STUDY
5 Weeks	**I**	Earth Systems
5 Weeks	**II**	Structure and Properties of Matter
4 Weeks	**III**	Interactions of Matter
3 Weeks	**IV**	Chemical Reactions
4 Weeks	**V**	Structure and Function of Life
5 Weeks	**VI**	Organization for Matter and Energy Flow in Organisms
7 Weeks	**VII**	Inheritance and Variation of Traits
3 Weeks	**VIII**	Body Systems

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit I: Earth Systems

<table>
<tr><td rowspan="7">STANDARDS / GOALS:

<u>NJSLS Science</u>

MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history

MS-ESS2-1: Develop a model to describe the cycling of Earth’s materials and the flow of energy that drives this process.

MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales

MS-ESS2-3: Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motion.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Earth’s geosystems can be understood by modeling the flow of energy and cycling of matter within and among different systems.</td><td>• How do constructive and destructive geoscience processes change Earth’s surface?</td></tr>
<tr><td>By using scientific evidence, the relative time of events can be constructed and used as a model of Earth’s vast history.</td><td>• How does scientific evidence play a part in our view of the Earth?</td></tr>
<tr><td>The Theory of Plate Tectonics explains observable and predictable patterns of earthquakes and landform locations.</td><td>• How can a large-scale geosystems changes be modeled to predict future and past events?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Water’s movements—both on the land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations.</td><td>Students will be able to:

Recall that the water cycle is driven by the sun’s energy.

Explore landforms created by various geosystem processes and predict how they were formed.</td></tr>
</table>

	Energy from the sun drives the movement of wind and water that causes the erosion, movement, and sedimentation of weathered Earth materials	Connect the water cycle and sun's energy to geoprocesses of weathering and erosion. Recall that energy from the sun drives movement of wind and connect to weathering, erosion, and sedimentation.
	The Earth's internal heat energy drives processes that move and push rock material to the Earth's surface.	Identify the processes and source within the rock cycle.
	The processes of melting, crystallization, weathering, deformation, and sedimentation act together to form minerals and rocks through the cycling of Earth's materials.	Develop a model to describe that energy from the Earth's interior and the sun drive Earth processes that together cause matter cycling through different forms of Earth materials. Utilizing the concept that any rock on Earth can be changed into a new type of rock by geosystem processes.
	Evidence makes clear how Earth's plates have moved great distances, collided, and spread apart.	Hypothesize how the shapes of continents, which roughly fit together, might suggest that those landmasses were once joined and have since separated. Define continental drift as the movement of continents as described by Alfred Wegner.
	Regions of different continents that share similar fossils and similar rocks suggest that, in the geologic past, those sections of continent were once attached and have since separated.	Using claims, evidence, and reasoning argue for and against Alfred Wegner's Continental Drift Theory.
	The distribution of seafloor structures combined with the patterns of ages of rocks of the seafloor supports the interpretation that new crust forms at the ridges and then moves away from the ridges.	Gather, read, and analyze more recent evidence for plate tectonics from sonar, satellite, earthquake plots, and GPS to strengthen the argument for plate tectonic theory.

		Observe a model that represents convection currents within the mantle as the source of motion that drives the movement of tectonic plates. Model plate movements kinesthetically. Describe how crust is recycled and formed with regards to plate tectonics. Map where crust is recycled and formed with regards to plate tectonics.
	The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Rock strata and the fossil record provide only relative dates, not an absolute scale. Fossil layers that contain only extinct animal groups are usually older than fossil layers that contain animal groups that are still alive today, and layers with only microbial fossils are typical of the earliest evidence of life. The geologic time scale is used to organize Earth's 4.6-billion-year-old geologic and evolutionary history.	Predict future events based on patterns from past plate motions (i.e. formation of mountain chains, formation of ocean basins, volcanic eruptions, glaciations, asteroid impacts, extinctions of groups of organism). Compare relative and absolute age dating. Define the law of superposition as newer rock layers sit on top of older rock layers, allowing for a relative ordering in time of the formation of the layers. Use evidence and reasoning to construct an explanation that rock strata and fossils contained within these strati have relative ages. Utilize index fossils and other evidence to identify the relative age date rocks. Using diagrams, identify the relative age date

