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The Purpose of the Science Curriculum Guide

The purpose of the Science Curriculum Guide is to provide teachers with all of the components and content which, when fully implemented, will lead to deep alignment of the Youngstown City Schools science Curriculum and Ohio’s New Learning Standards.

The Science Curriculum Guide is designed to maximize student achievement and is intended to be followed by all teachers. Much of the Science Curriculum Guide is flexible for teacher’s to design their own lessons within the framework of Ohio’s New Learning Standards. Student achievement is enhanced when students are taught the content on which they will be tested (content alignment); taught the curriculum in the format that it will be tested (context alignment); and taught the curriculum at the appropriate level of cognition (cognitive alignment). The Science Curriculum Guide contains teaching methodologies that are varied to ensure that students have acquired learning for both long-term and short-term mastery.

This curriculum document is designed to be a working resource. It provides the essential information and example that will assist teachers in providing classroom instruction that maximizes student learning. The strategies contained in this guide are designed to provide guidance to teachers on how to approach key concepts and skills. This curriculum guide cannot replace good teaching, but it can reinforce and guide teachers to provide all students with the skills, knowledge and experiences they will need to succeed in science in Youngstown City Schools and be successful at levels set by the Ohio Department of Education.

It is the intent of the Science Curriculum Guide that teachers and students are successful in meeting the expectations of the state science standards. Therefore, teaching and learning must be an active inquiry process. This means that teachers should take the opportunity to teach science as something in which students are actively engaged. When participating in inquiry, students learn to construct their knowledge and communicate their ideas and learning to others. This includes engaging all students with relevant, real-world activities that develop students’ knowledge, verbal and written communication skills and scientific process skills.

The following terms are used throughout this document:

**Content Statements:** These state the science content to be learned. They are the “what” of science that should be accessible to students at each grade level to prepare them to learn about and use scientific knowledge, principles and processes with increasing complexity in subsequent grades. These statements come directly from the Ohio New Learning Standards Document.

**Content Elaboration:** This section provides anticipated grade-level depth of content knowledge and examples of science process skills that should be integrated with the content. Content Elaborations also provides information to help identify what prior knowledge students should have and to what future knowledge the content will build. This section comes directly from the Ohio New Learning Standards Document and is the content from which state assessments are being developed.
### 7th Grade New Learning Standards at a Glance

**Earth and Space Sciences**

<table>
<thead>
<tr>
<th>Condensed Content Statement</th>
<th>Content Elaboration</th>
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</table>
| 7.ESS.1 The hydrologic cycle illustrates the changing states of water as it moves through the lithosphere, biosphere, hydrosphere and atmosphere. | - The different pieces of the hydrologic cycle (e.g., properties of water, changes of state, relationships of water to weather, effects of water on Earth’s surface) from the elementary grades are formally combined in grade 7 and applied to the components of the hydrologic cycle.  
- The movement of water through the spheres of Earth is known as the hydrologic cycle. As water changes state and energy is transferred, it cycles from one sphere into another (e.g., water transfers from the hydrosphere to the atmosphere when evaporation occurs). Ground water and surface water quality are important components of the hydrologic cycle. The porosity and permeability of the rock and/or soil (grade 6) can affect the rate at which the water flows. The pattern of the cycling illustrates the relationship between water, energy and weather.  
- The movement of water in the cycle also can move contamination through each of the spheres. Relating water flow to geographic and topographic landforms and/or features leads to an understanding of where water flows and how it moves through the different spheres. Topographic and aerial maps (can be virtual) can be used to identify drainage patterns and watersheds that contribute to the cycling of water. Lab investigations or technology can be used to simulate different segments of the hydrologic cycle. |
| 7.ESS.2 Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns. | - The earlier concepts of weather and the physical properties of air and water and their changes are expanded in grade 7 to the relationship of atmospheric and oceanic currents and climate. Current and climate patterns on a global level should be studied using a variety of maps, models and technology (e.g., remote sensing, satellite images, LANDSAT).  
- The causes of moving currents in the atmosphere and ocean must be connected to thermal energy, density, pressure, composition and topographic/geographic influences (e.g., continental mountains, ocean ridges). Studies also should include specific current patterns in both the atmosphere and the ocean that are mapped and documented through data. Contemporary studies regarding global climate must be based on facts and evidence.  
- This content statement is connected to the LS grade 7 content pertaining to biomes and the climatic zones of Earth. |
7.ESS.3
The atmosphere has different properties at different elevations and contains a mixture of gases that cycle through the lithosphere, biosphere, hydrosphere and atmosphere.

