

Learner Outcomes

Numbers in parentheses indicate standard-benchmark-grade-indicator from the Ohio Department of Education Academic Content Standards K-12.

Subunit 1: Discovery and Theories

- Students will state the significant contributions made to the atomic theory by each scientist. [*Memory/Recall*]
- Students will describe the atomic theory and model proposed by each atomic theorist. [*Memory/ Recall*]
- Students will create and present iMovie presentations detailing the timeline of atomic theory study. [*Synthesis*]
- Students will demonstrate that electromagnetic radiation is a form of energy (PS-G-9-18) [*Application*]
- Students will recognize that light acts as a wave. (PS-G-9-18) [*Comprehension*]
- Students will show that light is part of the electromagnetic spectrum (i.e. radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays). (PS-G-9-18) [*Comprehension*]
- Students will define concepts of wavelength and frequency in their own words. [*Comprehension*]
- Students will calculate wavelength and frequency then identify the type of electromagnetic radiation given specific values. [*Analysis*]
- Students will use historical examples to explain how new ideas are often initially rejected by the scientific establishment. (PS-H-9-26) [*Comprehension*]
- Students will use historical examples to explain how new ideas sometimes spring from unexpected findings. (PS-H-9-26) [*Analysis*]
- Students will use historical examples to explain how new ideas usually grow slowly through contributions from many investigators. (PS-H-9-26) [*Analysis*]

- Students will explain why a design should be continually assessed and the ideas of the design should be tested, adapted and refined. (ST-A-9-3) [*Evaluation*]
- Students will cite examples of ways that scientific inquiry is driven by the desire to understand the natural world and how technology is driven by the need to meet human needs and solve human problems. (ST-B-10-1) [*Memory/Recall*]
- Students will develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology. (SI-A-9-5) [*Analysis/Synthesis*]
- Students will present scientific findings using clear language, accurate data, appropriate graphs, tables, maps, and available technology. (SI-A-10-2) [*Analysis/Synthesis*]
- Students will explain how new scientific data can cause any existing scientific explanation to be supported, revised or rejected (SI-A-10-5) [*Application*]
- Students will comprehend that many scientific investigations require the contributions of women and men from different disciplines in and out of science. These people study different topics, use different techniques and have different standards of evidence but share a common purpose – to better understand a portion of our universe. (SWK-A-9-1) [*Comprehension*]
- Students will recognize that science is a systematic method of continuing investigation, based on the observation, hypothesis testing, measurement, experimentation, and theory building, which lead to more adequate explanations of natural phenomena. (SWK-A-10-3) [*Comprehension*]
- Students will justify that scientific theories are explanations of large bodies of information and/or observations that withstand repeated testing. (SWK-B-9-5). [*Comprehension*]
- Students will recognize that scientific knowledge and explanations have changed over time, almost always building on earlier knowledge. (SWK-B-9-7) [*Analysis*]
- Students will illustrate that much can be learned about the internal workings of science and the nature of science from the study of scientists, their daily work and their efforts to advance scientific knowledge in their area of study. (SWK-D-9-8) [*Application*]
- Students will investigate how the knowledge, skills and interests learned in science class apply to careers students plan to pursue. (SWK-D-9-9) & (SWK-D-10-7) [*Synthesis*]

Subunit 2: Periodic Table

- Students will recognize that all atoms of the same element contain the same number of protons. (PS-A-9-1) [*Memory/Recall*]
- Students will recognize that elements with the same number of protons may or may not have the same mass. (PS-A-9-1) [*Memory/Recall*]
- Students will recognize that the different masses for atoms of the same element are due to a varying number of neutrons. (PS-A-9-1) [*Memory/Recall*]
- Students will recognize that different masses for atoms of the same element are called isotopes. (PS-A-9-1) [*Memory/Recall*]
- Students will illustrate that atoms with the same number of positively charged protons and negatively charged electrons are electrically neutral. (PS-A-9-2) [*Comprehension*]
- Students will define atomic number. (PS-A-9-4) [*Memory/Recall*]
- Students will calculate the correct number of protons, electrons, and neutrons given an isotope symbol or name. [*Application*]
- Students will calculate the average atomic mass for an element given relative abundances and atomic masses for each of its naturally occurring isotopes. [*Application*]
- Students will show that when elements are listed in order according to the number of protons, the repeating patterns of physical and chemical properties identify families of elements. (PS-A-9-4) [*Application*]
- Students will predict the properties of one element when given the properties of another element within the same group. [*Application*]
- Students will recognize that the periodic table was formed as a result of the repeating pattern of electron configurations. (PS-A-9-4) [*Comprehension*]
- Students will define valence electrons. [*Memory/Recall*]
- Students will demonstrate how to calculate the number of valence electrons for an atom and write the correct electron dot structure for the atom. [*Application*]
- Students will describe how ions are formed when an atom or a group of atoms acquire an unbalanced charge by gaining or losing one or more electrons. (PS-A-9-5) [*Application*]

- Students will explain that the electric force between the nucleus and the electrons hold an atom together. (PS-B-9-6) *[Comprehension]*
- Students will show how atoms may be bonded together by losing, gaining, or sharing electrons. (PS-B-9-7) *[Application]*
- Students will show that in a chemical reaction, the number, type of atoms and total mass must be the same before and after the reaction. (PS-B-9-7) *[Application]*
- Students will define the Law of Conservation of Matter. *[Memory/Recall]*
- Students will write correct chemical formulas for a compound. (PS-B-9-7) *[Application]*
- Students will write balanced chemical equations. (PS-B-9-7) *[Application]*

Subunit 3: Nuclear Chemistry

- Students will describe radioactive substances as unstable nuclei that undergo random spontaneous nuclear decay emitting particles and/or high-energy wavelike radiation. (PS-F-9-3) *[Application]*
- Students will describe radioactive particles emitted during radioactive decay. *[Comprehension]*
- Students will summarize how nuclear reactions convert a small amount of matter into a large amount of energy (PS-F-9-14) *[Comprehension]*
- Students will define fission as the process that involves the splitting of a large nucleus into smaller nuclei. (PS-F-9-14) *[Memory/Recall]*
- Students will perform labs that simulate the process of controlled and uncontrolled nuclear fission and radioactive decay. *[Application & Analysis]*
- Students will define fusion as the joining of two small nuclei into a larger nucleus at extremely high energies. (PS-F-9-14) *[Memory/Recall]*
- Students will evaluate the energy policy of the United States. The students will suggest changes in terms of nuclear power based on their research. *[Evaluation]*