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DEPARTMENT OF EDUCATION

PA Core Standards: Science

Introduction

The 2020–21 school year presents a unique set of opportunities and challenges due to the disruption to instruction in spring 2020 as well as the uncertainty as the school year unfolds. Educators know that every school year there are students who require support in addressing unfinished learning from prior grades; a challenge that will be felt more prominently in the 2020–21 school year. It is vitally important that educators are supported to make deliberate instructional choices that allow all students to effectively engage with grade-level work.

The most effective and equitable way to support students in their learning is to ensure that the vast majority of time is spent engaging with grade-level content and accelerating as needed. It is entirely possible to hold high expectations for all students while addressing unfinished learning in the context of grade-level work. Since time is a scarce commodity in classrooms — made more limited by anticipated closures and remote or hybrid learning models in the fall of 2020 — strategic instructional choices about which content to prioritize must be made.[1]

Assessing students at the start of the year will identify learning gaps and provide data to inform instruction. Diagnostic Assessments determine student strengths, weaknesses, knowledge, and skills. Administering diagnostic assessments permits the instructor to intervene at the point where students begin to struggle or when they are performing below grade level expectations (running record, Classroom Diagnostic Tests [CDT]). Diagnostic assessments allow teachers to adjust the curriculum to meet the unique needs of all students. While some concepts have greater emphasis in a particular year, all standards deserve a defined level of instruction. Neglecting concepts may result in learning gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade.

This guidance document is designed to identify and define areas of high-level focus in Science instruction supported by key PA Academic Standards. Note that while all standards deserve a defined level of instruction, neglecting key concepts may result in learning gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade. Not all content in a given grade is emphasized equally in the standards. Some focus areas require greater emphasis then others based on the depth of the ideas, the time taken to master, and/or their importance to the future science grade levels. More time in these areas is also necessary for students to meet the Standards for Inquiry and Design and Unifying Themes.

[1] Adapted from 2020–21 Priority Instructional Content in English Language Arts/literacy and Mathematics, Student Achievement Partners/Achieve the Core. May 2020

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GRADE 9 – 12 FOCUS OF INSTRUCTION (2020-2021)

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Focus Areas of Instruction	PA Academic Standards
Chemistry • Construct models showing that stable forms of matter are those with minimum electrical field energy. • Construct models showing that energy is needed to break bonds and overcome intermolecular forces and that energy is released when bonds form (Enthalpy, Lattice energy are beyond the Eligible Content). • Use the atomic model and the periodic table to predict and explain trends in properties of elements. • Develop a model showing the likely position of electrons as determined by the quantized energy levels of atoms. • Develop explanations and/or mathematical expressions comparing solutions made from ionic and covalent solutes and how various factors affect the solubility of these solutions. • Analyze and interpret data to apply the laws of definite proportions and multiple proportions, to determine empirical and molecular formulas of compounds, percent composition and mass of elements in a compound. • Utilize mathematical relationships to predict changes in the number of particles (moles), the temperature, the pressure, and the volume in a gaseous system. • Use models to understand the effect of concentration, temperature, and surface area on frequency of collisions and subsequently rate. Describe the function of catalysts. • Develop and use models to explain that atoms (and therefore mass) are conserved during a chemical reaction. Models can include computer models, ball and stick models, and drawings. • Develop a model for chemical systems to support/predict changes in reaction conditions limited to simple equilibrium reactions. • Use system models (computers or drawings) to construct molecular-level explanations to predict the behavior of systems where a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. • Construct models to explain changes in nuclei during the processes of fission, fusion, and radioactive decay and the subatomic interactions that determine nuclear stability. • Using models, differentiate between acid and bases and acid-base systems. Determine neutralization point of a reaction. Determine pH of a solution. Show understanding of log scale.	**3.1.10.B** *Describe concepts of models as a way to predict and understand science and technology.* **3.1.10.C** *Apply patterns as repeated processes or recurring elements in science and technology.* **3.2.10.B** *Apply process knowledge and organize scientific and technological phenomena in varied ways.* **3.2.12.D** *Analyze and use the technological design process to solve problems.* **3.4.10.A** *Explain concepts about the structure and properties of matter.* **3.4.10.B** *Analyze energy sources and transfers of heat.* **3.4.10.D** *Explain essential ideas about the composition and structure of the universe* **3.4.12.A** *Apply concepts about the structure and properties of matter.* **3.4.12.D** *Analyze scale as a way of relating concepts and ideas to one another by some measure.*