		rock layers. Utilize models (e.g. cosmic calendar) of geologic time to comprehend a time scale much longer than human life.
	Earth's Systems interact over scales that range from fractions of a second to billions of years.	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
	Specific major events geologic events can be used to indicate geologic periods of time (extensive lava flows, volcanic eruptions, asteroid impacts).	Correlate geologic events and their effects to major extinction events. Predict future effects and possible extinction events if new geologic events occur.
	Geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth's systems. **VOCABULARY:** fossil, scale model, extinction, system, landform, volcano, rock cycle, crust, mantle, inner core, outer core, earthquake, energy, rocks, minerals **KEY TERMS:** geosystem, weathering, erosion, sedimentation, melting, crystallization, deformation, rift valley, volcanic island arc, deep sea trench, mid-ocean ridge, plate tectonics, continental drift, sea-floor spreading, tectonic plate, subduction, convergent, divergent, lithosphere, asthenosphere, fault, focus, epicenter, seismometer, seismograph, ssteroid Impacts, punctuated events, relative age dating, absolute age dating, law of superposition, law of cross-cutting, index fossil, geologic time	Provide examples of how the behaviors of life forms have altered Earth systems.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions
- Collaborative discussion
- Inquiry-based lab activities
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Research of primary and secondary resources
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Worldwide pattern of earthquakes activity (Plot earthquakes to observe plate boundaries) *Measuring Earthquakes*
- Worldwide pattern of Earthquakes, Volcanoes, and world elevation *Mapping Plates*
- Describe and model the rock cycle using specific examples of sedimentary, metamorphic, and igneous rock
- Kinesthetically model plate movement using green and blue foam pads
- Simulated Sonar to discover underwater landforms that support the theory of plate tectonics
- Relative Age Dating and Geologic Timeline *Earth Time, The Continent Puzzle*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit I: Earth Systems

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
5 Weeks	**Earth Systems**	*SEPUP LabAIDs Unit D: Plate Tectonics* *Rock Cycle Journey:* *Interactives-Dynamic Earth:* *pHet Simulations* • *Radioactive Dating Game: http://phet.colorado.edu/en/simulation/radioactive-dating-game* • *Plate Tectonics: http://phet.colorado.edu/en/simulation/legacy/plate-tectonics* • *Glaciers: http://phet.colorado.edu/en/simulation/glaciers* *GeoSystem Resources* *Newsela.com*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit II: Structure and Properties of Matter

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NJSLS Science</u>

MS-PS-1-1: Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS-1-2: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>The smallest unit of matter that still embodies the properties of that material is the atom. Atoms bond together to form larger structures, sometimes in simple molecules or repeating extended structures.</td><td>• How can we prove the existence of things that are too small to see?</td></tr>
<tr><td>A chemical reaction has occurred between substances when the atomic structures of both substances have permanently changed after the interaction takes place; as evidenced through changes in chemical properties (i.e. density, melting/boiling point, solubility, flammability, and odor).</td><td>• How might we know that a chemical change has occurred?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

The smallest unit of matter that still embodies the physical and chemical properties of that substance is the atom.</td><td>Students will be able to:

Construct an explanation using evidence to support the claim that atoms are the basic units of matter.

Identify the three basic parts of an atom as the proton, neutron, and electron and explain their basic properties/functions within the atom.</td></tr>
</table>

	Based on changes to the sub-atomic composition different 'types' of atoms are formed, which we call elements.	Explain how atoms change to become different 'types' or elements based on changes to their sub-atomic structure (ex: changes in number of protons).
	When two or more atoms, either of the same elements or combinations of different elements, interact and combine in various ways molecules are formed.	Define molecules as two or more atoms joined together through chemical means. Given a drawing, diagram, ball/stick, or various other visual depiction of a molecule, analyze its' atomic composition in terms of types and numbers of elements present. Conduct an investigation to examine how molecules can be disassembled and reassembled to form new substances using the same building blocks of atoms.
	Solids may be formed from small simple molecules (e.g. water/ice), larger more complex molecules (i.e. ammonia, caffeine, lipid, glucose), or they may be extended structures with simple repeating subunits (i.e., sodium chloride, diamonds).	Analyze the similarities and differences between given molecules that range in size, complexity, presence/absence of patterns. Develop models to describe the similarities and differences among the atomic composition of simple molecules and extended structures.
	Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that are to identify it. Density, melting point, boiling point, solubility, flammability, and odor are some of these characteristic properties.	Explain the difference between physical and chemical properties. Examine everyday objects and identify the physical properties (relative density-float/sink/suspend, relative melting/boiling point, odor, color, etc.) and chemical properties (flammability, solubility) present.

