# AMPHITHEATER ELEMENTARY SCIENCE GUIDE

8/12/2015

## Third Grade

The following pages provide guidance to teachers when implementing science instruction in Amphitheater Elementary Schools. This guide will be revised regularly to ensure alignment with current Arizona State Standards and the requirements of the district.

# FOREWARD

Dear Teachers and Administrators,

One of the best ways to engage children in their learning and in the world around them is to provide hands-on opportunities to learn and actually "do" science. Science and engineering education is more important than ever. Becoming college and career ready not only involves gaining factual knowledge, it also involves teaching children to question, explore, build, collaborate, explain, analyze, think critically and creatively, and communicate. Science provides the opportunity for all children to be engaged and solve problems which require these skills.

Over the past two years we have implemented new curriculum in the areas of reading and mathematics. Both of these curriculum areas are critical to student success. Science skills and processes give students real situations to apply what they have learned in reading, writing, and mathematics. Technical writing is necessary when students record their observations, record their analysis of data, and develop conclusions and reports. Integration of the subject areas is critical.

A committee of district teachers met over the past six months to discuss science in our schools, review the Arizona Science Standards, make recommendations regarding the teaching of science, discuss the need for materials, and to develop a science curriculum framework for our schools. According to the committee's analysis, science instruction is scarce in most elementary classrooms, if taught at all. There are classrooms where science is taught regularly. This was a pleasant finding. **The committee is recommending that science be taught a minimum of 90 minutes per week for all students beginning with the 2015-2016 school year.**

A common question is, "How will we fit this in?", or, "What should we give up?" in order to teach science. *You will be given the flexibility to reduce some of the time spent on reading and/or math in order to teach science.* Many creative scheduling ideas have come up when teachers begin to talk about how to fit the teaching of science into the day/week.

We introduce the **Amphitheater Elementary Science Guides**. These guides lay out the Arizona Science Standards by grade level, list important academic vocabulary in science, give suggestions for materials and resources and provide many other details for teachers as they prepare their science instruction. We added engineering standards to our curriculum because we know that this type of thinking and "doing" is an important part of STEM education. Inquiry and the Engineering Design Process are the two main threads from Kindergarten through fifth grade. The new curriculum guides will be available electronically and in print. Each school will be scheduling a time to review and discuss the guides, allocate time and resources toward science, and to inventory their science materials.

The guides are not all inclusive. There are many more resources in the community that are not listed, and many more materials that are very effective and practical. We hope to add to these as teachers contribute what they use in their classrooms.

Thank you for all you do to teach science to our youngest scientists!

Sincerely,

Dr. Roseanne Lopez, Chief Academic Officer Elementary Education

| Amphitheater Elementary Science Curriculum Plan | |
|---|---|
| **Grade: 3-5** | **Strand: 1 Inquiry Process (Science Lab)** |

**Enduring Understandings (Big Idea)**

Inquiry uses the scientific process to conduct a complete investigation which is embedded into all areas of science.

**Essential Questions**

What is the process for conducting an investigation?
What evidence should be in a science journal during a complete investigation?
How do we use scientific investigations to find answers to questions?
How is scientific knowledge generated and validated?

| Understanding the Content of this Standard | Essential Knowledge, Skills, and Processes |
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| 1. Identify a problem. | • Make **observations**<br>• Ask questions<br>• Clarify that a problem is **testable** and not an opinion.<br>(Testable: What soil is best?<br>Not Testable: Which is the best color flower?)<br>• Collect **research**<br>• Write a formal question to solve<br>• **Predict** the **results** in a **hypothesis** (using "if-then" language) |
| 2. Scientific testing | • Demonstrate safe behavior and appropriate procedures<br>• Find and list materials and tools<br>• List the complete steps to conduct the **investigation**<br>• Identify the **variables** for the **investigation**<br>• Conduct the **investigation** repeating the test three to five times (i.e. multiple groups, or repeated testing)<br>• Make **observations** and measurements<br>• Record **data** in a **data chart** (chart, table, list, log) |
| 3. Analyze data and draw conclusions | • Organize the data into **graphs** (bar, pictograph, tally chart)<br>• **Interpret** the results of the data<br>• **Compare** the results to the **hypothesis**<br>• Generate questions for possible future **investigations** |

