Earth Science A Syllabus

# Measurement, Geology, and Oceanography

Course Description:

This course covers a review of measurement, and the basic concepts of geology, and oceanography. Major topics covered include mineral and rock identification, the rock cycle, plate tectonics, Earthquakes and Volcanoes, the Earth's geologic history and the water cycle. The instruction is primarily aimed at aiding the continued development of the skills involved with observing, measuring, sampling, researching, experimenting, documenting, and presenting known as scientific inquiry.

Textbook:

*Holt Science & Technology: Earth Science*, copyright 2005

Topics Covered: 11 chapters

- Measurements
- Geology;
  - Earth layers and composition
  - Mineral Identification
    - Mineral Identification Lab
    - Cookie Mining Global
  - Rock Cycle;
    - Rock cycle video lab
    - Igneous rock formation/characteristics
      - Igneous rock ID lab
    - Sedimentary rock formation/characteristics
      - Sedimentary rock ID lab
    - Metamorphic rock formation/characteristics
      - Metamorphic rock ID lab
  - The Rock and Fossil Record
- Midterm
  - Geologic cross-section
  - Plate Tectonics
    - Plate tectonics video lab
    - Earthquakes and Volcanoes
      - Reshaping the Land;
    - Weathering, Erosion, and Deposition.
- Oceanography
  - The Water Cycle

Earth's Water
Currents, Climates, Waves, and Tides
Using Water Wisely
Pollution
Final Exam

Earth Science B Syllabus

# Meteorology, Environmental Issues, and Space Science

Course Description:

This course covers basic meteorology, environmental issues, and basic astronomy concepts. Students will learn about climate, global wind patterns, Earth's natural resources, alternative energy sources, and environmental quality. We will also focus on the size and scale of the universe, stars, galaxies, the solar system, and the effects of celestial bodies such as the sun and moon on the Earth and its systems. The instruction is primarily aimed at aiding the continued development of the skills involved with observing, measuring, sampling, researching, experimenting, documenting, and presenting known as scientific inquiry.

Textbook:

*Holt Science & Technology, Earth Science*, copyright 2005

Topics Covered:

Meteorology
The Atmosphere
Atmospheric Heating
Global Wind Patterns
Weather and Climate
Pollution
Testing for Particulates Lab
Warming Lab
Energy Resources and Environmental Quality Issues
Natural Resources
Fossil Fuels
Alternative Resources
Alternative energy video lab
Midterm
Astronomy
Exploring Space
Astronomers and Technology

Size and Scale of the Universe
Stars and the Life Cycle of Stars
Galaxies
Big Bang Theory *The Universe: Beyond the Big Bang* DVD
Formation of the Solar System
Sky Motions - Star Lab
Parts of the Solar System
Sun – fusion
Planets, meteors, asteroids, and comets
Moon – eclipses
Final Exam

# Earth Science A; Measurement, Geology, and Oceanography

**Curriculum Map**
Standard 1: Nature of Science
Standard 4: Earth & Space Systems
Standard 5: Personal & Social Perspectives; Technology

