Fourth Grade Science

Course Description (Storyline):

The performance expectations in fourth grade help students formulate answers to questions such as: "What are waves and what are some things they can do? How can water, ice, wind and vegetation change the land? What patterns of Earth's features can be determined with the use of maps? How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem?" Students are able to use a model of waves to describe patterns of waves

in terms of amplitude and wavelength, and that waves can cause objects to move. Students are expected to develop understanding of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. They apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans. In order to describe patterns of Earth's features, students analyze and interpret data from maps. Fourth graders are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of patterns; cause and effect; energy and matter; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the fourth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information.

Course Rationale:

Knowledge of science, as well as engineering and technology (as stated in the Next Generation Science Standards), is critical in preparing all students for higher education and jobs of the future as well as becoming informed, voting citizens. In addition, students need to gain substance in reading, writing, and figuring math solutions which allows for natural integration within the sciences. It is of critical importance to instill a high interest and knowledge of science so all students can succeed in a

technologically advanced, global society whether they choose to pursue college or the workforce upon graduation.

Course Curriculum Map:

Appendix – fourth grade scope and sequence

Fourth Grade Science Scope and Sequence

Course Materials and Resources:

- Pearson Interactive Science Edition + Digital Courseware 7 year license-1,500
- Teacher Edition Package-60 free
- Leveled Reader Library-60 sets (30 free/30 paid)
- Science Activity Card Set-60 free
- STEM Activity Book 60 free
- Science, Social Studies and ELA Connections books-60 free
- Science Examview CD and Untamed Science DVD-free
- Science Leveled Reader Database Teacher Access Pack grade k – 5- 60 free

4th Grade

Quarter 1

Engineering Design (embedded throughout all units, but introduced in chapters 1 and 2) and Energy: Interactive Science Textbook chapters:

- 1 (Nature of Science),
    - Chapter 1 Big Question: What is science?
- 2 (Technology and Design),
    - Chapter 2 Big Question: How does technology affect our lives?
- and 8 (Energy and Heat)
    - Chapter 8 Big Question: How does energy cause change?

Quarter 2

Waves: Interactive Science Textbook chapters:

- 9 (Electricity and Magnetism) and
    - Chapter 9 Big Question: How are electricity and magnetism used?
- 10 (Motion)
    - Chapter 10 Big Question: How can motion be described and measured?

Quarter 3

Earth's Systems: Interactive Science Textbook chapter:

- 5 (Earth's Resources) and
    - Chapter 5 Big Question: How do earth's resources change?
- **natural resources needs to be added, some ideas:
    1. http://beyondpenguins.ehe.osu.edu/issue/energy-and-the-polar-environment/teaching-about-natural-resources-and-energy-sources
    2. http://www.nasa.gov/pdf/326862main_Moon_Munchies_Lesson_1.pdf
    3. http://www.calacademy.org/teachers/resources/lessons/natural-resources-bingo/
    4. http://www.brainpopjr.com/science/conservation/naturalresources/grownups.weml
    5. http://www.ecofriendlykids.co.uk/NaturalResourcesEarth.html

Quarter 4

Molecules to Organisms: Interactive Science textbook chapters:

- 3 (Plants and Animals) and
    - Chapter 3 Big Question: Why do living organisms need to survive?
- chapter 4 (Ecosystems)
    - Chapter 4 Big Question: How do living things interact with their environment?

Energy

- Light
- Heat
- Sound
- Electricity
- Mechanical energy
- Chemical energy (stored energy)

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

Identify different forms of energy: sound, electricity, mechanical, magnetic, chemical, light, heat

- Identify and investigate how energy transfers from one object to another
- Explain the phenomenon of how energy changes from one form to another
- Identify what conservation of energy is, and investigate how one form of energy transforms to another (electric to light, electric to sound)
- Construct, hypothesize, and critique investigations to test the following interactions:
- Radiation transfers to light, heat
- Sun's energy transfers through light
- Absorption
- How plants use sun energy to grow
- How the sun's energy affects life on earth
- How sun's energy causes changes on earth (evaporation, temperature, etc)
- What happens when you bring two magnets together?
- How electric energy transforms to sound, light, or heat?
- What happens to motion when two objects collide?