**Science Vocabulary**

inquiry, scientific process, experiment, investigation, opinion, hypothesis, variables, independent variables, dependent variables, controlled variables, observations, data chart, graphs, interpret, testable, results, compare, communication, analysis, research, predict, data, trials, models, patterns/trends, reasonable, outcomes, conclusion, diagram, question, evidence, label, classify, etc.

| Assessment | |
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| Research report<br>Science Fair projects (individual, group, or class)<br>Interpretation and evaluation of data and graphs to answer the relevant question<br>Science journal showing reflections throughout the inquiry process<br>Presentation of the complete inquiry process<br>Teacher observation | |
| **Materials** | **Resources and Ideas** |
| Research materials specific to each design | Research sites for kids:<br>• www.factmonster.com<br>• www.kidsclick.org<br>• www.ipl.org/div/kidspace<br>• www.kidrex.org<br>www.sciencebuddies.org/<br>www.sarsef.org/ *(volunteers are available through SARSEF)*<br>www.powershow.com/view/26bf93-Mzg0N/LPS_Science_Fair_Bill_Nye_the_Science_Guy_powerpoint_ppt_presentation<br>FOSS kits<br>Engineering is Elementary units<br>Teachers Pay Teachers<br>BrainPop |

| Amphitheater Elementary Science Curriculum Plan | |
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| **Grade: 3** | **Strand: 4 Life Science** |

**Enduring Understandings (Big Idea)**

Living things possess the following:

- Basic structures that serve a function
- A unique life cycle
- *(Strand 2: Systems)*Relationships between living things and their environment
- The ability to adapt and survive to their environment

**Essential Questions**

1. What are the functions of plant structures?
2. What are the similarities and differences of the life cycles of various plants?
3. What are the relationships among various organisms and their environment?
4. How do plants and animals adapt to their environment?

| Understanding the Content of this Standard | Essential Knowledge, Skills, and Processes |
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| **Always use concepts from Stand 1 (Inquiry Process) when teaching each unit.*<br>**Concept 1**<br>• **Roots** absorb **nutrients**<br>• **Stems** provide support<br>• **Leaves synthesize** food<br>• **Flowers** attract **pollinators** and produce seeds for reproduction | **Concept 1**<br>• Observe, ask questions, and make predictions |
| **Concept 2**<br>• The plant **life cycle** consists of growth, death, and **decay**<br>• Compare the **life cycles** of various plants | **Concept 2**<br>• Conduct a simple investigation with various plants<br>• Maintain data using metric and U.S. Customary units of measure<br>• Create charts, tables, and graphs to compare the results |
| **Concept 3**<br>• Living things grow, reproduce and need food, air and water<br>• Ecosystems have **microscopic** and **macroscopic** organisms<br>• **Producers** are plants, **consumers** are animals, and **decomposers** are fungi, insects, bacteria<br>• Plants and animals cause change | **Concept 3**<br>• Observe, ask questions, and make predictions<br>• Create a food chain or web of life with examples of **producers, consumers,** and **decomposers**<br>• Demonstrate and describe how changing one part affects others<br>• Experiment/research different environmental factors |

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| in their environment<br>• Environmental factors such as soil, temperature, light, and water, may affect a living thing's ability to grow, reproduce, and thrive (possibly using a class/group terrarium)<br>• *(Strand 3)* Beneficial and harmful effects to human populations | • *(Strand 3)*Describe natural and human impacts on an environment such as famine, drought, disease, forest fires, flooding, and pesticides<br>• *(Strand 2)* Read about scientists/occupations: Jane Goodall, soil engineers, etc. |
| **Concept 4**<br>• Plants and animals **adapt** to their **environment** (for example: **camouflage, mimicry**, color, size, etc)<br>• **Extinction** is the inability to adapt to changing conditions | **Concept 4**<br>• Research to identify and describe ways that species adapt<br>• Cite examples that have led to extinction |