- The properties and composition of the layers of Earth’s atmosphere are studied, as they are essential in understanding atmospheric current, climate and biogeochemical cycles, which are seventh-grade concepts.
- Understanding the interactions between Earth’s spheres (Earth Systems Science) and how specific elements and/or molecules move between them should be emphasized. This study must include standard greenhouse gases (including water vapor), ozone (in the atmosphere and at Earth’s surface), and natural events/human activities that can change the properties of the atmosphere. Contemporary issues and technological advances should be included within this concept. Real-time scientific data pertaining to air quality and properties of air must be incorporated into the study of atmospheric properties and air quality.

7.ESS.4
The relative patterns of motion and positions of the Earth, moon and sun cause solar and lunar eclipses, tides and phases of the moon.

- The role of gravitational forces and tides are introduced in relationship to the position of the Earth, moon and sun. Models and simulations (can be 3-D or virtual) must be used to demonstrate the changing positions of the moon and Earth (as they orbit the sun) and lunar/solar eclipses, daily tides, neap and spring tides, and the phases of the moon. Earth and its solar system are part of the Milky Way galaxy, which are part of the universe.
- The emphasis should not be on naming the phases of the moon or tides, but in understanding why the phases of the moon or tides are cyclical and predictable. Advances in science knowledge regarding patterns and movement in the solar system are included in this content statement.
**Life Sciences**

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| **7.LS.1**  
Matter is transferred continuously between one organism to another and between organisms and their physical environments. | - The basic concepts for matter and energy flow were introduced in grades 3-5. The grades 3-5 concepts are expanded to include a comparison of photosynthesis and cellular respiration.  
- The use of light energy to make food is called photosynthesis. The breakdown of food to release the stored energy is called respiration. General formulas are appropriate at this grade level, because atoms and molecules are taught in grade 6. Details of both processes are not grade appropriate. In grade 6, cellular organelles are introduced. It is appropriate to reinforce that the chloroplast (the plant cell organelle that contains chlorophyll) captures the sun’s energy to begin the process of converting the energy from the sun into sugars and sugar polymers, such as starch.  
- As matter is cycled within the environment, it promotes sustainability. The emphasis is not on food webs, but on the transfer of matter and energy between organisms. The total amount of matter and energy remains constant in an ecosystem, even though the form and location undergo continual change. The concept of conservation of matter (introduced in PS grade 4) and conservation of energy are applied to ecosystems. An energy pyramid graphic can illustrate the flow of energy. At each stage in the transfer of energy within an ecosystem, some energy is stored in newly synthesized molecules and some energy is lost into the environment as heat produced by the chemical processes in cells. The elements that make up the molecules of living things are continuously recycled. Energy rich molecules that are passed from organism to organism are eventually recycled by decomposers back into mineral nutrients usable by plants.  
- New discoveries, technology and research must be used to connect the concept of energy transfer and transformation within the ecosystem and between ecosystems. For example, the use of biomass as an alternative energy source for the local area can focus on different types of biomass, competition between human food crops and biomass crops, and biomass vs. other types of alternatives to fossil-fuels energy. |
| **7.LS.2**  
In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors. | - Biomes are defined by abiotic components of the environment – topography, soil types, precipitation, solar radiation and temperature. Comparing the different biomes found on Earth is the focus of this content statement. Examples of the Earth’s biomes include aquatic (freshwater, brackish water and marine water), forest (tropical and temperate), desert (cold and hot), grassland, taiga and tundra. Biomes must be linked to climate zones on a global level by using a variety of maps, models and technology (e.g., remote sensing, satellite images, LANDSAT). This content statement is connected to the ESS middle school content pertaining to global climate patterns. |
| An ecosystem is composed of linked and fluctuating interactions between biotic and abiotic factors. Given adequate resources and an absence of disease or predators, populations of organisms in ecosystems increase at rapid rates. Finite resources and other factors limit population growth. As one population proliferates, it is held in check by one or more environmental factors (e.g., depletion of food or nesting sites, increased loss to predators, invasion by parasites). If a natural disaster such as a flood or fire occurs, the damaged ecosystem is likely to recover in a succession of stages that eventually results in a system similar to the original one. |
### Physical Science