| Syllabus Topics | Standard Goal | Objective | Instructional Objectives Content/Language | Essential Vocabulary | Task Analysis | Sample Assessment | Re-sources |
|---|---|---|---|---|---|---|---|
| **Scientific Inquiry; Using math and computational thinking** Measurements | **Goal 5.2: Understand the Relationship between Science and Technology** | 8-9.ES.5.2.3 Explain how science and technology are pursued for different purposes. (655.01b) | | **Prior:** telescope, thermometer, satellite **Explicit:** barometer **Introductory:** technology - science - scientific method - submersible | • Define science. • Define technology. • Explain why humans pursue science. • Explain why humans pursue technology. • Explain how science and technology are pursued for different purposes. | | Outside of current textbook |
| **Scientific Inquiry; Using math and computational thinking** Measurements | **Goal 1.3: Understand Constancy, Change, and Measurement** | 8-9.ES.1.3.1 **Measure changes** that can occur in and among systems. (648.03b) | | **Prior:** triple beam balance - digital balance - thermometer - metric ruler - meter stick - compass - protractor - flask - beaker - graduated cylinder **Explicit:** barometer, spectroscope, **Introductory:** | • Match scientific instruments with their usage. • Demonstrate the proper usage of scientific measuring equipment. | • Given an experiment list appropriate tools to measure change (example: thermometer, triple beam balance, etc.) | Outside of current textbook |
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| **Geology** ; Basic Earth Layers & Composition | **Goal 1.1: Understand Systems, Order, and Organization** | 8-9.ES.1.1.1 Explain the scientific meaning of system, order, and organization. (648.01a) | | **Prior:** system - atmosphere - biosphere order organization **Explicit:** hydrosphere • lithosphere **Introductory:** | • Define the meaning of a system. •Identify the four parts of Earth's system and how they interact. • Locate the atmosphere, biosphere, hydrosphere and geosphere in a picture or diagram of the Earth system. • List examples from the natural world that belong in each part of Earth's system. | | Outside of current textbook as a separate objective |
| Geology ; Basic Earth Layers & Composition | **Goal 1.3: Understand Constancy, Change, and Measurement** | 8-9.ES.1.3.3 Measure and calculate using the metric system. | | **Prior:** kilo - hecto - deca - deci - centi - milli - metric system - volume - density - mass - gram - degree Celsius - liter - meter **Explicit: Kelvin** **Introductory:** joule | • Recall the basic metric units of length, solid and liquid volume, mass and temperature. • **Collect and manipulate experimental** data using appropriate metric units. • Solve basic metric conversion problems. | • Measure length, width, mass, density and volume of objects in the classroom using the metric system. • Measure objects in the classroom and convert from one metric units to another. | |

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| | | (648.03c) Part 1 | | | | Convert units associated with the Earth Layers. | |
| Geology ; Basic Earth Layers & Composition **Scientific Inquiry; Asking questions and defining problems.** | **Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills** | 8-9.ES.1.6.7 Explain the differences among observations, hypotheses, and theories. (649.01g) | | **Prior:** quantitative observation - qualitative observation - hypothesis - theory | • **Define observation, hypothesis, and theory.** • Discuss the difference between a hypothesis and a theory. • Demonstrate the process of arriving at a hypothesis using observations, and developing a theory from the hypothesis. • Distinguish between observations, hypotheses and theories from examples on a list. • Formulate a hypothesis from your own observations. | Refer to assessment 1.2.1. | |
| Geology ; Basic Earth Layers & Composition **Scientific Inquiry; Asking questions and defining problems.** | **Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills** | 8-9.ES.1.6.1 Identify questions and concepts that guide scientific investigations . (649.01a) | | **Prior:** scientific question - scientific investigation **Explicit Introductory:** observable - measurable - testable - repeatable - predicative - tentative | • **List criteria for scientific questions** (OMT-RPT: Scientific questions must involve phenomenon that are observable, measurable, and testable. Scientific answers must be repeatable, predicative, and are tentative.) • Differentiate s between questions that can be answered scientifically and those that cannot. • Develop questions that can be answered scientifically. • Justify your question as scientifically testable. | • Given a list of problems determine which can be solved using the scientific method. | |
| Geology ; Basic Earth Layers & Composition; **Scientific Inquiry; Asking questions and defining problems. Models** | **Goal 1.2: Understand Concepts and Processes of Evidence, Models, and Explanations** | 8-9.ES.1.2.2 Develop models to explain concepts or systems. (648.02b) | | Prior: model – **(not covered at this time;** season - axis - orbit - revolution - rotation **Explicit:** - axial tilt - equinox - solstice **- Introductory:** precession - perihelion – aphelion) | • **Define model.** • Recognize situations when scientists need to use models (atoms, the solar system, etc). • Explain how scientific models can be used to represent concepts or systems that cannot be observed directly. • Construct and manipulate a model in order to illustrate a scientific concept. • Compare, contrast and justify the accuracy and usefulness of diverse models. | • Design and build a model to illustrate a concept (example: model of the solar system, Earth layers, atmosphere layers, etc.) | |
| Geology ; Basic Earth Layers & Composition **Scientific Inquiry; Asking questions and defining problems. Models** | **Goal 1.1: Understand Systems, Order, and Organization** | 8-9.ES.1.1.2 Apply the concepts of order and organization to a given system. (648.01a) | | **Prior:** system - order - organization - biosphere - atmosphere **Explicit:** hydrosphere lithosphere **Introductory:** | • Construct a model of the atmosphere, hydrosphere, biosphere, or lithosphere illustrating the levels of organization found there. •Point out how the parts of Earth's system shape the Earth's surface. •Compare and contrast the components of another planet's system with those of Earth. | | |