**Science Vocabulary**

**Concept 1**
Roots, stems, leaves, flowers, nutrients, synthesize, pollinators

**Concept 2**
Decay, life cycle

**Concept 3**
Producers, consumers, decomposers, microscopic, macroscopic

**Concept 4**
Adapt, camouflage, mimicry, extinction, population, environment

**Assessment**

**Concept 1**
Use various materials to make a model of a plant and label the parts and functions.
**Concept 2**
Draw conclusions from the investigation data.
**Concept 3**
Demonstrate and explain the relationships among living things in a web activity.
**Concept 4**
Describe ways living things adapt to their environment (current and new environment).
Explain why a living thing in one environment would not survive in another.
*(Strand 3)* Consider designing and constructing a technological solution to a common problem in the environment.

| Materials | Resources and Ideas |
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| **Concept 1**<br>Plants, magnifying glasses, various materials to create a plant model (for example: pipe cleaners, paper clips, post-it notes, string, etc.), books to research parts of plants | **Concept 1**<br>plant dissection<br>BrainPop<br>Check Smart Exchange |
| **Concept 2**<br>Seeds, soil, tissues, baggies, paper cups, graph paper, rulers | **Concept 2**<br>Graphing growth<br>Check Smart Exchange |
| **Concept 3**<br>Picture cards, yarn, terrarium, soil, seeds, thermometer | **Concept 3**<br>• Sort living and non-living materials<br>• PBS Learning Media<br>• Saburchill.com (7 characteristics of living things)<br>• Food web or food chain<br>• ocps.net – *picture cards*<br>• *(Strand 2)* Scientists/occupations: Jane Goodall, soil engineers, etc.<br>• Check Smart Exchange |
| **Concept 4**<br>Computers, books for research (natural disaster), picture cards | **Concept 4**<br>• mbgnet.net<br>• makemegenius.com<br>• splash.abc.net.au<br>• Design/construct a solution to a common environmental problem<br>• Check Smart Exchange<br>• Fact Monster<br>• www.teachengineering.org |

| Amphitheater Elementary Science Curriculum Plan | |
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| **Grade: 3** | **Strand: 5 Physical Science** |

**Enduring Understandings (Big Idea)**

Light and sound energy can change depending on their form and interaction with materials.

**Essential Questions**

What are the different forms of light energy and sound energy?

| Understanding the Content of this Standard | Essential Knowledge, Skills, and Processes |
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| **Always use concepts from Stand 1 (Inquiry Process) when teaching each unit.*<br><br>C*oncept 1-2 not taught in 3rd grade*<br>**Light: Concept 3**<br>• Light can be demonstrated by **reflection, refraction**, and **absorption** (mirrors, prisms, and dark surfaces)<br>• Differences in light behavior (**transparent** allows light to be passed through, **translucent** allows some light, and **opaque** allows no light) | *Concept 1-2 not taught in 3rd grade*<br>**Light: Concept 3**<br>• Formulate questions and conduct simple investigations<br>• Create charts to record data<br>• Use mirrors and flashlights to investigate the concept of **reflection**<br>• Use prisms/lenses and flashlights to investigate the concept of **refraction**<br>• Use dark and light materials to investigate how light is **absorbed** with a thermometer<br>• Use various materials (foil, tissue, paper, wax paper, bubble wrap, cardboard, etc) and flashlights to investigate the concepts of **transparent, translucent, and opaque**.<br>• *(Strand 2)*Identify Thomas Edison's contribution to scientific innovations (light bulb)<br>• *(Strand 3)* Use tools and techniques to solve problems (eye glasses, binoculars, telescopes, microscopes) |

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| **Sound: Concept 3**<br>• Vibrating objects produce sound: the **pitch** depends on the rate of **vibration** (long rubber band will produce a different pitch than a short rubber band)<br>• *(Strand 2)* Describe careers that use light and sound | **Sound: Concept 3**<br>• Investigate and use objects to produce different **pitches** such as rubber bands, string, rulers, xylophones<br>• *(Strand 2)* Helen Keller with **vibrations**, closed captioning |
| **Science Vocabulary** | |
| **Concept 3**<br>Reflection, refraction, absorption, transparent, translucent, opaque, vibration, pitch, energy | |
| **Assessment** | |
| **Concept 3**<br>• Given the set of objects students direct light from point A to point B<br>• Identify different objects as transparent, translucent, and opaque<br>• Produce an instrument that demonstrates multiple pitches<br>• Based on what was learned, design and construct a technological solution to a common problem | |
| **Materials** | **Resources and Ideas** |
| **Concept 3**<br>Mirrors, prisms, black paper or cardboard, clear plastic (plastic wrap or baggies), translucent materials (wax paper, frosted glass, scratched plastic), rubber bands, flashlights, thermometers, books for background knowledge and careers | **Concept 3**<br>www.teachengineering.org<br>FOSS kits |

| Amphitheater Elementary Science Curriculum Plan | |
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| **Grade: 3** | **Strand: 6 Earth Science** |

**Enduring Understandings (Big Idea)**

The Earth's history, composition and formative processes help students make informed decisions about issues affecting our planet.