4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.

- Identify and investigate how energy transfers from one object to another
- Explain the phenomenon of how energy changes from one form to another
- Identify what conservation of energy is, and investigate how one form of energy transforms to another (electric to light, electric to sound)
- 4-PS3- Identify how humans concentrate energy

- Identify examples of how humans concentrate, transport, and store energy in batteries, power grids, gas stations, solar panels
- Cite evidence of how these are used for practical use.

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Ideas could include:

Design a device that uses batteries to light a bulb, ring a bell, etc. Figure out how to make the device work better and improve it.

- Construct, hypothesize, and critique investigations that will convert energy from one form to another. Examples: electromagnets, telegraphs, alarm circuit, bell, solar oven
- Use questioning, create hypotheses, create and analyze data charts, and draw conclusions on investigations
- Identify how humans concentrate energy
- Identify examples of how humans concentrate, transport, and store energy in batteries, power grids, gas stations, solar panels
- Cite evidence of how these are used for practical use

<u>Essential Vocabulary</u>

Forces, Unbalanced forces, Energy, Motion, Transfer, Observe, Radiated, Absorbed, Collide, Stored energy, Potential energy, Kinetic energy, Generated, Concentrated energy, Proposal, Analyze, Evidence, Criteria, Constraints, Solutions, Relationship, Electric currents, Design, Construct, Device, Converts, Model, Renewable energy, Non-renewable energy, Sources of energy, Poles, Friction, Conservation

Websites

Energy Quest Room www.**energyquest**.**ca**.gov/

California Energy Commission's energy and environmental education site for students, parents and teachers.

Energy Kids - EIA www.eia.gov/**kids**

Learn about renewable and nonrenewable **energy** using games, activities and content for teachers.

Basic Elements - Fuel for the Future – Thinkquest

http://library.thinkquest.org/04apr/00215/

Learningscience.org http://www.learningscience.org/psc2ctransferenergy.htm- great website with tons of simulations, activities, examples, on multiple topics

Solar- Energy and Kids http://www.kids.esdb.bg/newenergy.html

Trade Book List for Teaching Energy:

1. *Newton and Me*. Lynne Mayer. Illustrated by Sherry Rogers. Sylvan Dell Publishing. 32pp. Trade ISBN 978-1-60718-067-8, $16.95. Paperback ISBN 978-1-60718-078-4, $8.95. (K–2)

Fourth Grade Science Scope and Sequence

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A young boy and his dog Newton explore the laws of motion in everyday activities like rolling a ball, riding a bicycle, and pulling a wagon. Questions, Science Notes. (SAR) III, VII. Supplemental Material: Developmentally appropriate activities (PBS Zoom)

2. The Boy Who Harnessed the Wind. William Kamkwamba and Bryan Mealer. Penguin/Dial.
The engineering and technology in the book's story makes it a great STEM resource and an inspirational human story.

3. What Color Is My World? Kareem Abdul-Jabbar and Raymond Obstfeld. Candlewick Press.
Integrated with technology, engineering and social studies, this book highlights unknown inventors. Useful for Invention units and STEM curricula. The variety of inventors and inventions will be appreciated.

4. Energy Island. Allan Drummond. Farrar Straus Giroux BYR, an imprint of Macmillan Children's Publishing Group. 40pp. Trade ISBN 978-0-374-32184-0, $16.99. (3–5) An inspiring true story about how citizens of Samso, an island in Denmark, drastically reduced their carbon emissions and became almost completely energy-independent. The witty illustrations by the author tell a story that exemplifies the impact of collaboration as they built wind turbines, erected solar panels, and built a biomass furnace. Sidebars provide teachers, parents, or advanced readers with additional information about energy topics such as nonrenewable and renewable energy, energy independence, global warming, wind energy and saving energy. Samso is now the home of Samso Energy Academy, where scientists and scholars come to exchange ideas about energy conservation. (SKD) VI, VII