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<th>Condensed Content Statement</th>
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| 7.PS.1 The properties of matter are determined by the arrangement of atoms. | - Mixtures are materials composed of two or more substances that retain their separate atomic compositions, even when mixed (e.g., water and sugar can be mixed together thoroughly at the molecular level but the water particles and sugar particles remain separate).  
- Elements are organized into groups based on their properties (including melting and/or boiling points) and position on the periodic table. These groups include metals, non-metals and gases that are almost completely nonreactive. The nonreactive gases exist primarily as elements and do not react to form many compounds. Most metals are malleable, have high melting points, are usually solid at room temperature and are good conductors of heat and electricity. Nonmetals are poor conductors of heat and electricity, are usually gases at room temperature and, as solids, tend to be dull and brittle.  
- The pH scale has a range of 0-14 and is used to measure the acidity or alkalinity of a compound. At the seventh-grade level, pH tests must be conducted on a variety of substances. The properties of the compounds that are acidic (below 7 on the pH scale), neutral (7 on the pH scale) or basic (above 7 on the pH scale) must be compared and evaluated. Acidity and alkalinity values must be related and connected to the natural world, as pH values are used to measure water, soil and air quality (e.g., sulfuric acid in the atmosphere can form acidic precipitation which can impact the acidity of a stream and the living organisms in the stream). The discussion of hydroxide and hydrogen ions as they relate to the pH scale is reserved for high school and will not be assessed at the grade 7.  
- Chemical and physical changes occur on a continuum and no distinct lines separate the two. In many cases when objects, substances or materials undergo change, there may be a combination of chemical and physical changes occurring. Under these standards, classifying specific changes as chemical or physical is not appropriate.  
- For any change in a closed system, the number and type of atoms stays the same, even if the atoms are rearranged. Therefore, the mass remains constant.  
- Note 1: Appropriate background knowledge such as graphics representing the atomic composition of the substances involved or descriptions of how the matter can be formed, decomposed or separated, should accompany questions asking to classify matter as an element, compound or mixture. The nature of chemical bonding is not appropriate at this grade.  
- Note 2: H+ and OH- ions as they relate to pH are found at the high school level.  
- Note 3: While mass is always conserved, this is not the case for volume. Mixing alcohol with water results in a volume that is less than the sum of the volumes. Boiling liquid results in a significant increase in volume.  
- Note 4: The idea of reversibility of changes is not a criterion for |
classifying changes as chemical or physical. Some changes cannot be reversed, like tearing paper. As students progress farther in chemistry, they will learn about equilibrium, which involves many chemical changes that are reversible. Dissolving an ionic substance is an example of a process that is not clearly chemical or physical since bonds are broken (Science: College Board Standards for College Success, 2009, page 125).

| 7.PS.2 | A system is separated from its surroundings by either a physical or mental boundary. An isolated system is one that does not interact with its surroundings. Matter and energy cannot get into or out of an isolated system. Most systems on Earth are open systems. Matter and energy can be transferred into or out of an open system. If energy appears to be gained or lost, it has just transformed or transferred into a different system. Examples of systems include ecosystems, the atmosphere, the hydrosphere, the solar system and the human body. |
|        | When energy transfers to a large system, it may be difficult to measure the effects of the added energy. Dissipated energy (energy that is transformed into thermal energy and released into the surroundings) is difficult or impossible to recapture. Some systems dissipate less energy than others, leaving more energy to use. |
|        | Investigation, testing and experimentation must be used to explore energy transfers and transformations. Observing the quantifiable energy changes in a virtual environment is recommended at this introductory level, as these can be difficult to measure accurately. |
|        | Note 1: This content statement does not deal with radiation, convection and conduction. That is addressed in the seventh grade Physical Science content statement. |
|        | Note 2: ESS grade 7 is connected to this content statement regarding thermal energy. Thermal energy is transformed as water changes state throughout the water cycle. Thermal energy transferred in the ocean and atmosphere contributes to the formation of currents, which influence global climate patterns (ESS grade 7). Middle school LS also is connected to this statement as it relates to the transfer and transformation of energy within ecosystems. |