**Essential Questions**

What are the basic properties of Earth's Materials?

- Layers of the Earth
- Types of rocks
- Fossils

| Understanding the Content of this Standard | Essential Knowledge, Skills, and Processes |
|---|---|
| **Always use concepts from Stand 1 (Inquiry Process) when teaching each unit.*<br><br>**<u>Concept 1</u>**<br>• Layers of the Earth are **crust, mantle, outer core, inner core**<br>• **Rocks** are made of **minerals** and can be classified into three types: **metamorphic, igneous, and sedimentary** (**metamorphic** – rocks that change by heat and pressure, **sedimentary** – rocks formed by sediment hardening in layers, **igneous**-rocks formed from a volcanic process<br>• Rocks have physical **properties** (color, size, texture, shape, hardness, etc.)<br>• **Fossils** are a record of past life forms<br>• **Fossils** are formed in various ways (**cast, mold, trace, amber**)<br>• *(Strand 3 and 6)* Humans use Earth's materials (fuel, building materials, growing food)<br>*Concepts 2 and 3 – not taught in 3rd Grade* | **<u>Concept 1</u>**<br>• Create a model of the Earth that shows a **cross section** (grapefruit, drawing, apple, baseball, clay, Power Point, etc)<br>• Create models of the types of rocks (cookies, clay, gumdrops)<br>• Conduct an investigation on sorting rocks by **property** (hardness test by scratching, magnet test, water test, sorting, touch test for texture, etc)<br>• Describe what a **fossil** is and how it is formed.<br>• *(Strand 3)* Identify careers that study **fossils.**<br>• Research and identify how **natural resources** are used in our world (fluorite – toothpaste, limestone – eyeglasses, fossil fuels – gasoline)<br>*Concepts 2 and 3 – not taught in 3rd Grade* |

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| **Science Vocabulary** | |
| **Concept 1**<br>Crust, mantle, outer core, inner core, cross section, rocks, minerals, metamorphic, sedimentary, igneous, properties, cast fossils, trace fossils, mold fossils, amber, natural resources | |
| **Assessment** | |
| **Concept 1**<br>Creation of Earth model<br>Rock collection<br>Making fossils<br>Timeline of fossils<br>Creating the three types of rocks<br>Geology Power Point | |
| **Materials** | **Resources and Ideas** |
| **Concept 1**<br>Play dough, grapefuit, colored construction paper, egg carton, rocks samples, mineral samples, fossils, books for research | **Concept 1**<br>"apple" Earth<br>Egg carton rock collection<br>Rock scavenger hunt<br>Grand Canyon Ranger<br>Watchknowlearn.org<br>Cookie mining<br>Gem and Mineral Show field trip<br>FOSS kits<br>Geology Kitchen – You Tube |

| Amphitheater Elementary Science Curriculum Plan | |
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| **Grade: K-5** | **Engineering Design Process** |

**Enduring Understandings (Big Ideas)**

- Defining and Delimiting Engineering Problems
- Developing Possible Solutions
- Optimizing the Design Solution

**Essential Questions**

How might we define a simple design problem reflecting a need or a want?

What are the constraints/criteria?

How might we generate and compare possible solutions to a problem?

How might we plan and carry out fair tests?