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| Geology ;<br>Mineral Identification and Paragenesis<br>**Scientific Inquiry; Asking questions and defining problems. Models** | **Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills** | 8-9.ES.1.6.5 Analyze alternative explanations and models. (649.01e) | | **Prior:** scientific method - conclusion - data -model | • Define and describe alternative explanations and models for a natural phenomenon.<br>• **Articulate alternative explanations and models to peers.**<br>• Compare and contrast benefits of alternative explanations and models.<br>• Evaluate the models and defend your choice. | Refer to assessment 1.2.1. | |
| Geology ; Rock Cycle and Rock Types; Igneous Rock, Sedimentary Rock, Metamorphic Rock | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.3 Show how interactions among the solid earth, oceans, atmosphere, and organisms have changed the earth system over time. (654.01c) **Part I** | | **Lithosphere:**<br>**Prior:** - Hypothesis - - - inner core - outer core - mantle - crust - rock cycle - erosion - - igneous - sedimentary - metamorphic<br>**Explicit:** - asthenosphere - | I. Lithosphere<br>A. Structure of the Earth<br>•Describe the layers of the lithosphere (Earth).<br>•Model the position, depth, composition, density and temperature of each layer.<br>B. Rock Cycle<br>•Enumerate the steps of the rock cycle.<br>•Diagram and restate the steps of the rock cycle. | | |
| Geology; Geologic History of the Earth (biogeology) Absolute & Relative Dating | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.2 Identify methods used to estimate geologic time. (654.01b) | | **Prior:** fossil<br>**Explicit:** relative dating - absolute dating - radioactive dating - half life - geologic time scale - superposition<br>**Introductory:** isotopes, radioisotopes - radioactive decay - ice core - tree ring - fossil types (cast, mold, trace) - index fossil | •Describe how Earth's history has been divided into units of time based on major geologic events.<br>•Construct the geologic time line.<br>•Explain the difference between absolute and relative age.<br>•List methods used to determine the relative and absolute age of rocks and fossils.<br>•Construct a model demonstrating superposition.<br>•Demonsrate the half-life of a material. | • Given a scale (i.e., 1 cm = 1 million years) construct the geologic time line and label each period of geologic time. | |
| Geology; Plate Tectonics | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.3 Show how interactions among the solid earth, oceans, atmosphere, and organisms have changed the earth system over time. (654.01c) **Part I** | | **Prior:** - Continental Drift Pangaea convection<br>**Explicit:** plate tectonics - convergent boundary - divergent boundary - transform boundary - subduction<br>**Introductory:** - folded mountain - fault block mountain - reverse fault - normal fault - strike slip fault - mid-ocean ridge (spreading center) - trench | C. Plate Tectonics<br>• Identify historical steps in the development of the Theory of Plate Tectonics (i.e.: Continental Drift, Pangaea)<br>• Diagram or model plate boundaries and identify features found at each one.<br>•Explain that convection in the mantle drives tectonic plate damage they cause. | | |
| Geology; Plate Tectonics | **Goal 4.2: Understand Geo-chemical Cycles and** | 8-9.ES.4.2.1 Explain the internal energy | | | I. Internal Energy Source<br>•Relate convection currents in the mantle to heat rising from the interior.<br>. | • Describe how radioactive decay within the Earth drives the tectonic plates. Use the term, uranium. | |