Waves

4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

- Identify what waves are and the parts of a wave.
- Identify that all energy moves in waves.
- Identify how waves move and create diagrams/examples to show how they move.
- Identify and compare what amplitude and wavelength are.
- Draw conclusions about why waves move differently in deep water versus shallow water.
- NOAA website (resource)
- Students will create a model to describe the amplitude and wavelength of waves

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

- Identify and understand that light travels in waves

- Identify that white light is a combination of spectral colors
- A prism can separate white light into its color spectrum
- Identify reflection and refraction
- The eye has two types of cells rods and cones
- Rod cells detect light and dark

- Cone cells detect color
- Identify and define an optical illusion

4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.

- Create a model, like a telegraph, to solve the problem of transferring information using mechanical waves that can be decoded.
- Analyze how cell phones and computers work
- Identify how satellites transfer information using mechanical waves.
- Identify what pixels are and how they transmit information.
- Identify different types of technology that store and transmit digital information: memory sticks, texting, activexpressions.
- Compare differences in energy transfer on bobbing corks, seabirds, boats on waves in deep water versus waves hitting the shoreline (push/pull)
- Identify how tides are formed and the difference between low and hide tide.

Essential Vocabulary

Waves, Motion, Amplitude, Wavelength, Phase, Seismic waves, Digitized information, Transmit, Degradation, High-tech devices, Models, Engineering, Evidence, Interaction, Qualitative, Quantitative, Erosion, Mechanical waves, Decoding, Communicate, Observations

Websites

http://ilovenewton.com/energy-light-sound-4th-grade-science

http://www.acs.psu.edu/drussell/demos/waves/wavemotion.html

http://www.acs.psu.edu/drussell/demos.html

http://www.noaa.gov/

http://www.onr.navy.mil/focus/ocean/motion/waves1.htm

http://classroom.jc-schools.net/sci-units/energy.htm#4

http://www.tryscience.org/experiments/experiments_japan_online.html (game)

http://www.acoustics.salford.ac.uk/schools/index1.htm

http://www.brainpopjr.com/science/energy/sound/grownups.weml

http://www.sciencekids.co.nz/sciencefacts/sound.html

Books

1. **Waves by Steve Hawk (Apr 21, 2005)**

Any ocean lover knows the transformative power of the ocean wave and its perfect confluence of energy, water, and light. Waves offers a mesmerizing collection of photography that explores the many faces of the singular ocean wave, whether it is the quiet rush of a crystalline wavelet over tropical sand or the deadly slam of storm surf against Oregon cliffs. Former editor of Surfer magazine, Steve Hawk has selected photographs from New Zealand to Newfoundland, from Fiji to the Aleutians, and paired them with insightful ruminations on the science and poetry of waves.

Fourth Grade Science *Scope and Sequence*

With work from world-renowned photographers such as Art Brewer, Jeff Divine, Wayne Levin, and Joel Meyerowitz, Waves will captivate all those with a passion for the sea.

2. **Sound Waves** (Energy in Action) by Ian F. Mahaney
3. **Sounds All Around** (Let's-Read-and-Find-Out …› Wendy Pfeffer
4. **Light** (Energy in Action)› Ian F. Mahaney

Earth Systems

4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

- Use evidence to construct an explanation that some rocks and minerals are formed from the remains of organisms.
- Identify the process for how fossils are formed in sedimentary rock.
- Identify the three types of rocks (sedimentary, metamorphic, and igneous) and evaluate samples to identify which type that sample is.
- Identify what tree rings and ice cores are

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation

- The History of Planet Earth. Earth has changed over time. Understanding how landforms develop, are weathered (broken down into smaller pieces), and erode (get transported elsewhere) can help to infer the history of the current landscape.
- Earth Materials and Systems. Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-a),(4-ESS2-b),(secondary to 4-ESS1-a)
- The Roles of Water in Earth's Surface Processes. The downhill movement of water as it flows to the ocean shapes the appearance of the land.
- Biogeology. Living things affect the physical characteristics of their regions (e.g., plants' roots hold soil in place, beaver shelters and human-built dams alter the flow of water, and plants' respiration affects the air). Many types of rocks and minerals are formed from the remains of organisms or are altered by their activities.
- Earth has changed over time. Understanding how landforms develop, are weathered (broken down into smaller pieces), and erode (get transported elsewhere) can help to infer the history of the current landscape.
- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are

often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features where people live and in other areas of Earth.