How might we improve upon our design?

| Understanding the Content of this Standard | Essential Skills and Processes |
|---|---|
| Students will be able to use the **Design Process.** *(italics denote K-2 language)* | **Design Process:**<br>Students will understand how technology solves problems and makes work easier.<br>Identify the problem (*Ask)*<br>Do research<br>Develop possible solutions *(Imagine)*<br>Choose one solution<br>Design and construct a prototype *(Plan and Create)*<br>Test the prototype *(Test)*<br>Evaluate and redesign *(Improve)*<br>Communicate results |
| **Identify the problem (*Ask)***<br>***Research***<br><br>Find a design problem, based on the fact that peoples' needs and desires change over time as well as their demand for new technologies. | • Identify & create a solvable **design problem/need/want**<br>• Explain why that problem is relevant<br>• Conduct research |

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| Create or identify criteria for success and constraints. | • Understand & explain that there are **constraints** on **material**, **time** and **costs** |
| **Develop possible solutions *(Imagine)*** Generate and compare possible solutions to a problem. | • Work within the criteria while **generating** possible **solutions**<br>• Judge solutions against constraints<br>• Identify solution(s) that best fits problem |
| **Design and construct a prototype *(Plan and Create)*** Plan the model or prototype based on chosen solution(s). Create the model prototype. | • Design a **model**.<br>• Communicate the design of a model (written on paper, whiteboard, or computer software, etc.)<br>• Construct a model using available resources. |
| **Test the prototype *(Test)*** Design and conduct fair tests with controlled variables. | • Plan and conduct **fair tests** using **prototypes**<br>• **Control variables**<br>• Consider **failure points** found through testing |
| **Evaluate and redesign *(Improve)*** Evaluate & redesign model. | • Use failure points to identify parts of a model that can be improved<br>• Make changes to the model (**redesign**).<br>• Repeat testing process |
| **Communicate results** Communicate results. | • Explain your results using data<br>• Gather input from peers<br>• Describe successes and failures<br>• Suggest improvements based on the criteria and failure points |
| **History of Engineering and Innovation** | |
| How have individuals contributed to engineering innovations? | • Research the various contributions of scientists and innovators in this field (e.g., Wilber and Orville Wright, Leonardo da Vinci, Thomas Edison, Benjamin Franklin, Steve Jobs, Bill Gates, Mary Anderson-windshield wiper, George de Mestral-velcro, Alan Turing-computer science/cryptologist, Hedy Lamarr- basis for wi-fi).<br>• Describe how science, engineering and technology have improved the lives of people.<br>• Critique the benefits and risks related to the use of technology.<br>• Investigate careers related to engineering & design. |
| **Science Vocabulary** | |
| prototype, model, design, process, predict, evaluate, technology, record, research, create, problem, solution, design problem, want, need, individual, community, global, technology, criteria, constraints, materials, cost, generate, compare, options, reasonable, plan, blueprints, investigate, variable, fair test, control, failure points, redesign | |

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<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Assessment</td></tr>
<tr><td>Formative</td><td>Summative</td></tr>
<tr><td><ul><li>Reflections</li><li>Center activities (teacher observation)</li><li>Engineering Journals</li></ul></td><td><ul><li>Performance assessment</li><li>Presentation of design</li></ul></td></tr>
<tr><td>Materials</td><td>Resources</td></tr>
<tr><td>Engineering is Elementary Units<br>Various materials for making models and prototypes</td><td><ul><li>Discovery Education</li><li>Reading Street Leveled Readers (on-line)</li><li>Reading A-Z leveled readers</li><li>Khan Academy</li><li>http://www.sciencekids.co.nz/engineering.html</li><li>www.teachengineering.org</li><li>http://www.childrensengineering.org/</li><li>http://www.childrensengineering.com/freeresources.htm</li><li>https://www.teachengineering.org/googlesearch_results.php</li><li>http://betterlesson.com/lesson/620237/the-wonderful-towers-of-watts-building-background-knowledge?grade=14&subject=2&from=bl_directory_no-keywords_second-grade_technology-and-engineering_mt-lesson_620237_title</li><li>http://www.engr.ncsu.edu/theengineeringplace/educators/k8plans.php</li><li>https://drive.google.com/folderview?id=0Bzm8D1yH2vdZXzlERWhDYTFFLXc&usp=sharing</li><li>YouTube videos<ul><li>Nasa For Kids: Intro to Engineering</li><li>The Engineering Process: Crash Course Kid</li></ul></li><li>National Science Foundation Resources: https://www.nsf.gov/news/classroom/engineering.jsp</li><li>Teachers Pay Teachers</li></ul></td></tr>
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