Class Description: The organization of this class will include topics from the physical sciences, Biology, and earth Science. This year you will be learning and focusing on the process known as scientific inquiry and the topics listed below:

**Physical Science/ Chemistry;**
- Matter is made up of Particles called Atoms
- Elements, Compounds, and Mixtures
- Physical Properties of Matter
  - States of Matter
- Physical Changes

**Biology**
- Cell Biology
- Inheritance
- Cell Chemistry; Photosynthesis

**Earth Systems**
- Rock Cycle
- Igneous, Metamorphic, and Sedimentary Rock
- Layers of the atmosphere and solid Earth
- Interactions; Erosion and Climate
- Plate Tectonics and Continental Drift
# Course Title; 5th Grade Science

**Course Description:**

**Curriculum Map:**
- Standard 1: Nature of Science
- Standard 2: Physical Science
- Standard 3: Biology
- Standard 4: Earth and Space Systems

## Syllabus Topics

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<th>Physical Science; Chemistry</th>
<th>Standard Goal</th>
<th>Objectives/Content Limit</th>
<th>Instructional Objectives Content/Language</th>
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<tr>
<td>Matter is made up of Particles called Atoms</td>
<td>Goal 2.1: Understand the Structure and Function of Matter and Molecules and Their Interactions</td>
<td>5.S.2.1.1 Describe the differences among elements, compounds, and mixtures. CL: D Content Limit: Students will be able to define an element, compound, and mixture.</td>
<td>Chapter 2 parts of Lesson 1 and lesson 2. Notice we will cover the topics not in the order of the textbook. Your textbook is not good enough here, I would recommend getting a junior high text as a resource or going online? 6th grade will cover subatomic particles and periodic chart!</td>
<td>Essential; Matter, particles, atoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atoms; Scientific Inquiry; Asking Questions, and Defining Problems</td>
<td>Goal 1.2: Understand Concepts and Processes of Evidence, Models, and Explanations</td>
<td>5.S.1.2.2 Explain the difference between observation and inference. CL: D Content Limit: Observations are made with our senses. Tools are used to collect data. Inferences are statements based upon an interpretation of data.</td>
<td>activity = mystery boxes Design a lab; where students can observe and collect data and infer an explanation in terms of particles. why a balloon expands when air is blown into the balloon. on cooling</td>
<td></td>
<td>How do we know matter is made up of particles too small to see?</td>
<td>Mystery boxes Balloons</td>
<td></td>
</tr>
<tr>
<td>Atoms are sometimes combined; Elements, Compounds, and Mixtures</td>
<td>Goal 1.2: Understand Concepts and Processes of Evidence, Models, and Explanations</td>
<td>5.S.1.2.1 Use observations and data as evidence on which to base scientific explanations and predictions. CL: E Content Limit: Explanations and predictions are limited to directly described or illustrated information in the item.</td>
<td>Leggos can be used as a model; hydrogen atom = 1 red leggo, element hydrogen= all red leggos. The blue leggos represent oxygen. Compound occurs when a blue leggo and red leggo are put together. Mixture occurs when</td>
<td>Essential; Particles, atoms</td>
<td></td>
<td></td>
<td>leggos</td>
</tr>
</tbody>
</table>

## Essential Vocabulary

- Asmus

## Sample Assessment

- Asmus
**Physical Properties describe Matter**

**Goal 1.8:** Understand Technical Communication

5.S.1.8.1 Read and follow technical instructions.

CL: C

Content Limit: Assessed in the classroom, not on the ISAT.

*Textbook OK Chapter 1 lesson 1* and supplement

Create a lab; Learn the physical properties of matter and how to measure physical properties. Create a chart and test the physical properties of various substances.

**Essential:**
- Length, volume, weight/mass, temperature, density, solubility, magnetism, texture, ductility, buoyancy, malleability, color

**Physical Properties describe Matter Measurements and Tools Scientific Inquiry; Using Math and Computational Thinking**

**Goal 1.3:** Understand Constancy, Change, and Measurement

5.S.1.3.2 Measure in both U.S. Customary and International System of Measurement (metric system) units with an emphasis on the metric system.