| 7.PS.3 | Mechanical energy is transferred when a force acts between objects that move one of the objects some distance with or against the force. The amount of energy transferred increases as the strength of the force and/or the distance covered by object increases. This energy transfer (work) stops when the objects no longer exert forces on each other. |
|        | Vibrations cause wave-like disturbances that transfer energy from one place to another. Mechanical waves require a material (medium) in which to travel. The medium moves temporarily as the energy passes through it, but returns to its original undisturbed position. Mechanical waves are classified as transverse or longitudinal (compression) depending on the direction of movement of the medium. |
|        | Waves can be described by their speed, wavelength, amplitude and frequency. The energy of a mechanical wave depends upon the material, decreases with increasing wavelength, and increases with amplitude. |
The pitch of a sound wave increases with the frequency and the loudness increases with amplitude. While light and other electromagnetic waves do not require a medium and can travel through a vacuum, they can travel through some media, such as clear glass. A wave travels at a constant speed through a particular material as long as it is uniform (e.g., for water waves, having the same depth). The speed of the wave depends on the nature of the material (e.g., waves travel faster through solids than gases). For a particular uniform medium, as the frequency \((f)\) of the wave is increased, the wavelength \((\lambda)\) of the wave is decreased. The mathematical representation is \(V_{\text{wave}} = \lambda f\).

- For grade 7, investigation and experiments (3-D and virtual) must be used to connect energy transfer and waves to the natural world. Real data must be used, such as oceanic or seismic wave data or light and sound wave data.

- Heat is thermal energy transferred between objects and travels from a warm object to a cooler one, unless additional energy is used. Thermal energy can be transferred when moving atoms collide. This is called conduction. Thermal energy also can be transferred by means of thermal currents in air, water or other fluids. As fluids are heated, they expand, decreasing the density. Warmer material with less density rises, while cooler material with a greater density sinks, causing currents that transfer energy in a process called convection. Thermal energy also can be transformed into waves that radiate outward. This energy transferred by the waves can be transformed back into thermal energy when it strikes another material through a process called radiation. Technology (e.g., virtual simulations, satellite imagery, remote sensing, accessing real-time temperature data) can be used to demonstrate the transfer of thermal energy on the surface or interior of Earth and within the solar system.

- An electric circuit exists when an energy source (e.g., battery, generator, solar cell) is connected to an electrical device (e.g., light bulb, motor) in a closed circuit. The energy source transfers energy to charges in the circuit. Charges flow through the circuit. Electric potential is a measure of the potential electrical energy of each charge. Differences in voltages can be measured with a voltmeter. The energy source does not create the charges; they were already present in the circuit. When the charges reach an electrical device, energy can be transformed into other forms of energy (light, sound, thermal or mechanical). The voltage drops after this energy transfer, but the charges continue to move through the circuit. In an open circuit, the charges stop flowing and energy is not transferred. Current is the rate of charge flow through conductors and can be measured with an ammeter. The degree to which current is opposed in a circuit is called resistance. Generally, for a particular energy source, the greater the resistance, the lower the current. The resistance through a wire depends upon the type of metal, the length of the wire and the diameter of the wire. Electrical devices can be connected in a series or as a parallel circuit. As the number of devices in a series loop increases, the
| current in the loop decreases. In a parallel circuit, the currents in each loop are the same as they would be if each loop were the only loop in the circuit. Testing and experimenting (3-D or virtually) with electrical circuits to evaluate the energy transfers, resistance, current and changes in voltage are required. |
| Note: The electromagnetic nature of electromagnetic radiation is not appropriate at this grade level nor are mathematical calculations of work or electricity. |
SCIENCE LABORATORY SAFETY CONTRACT