4-ESS3-a Construct a model using abstract representations and examples to describe differences between renewable and non-renewable sources of energy.

- Use evidence to construct an explanation that some rocks and minerals are formed from the remains of organisms.
- Use evidence to construct explanations for how environments today may be different from past environments in which fossilized organisms once lived.
- Identify types of renewable and nonrenewable fuels (biodiesel, ethanol, oil, etc)

4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

- Obtain information about the locations of a variety of Earth's features and map the geographic patterns that emerge.
- Identify and map the following: Patterns of rock formations, locations of volcanoes and earthquake faults, movement of Earth's plates.
- Analyze maps and other data to determine the likelihood of geological hazards occurring in an area and evaluate the possible effects on landforms and organisms.
- Define the types of hazards: tsunami, earthquakes, volcanoes, etc.

Essential Vocabulary

Testable question, Erosion, Investigations, Document, Patterns, Ice cores, Tree rings, Evidence, Physical characteristics, Weathering, Erosion, Construct, Minerals, Rocks, Fossil record, Construct, Environments, Organisms, Geographic patterns, Analyze, Geological hazards, Evaluate, Landforms, Construct, Fossils, Similarities, Differences, Particles, Sediments, Plate tectonics, Market research, Field observations

Websites

http://www.neok12.com/Earth.htm

http://www.learningscience.org/esc2astructureearthsystem.htm

http://www.kidsgeo.com/index.php

http://www.kidsgeo.com/geology-for-kids/0043-plate-tectonics.php

Molecules to Organisms

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

- Function of organs
- Identify and label structures of plants and animals using models
- Identify similar/different structures of different animals (humans vs. birds, etc)
- Identify circulatory, muscular, reproduction, digestive, skeletal, nervous systems
- Identify senses used for survival. How systems interact within each other.

4-LS1-2. Use a model to describe that animals' receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

- Identify examples of sensory receptors: eyes, nose, brain, foot pads, ears, nerves, tongue (taste buds), hair, fur, skin, whiskers.

Essential Vocabulary

Survival, Behavior, Growth, Reproduction, Internal/ external, Thorns, Stems, Roots, Stamen, Ovaries, Heart, Skin, Bones, Organs, Mobility, Animal sense, Environment, Sensory receptors, Perception, Instinctive, Life cycles, Growth Development, Death, Flowering plants, Off spring

Websites

1. www.faculty.washington.edu/chadler/amaze.html
2. Search for Your Favorite **Animals** -- National Geographic **Kids**

kids.nationalgeographic.com/**kids**/**animals**/creaturefeature/

Browse **animals** by species or habitat to access National Geographic **Kids**' in- depth Creature Features, including amazing photo and video footage.

3. I'm a Survivor: **Structures** and Functions of **Animal** and Plant **Survival**

www.orgs.ttu.edu/nsta/handouts/PlantAnd**Animal**Adaptations.pdf

File Format: PDF/Adobe Acrobat - Quick View
functions in a variety of both plants and **animals**. It is important that students are able to identify how these **structures** and functions help the organism **survive**.

4. Nature Works: Videos covering animal adaptations, plant adaptations, animal senses, etc; and activities following to design and create a new animal with specific adaptations.
http://www.nhptv.org/natureworks/nwep.htm

Books:

Animal Senses by Pamela Hickman

The Plant Hunters- by Anita Silvey

Track That Scat! By Lisa Morlock

Biomimicry: Inventions Inspired by Nature by Dora Lee

Pierre the Penguin by Jean Marzolic