

Making a Treehouse Webpage and the Arizona State Science Standards for High School Students

Summary:

- Building treehouses *meets or could meet many* standards from Standard 1: Science as inquiry
- Building treehouses *could meet some* standards from Standard 2: History and nature of science
- Building treehouses *could meet many* standards from Standard 3: Personal and social perspectives in science and technology
- Building treehouses *meets or could meet some* standards from Standard 4: Life science
- Building treehouses *could meet some* standards from Standard 6: Earth and space science

Use the following key to see how conducting an investigation and documenting results in a treehouse webpage meets standards:

KEY:

- * Definitely meets this specific standard
- # Could meet standard depending upon research problem
 - Not directly addressed by treehouse building

Standard 1: Science As Inquiry

Students understand and use the processes of scientific investigation and scientific ways of knowing. They are able to design, conduct, describe and evaluate these investigations. They are able to understand and apply concepts that unify scientific disciplines.

PROFICIENCY - (Grades 9-12)

- * **1SC-P1. Propose solutions to practical and theoretical problems by synthesizing and evaluating information gained from scientific investigations**

PO 1. Evaluate scientific information for relevance to a given problem

PO 2. Propose solutions to a problem, based on information gained from scientific investigations

- # **1SC-P2. Compare observations of the real world to observations of a constructed model (e.g., an aquarium, a terrarium, a volcano)**

PO 1. Assess the capability of a model to represent a "real world" scenario

- **1SC-P3. Analyze and evaluate reports of scientific studies**

- PO 1. Analyze reports of scientific studies for elements of experimental design
- PO 2. Compare conclusions to original hypotheses
- PO 3. Evaluate validity of conclusions

*** 1SC-P4. Create and defend a written plan of action for a scientific investigation**

- PO 1. Design an appropriate protocol (written plan of action) for the investigation of a scientific problem
- PO 2. Justify the protocol in terms of the elements of experimental design

1SC-P5. Apply the concepts of equilibrium, form and function to a variety of phenomena

- PO 1. Predict the effects of various factors on the equilibrium of a system
- PO 2. Explain how the relationships between form and function are evident in natural and designed systems
- PO 3. Describe how present form and function of an object, organism or system could have evolved from prior form and function

*** 1SC-P6. Identify and refine a researchable question, conduct the experiment, collect and analyze data, share and discuss findings**

- PO 1. Construct a researchable question
- PO 2. Employ a research design that incorporates a scientific method to carry out an experiment
- PO 3. Analyze experimental data
- PO 4. Communicate experimental findings to others

DISTINCTION (Honors)

Students know and are able to do all of the above and the following:

1SC-D1. Design and complete an advanced scientific investigation, either individually or as part of a team, and formally report results to peers, teachers and others

- **1SC-D2. Apply the concepts of emergent properties, feedback, subsystems, equilibria, and unpredictability to a complex system (e.g., weather, the brain)**

1SC-D3. Interview science professionals (e.g., scientists, philosophers of science) to understand how they view science and formally report results to peers, teachers and others

Standard 2: History and Nature of Science

Students understand the nature of scientific ways of thinking. Students understand that scientific investigation grows from the contributions of many people.

PROFICIENCY (Grades 9-12)

- **2SC-P1. Identify and describe key factors (e.g., technology, competitiveness, world events, personalities, societal views) that affect the development and acceptance of scientific thought**

PO 1. Define key factors that affect the development of scientific thought
PO 2. Describe how different key factors affect the development and acceptance of scientific thought

- **2SC-P2. Explain how scientific innovations can challenge accepted ideas**

PO 1. Describe how an accepted idea could be challenged by scientific innovation

- **2SC-P3. Explain the impact on society of major scientific developments (e.g., germ theory, molecular biology, relativity)**

PO 1. Describe the benefits, limitations, and consequences of major scientific developments in pure and applied science

PO 2. Explain how major scientific developments in pure and applied science have affected, or could affect, society

- # **2SC-P4. Trace the development and consequences of an invention, theory or discovery to demonstrate the dynamic nature of science**

PO 1. Trace the development of a selected invention, theory or discovery from its inception to modern day

PO 2. Explain the progression of changes in the invention, theory or discovery

PO 3. Describe the impact of the invention, theory or discovery on further scientific thought

- **2SC-P5. Explain how theory, law and fact are developed in science to answer a specific question**

PO 1. Define theory, law and fact

PO 2. Describe the relationships among theories, laws and facts

PO 3. Explain how theories, laws and facts are used to answer specific questions

- **2SC-P6. Analyze evidence that supports past and current scientific theories about a specific topic**

PO 1. Distinguish between evidence which supports a given scientific theory (e.g., model of the atom, plate tectonics, natural selection) and evidence which does not support the theory

DISTINCTION (Honors)

- **2SC-D1. Conduct a detailed case study of the societal response to a major scientific finding or theory (e.g., theories of Einstein, Galileo, Copernicus)**

Standard 3: Personal and Social Perspectives in Science And Technology

Students understand the impact of science on human activity and the environment and are proficient in the uses of technology as they relate to science.