- I will act responsibly at all times during a laboratory experiences.
- When entering the lab classroom, I will wait for instructions before touching any equipment, chemicals, or other materials in the laboratory area.
- I will not eat food, drink beverages, or chew gum in the laboratory.
- I will not use laboratory glassware as containers for food or beverages.
- I will keep my area clean during a lab.
- I will wear appropriate safety glasses/goggles when working with heat, glass or chemicals and protective apron when necessary.
- I know the locations and operating procedures of all safety equipment including the first aid kit, eyewash station, safety shower, fire extinguisher, and fire blanket. I know where the fire alarm and the exits are located.
- I will immediately notify a teacher of any accident (spill, breakage, etc.) or injury (cut, burn, etc.), no matter how trivial it may appear.
- I know my school's Emergency Response Team Plan and the people to contact in the event of an emergency.
- I know what to do if there is a fire drill during a lab period.
- I will handle all living organisms used in a lab activity in a humane manner. Preserved biological materials are to be treated with respect and disposed of properly.
- I will tie back long hair, remove jewelry and wear shoes with closed ends (toes and heels) while in lab/classroom.
- I will never work alone in the lab/classroom.
- I will not take chemicals or equipment out of the classroom unless instructed to do so.
- I will dispose of all chemical waste properly (according to teacher's directions).
- All chemicals in the laboratory are to be considered dangerous. I will not touch, taste, or smell any chemicals unless specifically instructed to do so.
- I will not enter or work in the storage room unless supervised by a teacher.

AGREEMENT
I, ____________________________________________, have read each of the statements in the Science Laboratory Safety Contract and understand these safety rules. I agree to abide by the safety regulations and any additional written or verbal instructions provided by the school district or my teacher. This contract ensures that students and the teacher know exactly what is expected of them.

1. Please list any food or contact allergies (e.g. allergy to peanuts, plant, latex, etc.)

2. Please provide a daytime emergency contact:

   (Contact person) __________________________ (Contact phone number) __________________________

3. Student Signature __________________________ Date ______________

4. Parent Signature __________________________ Date ______________

Adapted from http://www.flinnsci.com/Documents/miscPDFs/Safety_Contract.pdf
Optimize  Classify  Communicate

Experiment  Predict  Problem Solving

Measure  Infer  Hypothesize
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<tr>
<th>Optimize</th>
<th>Classify:</th>
<th>Observe:</th>
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<tbody>
<tr>
<td>To make the best or most effective use of (a situation, opportunity, or resource)</td>
<td>Group or organize objects or events into categories based on specific criteria</td>
<td>Use one or more of your senses to perceive properties of objects and events; can be done directly with the senses or indirectly through the use of simple or complex instruments</td>
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<tr>
<th>Problem Solving:</th>
<th>Predict:</th>
<th>Experiment:</th>
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<tr>
<td>Build new mathematical or scientific knowledge through problem solving; solve problems that arise in mathematics, science and in other context; apply and adapt a variety of appropriate strategies to solve problems; and monitor and reflect on the process of mathematical and scientific problem solving</td>
<td>Anticipate outcomes of future events, based on patterns or experience</td>
<td>Design procedures for gathering data to test hypotheses under conditions in which variables are controlled or manipulated</td>
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<tr>
<th>Hypothesize:</th>
<th>Infer:</th>
<th>Measure:</th>
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<tr>
<td>Pose a testable explanation for observations or events and state it as the expected outcome of an experiment</td>
<td>Use logical reasoning to make conclusions based on observations</td>
<td>Make quantitative observations using both nonstandard and standard measure</td>
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<td>Control Variables</td>
<td>Interpret Data</td>
<td>Design</td>
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<td>Representation</td>
<td>Reasoning</td>
<td>Constraints</td>
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<td>Critique</td>
<td>Compare</td>
<td>Draw Conclusions</td>
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<tr>
<td>Design:</td>
<td>Interpret Data:</td>
<td>Control Variables:</td>
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</tr>
<tr>
<td>Develop procedures for gathering data to test hypotheses</td>
<td>Make observations of objects or events to make inferences or predictions; write down the observations on paper as notes or display the data in charts, tables or graphs; make predictions, inferences and hypotheses from a set of data</td>
<td>State or control factors that affect the outcome of an experiment</td>
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<tr>
<th>Constraints:</th>
<th>Reasoning and Proof:</th>
<th>Representation:</th>
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<tbody>
<tr>
<td>Limitations or restrictions on a process or procedure.</td>
<td>Recognize reasoning and proof as fundamental aspects of mathematics and science; make and investigate mathematical and scientific conjectures; develop and evaluate mathematical and scientific arguments and proofs; and select and use various types of reasoning and methods of proof</td>
<td>Create and use representations to organize, record and communicate mathematical and scientific ideas; select, apply and translate among mathematical and scientific representations to solve problems; and use representations to model and interpret physical, social, mathematical and scientific phenomena</td>
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<tr>
<th>Draw Conclusions:</th>
<th>Compare:</th>
<th>Critique:</th>
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<tr>
<td>Interpret data to make conclusions; the final step of an investigation</td>
<td>Identify common and distinguishing characteristics among objects or events.</td>
<td>Evaluate (a theory or practice) in a detailed and analytical way.</td>
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**Middle School Science Lab Report Guidelines**

