Grades 9–12

3.2.9-12.N Physical Science: Structure and Properties of Matter

Students who demonstrate understanding can *communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*

Clarifying Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.

Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.

Science and Engineering Practices (SEP)	Disciplinary Core Ideas (DCI)	Crosscutting Concepts (CCC)
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 9–12 builds on K–8 and progresses to evaluating the validity and reliability of the claims, methods, and designs. • Communicate scientific and technical information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	**Types of Interactions** • Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. **Structure and Properties of Matter** • The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.	**Structure and Function** • Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.

Pennsylvania Context: N/A

PA Career Ready Skills: Select expressive communication strategies specific to context.

Connections to Other Standards Content and Practices

Standard Source	Possible Connections to Other Standard(s) or Practice(s)
Agriculture (AFNR)	CS.06.01.01.a: Research and explain the foundational cycles in AFNR (e.g., water cycle, nutrient cycle, carbon cycle, etc.).
Science, Environmental Literacy and Sustainability (NAAEE)	9-12 Strand 1.G. Drawing conclusions and developing explanations: Learners propose explanations that address their initial environmental questions using quantitative and qualitative data and evidence that has been collected and analyzed.

Standard Source	Possible Connections to Other Standard(s) or Practice(s)
PA Core Standards: ELA	CC.3.5.9-10.A: Cite specific textual evidence to support analysis of science and technical texts attending to the precise details of explanations or descriptions. CC.3.5.11-12.A: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CC.3.6.9-12.B: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
PA Core Standards and Practices: Math	CC.2.1.HS.F.3: Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. CC.2.1.HS.F.4: Use units as a way to understand problems and to guide the solution of multistep problems.
PA Standards: Social Studies	N/A
Educational Technology (ISTE)	1.6. Creative Communicator: Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.
Technology and Engineering (ITEEA)	STEL-10: Assess how similarities and differences among scientific, mathematical, engineering, and technological knowledge and skills contributed to the design of a product or system.