		Using known physical and chemical properties as evidence justify the identification of a mystery substance.
	Density is one of the most important physical properties of a substance because each known material has a very unique density that correlates to only that material, found using the formula density=mass/volume.	Define density as the amount of matter contained in a specific volume. Calculate the density of given materials using the formula d=m/v. Gather, calculate, and analyze densities of unknown materials in order to identify them as common known materials.
	In a chemical process, the atoms that make up the original substances are regrouped into different molecules; these new substances have different properties from those of the reactants.	Using various visual depictions (ball and stick, diagrams, student models, drawings) to analyze the atomic changes in molecular structure that occurred during a given chemical reaction. Analyze the differences in physical and chemical properties between the reactants and products of a given chemical reaction in order to support the claim that entirely new substances were created during the chemical reaction.
	In order to tell if a chemical reaction has occurred, five indicators can be examined; color change, odor production/change, heat/light production, precipitate formation, or gas production. The analysis of data on the properties of products and reactants can be used to determine whether a chemical reaction has occurred.	Develop exemplar models of chemical reactions that demonstrate each of the five chemical change indicators using common well-known reactions. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred (i.e. temperature, gas production, odor, color, etc.).

	VOCABULARY: physical, chemical, properties, reaction, substance, simple, complex, mass, space, composition, volume, identification **KEY TERMS:** atom, nucleus, orbits, proton, electron, neutron, products, reactants, precipitate, chemical reaction, macroscopic, microscopic, atomic-level, molecules, matter, density, flammability, solubility, melting point, boiling point	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Review of scientific documents/historical lab conclusions
- Explanatory writing
- Collaborative discussions
- Inquiry-based lab activities
- Data Analysis
- Sample analysis/hands-on activities
- Development of student-created models (i.e. drawings, diagrams, 3-D models, etc.)

KEY LEARNING EVENTS AND INSTRUCTION:

- Independent study of individual elements to explain the differences in atomic structure, basic chemical/physical properties *Families and Elements*
- 3-D model (using molecular building kits) investigation *Modeling Molecules*
- Investigate and classify common everyday objects with various physical and chemical properties
- Identify a physical/chemical property of an object through an investigation *Physical and Chemical Properties of Materials*
- Endothermic/exothermic reaction lab
- Chemical reaction indicator lab
- Calculating density of materials using d=m/v formula. Students should be able to realistically find the mass and volume of a sample and further calculate the density of it using the found information.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit II: Structure and Properties of Matter

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
5 Weeks	**Structure and Properties of Matter**	*SEPUP LabAIDs Unit B: The Chemistry of Materials* *pHet simulations:* • *Density:* *http://phet.colorado.edu/en/simulation/density* • *Salts and Solubility:* *http://phet.colorado.edu/en/simulation/legacy/membrane-channels* *Article on physical properties:* *https://student.societyforscience.org/print/article/golds-glittery-rewards* *Solubility simulation:* *https://concord.org/stem-resources/solubility* *Newsela.com*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit III: Interactions of Matter

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NJSLS Science</u>

MS-PS1-3: Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

MS-PS1-4: Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>As thermal energy is added or removed molecules of substance change in terms of particle speed and space; thereby affecting the entire material’s state of matter and overall temperature.</td><td>• How does thermal energy effect the molecules of a substance?</td></tr>
<tr><td>Synthetic materials are produced from the rearrangement of atoms of natural resources through various chemical reactions.

The synthetic material will have different physical and chemical properties due to the changes made to particle arrangement.</td><td>• How can we trace synthetic materials back to natural ingredients?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Each state of matter (solid, liquid, gas) has unique characteristic spacing and motion of the molecules or inert atoms depending on the material being studied .</td><td>Students will be able to:

Explain the relative motion (spacing and speed) of the molecules or inert atoms (depending on the material studied) for each of the three main states of matter (solid, liquid, gas).</td></tr>
</table>

	The term heat as used in everyday language refers both to thermal energy and the transfer of that thermal energy from one object to another (Thermal energy is also the motion of atoms or molecules within a substance).	Identify the many definitions of thermal energy.
	The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material).	Correlate thermal energy, e.g. the temperature of the substance, to the atomic-level kinetic motion of the atoms inside that material.
	An increase in the temperature of the system causes an increase in kinetic energy of the particles.	Using various models (e.g. simulations) summarize how changes in temperature cause changes in the movement of the particles.
	Changes in particle motion, temperature, and state of a pure substance occur when thermal energy is added or removed.	Conduct an investigation to gather data to support that when thermal energy is added or removed a change in state of matter occurs. Relate the large-scale changes in state of matter to the atomic-level changes in particle movement (speed and spacing).
	Qualitative molecular-level models of solids, liquids, and gases can be used to show that adding or removing thermal energy increases or decreases the kinetic energy of the particles until a change of state occurs.	Develop a model drawing or diagram, that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
	Cause-and-effect relationships may be used to predict and describe changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed in natural systems.	Use cause-and-effect relationships to predict changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed in natural or designed systems.

