Ohio Science

Physical Geology Content Elaborations: Grades 9-12

Adopted 2018

Physical Geology

Minerals

1. Students understand that this topic incorporates knowledge of mineral properties and crystalline structures (chemical compositions and bonding) included in the chemistry sections of other high school courses. PG.M.1.1
2. Students understand that the emphasis in this course is to relate the chemical and physical components of minerals to the properties of the minerals. PG.M.1.2
    a. Students also understand that this requires extensive mineral testing, investigations, experimentation, observation, use of technology and models/modeling. PG.M.1.2.A
3. Students understand that the focus is on learning the ways to research, test and evaluate minerals, not in memorization of mineral names or types. PG.M.1.3
4. Students understand that properties such as cleavage and hardness are connected to the chemical structure and bonding of the mineral. PG.M.1.4
5. Students understand that in addition, the environment in which minerals form should be part of the classification of the mineral, using mineral data to help interpret the environmental conditions that existed during the formation of the mineral. PG.M.1.5

Igneous, Metamorphic And Sedimentary Rocks

1. Students understand that rocks and minerals are tested and classified. PG.IMS.1.1
2. Students understand that in this course, geologic, topographic, seismic and aerial maps are used to locate and recognize igneous, metamorphic and sedimentary structures and features. PG.IMS.1.2
3. Students understand that technological advances permit the investigation of intrusive structures and the interior of Earth. PG.IMS.1.3
4. Students understand that connections between the minerals present within each type of rock and the environment formed are important. PG.IMS.1.4
5. Students understand that the processes and environmental conditions that lead to fossil fuel formation (Note: this links to the energy resources section below) includes the fossil fuels found in Ohio, nationally and globally. PG.IMS.1.5
6. Students understand that Bowen's Reaction Series is used to develop an understanding of the relationship of cooling temperature, formation of specific igneous minerals and the resulting igneous environment. PG.IMS.1.6
7. Students understand that virtual demonstrations and simulations of cooling magma and crystallization of the igneous minerals found on the series can be helpful in conceptualizing the chart. PG.IMS.1.7
8. Students understand that the magnetic properties of Earth are examined through the study of real data and evidence. PG.IMS.1.8
9. Students understand that the relationship of polar changes, magnetic striping, grid north, true north and the North Pole are included in the study of Earth's magnetic properties. PG.IMS.1.9
10. Students understand that features found in the ocean include all types of environments (igneous, metamorphic or sedimentary). PG.IMS.1.10
11. Students understand that using models (3-D or virtual) with real-time data to simulate waves, tides, currents, feature formation and changing sea levels to explore and investigate the ocean fully is recommended. PG.IMS.1.11
12. Students understand that interpreting sections of the geologic record to determine sea level changes and depositional environments, including relative age, is also recommended. PG.IMS.1.12
13. Students understand that technological advances can be used to observe and record the physical features of the Earth, including the ocean floor. PG.IMS.1.13
14. Students understand that interpreting geologic history using maps of local cross-sections of bedrock can be related to the geologic history of Ohio, the United States and Earth. PG.IMS.1.14

Earth's History

1. Students understand that in the Earth and Space Science strand, sedimentary, igneous and metamorphic rocks are introduced. PG.EH.1.1
2. Students understand that rocks and minerals are tested and classified. PG.EH.1.2
3. Students understand that plate tectonics, seismic waves and the structure of Earth are studied and the geologic record is explored (including uniformitarianism, superposition, cross-cutting relationships and the evidence of climatic variances through Earth's history). PG.EH.1.3
4. Students understand that in the Life Science strand, fossils and depositional environments are included as they relate to the documented history of life in the geologic record. PG.EH.1.4
5. Students understand that in the Physical Science strand, radiometric dating, seismic waves, thermal energy, pressure and gravity are presented. PG.EH.1.5
6. Students understand that in this course, the long-term history of Earth and the analysis of the evidence from the geologic record (including fossil evidence) are investigated. PG.EH.1.6
7. Students understand that using actual sections of the geologic record to interpret, compare and analyze can demonstrate the changes that have occurred in Ohio, in North America and globally. PG.EH.1.7
8. Students understand that the emphasis for this unit is to explore the geologic record and the immensity of the geologic record. PG.EH.1.8
9. Students understand that the analysis of data and evidence found in the variety of dating techniques (both absolute and relative), the complexity of the fossil record, and the impact that improving technology has had on the interpretation and continued updating of what is known about the history of Earth are investigated. PG.EH.1.9
10. Students understand that geologic principles are essential in developing this level of knowledge. PG.EH.1.10
    a. Students understand that these principles can be tested and experienced virtually, or through modeling, field studies, research and in-depth investigations. PG.EH.1.10.A

Plate Tectonics

1. Students understand that evidence and data analysis are key in understanding this part of the Earth system. For example, GIS/GPS and/or satellite data provide evidence for moving plates and changing landscapes (due to tectonic activity). PG.PT.1.1
2. Students understand that the causes for plate motion, the evidence of moving plates and the results of plate tectonics must be related to Earth's past, present and future. PG.PT.1.2
3. Students understand that the use of evidence to support conclusions and predictions pertaining to plate motion is an important part of this unit. PG.PT.1.3

Earth's Resources

1. Students understand that the feasibility, availability and environmental cost are included in the extraction, storage, use and disposal of both abiotic and biotic resources. PG.ER.1.1
2. Students understand that modeling (3-D or virtual), simulations and real-world data are used to investigate energy resources and exploration. PG.ER.1.2
3. Students understand that the emphasis is on current, actual data, contemporary science and technological advances in the field of energy resources. PG.ER.1.3
4. Students understand that relating Earth's resources (e.g., energy, air, water, soil) to a global scale and using technology to collect global resource data for comparative classroom study is recommended. PG.ER.1.4
5. Students understand that in addition, it is important to connect industry and the scientific community to the classroom to increase the depth of understanding. PG.ER.1.5
6. Students understand that critical thinking and problem-solving skills are important in evaluating resource use and conservation. PG.ER.1.6
7. Students understand that smaller scale investigations, such as a field study to monitor stream quality, construction mud issues, storm water management, nonpoint source contamination problems (e.g., road-salt runoff, agricultural runoff, parking lot runoff) or thermal water contamination, can be useful in developing a deeper understanding of Earth's resources. PG.ER.1.7
8. Students understand that earth systems are used to illustrate the interconnectedness of each of Earth's spheres (hydrosphere, lithosphere, atmosphere and biosphere) and the relationship between each type of Earth's resources. PG.ER.1.8

Glacial Geology

1. Students understand that an emphasis for this unit is tracing and tracking glacial history and present-day data for Ohio, the United States and globally. PG.GG.1.1
2. Students understand that scientific data found in the analysis of the geologic record, ice cores and surficial geology should be used to provide the evidence for changes that have occurred over the history of Earth and are observable in the present day. PG.GG.1.2
3. Students understand that new discoveries, mapping projects, research, contemporary science and technological advances are included in the study of glacial geology. PG.GG.1.3
4. Students understand that the focus should be on the geologic processes and the criteria for movement. PG.GG.1.4
5. Students understand that modeling and simulations (3-D or virtual) can be used to illustrate glacial movement and the resulting features. PG.GG.1.5
6. Students understand that field investigations to map and document evidence of glaciers in the local area (if applicable) or virtual investigations can help demonstrate the resulting glacial features and the impact that ice has had on the surface of Earth throughout history. PG.GG.1.6
7. Students understand that real-time data (using remote sensing, satellite, GPS/GIS, aerial photographs/maps) can help support this topic. PG.GG.1.7