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| | **Energy in the Earth System** | sources of the earth (654.02a) Part I | | | | | |
| Geology; Earthquakes and Volcanoes | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.3 Show how interactions among the solid earth, oceans, atmosphere, and organisms have changed the earth system over time. (654.01c) **Part 2** | | **Prior:** earthquake - focus - epicenter - volcano - lava – magma **Explicit** - seismic wave - magnitude - fault - intensity – lithosphere **Introductory:** primary wave - secondary wave - surface wave - | D. Earthquakes •Define earthquake, and identify causes. •Recognize that earthquakes occur at faults. •Compare and contrast the magnitude and intensity of earthquakes. •Explain how seismometers and seismographs can be used to determine the epicenter of an earthquake. •Distinguish between seismic wave types, and the E. Volcanoes •List and label types of volcanoes (ie: shield, composite, and cinder cone) •Correlate volcano type with the eruption that produced it. •Show how volcanic eruptions impact other parts of Earth's system. •Correlate earthquakes, volcanism, and mountain building to the movement of tectonic plates. •Predict how the magnitude and intensity of earthquakes might impact human society. | | |
| Geology; Earthquakes and Volcanoes **Scientific Inquiry; Planning and carrying out investigations.** | **Goal 1.2: Understand Concepts and Processes of Evidence, Models, and Explanations** | 8-9.ES.1.2.3 Develop scientific explanations based on knowledge, logic, and analysis. (648.02c) | | **Prior:** scientific method - hypothesis - conclusion - data - experiment **Explicit: independent variable, dependent variable, control group** **Introductory:** | • **Review and recall topic specific vocabulary** and knowledge. • Hypothesize the cause of a natural phenomenon, • Develop an experiment, gather data and analyze results. • Use results to support or refute your original explanation. | -class project? -focus is on planning and carrying out the experiment and collecting data onto a chart. -teacher will explain the group evidence at this point. | |
| Geology; Earthquakes and Volcanoes **Scientific Inquiry; Analyzing and interpreting data.** | **Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills** | 8-9.ES.1.6.3 Use appropriate technology and mathematics to make investigations . (649.01c) | | **Prior:** technology - scientific investigation - data - kilo - hecto - deca - deci- centi - milli - metric - meter - liter - gram - degree Celsius - system **Explicit: Introductory:** joule | • Identify the use of appropriate technology (i.e.: calculators, computers, probe ware) •Demonstrate the proper use of technology in the classroom Identify the appropriate mathematical formula/paradigm to collect appropriate data and analyze results. formula/paradigm | • Use computer to construct data table or graph given a specific task. | |
| Geology**;** Environmental | **Goal 1.3:** | 8-9.ES.1.3.2 | | | •Summarize data in graphical form. | • Using data from an | |

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| Quality Issues; Erosion Weathering and Soil Formation, Agents of Erosion and Deposition, Mining and Reclamation | **Understand Constancy, Change, and Measurement** | Analyze changes that can occur in and among systems. (648.03b) | | | •Determine patterns in data.<br>•Describe the changes that occur within the systems.<br>•Predict future changes in a natural system using observed patterns.<br>•Evaluate the possible consequences of change in a natural system. | experiment construct tables and graphs. | |
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| **Oceanography;** Water Cycle, Currents and Climate, Waves, Tides | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.3 Show how interactions among the solid earth, oceans, atmosphere, and organisms have changed the earth system over time. (654.01c) **Part 2** | | **Hydrosphere:**<br>**Prior:** water cycle, evaporation, condensation, precipitation, hurricane - tornado - climate - weather - transpiration - aquifer<br>**Explicit:**<br>**Introductory:** permeable - nonpermeable - percolate - water table | II. Hydrosphere<br>•Review the water cycle.<br>•Develop a diagram or model to illustrate the distribution of water on Earth.<br>•Diagram an aquifer.<br>•Trace the sources of your local water supply. | | |
| Oceanography**;** Water Cycle, Currents and Climate, Waves, Tides **Scientific Inquiry; Constructing explanations or designing solutions.** | **Goal 1.8: Understand Technical Communication** | 8-9.ES.1.8.1 Analyze technical writing, graphs, charts, and diagrams. (658.02a) | | **Prior:** line graphs - circle graphs -bar graphs - diagram - experiment - scientific data<br>**Explicit:**<br>**Introductory:** technical writing | • Read technical writing, graphs, charts or diagrams.<br>• Restate the information on the graph, chart, or diagram.<br>• Interpret technical writing, graphs, charts, or diagrams.<br>• Use information to answer questions about the graph, chart, or diagram.<br>• Create your own graph, chart, or diagram that displays the information in an original way (ie: line graph to pie chart). | • Given experimental sample data write a scientific conclusion. | |