	The pressure of a substance, most notably gases, is determined through the total number of collisions occurring between the molecules or inert atoms as well as with the sides of the gas's container.	Correlate the number of minute collisions among the atoms and between the atoms and the container to the pressure of an overall substance.
	If the motion of molecules in a gaseous state is increased, through the addition of thermal energy, the moving molecules in the gas will have greater kinetic energy, thereby colliding with molecules in surrounding materials with greater force and exerting a greater overall pressure. This same phenomenon is since with reversed conditions to result in lower gas pressure.	Use cause-and-effect relationships to construct an explanation for the increase/decrease in pressure of a gas when thermal energy is added or removed.
	With a decrease in pressure, a smaller addition of thermal energy is required for particles of a liquid to change to gas because particles in the gaseous state are colliding with the surface of the liquid less frequently and exerting less force on the particles in the liquid, thereby allowing the particles in the liquid to break away and move into the gaseous state with the addition of less energy.	Using student-created models justify how liquids have a lower boiling point when heated at a lower pressure (such as different elevations).
	In a chemical process, the atoms that make up the original substances are regrouped into different molecules; which have different properties from those of the reactants.	Recall how chemical reactions provide rearrangements of molecules from the reactants to the new products, which differ in physical/chemical properties. Provide molecular-level accounts of states of matter and changes between states, of how chemical reactions involve regrouping of atoms to form new substances, and of how atoms rearrange during chemical reactions.
	Natural resources can undergo a chemical process to form synthetic material.	Gather, read, and synthesize research regarding actual examples of synthetic materials produced through chemical reactions of natural resources.

		Conduct an investigation to produce a basic synthetic material using natural ingredients. Discuss uses of the produced synthetic material.
	Structures can be designed to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.	Conduct an investigation to determine the best possible material to be used to serve a particular function taking into account the properties, such as shaping, of the available substances.
	The uses of technologies (engineered/synthetic materials) and any limitations on their use are driven by individual or societal needs, desires, regions and values; as well as by the findings of scientific research and by difference in such factors as climate, natural resources, and economic conditions.	Obtain, evaluate, and communicate information to show that synthetic materials come from natural resources and affect society. Hypothesize why certain technologies (engineered/synthetic materials) are/are not used based on societal needs, desires, regions, values, the findings of scientific research, differences in such factors as climate, natural resources, or economic conditions.
	VOCABULARY: energy, speed, motion, space, matter, temperature, molecules, substance, physical, chemical, properties, solid, liquid, gas, collisions, increase, decrease, chemical reaction, products, reactants, melt, freeze, boil, condense, evaporation, sublimate, deposition **KEY TERMS:** thermal energy, synthetic materials, natural resources, pressure, kinetic energy, phase change, states of matter, force	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Review of primary documents
- Explanatory writing
- Collaborative discussions
- Inquiry-based lab activities
- Data Analysis (use graphing skills)
- Development of student-created models (i.e. drawings, diagrams, 3-D models, etc.)

KEY LEARNING EVENTS AND INSTRUCTION:

- Particle movement simulations
- Investigation to observe phase change with temperature change (ice melting-water-steam)
- Gas properties simulations
- Making a basic synthetic material (slime, jello, polymer etc.) using natural ingredients. Discuss uses of this synthetic material after production *Creating New Materials*
- Molecular modeling kits to demonstrate regrouping of particles during a chemical reaction *Modeling Polymers*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit III: Interactions of Matter

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
4 Weeks	**Interactions of Matter**	*SEPUP LabAIDs Unit B: The Chemistry of Materials* *LabDisc: Water Phase Changes* *pHet simulations:* • *States of Matter:* *http://phet.colorado.edu/en/simulation/states-of-matter* *http://phet.colorado.edu/en/simulation/legacy/states-of-matter-basics* • *Gas Properties:* *http://phet.colorado.edu/en/simulation/gas-properties* *Phase Change Materials Technologies:* *http://discovermagazine.com/2013/september/21-running-hot-and-cold-forever* *Scientific American Magazine "Playing with Polymers":* *http://www.scientificamerican.com/article/bring-science-home-playing-with-polymers/* *Polymer Chemistry:* *http://agsci.oregonstate.edu/sites/agsci.oregonstate.edu/files/bioenergy/polymer-chemistry-and-biofuels-activity-v1.3.pdf*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit IV: Chemical Reactions