PROFICIENCY (Grades 9-12)

- # **3SC-P1. Apply scientific thought processes and procedures to personal and social issues**

PO 1. Apply scientific thought processes of skepticism, empiricism, objectivity and logic to seek a solution to personal and social issues

PO 2. Apply a scientific method to the solution of personal and social issues

3SC-P2. Propose and test, using computer software or common materials, a solution to an existing problem; or design a product to meet a need, using a model or simulation

PO 1. Describe a problem or need

PO 2. Propose a solution to the problem or design a product to meet the need

PO 3. Design a method of testing the solution or design a model or simulation to test the product

PO 4. Carry out the test of the solution or product

PO 5. Evaluate the test results

• 3SC-P3. Compare and contrast the goals of science and technology

PO 1. Define the goals of science and the goals of technology

PO 2. Compare the goals of science and the goals of technology

PO 3. Describe the impact of technology on the life, physical, earth and space sciences

3SC-P4. Identify and describe the basic processes of the natural ecosystems and how these processes affect, and are affected by, humans

PO 1. Describe the basic processes of the natural ecosystems (e.g., water cycle, nutrient cycles)

PO 2. Explain how these processes affect, and are affected by, humans

3SC-P5. Describe and explain factors that affect population size and growth (e.g., birth and death rates, quality of environment, disease, education)

PO 1. Describe biotic and abiotic factors that affect populations

PO 2. Predict the effect of a change in a specific factor on a population

DISTINCTION (Honors)

3SC-D1. Explore the scientific and technological aspects of contemporary problems; analyze and evaluate proposed solutions

Standard 4: Life Science

Students understand the characteristics of living things, the diversity of life and how organisms change over time in terms of biological adaptation and genetics. Students understand the interrelationships of matter and energy in living organisms and the interactions of living organisms with their environment.

PROFICIENCY (Grades 9-12)

*** 4SC-P1. Use and construct a variety of classification systems, including evolutionary relationships.**

PO 1. Employ classification systems to identify organisms

PO 2. Create classification systems to identify organisms

PO 3. Use a biological classification scheme to infer and discuss the degree of divergence of various species from prior organisms

4SC-P2. Describe the molecular basis of heredity (e.g., DNA, genes, chromosomes and mutations)

PO 1. Explain the relationships among DNA, genes and chromosomes

PO 2. Describe the structure and function of DNA and its role in heredity

PO 3. Describe how the various types of mutations may act as a source of genetic diversity

PO 4. Describe how genetic information is transmitted from parents to offspring

• 4SC-P3. Describe the basic cellular processes of photosynthesis, respiration, protein synthesis and cell division

PO 1. Differentiate between the processes of photosynthesis and respiration in terms of energy flow, reactants and products

PO 2. Describe the process of protein synthesis

PO 3. Compare the purpose and process of mitosis with the purpose and process of meiosis

• 4SC-P4. Describe and explain the cycling of matter and the flow of energy through the ecosystem's living and non-living components

PO 1. Explain the relationships among abiotic and biotic components of an ecosystem in terms of energy flow and the cycling of matter

• 4SC-P5. Describe and explain how energy is used in the maintenance, repair, growth and development of cells

PO 1. Describe the energy demands required by physiological mechanisms needed to regulate homeostasis

PO 2. Describe the energy demands required by cells for growth, development and repair

4SC-P6. Describe and explain how the environment can affect the number of species and the diversity of species in an environment

PO 1. Explain how the adaptations of various species are related to their success in an ecosystem

PO 2. Explain why genetic variation within a population can impact the success of a species subjected to new environmental conditions

PO 3. Predict how a change in an environmental factor can affect the number of organisms in a population

PO 4. Predict how a change in an environmental factor can affect the biodiversity in an ecosystem

4SC-P7. Describe the role of the systems (e.g., nervous, digestive, respiratory) that regulate the behaviors of multi-celled organisms

PO 1. Describe the physiological relationship of the systems and their function in homeostasis

PO 2. Describe an organism's behavioral responses to internal and external stimuli

PO 3. Compare the selective advantage of several behavioral responses

- **4SC-P8. Explain how evolution provides a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms.**

PO 1. Using fossil records, trace the changes in number and type of organisms over time

PO 2. Compare the fossil record of one ancient organism to the modern form of that organism (e.g. ammonite to nautilus, eohippus to horse) identifying molecular and/or structural similarities