# Earth Science B – Meteorology, Environmental Issues, and Space Science

## Curriculum Map

Standard 1: Nature of Science
Standard 4: Earth & Space Systems
Standard 5: Personal & Social Perspectives; Technology

| Syllabus Topics | Standard Goal | Objective | Instructional Objectives Content/ Language | Essential Vocabulary | Task Analysis |
|---|---|---|---|---|---|
| **Meteorology;** Characteristics, Global Wind Patterns | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.3 Show how interactions among the solid earth, oceans, atmosphere, and organisms have changed the earth system over time. (654.01c) **Part 3** | | **Atmosphere:**<br>**Prior:** cloud - cirrus - stratus - cumulus - cumulonimbus - air mass - front - air pressure -wind - hurricane - tornado<br>**Explicit: troposphere - stratosphere - mesosphere -** | III. Atmosphere<br>•State the importance of the atmosphere to life on Earth.<br>•List and label the layers of the atmosphere.<br>•Summarize the composition and features of each layer.<br>•Describe how high and low pressure centers create wind. Movement. |

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| | | | | **thermosphere - ozone - low pressure system - high pressure system - Coriolis effect - rain shadow Introductory: ionosphere - exosphere** | |
| Meteorology; Atmospheric Heating Climate and Climate Zones | **Goal 4.2: Understand Geo-chemical Cycles and Energy in the Earth System (Part 1)** | 8-9.ES.4.2.1 Explain the external energy sources of the earth (654.02a) Part 2 | | **Explicit:** conduction - convection – radiation- heat transfer | External Energy Source<br>•Recognize the Sun as Ear th's external energy source<br>•Identify and diagram three types of heat transfer and how these warm the, atmosphere. |
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| **Energy Resources and Environmental Quality Issues**; **Scientific Inquiry;** Asking questions and defining problems. | **Goal 5.1: Understand Common Environmental Quality Issues, Both Natural and Human Induced** | 8-9.ES.5.1.1 Analyze environmental issues such as water and air quality, hazardous waste, and depletion of natural resources. (656.01a) **Part 3** | | **Prior:** pollution - acid rain **Introductory:** eutrophication **Explicit:** global climate change (global warming) - ozone - greenhouse effect | |
| Energy Resources and Environmental Quality Issues; Fossil Fuels | **Goal 5.1: Understand Common Environmental Quality Issues, Both Natural and Human Induced** | 8-9.ES.5.1.1 Analyze environmental issues such as water and air quality, hazardous waste, and depletion of natural resources. (656.01a) | | **Prior:** pollution - recycling - solar and wind energy - fossil fuels **Introductory:** - deforestation | • Review the carbon cycle.<br>• Examine the relationship between the carbon cycle and the formation and combustion of fossil<br>• Give examples of global, national and local environmental issues.<br>• Examine the environmental impact of human use of natural resources.<br>• Communicate how environmental issues impact Earth's spheres. |
| Energy Resources and Environmental Quality Issues; Energy Alternatives | **Goal 5.3: Understand the Importance of Natural Resources and the Need to Manage and Conserve Them** | 8-9.ES.5.3.1 Describe the difference between renewable and nonrenewable resources. (656.03a) | | **Prior:** solar energy - wind energy - fossil fuel conservation **Explicit:** natural resource - renewable resource - nonrenewable resource - alternative energy resource **Introductory:** hydroelectric energy - geothermal energy - biomass - nuclear energy | • Describe what is meant by renewable and non- renewable resources.<br>• List examples of renewable and non-renewable resources.<br>• Discuss the advantages and disadvantages of renewable and non-renewable resources.<br>• Defend the use of an energy resource. |
| Energy Resources and Environmental Quality Issues; | **Goal 1.6: Understand Scientific Inquiry and** | 8-9.ES.1.6.4 Formulate scientific explanations and models using logic and evidence. (649.01d) | | **Prior:** hypothesis - prediction - evidence - conclusion - scientific method - model **Explicit: Introductory:** | • **Gather data from** a scientific investigation.<br>• **Formulate a conclusion** from summarized data.<br>• **Construct a model** to explain results of scientific investigation. |