<table>
<tr><th>STANDARDS / GOALS:</th><th>ENDURING UNDERSTANDINGS</th><th>ESSENTIAL QUESTIONS</th></tr>
<tr><td rowspan="6"><u>NJSLS Science</u>

MS-PS1-5: Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved

MS-PS1-6: Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.</td><td>Substances combine or change to make new substances through the process of chemical reactions, which regroups atoms into new arrangements, such as baking.</td><td>• How do substances combine or change to make new substances?</td></tr>
<tr><td>Chemical reactions can produce thermal energy (exothermic) or consume thermal energy (endothermic).

Devices can utilize chemical reactions to release or absorb thermal energy.</td><td>• How can a device be designed and prototyped that either releases or absorbs thermal energy using chemical processes?</td></tr>
<tr><td>Engineers and scientists use the engineering design process to design, test, and optimize solutions to a challenge.</td><td>• How does the process of redesign strengthen the success of a product?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

In a chemical reaction, the atoms that make up the original substances are regrouped into different molecules.</td><td>Students will be able to:

Recall that during a chemical reaction atoms are rearranged from reactants to products.

Observe chemical reactions and record data to determine attributes of chemical reactions, such as temperature change.</td></tr>
</table>

	New substances created in a chemical reaction have different properties from those of the reactants.	Define reactant and product. Write chemical equations to visually describe the reactants and the products.
	The total number of each type of atom in a chemical process is conserved, and thus the mass does not change (the law of conservation of matter).	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. Describe mathematically the law of conservation of mass in chemical reactions. Design an investigation to prove the law of conservation of mass.
	Some chemical reactions release energy (exothermic), while others store energy (endothermic).	Observe chemical reactions and record data to determine attributes of endothermic and exothermic chemical reactions.
	Chemical reactions, which rearrange atoms, can either be classified as constructive (synthesis), destructive (decomposition, combustion), or replacement (single or double).	Classify the type of reaction as single replacement, double replacement, synthesis, decomposition, and combustion.
	The transfer of thermal energy can be tracked as energy flows through a designed or natural system.	Diagram the flow of energy within a designed or natural system by following the carbon bonds (Combustion, Photosynthesis, Respiration).
	The engineering and design process is a systematic method for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy driven by chemical processes.

	The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. **VOCABULARY:** problem, brainstorm, design, invention, iteration, modify, test, evaluate, energy, atoms, molecules, product, reactant **KEY TERMS:** chemical equation, chemical reaction, endothermic, exothermic, single replacement, double replacement, synthesis, decomposition, combustion, synthetic, engineering, design process, constraint, innovation, iteration, prototype, troubleshoot, optimize, law of conservation of mass (matter)	Optimize the solution, prototype or model by identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. Share the design and design process with others.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Reflection including asking questions
- Collaborative discussion
- Inquiry-based lab activities
- Explanatory writing
- Developing and using models
- Analyzing and interpreting data
- Research of primary and secondary resources
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

KEY LEARNING EVENTS AND INSTRUCTION:

- Endothermic/Exothermic Station Lab (calcium chloride and water, hydrogen peroxide and yeast, baking soda and vinegar, etc.) *Another Approach to Metal Reclamation*
- Alka-Seltzer and water law of conservation mass lab development *Conservation of Mass*
- Identify the type of reactions given chemical equations *Reclaiming the Metal*
- Design a device to emit or absorb thermal energy using chemical reaction

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit IV: Chemical Reactions

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
3 Weeks	**Chemical Reactions**	*SEPUP LabAIDs Unit B: The Chemistry of Materials* *LabDisc: Endo/Exothermic Reactions* *Hand-warmer Egg Incubator - ACS Middle School Chemistry:* *http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson7* *Engineering Design Graphic* http://www.jpl.nasa.gov/edu/pdfs/engineering_design_process_light.pdf *Newsela.com*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit V: Structure and Function of Life

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NJSLS Science</u>

MS-LS1-1: Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS1-2: Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>All living things share 7 characteristics essential for sustaining life.</td><td>• How can we determine if something is alive?</td></tr>
<tr><td>The cell is a system that functions due to interactions between organelles.