**Title:** A descriptive complete sentence.

**Introduction:** This section should include an introductory paragraph discussing question(s)/problems in which you are trying to answer. This paragraph should also include preliminary observations or basic researched information about the subject as well as listing any formulas that will be used during the lab.

**Hypothesis:** This section requires you to write a possible solution for the problem found within the introductory paragraph. Make sure this solution is testable and written as a complete sentence. (Use “If/Then” statements for 6th grade)

**Materials:** Create a bulleted list of all items used in the lab

**Safety Concerns:** Create a list of all safety precautions/concerns within the lab.

**Procedure:** This section will be numerically listed (1, 2, 3…) step by step list of instructions to complete the lab exercise. These steps must be written so that another person can use the directions to complete the activity.

**Results/Data:** This section should include all observations or additional notes you make during the lab. It must include appropriate labeled tables, graphs and charts needed to simplify your data. Add color when appropriate.

**Conclusion:** The conclusion section of your lab should be at least a paragraph long. Your conclusion should begin with restating your hypothesis. Then you need to either support or reject your hypothesis based on your results and analyzed data taken from your lab. Explain why you supported or rejected your hypothesis-support your decision with facts from your lab. Additionally state one thing you learned from the lab and describe how it applies to real-life situations.

**Diagram/Illustration (if necessary):** Examples: Draw a visual representation of your lab set up describing what occurred/draw what you saw under the microscope/before and after illustration of the lab results. This will be determined by your teacher.

* Lab reports should be written using Third Person. However, use your best judgment when it concerns your students. (Modeling will help.)
Procedure:
1. ______________________________________________________
2. ______________________________________________________
3. ______________________________________________________
4. ______________________________________________________
5. ______________________________________________________
6. ______________________________________________________
7. ______________________________________________________
8. ______________________________________________________
9. ______________________________________________________
10. _________________________________________________

Results/Data:

Optional: Attach Graph
Conclusion:

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Inquiry Design Cycle
Teacher Explanation

Define the Problem: The students will identify what needs to be done. They will come back to this stage each time they encounter a problem throughout the design process. Be sure that students are documenting changes on the Inquiry Design Challenge page or the Daily Notebook.

What students are doing during this stage:
- Making observations
- Listing all driving questions

Develop the Solution: This stage involves brainstorming, drawing, modeling, and building. Students are actively engaged in the solving of or discussion of the problem. During this time students will often switch back and forth between Defining the problem and Optimizing their design. They may not realize they are doing it so remind them to document ideas and modifications.

What students are doing during this stage:
- Collaborating and writing down every idea that may be the solution (brainstorming)
- Sketching what the solution may look like
- Research if anyone else has asked the same or a similar question
- Labeling drawings and selecting material
- Evaluating each idea with the assessment criteria and scoring rubric
- Selecting the best solution based on the criteria and scoring rubric
- Creating a prototype to test

Optimize/Improve: Students are challenging their own solutions and making their product better in response to the problem. This is where real learning occurs. Working through difficulties and learning “grit” or persistence is an important characteristic to success in any field.