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| **Scientific Inquiry;** Asking questions and defining problems. | **Develop Critical Thinking Skills** | | | | |
| Energy Resources and Environmental Quality Issues; **Scientific Inquiry;** Planning and carrying out investigations. | **Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills** | 8-9.ES.1.6.2 Utilize the components of scientific problem solving to design, conduct, and communicate results of investigations. (649.01b) | | **Prior:** variable - scientific method - qualitative observation - quantitative observation - hypothesis - experiment - theory - conclusion - data - line graph - bar graph - circle graph **Explicit:** controlled variable - independent variable - dependent variable **Introductory:** manipulated variable - responding variable | • **Recal**l the steps of the scientific method.<br>• Describe the steps of the scientific method.<br>• Construct a situation requiring the use of the scientific method.<br>• List the experimental controls.<br>• List the experimental variables.<br>• Construct and conduct a scientific experiment.<br>• Summarize results using graphs, charts, tables.<br>• Present and share experimental results. |
| Energy Resources and Environmental Quality Issues; **Scientific Inquiry;** Analyzing and interpreting data. | **Goal 1.2: Understand Concepts and Processes of Evidence, Models, and Explanations** | 8-9.ES.1.2.1 Use observations and data as evidence on which to base scientific explanations. (648.02a) | | **Prior:** qualitative observation • quantitative observation • data - graph - chart - table - conclusion • hypothesis • theory | • List and define the two types of **observations.**<br>• Recognize examples of scientific hypotheses.<br>• Use qualitative and quantitative observations to **create a hypothesis**.<br>• **Record data** in charts and tables.<br>• Illustrate and summarize data by creating bar, line, and circle graphs.<br>• **Formulate conclusions** based on scientific observation and data collection. |
| Energy Resources and Environmental Quality Issues; **Scientific Inquiry;** Constructing explanations or designing solutions. | **Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills** | 8-9.ES.1.6.6 Communicate and defend a scientific argument. (649.01f) | | **Prior:** data - scientific investigation - conclusion - model | • **Find and identify information supporting** a scientific argument.<br>• Illustrate your information using media (PowerPoint, poster, skit . . .).<br>• Develop a presentation to communicate your information to your peers.<br>• Present your information, field questions, and defend your position. |
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| **Astronomy;** Early | **Goal 5.2: Understand the** | 8-9.ES.5.2.1 Explain how science advances | | **Prior:** telescope, thermometer, satellite **Explicit:** barometer **Introductory:** technology | • Define science.<br>• Define technology.<br>• Describe the process scientists use to solve problems.<br>• Explain how the use of technology aids in scientific problem solving. |