The cells theory states that all living things successfully function due to different levels of organization.</td><td>• How do the processes within the cell support itself and an entire organism?</td></tr>
<tr><td>The cell membrane is constructed of a semi-permeable membrane.</td><td>• How can the cell regulate what goes in and out? Why is this process important?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Life is a quality that distinguishes living things—composed of living cells—from once-living things that have died or things that never lived.</td><td>Students will be able to:

Conduct an investigation to determine what characteristics different samples of living things have in common.</td></tr>
</table>

		Gather, read and synthesize information regarding the 7 characteristics of living things. Using claims evidence and reason, argue why a given object is or is not alive (Ex. Fire).
	All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).	Define cells as the basic unit of structure and function in living things. Compare multicellular and unicellular organisms for their similarities and differences. Provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
	Cells that can be observed at one scale may not be observable at another scale.	Illustrate and identify the different microscope parts. Using a microscope, investigate the structure of different cells and determine their structure.
	Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. The functioning between these organelles helps the cell operate as a whole.	Explain the individual functions of the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall. Construct an analogy between the functions of organelles and real world situations. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

	Engineering advances have led to important discoveries in the field of cell biology, and scientific discoveries have led to the development of entire industries and engineered systems.	Gather, read, and synthesize information about modern advances in spectrometry and how it is leading to advances in the field.
	Materials can move through one another using the processes of osmosis and diffusion.	Compare and contrast osmosis and diffusion. Demonstrate an example of osmosis and which direction water would move. Predict what direction water will move (into, out of) when placed in different solutions (hypertonic, hypotonic, isotonic).
	Within cells, the cell membrane forms the boundary that controls what enters and leaves the cell.	Explain the structure of the cell membrane in terms of permeability. Predict how a given material will or will not move across the cell membrane.
	The structures of the cell wall and cell membrane determine how and what materials can pass through. **VOCABULARY:** energy, cell wall, organism, living, non-living, active, passive, structure, function, boundary, direction, characteristics **KEY TERMS:** spectrometry, hypotonic, hypertonic, isotonic, cell, multicellular, unicellular, cell membrane, cell wall, nucleus, chloroplast, mitochondria, diffusion, osmosis, microscope, stage, lens, magnification, semipermeable, facilitated, lipid, organelle	Compare and contrast active, passive transport and facilitated diffusion.

ASSESSMENT EVIDENCE: Students will show their learning in various ways, including but not limited to:

- Research of primary and secondary resources
- Reflection
- Explanatory writing
- Debate
- Collaborative discussions
- Inquiry-based lab activities
- Data Analysis
- Development of models

KEY LEARNING EVENTS AND INSTRUCTION:

- Model an infectious agent's impact on a community *Outbreak!*
- Microscope parts and sample investigations *Observing Plant and Animal Cells, Observing Single Celled Organisms*
- Real world analogies for cellular functions *A Cell Model*
- Gummy Bear Lab (Osmosis)

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit V: Structure and Function of Life

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
4 weeks	**Structure and Function of Life**	*SEPUP LabAIDs Unit: Cell Structure and Function* *Iodine and Corn Starch Experiment (Diffusion)* *Sewerlice Experiment (Living/Non-living)* *pHet Simulations* • *Membrane Channels (diffusion, transport): http://phet.colorado.edu/en/simulation/legacy/membrane-channels* *Scientific American articles* *Newsela.com*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit VI: Organization for Matter and Energy Flow in Organisms

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NJSLS Science</u>

MS-LS1-6: Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS1-7: Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>A process known as photosynthesis occurs in the chloroplasts where sunlight is converted to a useable energy source that can be stored for future use.</td><td>• Why is sunlight necessary for plant life?</td></tr>
<tr><td>A process known as cellular respiration occurs in the mitochondria where food is converted into a useable energy source.</td><td>• How do animals get energy from food?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.</td><td>Students will be able to:

Evaluate graphs that focus on the composition of Earth’s early atmosphere and the rise of the O_2 is due to photosynthesis of stromatolites and other early life forms (cyanobacteria).