CL: C

Content Limit: Measurement should be in meter, liter, and grams. Reference Math Content 2.M.1.1

See above

**Essential:**
- Length-
  - centimeter-ruler
- Volume-
  - milliliter-graduate
- Weight/mass-
  - gram-scale
- Temperature-
  - degree Celsius-
  - thermometer
- Density-
  - grams/cen
  - meter- combo of weight and volume
- Water Solubility
  (yes or no)
- Nonpolar Solubility
  (yes or no)
- Magnetism
- Texture
- Hardness
- Ductility
- Buoyancy
- Malleability
- Color

Round to closest digit

**Physical Properties States of Matter**

**Goal 2.1:** Understand the Structure and Function of Matter and Molecules and Their Interactions

5.S.2.1.2 Compare the physical differences among solids, liquids and gases.

CL: D

Content Limit: Students will be able to recognize the differences in molecular

*Textbook chapter 1 lesson 2 pages E14-E17* but will have to be supplemented to cover vocabulary.

Leggos can be used again as an introduction; solid = Prior;
- Length, volume, weight/mass, temperature, density, solubility, magnetism,

**Rulers**
- Graduates
- Scales
- Thermometer
- Density blocks?
- Hardness scale?
- Magnets

**elements and compounds to test**

**Hot plates**
### Physical Change 1

**Goal 2.1:** Understand the Structure and Function of Matter and Molecules and Their Interactions

5.S.2.1.3 Explain the nature of physical change and how it relates to physical properties.

**CL:** D  
**Content Limit:** Students will be able to recognize the change(s) in physical properties that take place when physical changes occur including ice melting into water and water being heated into steam and the reverse processes.

**Lab idea:** 6th grade textbook; Matter and Energy chapter 2 lesson 1 E44-E49  
6th grade textbook; Matter and Energy chapter 2 lesson 1 E44-E49  
Lab idea; Ex of physical changes; Have the kids follow scientific inquiry including filling in charts.

| What physical properties remain unchanged when material is cut in half? |
| What physical properties change when material is cut in half? |

### Physical Change 2

**Goal 2.1:** Understand the Structure and Function of Matter and Molecules and Their Interactions

5.S.2.1.3  
**CL:** D  
**Content Limit:** Students will be able to recognize the change(s) in physical properties that take place when physical changes occur including ice melting into water and water being heated into steam and the reverse processes.

**Lab idea:** water in its 3 different states. I would suggest looking up a lab on the internet. **This should be a big lab as it is the end of a unit!**  
6th grade will cover chemical properties so textbook pages E20-E25 should not be covered.

**Does changing the state of a material affect physical properties such as texture, magnetism, ductility, buoyancy, malleability, color, and density?**

### Chemistry; Physical Change

**Scientific Inquiry; Planning and Carrying out Investigations**

Goal 1.6:  
5.S.1.6.2 Conduct scientific investigations using a control and a variable.

