AMPHITHEATER ELEMENTARY SCIENCE GUIDE

8/12/2015

Fifth 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
1. Identify a problem.	• Make **observations** • Ask questions • Clarify that a problem is **testable** and not an opinion. (Testable: What soil is best? Not Testable: Which is the best color flower?) • Collect **research** • Write a formal question to solve • **Predict** the **results** in a **hypothesis** (using "if-then" language)
2. Scientific testing	• Demonstrate safe behavior and appropriate procedures • Find and list materials and tools • List the complete steps to conduct the **investigation** • Identify the **variables** for the **investigation** • Conduct the **investigation** repeating the test three to five times (i.e. multiple groups, or repeated testing) • Make **observations** and measurements • 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) • **Interpret** the results of the data • **Compare** the results to the **hypothesis** • Generate questions for possible future **investigations**
4. Communication	Explain the results • Create a display of the complete **investigation** • Include a science journal with all parts of the **inquiry process** including **research**, testing, and **analysis** • Present the results with others (classroom, grade level,

	Science Fair)

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
Research report Science Fair projects (individual, group, or class) Interpretation and evaluation of data and graphs to answer the relevant question Science journal showing reflections throughout the inquiry process Presentation of the complete inquiry process Teacher observation

Materials	**Resources and Ideas**
Research materials specific to each design	Research sites for kids: • www.factmonster.com • www.kidsclick.org • www.ipl.org/div/kidspace • www.kidrex.org www.sciencebuddies.org/ www.sarsef.org/ *(volunteers are available through SARSEF)* www.powershow.com/view/26bf93-Mzg0N/LPS_Science_Fair_Bill_Nye_the_Science_Guy_powerpoint_ppt_presentation FOSS kits Engineering is Elementary units Teachers Pay Teachers BrainPop

Amphitheater Elementary Science Curriculum Plan	
Grade: 5	**Strand 4 Concept 1: Structures and Functions in Living Systems (Human Body)**

Enduring Understandings (Big Idea)

What are the relationships between structures and functions of the human body?

Essential Questions

What are the functions and parts of the skeletal system?
What is the essential role(s) of the skeletal system?
What are the different types of muscles found in the human body?
What are the roles/functions of each type of muscle in the human body?
How does your nervous system operate?
What are the different parts of the nervous system?
What are voluntary/involuntary responses? Differences? What controls these types of responses?

Understanding the Content of this Standard	Essential Knowledge, Skills and Processes
The different parts of the skeletal system (protection, support, movement)	Identify and recognize the skeletal system as a system used for protection, support and movement.
Cardiac, smooth, and skeletal muscles	Classify and distinguish between the different types of muscles found in the human body.
Nervous system (brain, spinal cord, nerves)	Categorize and connect the nervous system based on its three main components: **brain**, **spinal cord**, and **nerves**
Voluntary and involuntary responses	Differentiate between **voluntary** and **involuntary response** (i.e., breathing, digesting food, blinking, moving your arm, walking, smiling, etc.)

Science Vocabulary

Skeletal System: 25-30 major bones such as femur, ulna, radius, cranium, pelvis, etc. The layers of the bone such as periosteum, compact bone, spongy bone, marrow, etc. **Parts of the Brain**: Parietal lobe, frontal lobe, occipital lobe, temporal lobe, medulla oblongata, brain stem, cerebrum, cerebellum, etc.	**Nervous System**: Brain, spinal cord, nerves, neuron, synapse, dendrite, axon, neurotransmitter, cell body, nucleus, etc. **Muscle Types**: Smooth, cardiac, and skeletal muscles Voluntary and involuntary responses

Assessment	
The learner will build a 3D model of the skeletal system (life-sized). The model can be made of virtually anything!	Owl pellet dissection to compare/contrast human skeletal system with skeletal systems of rodents, birds, etc. Learner gets a first-hand look at the different bone types found within an animal.
Learner will build a model of the layers of a bone (periosteum, compact bone, spongy bone, marrow, etc)	
Materials and Resources	
Owl pellets for owl pellet dissection, Virtual Owl Pellet online: http://kidwings.com/nests-of-knowledge/virtual-pellet/	Kidshealth.org is a great website to use for supplemental reading material, videos, interactive ideas, etc. See link below for nervous system: http://kidshealth.org/kid/cancer_center/HTBW/brain.html
Discovery Education offers a great deal of videos and resources to help supplement your lessons	-Human body Foss kit -YouTube of videos -BrainPop