Develop an equation which demonstrates what materials are needed and produced during photosynthesis.</td></tr>
</table>

		Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. Conduct an experiment to analyze the effect of different amounts of sunlight and CO_2 in photosynthesis.
	Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon are broken down and rearranged to form new molecules; they react with oxygen to produce carbon dioxide and other materials.	Demonstrate using student derived equation how sugars are broken down for energy. Correlate using temperature data, the breakdown of a molecule to an exothermic process where energy is produced. Construct a scientific explanation based on evidence for the role of both cellular respiration and photosynthesis in the cycling of matter and flow of energy into and out of organisms.
	Through the process of cellular respiration, new macro molecules are formed such as carbohydrates, lipids, nucleic acids, and proteins.	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. Explain the difference between carbohydrates, lipids, nucleic acids and proteins.
	ATP is created by the breakdown of carbohydrates and is most notably used in the active transport of molecules across the lipid bilayer.	Describe the effect of ATP on active transport, in the cellular process.

	The origin of proteins can be traced back to the nucleus. Transcription and translation dictate the conversion of DNA to RNA to protein. Errors made by the cell during the gene to protein process can result in large scale protein disorders. **VOCABULARY:** air, oxygen, carbon dioxide, water, organelles, energy, disorder, sugar, bilayer, products, reactants, active transport, ribosome **KEY TERMS:** photosynthesis, cellular respiration, stoma, carbohydrate, lipid, protein, nucleic acid, DNA, RNA, ATP, translation, transcription	Trace the creation of new proteins through translation and transcription of the DNA to the RNA and then to the mitochondria. Demonstrate the gene to protein process. Gather, read and analyze information on various protein disorders and the effect on individuals.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Research of primary and secondary resources
- Reflection
- Explanatory writing
- Collaborative discussions
- Inquiry-based lab activities
- Data Analysis
- Deriving Equation/Manipulation

KEY LEARNING EVENTS AND INSTRUCTION:

- Lab Aids Photosynthesis Investigation *A Closer Look Into Plant and Animal Cells*
- Virtual Photosynthesis Simulation Lab
- Investigation into Cellular Respiration Products and Reactants *Cells Alive!*
- Levels of Organization *Levels of Organization: Cells, Tissues, Organs*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit VI: Organization for Matter and Energy Flow in Organisms

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
5 weeks	**Organization for Matter and Energy Flow in Organisms**	*SEPUP LabAIDs Unit: Cell Structure and Function* *Photosynthesis Investigation with Spinach Leaves* *Ted Ed Cell vs Virus* *Scientific American* *National Geographic* *Newsela.com*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit VII: Inheritance and Variation of Traits

<table>
<tr><td rowspan="6">STANDARDS / GOALS:

<u>NJSLS Science</u>

MS-LS3-1: Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

MS-LS3-2: Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Through sexual reproduction, we carry chromosomes from our parents therefore gene mutation and sexual reproduction contribute to genetic variation.</td><td>• Why do you look similar to your parents?</td></tr>
<tr><td>Any change in the genetic code of an organism changes the protein produced. Cells require specific proteins to serve particular functions.</td><td>• How can a simple change in a gene affect an organism?</td></tr>
<tr><td>Asexual reproduction leads to less genetic variation in a species, whereas sexual reproduction leads to more.</td><td>• How do the products of asexual and sexual reproduction compare?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.</td><td>Students will be able to:

Describe how genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes, one half inherited from our mother and the other half from our father.</td></tr>
</table>

	There is an organized process by which cells divide and ensure complete inheritance of genetic code.	Develop a model of the cell cycle with the different phases of mitosis.
	There is an organized process by which sex cells are produced and provide the opportunity for variation of traits in offspring.	Develop a model of the cell cycle with the different phases of meiosis. Compare and contrast the phases and the end results of mitosis and meiosis. Define the difference between dominant and recessive alleles. Define Genotype and Phenotype
	Patterns of inheritance were most notably defined and describe by the pea plant experiments of Gregor Mendel.	Gather, read and analyze data on Mendel's experiments on pea plants and the different ways traits are expressed. Compare the patterns of inheritance for complete dominance, co-dominance, incomplete dominance, using the pea plant experiments of Gregor Mendel.
	Punnett squares provide a visual model of all possible outcomes of a trait expressed in the offspring of a selected breeding pair. Punnett squares can mathematically express the probability for inheritance of a specific trait.	Utilize Punnett Squares to construct arguments regarding the genetic outcome of an offspring of two specific individuals. Analyze Punnett squares to express the inheritance of a specific trait in terms of both phenotypic and genotypic ratios. Extend their understanding of monohybrid crosses to construct, analyze, and mathematically represent the results of a dihybrid cross.