What students are doing during this stage:
- Testing the solution and recording what works or additional problems
- Redrawing a simpler sketch
- Labeling details of the sketch
- Testing different materials
Inquiry Design Cycle

**Define the Problem:**
What is the problem you want solved?

**Develop the Solution:**
Sketch possible solutions/choose the best idea.

**Optimize/Improve**
Test the solution: Does it solve the problem? Can you explain the solution? Can it be made simpler?
Name __________________________ Date __________________

Inquiry Design Challenge

1) Define the problem. While observing, what were the questions that came to your mind?

2) Brainstorm several ways that may solve the problem. Sketch ideas or write out. What do you want the solution to do? Scientific Hypothesis: each solution should be testable. The final solution will be modified and optimized several times after repeated testing.

3) Develop the solution. Pick ONE of your brainstorm ideas. Explain why it will work the best. Scientific Hypothesis: Would this solution answer the problem? Is this the simplest solution?
4) Constraints. Identify materials needed to build your solution. How much time will be required? Where will you obtain the materials? List any safety concerns.

5) Design. Draw a picture of your design. Label each part. Identify the materials used. Describe how it will be created or assembled.

6) Build your prototype. Engineering: Stick to the design and record all modifications.
7) Critique. Did your prototype work as you expected it would?

8) Optimize. Can it be made simpler or with less materials?

9) Define the Problem. Does the solution create any additional problems that need addressed?

Return to Step 1
Science Inquiry Notebook

What phase of the design cycle were you using today? Explain what you did for the design challenge today.

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________________________________________________________________________
________________________________________________________________________
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Draw a picture of how you contributed.


Describe 3 things you learned about science or engineering from what you did today.

________________________________________________________________________
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Features
Five Types of Writing
Type One

- Gets ideas on paper – brainstorming in printed form
- Timed
- Requires a minimum number of lines
- Develops fluency, comfort and confidence
- One draft

Type Two

- Writing that shows the writer knows something about a topic
- It is a correct answer to a specific question
- Can be a quick quiz
- One draft

Type Three

- Writing has substantial content
- Identifies three specific standards called focus correction areas
- Read aloud by writer to listen for fluency and self correct
- Reviewed to see if draft meets certain criteria
- One draft

Type Four

- Writing that is Type Three writing that is read out loud by another person
- Critiqued by that person
- Rewritten with corrections made
- Two drafts

Type Five

- Writing that is of publishable quality
- Multiple drafts
Writing Program Reasoning

To demand more writing and thinking, especially writing, requires more teacher work in an unending cycle of assessment. How do we get students to do more writing and thinking without overwhelming the teacher?

The Collins Writing program being recommended is not designed to turn all teachers into English teachers. The program is designed to help teachers in all content areas achieve their goals by requiring students to think on paper.

Frequent, usually short, writing assignments can be used to increase students’ involvement in lessons, check on their understanding of concepts, and promote their thinking about content.

The program can be used to encourage students to take responsibility for their own learning.

The program can be used to refine listening and speaking skills. Some types of assignments require that the students read their writing out loud and listen critically to writing that is being read to them.
Why is Writing Important in Science Classes?

- Writing helps students to synthesize knowledge by improving the learning of content.

- Writing helps students organize their thoughts.

- Writing is a memory aid that entails a higher degree of involvement than listening or reading.

- We write to discover what we know and what we need to learn.
General Guidelines for Teachers Using Type One and Type Two Writing Assignments

- Post the definitions for Type One and Type Two writing in a conspicuous place or places in the classroom.

- Always tell students what type of writing they will be doing.

- Have the students label Type One and Type Two assignments on the top line, left-hand side of the paper.

- Skip lines for all body text.

- Give a quota for the number of lines

- Student should write the entire time.

- Give a limited amount of time for trying.

- Have students underline key words.
Advantages and Disadvantages of Type One Writing

Advantages:

- Spontaneous – requires little preparation by teacher.
- Takes little class time to complete.
- Very easy to evaluate, produces effort or participation grade.
- Provides opportunity for all students to stop and think, to review prior knowledge, and to develop questions.
- When used before instruction, provides opportunity for teacher to assess student knowledge and make decisions about what to teach.
- Special advantage to quiet, less verbal students.
- Promotes writing fluency.