Amphitheater Elementary Science Curriculum Plan	
Grade: 5	**Strand 5 Concept 1: Properties and Changes of Properties in Matter (Chemistry)**
Enduring Understandings (Big Idea) How can you classify matter? What causes matter to change?	
Essential Questions	
What are the three states of matter? What are elements and their properties? What are the parts and functions of an atom? What are the differences between mixtures and compounds? What are chemical changes? What are physical changes? How are physical and chemical changes similar and dissimilar?	
Understanding the Content of this Standard	**Essential Knowledge, Skills and Processes**
Identify that matter is made of smaller units called: Molecules (e.g., H20, CO2) Atoms (e.g., H, N, Na)	Differentiate between **solids**, **liquids**, and **gases**. Design a **molecule** and an **atom**. Compare and contrast different atoms and molecules. Identify how many **protons, neutrons,** and **electrons** an element contains. Recognize the importance and composition of a **nucleus** of an atom. How are **elements** grouped?
Distinguish between mixtures and compounds	Explore and identify different **mixtures** and **compounds**. Investigate **solute** and **solvents**. Investigate **solubility** limits. Recognize compounds as having properties different from their elements.
Describe changes in matter: Physical- cutting wood, ripping paper, freezing water Chemical- burning of wood, rustling of iron, milk turning sour	Compare and contrast different ways that **matter** changes state. Classify changes in matter as **chemical** or **physical**.
Describe the properties of acids and bases.	Differentiate between **acids** and **bases**. Investigate how indicators can be used to identify acids and bases.
Science Vocabulary	
Matter: Atom, molecule, solid, liquid, gas, protons, neutrons, electrons, nucleus, element, metal, nonmetal, metalloid, atomic	**Mixtures and Compounds**: Mixture, compound, solute, solvent, solubility, freezing point, melting point, boiling point, reaction

number, atomic mass, atomic symbol	**<u>Physical and Chemical Changes</u>**
Assessment	
Research an element in the periodic table and create a pamphlet about your element. Use photos, drawings, charts, or other graphics.	Design a molecule and an atom. Research John Dalton's atomic theory and create an illustrated booklet showing each part of the theory.
Create a poster listing the metals that are solid at room temperature and list all the metalloids and their properties, symbols, and atomic numbers. *Approaching:* Have students write sentences explaining the uses of two different mixtures. *On Level:* Have students write a paragraph explaining solubility limits. *Challenge:* List the steps of a procedure to follow separating any mixture. Performance Assessment: Fizzy Evidence Determine whether lemon juice or apple juice is more acidic when reacting with baking soda- a weak base- to form water and a salt.	Using the periodic table, classify elements that are found in the atmosphere by atomic number and symbol. Create and label a diagram of a bottle of salad dressing in which a layer of oil has formed on top of a layer of vinegar. Create a diagram modeling the atoms in carbon and oxygen that are in carbon dioxide. Create a diagram and write the formula for common compounds.
Materials and Resources	
Foss kit	BrainPop
YouTube offers a plethora of videos/resources to supplement	http://www.chem4kids.com/

Amphitheater Elementary Science Curriculum Plan	
Grade: 5	**Strand 5 Concept 2: Motion and Forces (Physics)**
Enduring Understandings (Big Idea) How do forces move objects?	
Essential Questions	
What is the relationship between position, motion, velocity, and acceleration? How do you calculate velocity and acceleration? What are the differences between balanced and unbalanced forces? How do gravity and friction affect motion? How can I apply Newton's Three Laws of Motion? What are the six types of simple machines? (e.g., lever, pulley, wedge, wheel and axle, inclined plane, and screw).	
Understanding the Content of this Standard	**Essential Knowledge, Skills and Processes**
Understand the relationship between force and motion.	Distinguish between force and motion.
Describe the forces of gravity and friction.	Investigate and demonstrate **forces** and **motion**.
Newton's Three Laws	Describe, plan, and implement **Newton's Three Laws of Motion**.
Simple Machines	Classify and differentiate between **simple machines**.
Science Vocabulary	
Motion: gravity, friction, position, speed, velocity, acceleration, momentum **Forces and Motion:** force, friction, balanced and unbalanced forces, inertia, action and reaction forces	**Simple Machines:** load, effort, fulcrum, pulley, lever, wedge, wheel and axle, inclined plane, screw, compound and simple machines
Assessment	
Motion: *Approaching:* Write sentences using the terms position and motion. *On Level:* Write a paragraph explaining the difference between speed and velocity. *Challenge:* Write a paragraph explaining why two cars with the same velocity can have different momentums.	**Simple Machines:** *Performance Assessments* Design a machine that people can use to help move objects in the kitchen (using simple machines). Design a Rube Goldberg "How-to" Poster using all simple machines. (e.g., how to pour dog food, how to turn off a light).