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| Astronomers and Technology | **Relationship between Science and Technology** | technology. (655.01a) | | - science - scientific method - submersible | • Discuss specific scientists whose discoveries have significance and ramifications in today's world. |
| Astronomy; Telescopes | **Goal 5.2: Understand the Relationship between Science and Technology** | 8-9.ES.5.2.2 Explain how technology advances science. (655.01a) | | **Prior:** telescope, thermometer, satellite **Explicit:** barometer **Introductory:** technology - science - scientific method - submersible | • Define science.<br>• Define technology.<br>• Describe the process scientists use to solve problems.<br>• Explain how the use of technology aids in scientific problem solving. |
| Astronomy; Formation of the Universe; | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.1 Explain the current scientific theory that suggests that the solar system formed from a nebular cloud of dust and gas. (654.01a) Part 1 | | **Prior:** universe, space, solar system - gravity - rotation - revolution - orbit - star - galaxy - constellation **Explicit:** nebula - - light year - parallax- | **I. Origin and Structure of the Universe**<br>•Define the Big Bang Theory<br>•Discuss the evidence used to support the Big Bang Theory. |
| Astronomy; Stars, Constellations, and Galaxies | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.1 Explain the current scientific theory that suggests that the solar system formed from a nebular cloud of dust and gas. (654.01a) Part 2 | | **Prior:** universe, space, solar system - gravity - rotation - revolution - orbit - star - galaxy - constellation **Explicit:** electromagnetic radiation - | •Explain the order and organization of the universe (Stars, constellations, galaxies).<br>•Construct a model of the internal structure of a star (i.e.: the sun). |
| Astronomy; Stars; Life Cycle | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.1 Explain the current scientific theory that suggests that the solar system formed from a nebular cloud of dust and gas. (654.01a) Part 3 | | **Prior:** universe, space, solar system - gravity - rotation - revolution - orbit - star - galaxy - constellation **Introductory:** Doppler effect - wavelength - spectrum - red shift - blue shift **Explicit:** - plasma - nuclear fusion | •Summarize the life cycles of low- and high-mass stars. |
| Astronomy; Formation of the Solar System | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent** | 8-9.ES.4.1.1 Explain the current scientific theory that suggests that the solar system formed from a nebular cloud of dust and gas. (654.01a) | | **Prior:** universe, space, solar system - gravity - rotation - revolution - orbit - star - galaxy - constellation **Explicit:** astronomical unit | **II. Origin and Structure of the Solar System**<br><br>•Define nebula<br>•Explain how the sun, planets, moons, asteroids and comets form from nebular materials. |

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| | **Changes in the Universe and Earth Systems** | Part 4 | | | |
| Astronomy; Inner vs. Outer Planets, Planetary Satellites, Comets, and Asteroids | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.1 Explain the current scientific theory that suggests that the solar system formed from a nebular cloud of dust and gas. (654.01a) Part 5 | | **Prior:** universe, space, solar system - gravity - rotation - revolution - orbit - star - galaxy - constellation **Explicit:** - apogee - perigee | **II. Origin and Structure of the Solar System** . •Compare and contrast bodies within the solar system. •Create a model comparing the location and sizes of the planets. |
| Astronomy; Planetary Motion; Modern Astronomers and Technology | **Goal 4.1: Understand Scientific Theories of Origin and Subsequent Changes in the Universe and Earth Systems** | 8-9.ES.4.1.1 Explain the current scientific theory that suggests that the solar system formed from a nebular cloud of dust and gas. (654.01a) Part 6 | | **Prior:** universe, space, solar system - gravity - rotation - revolution - orbit - star - galaxy - constellation **Explicit:** lunar phase - eclipse - waxing - waning - gibbous - crescent | **III. Sun, Earth, Moon Interactions** •Explain the phases of the moon. •Illustrate the phases of the moon •Describe how the changing positions of the Earth, Sun, and Moon create the eclipses. •Diagram the positions and interactions of the Earth, Sun and Moon during an eclipse. |
| Astronomy; Exploring Space | | | | | |

## 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**
   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 <u>independent variable</u> <u>increases</u>, the <u>dependent variable</u> <u>decreases</u>",

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;

$$y = m x + b$$

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

The formula should read;

<u>Dependent variable</u> = <u>m</u> times the <u>independent variable</u> + <u>b</u>

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 _____**
Short Form (more experienced science students)

**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.
۞ 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 = m x + 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.