Disadvantages:

- Does not directly improve specific writing skills (sentence variety, organization, word choice, etc.).
Advantages and Disadvantages of Type Two Writing

Advantages:

- Spontaneous – requires little preparation by teacher.
- Quick assessment of student knowledge resulting in quiz grade.
- Promotes active learning by requiring student to produce information rather than simply identify information produced by others (e.g., objective test)
- Promotes content-rich writing.
- Promotes writing fluency.

Disadvantages:

- Does not directly improve specific writing skills (sentence variety, organization, word choice, etc.).
Quick Write: Type One Example

Word Splash

Tell me everything you know about these words:

- Observation
- Inference
- Variable
- Control

Quick Write: Type Two Examples

Who did the variable effect the dissolving candy?

What were three of the most important points from today’s class discussion?
Type One Writing

✓ Quick write

✓ Generating ideas

✓ Getting those ideas on paper

✓ No right or wrong answer

✓ Self edit

✓ Minimum number of lines written

✓ Time limit

✓ Keep writing until time is up

✓ Checked for writing minimum number of lines
Type Two Writing

✓ Quick write

✓ Writing that shows you know something about the topic given

✓ Correct answer to a specific question

✓ Graded as a quiz

✓ Can have a minimum number of lines written

✓ Should include vocabulary that applies to the given topic
Exit ticket and Quick write forms for your students.

YOUR “KEY” OUT

Name: ___________________________ Date: ________________

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YOUR “KEY” OUT

Name: ___________________________ Date: ________________

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YOUR “KEY” OUT

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Venn Diagram
1 centimeter grid
Filmstrip template
## Index Graphic Organizers

**Benefits of graphic organizers**
- Focus attention on key elements
- Help integrate prior knowledge with new knowledge
- Enhance concept development
- Enrich reading, writing and thinking
- Aid writing by supporting planning and revision
- Promote focused discussion
- Assist instructional planning
- Serve as assessment and evaluation tool

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### Websites for other Graphic Organizers


Compare/Contrast

Comparison/Contrast is used to show similarities and differences.

Key frame questions: What are being compared? How are they similar? How are they different?

Clustering

Clustering is a nonlinear activity that generates ideas, images and feelings around a stimulus word. As students cluster, their thoughts tumble out, enlarging their word bank for writing and often enabling them to see patterns in their ideas. Clustering may be a class or individual activity.
Chain of Events

Chain of Events is used to describe the stages of an event, the actions of character or the steps in a procedure.

Key questions: What is the first step in the procedure or initiating event? What are the next stages or steps? How does one event lead to one another? What is the final outcome?

Continuum

Continuum is used for time lines showing historical events, ages (grade levels in school), degrees of something (weight), shades of meaning, or rating scales (achievement in school).

Key frame questions: What is being scaled? What are the end points or extremes?
Cycle

A depiction of a Cycle attempts to show how a series of events interacts to produce a set of results again and again, such as the life cycle or a cycle of poor decisions.

Key frame questions: What are the main events in the cycle? How do they interact and return to the beginning again?

Problem/Solution

Problem/Solution requires student to identify a problem and consider multiple solutions and possible results.
Prior Knowledge Topic Survey
Anticipation/Reaction Guide

Instruction: Respond to each statement twice: once before the lesson and again after reading it.
- Write A if you agree with the statement
- Write B if you disagree with the statement

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Fishbone Mapping

A Fishbone Map is used to show the causal interaction of a complex event (an election, a nuclear explosion) or a complex phenomenon (juvenile delinquency, learning disabilities, etc).

Key frame question: What are the factors that cause X? How do they interrelate? Are the factors that cause X the same as those that cause X to persist?

K-W-L-H Technique

The K-W-L-H teaching techniques is a good method to help students activate prior knowledge. It is a group instruction activity developed by Donna Ogle (1986) that serves as a model for active thinking during reading.

K- Stands for helping students recall what they know about the topic
W- Stands for helping student determine what they want to learn.
L – Stands for helping students identify what they learn as they read.
H- Stands or how we can learn more (other sources were additional information on the topic can be found).

Students complete the “categories” section at the bottom of the graphic organizer by asking themselves what each statement in the “L” section (What We Learned) describes.

They use these categories and the information in the “H” section (How Can We Learn More) to learn more about the topic. Students also can use the categories to create additional graphic organizers. They can use the organizers to review and write about what they’ve learned.