Forces and Motion:	**Simple Machines:**
Measure the acceleration of a model car.	*Approaching:* Write sentences that describe the use of a first-class lever. *On Level:* Write a paragraph explaining the differences between first-class, second-class, and third-class levers. *Challenge:* Write a paragraph comparing and contrasting a wheel and axle and a pulley.
Materials and Resources	
Measure the acceleration of a model car- Masking tape, meter stick, two wood clocks with thumbtacks, rubber bands, safety goggles, model cars, stopwatch	You tube video, Artist: OK Go Title: This too shall pass (Rube Goldberg)
Newton's Three Laws of Motion Interactive www.sciencechannel.org	

Amphitheater Elementary Science Curriculum Plan	
Grade: 5	**Strand 6 Concept 2 and 3: Earth and Space Science (Planetary Science)**
Enduring Understandings (Big Idea) What are the processes acting on the Earth and their interactions with Earth's systems? What is the relationship between Earth and objects in our solar system?	
Essential Questions	
Why does the moon have phases? What causes this to occur? What causes day and night on Earth? What are the differences between real and apparent motion? How are revolution and rotation different from one another? How does gravity play a role with celestial objects? What efforts have been made to explore space?	
Understanding the Content of this Standard	**Essential Knowledge, Skills and Processes**
Phases of the moon	Draw conclusions as to why there are **moon phases**.
Earth's rotation and revolution	Distinguish between **rotation** and **revolution**.
The role of gravity	Describe the role of **gravity** between celestial objects
-Planets in our solar system -Various objects in the sky -Earth's change in position and motion over time	-Identify the known planets of our **solar system**, **dwarf planets**, etc. -Compare **asteroids**, **comets**, **stars**, **meteors**, etc. -Investigate and contrast between **real** and **apparent motion**
Science Vocabulary	
Moon Phases: New Moon, Waxing Crescent, First Quarter, Waxing Gibbous, Full Moon, Waning Gibbous, Third Quarter, Waning Crescent **Earth's Change in Position:** Real and Apparent motion, rotation, revolution, gravity	**Moon**: Crater, Mare, Regolith, Ejecta, etc. **Names of Planets/Dwarf Planets**: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Dwarf Planet Pluto **Other**: Asteroid, comet, meteor, star, satellite, solar system, galaxy, universe, etc.

Assessment	
Oreo cookie moon phase lab (students create moon phases using Oreo cookies)	Crater impact moon lab: http://www.lpi.usra.edu/education /explore/LRO/activities/craterCreations/
Students create a two-page spread on a planet of their choice (think of a magazine two-page spread), students will use informational text features, such as title, header, sub header, caption, etc.	
Materials and Resources	
NASA website: https://solarsystem.nasa.gov/planets/	-Youtube offers a great deal of videos on planetary science -BrainPop
Google "Oreo Cookie Moon Phase Lab" for resources and visuals	-Planetary Science Foss kit http://www.lisd.org/technology/itswebs/elem/curr/science/5sciwebsites.htm

Amphitheater Elementary Science Curriculum Plan	
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:** Students will understand how technology solves problems and makes work easier. Identify the problem (*Ask)* Do research Develop possible solutions *(Imagine)* Choose one solution Design and construct a prototype *(Plan and Create)* Test the prototype *(Test)* Evaluate and redesign *(Improve)* Communicate results
Identify the problem (*Ask)* ***Research*** 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** • Explain why that problem is relevant • Conduct research
Create or identify criteria for success and	• Understand & explain that there are

constraints.	**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** • Judge solutions against constraints • 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**. • Communicate the design of a model (written on paper, whiteboard, or computer software, etc.) • 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** • **Control variables** • 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 • Make changes to the model (**redesign**). • Repeat testing process
Communicate results Communicate results.	• Explain your results using data • Gather input from peers • Describe successes and failures • 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). • Describe how science, engineering and technology have improved the lives of people. • Critique the benefits and risks related to the use of technology. • 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

Assessment	
Formative	Summative
• Reflections • Center activities (teacher observation) • Engineering Journals	• Performance assessment • Presentation of design
Materials	**Resources**
Engineering is Elementary Units Various materials for making models and prototypes	• Discovery Education • Reading Street Leveled Readers (on-line) • Reading A-Z leveled readers • Khan Academy • http://www.sciencekids.co.nz/engineering.html • www.teachengineering.org • http://www.childrensengineering.org/ • http://www.childrensengineering.com/freeresources.htm • https://www.teachengineering.org/googlesearch_results.php • 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 • http://www.engr.ncsu.edu/theengineeringplace/educators/k8plans.php • https://drive.google.com/folderview?id=0Bzm8D1yH2vdZXzlERWhDYTFFLXc&usp=sharing • YouTube videos ▪ Nasa For Kids: Intro to Engineering ▪ The Engineering Process: Crash Course Kid o National Science Foundation Resources: https://www.nsf.gov/news/classroom/engineering.jsp o Teachers Pay Teachers