	Pedigree provide visual models of inheritance patterns for a trait found in multiple generations of a specific species.	Analyze and describe a given pedigree for its symbols, organization, and usage. Predict possible genotypes for individuals listed in a pedigree. Justify inheritance pattern based on the pedigree of a family with a genetic disorder.
	Karyotypes provide visual models of all the chromosomes present in a specific organism.	Analyze and describe a given karyotype for its symbols, organization, and usage. Construct a model karyotype using images of chromosomes. Predict if an organism will display a genetic disorder based on evidence from a karyotype.
	Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.	Identify the type of mutation (insertion, deletion, nonsense, replacement, duplication) present in a given replication. Develop and utilize a model to predict what affects, both small scale and whole organism, may occur when a mutation in the genetic code occurs. Argue why some changes to genetic material are beneficial, others harmful, and some neutral to the organism. Design an experiment to test whether a genetic trait comes from a mutation or from inheritance.

	Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. **VOCABULARY:** cell, nucleus, trait, offspring, reproduce, protein, RNA, DNA, ribosome **KEY TERMS:** chromosomes, genes, sexual reproduction, asexual reproduction, mitosis, prophase, metaphase, anaphase, telophase, cytokinesis, interphase, cell cycle, mutation, F_1 generation, F_2 generation, inheritance, variation, purebred, hybrid, monohybrid, dihybrid, dominant, recessive, genotype, phenotype, incomplete dominance, co-dominance, allele, pedigree, karyotype	Demonstrate how a variation of inherited traits can occur within several generations of an organism through sexual reproduction. Demonstrate how variation of inherited traits is not possible through asexual reproduction. Develop and use a model to compare the possibility for genetic variation during both sexual and asexual reproduction.

ASSESSMENT EVIDENCE: Students will show their learning in various ways, including but not limited to:

- Research of primary and secondary resources
- Reflection
- Explanatory writing
- Collaborative discussions
- Data Analysis
- Argumentative writing
- Developing and utilizing student-created models

KEY LEARNING EVENTS AND INSTRUCTION:

- Modeling Activity with Cell Cycle *Show Me The Genes!*
- Punnett's Square Lab *Gene Squares, Gene Combo*
- Pedigree Activity *Creature Features*
- Karyotyping Chromosomes
- Gene to Protein modeling

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit VII: Inheritance and Variation of Traits

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
7 weeks	**Inheritance and Variation of Traits**	*SEPUP LabAIDs Unit: Reproduction* *Creature Project* *pHet Simulations:* • *Gene Expression* *http://phet.colorado.edu/en/simulation/gene-expression-basics* *Scientific American articles* *Newsela.com*

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit VIII: Body Systems

<table>
<tr><td rowspan="5">STANDARDS / GOALS:

<u>NJSLS Science</u>

MS-LS1-3: Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS1-8: Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Body systems rely on each other to aid in the successful function of the organism.</td><td>• How do your body systems work together to keep you moving, healthy, and living?</td></tr>
<tr><td>The sensory organs such as, eyes, ears, skin, tongue, nose, have specially designed cells to pick up subtle changes in the environment.</td><td>• How do we gather information from our environment?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Body subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.

In multicellular organisms, the body is a system of multiple interacting subsystems.</td><td>Students will be able to:

Identify the levels of organization within an organism.

Identify the various systems of the body and their basic functions.

Model how body systems are constantly interacting with each other.</td></tr>
</table>

		Gather, read and analyze information on various systems and how they need each other to provide our body functions. Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of specialized cells. Predict the effects on an organism if a body system does not function properly.
	Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. **VOCABULARY: b**lood, multicellular, cells, tissues, organs, function, sight, hearing, touch, smell, taste, ear drum, touch receptors, taste buds, heart **KEY TERMS:** excretory system, circulatory system, skeletal system, muscular system, digestive system, nervous system, lymph system, integumentary system, reproductive system, retina, cornea, lens, cochlea	List our multiple senses and the organs required for them to function. Describe how our eyes, ears, tongue, nose and skin responds to different inputs and the various structures that allow the organs to function. Conduct and analyze an experiment on sweat production of the excretory system and how it relates to homeostasis.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Grade 7 Science
Unit VIII: Body Systems

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
3 weeks	**Body Systems**	*SEPUP LabAIDs Unit: Body Works* *Lab Disc: Heart Rate* *Skeletal System Joints Activity* *Scientific American* *National Geographic* *Newsela.com*

APPENDIX A

NGSS http://www.nextgenscience.org/next-generation-science-standards
NJ State Model Curriculum http://www.nj.gov/education/modelcurriculum/sci/ms.shtml
Office 365 Folder "7th GRADE SCIENCE PLC"