- **4SC-P9. Use scientific evidence to demonstrate that descent from common ancestors produced today's diversity of organisms over more than 3.5 billion years of evolution.**

PO 1. Using scientific evidence, (e.g., the fossil record, homologous structures, embryological development or biochemical similarities) illustrate that descent from common ancestors produced today's diversity of organisms

- **4SC-P10. Demonstrate an understanding of the theory of evolution by natural selection as a consequence of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection by the environment of those offspring better able to survive and leave offspring**

PO 1. Identify the components of natural selection

PO 2. Predict the success or failure of a population of organisms over time when exposed to changing environmental factors

PO 3. Predict the success or failure of a population of organisms over time based on the genetic variability of offspring and ability to reproduce

DISTINCTION (Honors)

- **4SC-D1. Analyze the general structure and function of DNA and its role in heredity, protein synthesis, and disease as a vehicle for genetic continuity and as a source of genetic diversity upon which natural selection can act**
- **4SC-D2. Explain the role of exposure to certain factors (e.g., sunlight, ozone, nitrates) that may increase the rate of mutation, the incidence of cancer and other diseases, or the opportunities for other adaptations**

Standard 6: Earth And Space Science

Students understand the composition, formative processes, and history of the earth, the solar system and the universe.

PROFICIENCY (Grades 9-12)

- # **6SC-P1. Explain prominent scientific theories of the origin of: the universe (Big Bang Theory), the solar system (formation from a nebular cloud of dust and gas), and life forms (evolution)**

PO 1. Describe the processes explained by prominent scientific theories of the origin of the universe

PO 2. Describe the processes explained by prominent scientific theories of the origin of the solar

system

PO 3. Describe the processes explained by prominent scientific theories of the origin of life forms

PO 4. Relate physical laws to processes explained by prominent scientific theories of the origin of the universe, solar system, and life forms

- **6SC-P2. Demonstrate an understanding of the earth's tilt, rotation and revolution and their effects on the seasons and the length of days**

PO 1. Describe how the earth's rotation causes day and night

PO 2. Describe how the earth's tilt on its axis and revolution around the sun cause changes in relative length of days and nights

PO 3. Describe how the earth's tilt on its axis and revolution around the sun cause changes in seasons

PO 4. Describe the flow of energy to and from the earth based on its shape, tilt, rotation and revolution

- **6SC-P3. Use the theory of plate tectonics to explain relationships among earthquakes, volcanoes, mid-oceanic ridges and deep sea trenches**

PO 1. Describe the relationship between the earth's internal heat and plate tectonics

PO 2. Describe the relationships among earthquakes, volcanoes, mid-oceanic ridges, deep sea trenches and tectonic plates

- **6SC-P4. Use evidence (e.g., fossils, rock layers, ice cores, radiometric dating) to investigate how earth has changed or remained constant over short and long periods of time**

PO 1. Provide evidence for changes in earth's geologic history, using data from relative age-dating techniques

PO 2. Provide evidence for changes in earth's geologic history, using data from absolute age-dating techniques

PO 3. Describe changes or relative constancy in earth's geologic history, using evidence gained through geologic dating techniques

- **6SC-P5. Identify, investigate and predict the factors that influence the quality of water and how it can be reused, recycled and conserved**

PO 1. Describe the properties of water that make water a unique and essential substance

PO 2. Describe factors that impact water quality

PO 3. Describe factors that influence the reuse, recycling and conservation of water

PO 4. Predict future trends in water quality control and conservation, based on factors that influence water quality and usage

- **6SC-P6. Identify and compare the interactions between water and other earth systems including the biosphere, lithosphere and atmosphere**

PO 1. Describe the processes involved in the water cycle

PO 2. Describe the interactions between water and the biosphere

PO 3. Describe the interactions between water and the lithosphere

PO 4. Describe the interactions between water and the atmosphere

PO 5. Compare the interactions between water and earth systems

- **6SC-P7. Investigate, analyze and evaluate the factors that may influence weather; describe their effects on the environment and daily activities on earth**

PO 1. Analyze how weather and climate are influenced by heat transferred from the sun to the earth

PO 2. Analyze how weather is influenced by both natural and artificial earth features (e.g., mountain ranges, cities, bodies of water)

PO 3. Analyze how weather is influenced by both natural and artificial dynamic processes (e.g., sunspots, volcanoes, pollution, air and ocean currents)

PO 4. Evaluate the effects of various weather factors on the environment and daily activities on earth

DISTINCTION (Honors)

- **6SC-D1. Identify and predict natural hazards, using historical data**
- # **6SC-D2. Analyze and evaluate prominent scientific theories of the origin of the universe**
- **6SC-D3. Explain the geochemical cycle through the movement of matter as it exists in different chemical reservoirs**