

Foundations of Science Literacy

History of Science and Impacts on Society **FSL.1**

Conceptual Understanding: The history of science is a compilation of the works of many people. To understand science and its applications, the history of scientific experiments and developments must be understood. The needs of society have been the driving force behind numerous advances in science and technology. Advances in science and technology have changed forever and will continue to change society.

- A** Students will relate the importance of significant historical experiments and their impact on research and development. **FSL.1A**
- 1** Trace and model the historical development of scientific ideas and theories (e.g., atomic theory, plate tectonics, evolution, genetics, discovery of cells) through the development of a timeline. **FSL.1A.1**
 - 2** Research, analyze, explain, and communicate how scientific enterprise relates to society and classic inventions (e.g., microscope, telescope, computer, and telephone). **FSL.1A.2**
 - 3** Identify and communicate the impact of mathematics and technology in the development of scientific thought and the practice of science (e.g., space exploration, the human genome project, and ocean exploration). **FSL.1A.3**
 - 4** Enrichment: Research, analyze, explain, and communicate the influence of society, including cultural components, on the direction and progress of science and technology (e.g., medical treatments, antibiotic resistance, alternative energy development, and biomimicry). **FSL.1A.4**

Nature of Technology and Engineering **FSL.2**

Conceptual Understanding: Societal demands influence the need for engineering design and technology. The goal of engineering is to design and manufacture useful devices or materials (technologies) to meet societal demands. Global challenges such as climate change, medical treatments, space exploration, food supply, and clean water drive engineering design and technology development to solve societal needs and wants. Engineering practices are critical to undertaking the world's challenges. Exposure to engineering activities sparks interest in the study of science, technology, engineering, and mathematics careers.

- A** Students will identify, research, and communicate the development of technology and engineering practices. **FSL.2A**
- 1** Research and present a technology that was developed through engineering design. Identify its purpose, how it has advanced through alterations in design (e.g., systems that provide homes and businesses with utilities, parking structures, park and recreational structures, and traffic flow), and careers related to its use). **FSL.2A.1**
 - 2** Use an engineering design process to identify a problem within the local community and propose and develop a possible solution to that problem.
* **FSL.2A.2**
 - 3** Enrichment: Use a computer simulation to model the impact of proposed solutions on a complex, real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
* **FSL.2A.3**
-

Nature of Science **FSL.3**

Conceptual Understanding: Science is characterized by the systematic gathering of information through various forms of direct and indirect observations, and the testing of this information by methods including, but not limited to, experimentation. By formulating their own questions, planning, and conducting investigations, learners build new meaning, understanding, and knowledge of science. This helps develop their critical thinking, reasoning and decision-making skills that will serve a learner for a lifetime.

- A** Students will apply science and engineering practices and skills to scientific investigations. **FSL.3A**
- 1** Ask questions and conduct research to generate a hypothesis, determine independent/dependent variables, and appropriate controls for scientific investigations and experiments. **FSL.3A.1**
 - 2** Analyze data from simple experiments and construct organized models (e.g., data tables, graphs) detailing results from the experiments. **FSL.3A.2**
 - 3** Demonstrate the proper use of safety procedures and scientific laboratory equipment. Select and use appropriate tools and instruments to collect qualitative and quantitative data. **FSL.3A.3**
 - 4** Use mathematical and computational thinking to (1) use and manipulate appropriate metric units, (2) express relationships between variables for investigations, and (3) compare or combine data from two or more simple data presentations (e.g., order or sum data from a table, categorize data from a table using a scale from another table). **FSL.3A.4**
 - 5** Analyze data sets from experiments for patterns and trends and identify any weaknesses in the experimental designs. **FSL.3A.5**
-

Conceptual Understanding: Scientists interpret tables, graphs, and diagrams to locate data, examine relationships in the data, and extend those relationships beyond the data. Students should analyze scientific investigations and data presented in passages like those found in the science section of the ACT (e.g., Data Representation, Research Summaries, and Conflicting Viewpoint passages).

B Students will apply scientific literacy and thinking skills to analyze and interpret data found in various graphics including, but not limited to, those found in sample ACT science passages. **FSL.3B**

- 1** Analyze select data from a simple and complex data presentation (e.g., charts, graphs, diagrams). **FSL.3B.1**
- 2** Compare or combine data from two or more simple data presentations (e.g., order or sum data from a table, categorize data from a table using a scale from another table, relationships between data sets). **FSL.3B.2**
- 3** Translate information into a table, graph, or diagram. Determine patterns, trends, and relationships as the values of variables change. **FSL.3B.3**
- 4** Perform a simple interpolation or simple extrapolation using data in a table or graph. Determine and/or use a simple (e.g., linear) mathematical relationship that exists between data. **FSL.3B.4**
- 5** Analyze presented information when given new information (e.g., given a new scenario, how would a given scenario be changed). **FSL.3B.5**

Conceptual Understanding: Scientists understand experimental design and procedures, compare designs and procedures across experiments, and understand how changes in design and procedures affect experimental results. Students should analyze scientific investigations and data presented in passages like those found in the science section of the ACT (e.g., Data Representation, Research Summaries, and Conflicting Viewpoint passages) to understand experimental designs and procedures.

C Students will apply scientific literacy and thinking skills to analyze scientific investigations found in various experimental designs including, but not limited to, those found in sample ACT science passages. **FSL.3C**

- 1** Analyze the methods and choice of tools used in simple and complex experimental designs. **FSL.3C.1**
- 2** Determine the validity of scientific questions (e.g., hypothesis) and variables for complex experimental designs. **FSL.3C.2**
- 3** Select and describe an alternate method for testing a hypothesis. **FSL.3C.3**
- 4** Predict how modifying the experimental design or adding another measurement in an experimental design will affect results of the experiment. **FSL.3C.4**
- 5** Determine which additional trials could be performed in an investigation to enhance the results of an experimental design. **FSL.3C.5**

Conceptual Understanding: Scientists evaluate multiple explanations for the same phenomena to determine their differences, similarities, strengths, and weaknesses, and they evaluate the validity of conclusions based on experimental results. Students should analyze scientific investigations and data presented in passages like those found in the science section of the ACT (e.g., Data Representation, Research Summaries, and Conflicting Viewpoint passages) to evaluate scientific explanations.

- D** Students will apply scientific literacy and thinking skills to evaluate theoretical models, inferences, and experimental results found in various experimental designs including, but not limited to, those found in sample ACT science passages. **FSL.3D**
- 1** Select the hypothesis, prediction, or conclusion that is, or is not, supported by data presentation or pieces of informational text. **FSL.3D.1**
 - 2** Determine whether given information supports or contradicts a hypothesis or conclusion and provide support for the reasoning. **FSL.3D.2**
 - 3** Analyze and interpret data from informational texts and data to (1) reveal patterns and construct meaning (2) support or refute hypotheses, explanations, claims, designs, or (3) evaluate the strength of conclusions. **FSL.3D.3**
 - 4** Use new information to make a prediction based on a theoretical model. **FSL.3D.4**
 - 5** Select and explain why a hypothesis, prediction, or conclusion is, or is not, supported by two or more data presentations or theoretical models. **FSL.3D.5**