**CL:** C  
**Content Limit:** Assessed in the classroom, not on the ISAT.

| See above |

### Chemistry

Goal 1.6:  
5.S.1.6.6 Compare alternative

| See above |
| Physical Change Scientific Inquiry; Analyzing and Interpreting Data | Understand Scientific Inquiry and Develop Critical Thinking Skills | explanations and predictions.  
CL: E  
Content Limit: When provided sequential graphics and a set of possible explanations, students will be able to select the most logical explanation from a list of possible options. |  |
|---|---|---|
| **Biology** | **Cell Biology; Cells** | **Goal 3.3:** Understand the Cell is the Basis of Form and Function for All Living Things | 5.S.3.3.1 Compare and contrast the structural differences between plant and animal cells.  
CL: E  
Content Limit: Address only the readily observable organelles: cell wall, cell membrane, chloroplasts, mitochondria, vacuoles, nucleus |  |
| **Cell Biology; Cells** | **Goal 1.1:** Understand Systems, Order, and Organization | 5.S.1.1.1 Compare and contrast different systems.  
CL: E  
Content Limit: Compare one item to another; do not make multiple-item comparisons. Systems tested should be familiar to students. Systems that could be used to develop items include classroom systems, school systems (student: teacher: principal), cell systems, plant systems, plate tectonics, and rock cycle. |  |
| **Cell Biology; Cells** | **Goal 1.6:** Understand Scientific Inquiry and Develop Critical Thinking Skills | 5.S.1.6.5 State a hypothesis based on observations.  
CL: E  
Content Limit: When provided sequential graphics, students will be able to select the most logical hypothesis of what is being tested from a list of possible options. |  |
| **Cell Biology; Cells** | **Scientific Inquiry; Asking Questions, and Defining Problems** | **Goal 1.5:** Understand Concepts of Form and Function | 5.S.1.5.1 Explain how the shape or form of an object or system is frequently related to its use or function.  
CL: E  
Content Limit: Items are limited to very visual content, including the streamlining of a fish's body and the webbing on a duck’s foot. |  |
| **Inheritance; The Nucleus.** | **Goal 3.3:** Understand the Cell is the Basis of Form and Function for All Living Things | 5.S.3.3.2 Explain the concept that traits are passed from parents to offspring.  
CL: D  
Content Limit: Traits should be limited to clearly observable physical characteristics |  |
| Cell Chemistry; Photosynthesis | Goal 3.2: Understand the Relationship between Matter and Energy in Living Systems | 5.S.3.2.1 Communicate how plants convert energy from the Sun through photosynthesis.  
   **CL:** D  
   **Content Limit:** Students will know that chlorophyll, carbon dioxide, and water are necessary for photosynthesis to occur. Additionally, students will know that the energy necessary to “power” the photosynthetic reaction is provided by the Sun. |
| Cell Chemistry; Photosynthesis Scientific Inquiry; Asking Questions, and Defining Problems | Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills | 5.S.1.6.1 Write and analyze questions that can be answered by conducting scientific experiments.  
   **CL:** C  
   **Content Limit:** Given the description of a simple experiment the student will be able to identify the question being asked. |
| Cell Chemistry; Photosynthesis Scientific Inquiry; Planning and Carrying out Investigations | Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills | 5.S.1.6.3 Select and use appropriate tools and techniques to gather and display data.  
   **CL:** C  
   **Content Limit:** Content should be limited to metric rulers, bar graphs, and basic tables. |
|  |  | 5.S.1.6.2 Conduct scientific investigations using a control and a variable.  
   **CL:** C  
   **Content Limit:** Assessed in the classroom, not on the ISAT. |

| Earth and Space Systems | Earth Science; Rock Cycle | Goal 4.2: Understand Geochemical Cycles and Energy in the Earth System | 5.S.4.2.1 Explain the rock cycle and identify the three classifications of rocks.  
   **CL:** D  
   **Content Limit:** How sedimentary, igneous, and metamorphic rocks are formed. |
| Earth Science; Igneous, | Goal 4.2: Understand Geo- | See above  
5.S.4.2.1 Explain the rock cycle and |
| **Metamorphic, and Sedimentary Rock** | **chemical Cycles and Energy in the Earth System** | **identify the three classifications of rocks.**

**CL:** D  
**Content Limit:** How sedimentary, igneous, and metamorphic rocks are formed. |
| **Earth Science; Igneous, Metamorphic, and Sedimentary Rock** | **Goal 1.3:** Understand Constancy, Change, and Measurement | **5.S.1.3.1** Analyze changes that occur in and among systems.  

**CL:** E  
**Content Limit:** Analysis is limited to changes directly described or illustrated in the item. |
| **Earth Science; Layers of the atmosphere and solid Earth** | **Scientific Inquiry; Asking Questions, and Defining Problems** | **Goal 1.2:** Understand Concepts and Processes of Evidence, Models, and Explanations  

**5.S.1.2.3** Use models to explain or demonstrate a concept.  

**CL:** D  
**Content Limit:** Examples may include: Rock cycle, model of plant cell, and model of animal cell, molecular position and motion of solid, liquids and gases. |
| **Earth Science; Interactions; Erosion Climate** | **Goal 4.1:** Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems | **5.S.4.1.1** Describe the interactions among the solid earth, oceans and atmosphere (erosion, climate, tectonics and continental drift).  

**CL:** D  
**Content Limit:** The role wind and water play in erosion, and the formation of earthquakes and volcanoes can all be addressed. |
| **Earth Science; Interactions; Erosion Climate Scientific Inquiry; Planning and Carrying out Investigations** | **Goal 1.6:** Understand Scientific Inquiry and Develop Critical Thinking Skills | **5.S.1.6.2** Conduct scientific investigations using a control and a variable.  

**CL:** C  
**Content Limit:** Assessed in the classroom, not on the ISAT. |
| **Earth Science; Interactions; Erosion Climate Scientific** | **Goal 1.6:** Understand Scientific Inquiry and Develop Critical Thinking Skills | **5.S.1.6.7** Communicate scientific procedures and explanations.  

**CL:**  
**Content Limit:** Assessed in the classroom, not on the ISAT. |
### Scientific Inquiry (NGSS in bold)
Prepared by Elaine Asmus

There are activities and labs. Every science course should include labs based on scientific inquiry. It is part of scientific inquiry to experience odd results at times or find that there is an error in the way an experiment was carried out. Scientists collaborate at these times and start again. The process is fun; a possible discovery is the treat! Emphasize scientific inquiry throughout coursework.

1. **Using Math and Computational Thinking**
   Emphasis on proper measuring techniques during the investigation
   Can the students use tools and properly measure?

2. **Asking Questions, and Defining Problems.**
   Research
   **Develop and Use Models**
   Form a Hypothesis Statement
   Supported hypothesis become Laws

3. **Planning and Carrying out Investigations**

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<td>Scientific Inquiry; Analyzing and Interpreting Data</td>
<td>5.S.1.6.4 Use evidence to analyze descriptions, explanations, predictions, and models.</td>
</tr>
<tr>
<td></td>
<td>CL: E Content Limit: Students will be presented a set of evidence or series of observations and be asked to derive information or make predictions based on this evidence.</td>
</tr>
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</table>
Measuring
Gather data into charts
Single Variable; should be identified
   All other factors remain the same
Control Group/Experiment Group
   (High school) multiple experimental groups
Include a high number of subjects

4. Analyzing and Interpreting Data
   Results are entered onto a Data Chart
   Dependent & Independent variable (begin in Junior High)
   Charts generate Graphs
   Using Math and Computational Thinking;
   (High School?) Graphs produce Mathematical Formulas
   (High School) Chi Square Value; differences are significant

5. Constructing Explanations or Designing Solutions
   Obtaining, Evaluating, and Communicating Information
   Engaging in Argument from Evidence

Producing a Graph from a Data Chart; Instructions and Rubric;   Names ______________________
Long Form
Scientists qualify information by carrying out scientific experimentation through a process known as the scientific method. In an experiment, the variables which will not be studied are controlled. The scientist selects a single variable to change (independent variable) and watches the effect of that change on another variable (dependent variable). Data is collected and placed in a chart.

Scientists quantify the results of an experiment when he/she graphs the collected data. The data collected is represented by dots on the graph. The best-fit line of a graph represents the result or lesson proved from the experiment. Scientists and mathematicians create formulas from line graphs. All formulas arise from graphs.

What are the 2 variables being watched? Factor 1 ________________ Factor 2 ___________________

Which is the Independent Variable? _______________ Range of values (units)? _______to _________

Which is the dependent Variable? _______________ Range of values (units)? _______to _________

On the graph (use the ☐ to check off the items as you place them on the graph);

☐ Title both axes (Independent variable is placed on the x-axis, dependent variable on the y-axis).

☐ Label both axes’ units.

☐ Using the range for each variable, place the units on each axis utilizing the entire axis. It is important to have the same amount of unit variation between each line on the graph, for example, each line represents an increase of 5 numerals.

☐ Place data dots onto the graph in the appropriate places.

Best Fit Line; represents the trend of the data points. Best-fit lines are often either straight or curving lines. Discuss the following with the teacher if necessary before drawing a best-fit line;

☐ Does the graph’s best fit line pass through the origin? _______ Why or why not? __________________

____________________________________________________________________________________

☐ Does a best fit line connect the dots? ______________________ Why or why not? __________________
Within the lab group, discuss if any data points might be random mistakes and why these data points might be excluded from the best fit line. Label these points and the reason for excluding any data point from the best fit line.

Is the best fit line straight or curved? ___________________________________________________

The best fit line should be solid as the line passes between data points, but dashed if the line is extended past or before data points. A dashed line represents predicted behavior not supported by the current experiment.

Draw a best-fit line

Abstract and results; each graph should include an abstract sentence or paragraph. The abstract should sound like, “The lab group found that as the independent variable increases, the dependent variable decreases”, where the student substitutes the specific experimental data for the underlined items. Also include any explanations or notable events of the experiment.

Write the abstract statement or paragraph on the bottom of the graph.

Write a complete sentence for the graph title. Titles should be clear and concise.

Advanced; determination of a graph’s formula.
Straight line graphs produce the following formula format; 

\[ y = mx + b \]

Where \( m \) = slope of the line and \( b \) = the y intercept of the line.

The formula should read; 

\[ \text{Dependent variable} = m \text{ times the independent variable} + b \]

where the student substitutes actual experimental data for the underlined items.

Calculate the formula showing all work.
Write the formula in sentence form.

Calculate a “y” value that was not experimented by randomly selecting an x axis value and using the formula. Please show all work.

Producing a Graph from a Data Chart; Instructions and Rubric; Names ______________________

Scientists qualify information by carrying out scientific experimentation through a process known as the scientific method. In an experiment, the variables which will not be studied are controlled. The scientist selects a single variable to change (independent variable) and watches the effect of that change on another variable (dependent variable). Data is collected and placed in a chart.

Scientists quantify the results of an experiment when he/she graphs the collected data. The data collected is represented by dots on the graph. The best-fit line of a graph represents the result or lesson proved from the experiment. Scientists and mathematicians create formulas from line graphs. All formulas arise from graphs.

What are the 2 variables being watched? Factor 1 ________________ Factor 2 ________________

Which is the Independent Variable? _____________ Range of values (units)? _________to __________

Which is the dependent Variable? ______________ Range of values (units)? _________to __________

On the graph (use the ☐ to check off the items as you place them on the graph);
☐Title both axes (Independent variable is placed on the x-axis, dependent variable on the y-axis).
☐Label both axes’ units.
☐Using the range for each variable, place the units on each axis utilizing the entire axis. It is important to have the same amount of unit variation between each line on the graph, for example, each line represents an increase of 5 numerals.
☐Place data dots onto the graph in the appropriate places.

Best Fit Line; represents the trend of the data points. Best-fit lines are often either straight or curving lines. Discuss the following with the teacher if necessary before drawing a best-fit line;
☐Does the graph’s best fit line pass through the origin? Why or why not?
☐Does a best fit line connect the dots? Why or why not?
☐Within the lab group, discuss if any data points might be random mistakes and why these data points might be excluded from the best fit line. Label these points and the reason for excluding any data point.
☐Is the best fit line straight or curved?
The best fit line is solid as the line passes between data points, but dashed if the line is extended past or before data points. A dashed line represents predicted behavior not supported by experimentation.

Draw a best-fit line

Abstract and results; each graph should include an abstract sentence or paragraph. The abstract should sound like, “The lab group found that as the independent variable increases, the dependent variable decreases”, where the student substitutes the specific experimental data for the underlined items. Also include any explanations or notable events of the experiment.

Write the abstract statement or paragraph on the bottom of the graph.

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Advanced; determination of a graph’s formula.
Straight line graphs produce the following formula format; \( y = mx + b \), Where \( m \) = slope of the line and \( b \) = the y intercept of the line. The formula should read; Dependent variable = \( m \) times the independent variable + \( b \), where the student substitutes actual experimental data for the underlined items.

Calculate the formula showing all work.
Write the formula in sentence form.
Calculate a “y” value that was not experimented by randomly selecting an x axis value and using the formula. Please show all work.