

Colorado Environmental Science Course Scope and Sequence

Course Name	Geological Sciences		Course Details	Level 2 course, second course in the Geological Resources strand.	
			Course = 0.50 Carnegie Unit Credit		
Course Description	This course walks students through the basic understanding of geology, from the earth's internal structures, rock formations through meteorology, mining, fossil fuels, fracking, climate change, and energy resources in regarding to the earth's resources, reserves, and successfully utilization of those resources through an increase in human activities and use. This course will be a prerequisite for the level 4 course of Geographic Information Systems				
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.				
SCED Identification #		Schedule calculation based on 60% of a semester instructional time. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.			
All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at https://www.cde.state.co.us/standardsandinstruction/essentialskills					
Unit Number, Title and Brief Description	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration	
Mapping	NRES.02 Recognize the importance of navigation and the variety of navigational tools.	NRES.02.01 Understand topographic maps, their features and uses.	NRES.02.01.a Describe the purpose of topographical maps. NRES.02.01.b Identify features of a topographical maps NRES.02.01.c utilize a map for a specific purpose (route an irrigation ditch, determine watershed, plot a route/migration) NRES.02.01.d Create a topographical map of your local area.		
Internal structure of the Earth	ESS.03 Develop proposed solutions to environmental issues, problems, and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry, and ecology	ESS.03.01 Apply meteorology principles to environmental service systems. RST.11-12.1 RST.11-12.2 RST.11-12.7 WHST.9-12.7	ESS.03.01.01.a Distinguish between the different components and structural layers of the earth's atmosphere. ESS.03.01.01.b Differentiate how components of the atmosphere (e.g. weather systems and pattern, structure of the atmosphere, etc) affect environmental service systems.		

		MA.HS.N.Q.A Understand the uneven distribution of resources around the earth. Understanding the life cycle components of natural resources in relation to internal structures of the earth and how they reflect positive and negative changes.	Identify and discuss the importance of the three pillars of the sustainability triangle.	
Mines, Ores, & Minerals	NRES.04 Recognize the areas of resource management and understand their importance.	NRES.04.08 Appropriately manage mining and mineral resources.	NRES.04.08.a Identify valuable minerals in your local area and around Colorado. NRES.04.08.b Distinguish methods of mineral (optional inclusion of gems) extraction and reclamation. NRES.04.08.c Analyze the impact of mineral extraction (economic and environmental) NRES.04.08.d Create a reclamation and extraction plan. Research a current problem or challenge in this unit and develop possible solutions for improvement and sustainability.	
Fossil Fuels & Hydraulic Fracturing	NRS.03 Develop plans to ensure sustainable production and processing of natural resources.	NRS.03.01 Sustainably produce, harvest, process, and use natural resources (e.g. forest products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc) RST.11-12.1 RST.11-12.2 RST.11-12.7 WHST.9-12.7 MA.HS.N.Q.A	NRS.03.01.04.a Compare and contrast the costs and benefits (e.g. impacts on environmental, economic, wildlife, etc) of fossil fuels to a local, state, and/or national economy. NRS.03.01.04.b Assess the economic impact of fossil fuel extraction in regards to the costs and benefits to a local, state, and/or national economy. NRS.03.01.04.c Evaluate methods used to extract and process fossil fuels for economic, environmental, and social sustainability. NRS.03.01.05.a Compare and contrast the costs and benefits (e.g. environmental impacts, etc) of shale oil from fracking to a local, state, and/or national economy.	

			NRS.03.01.05.b Assess the economic impact of shale oil extraction (i.e. fracking) in regards to the costs and benefits to a local, state, and/or national economy. NRS.03.01.05.c Evaluate methods used to extract and process shale oil for economic, environmental, and social sustainability.	
Geological Technologies	NRS.03 Develop plans to ensure sustainable production and processing of natural resources. NRES.02 Recognize the importance of navigation and the variety of navigational tools.	NRS.03.02 Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing, and evaluating natural resource management plans <i>RST.11-12.1</i> <i>RST.11-12.2</i> <i>RST.11-12.7</i> <i>WHST.9-10.7</i> <i>WHST.11-12.7</i> <i>MA.HS.N.Q.A</i> NRES.02.03 Describe the functionality of global positioning systems	NRS.03.02.01.a Summarize how to use maps and technologies to identify directions, land features, calculate actual distance and determine the elevation of points. NRS.03.02.01.b Apply cartographic skills, tools, and technologies (e.g. land surveys, geographic coordinate systems, etc) to locate natural resources. NRES.02.03.a Define GPS and identify equipment used in GPS. NRES.02.03.b Plot locations (way points) using GPS. NRES.02.03.c Calculate area using GPS NRES.02.03.d Utilize GPS data in wildlife management case studies. ESS.05.01.01.a Examine the importance and describe applications of surveying and mapping for environmental service systems.	
Energy Resources and impact on Climate Change	ESS.04 Demonstrate the operation of environmental service systems (e.g. pollution control, water treatment, wastewater treatment, solid waste	ESS.04.04 Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental service systems.	ESS.04.04.05.a Examine and explain how energy consumption and the carbon cycle relate to environmental monitoring.	

	management, and energy conservation) HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of the Earth's systems result in changes in climate. HS-ESS3-5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.	<i>RST.11-12.1</i> <i>RST.11-12.8</i> <i>WHST.9-10.5</i> <i>WHST.11-12.5</i> <i>WHST.9-10.7</i> <i>WHST. 11-12.7</i> <i>RST.11-12.2</i> <i>RST.11-12.9</i> <i>WHST.11-12.9</i> <i>MA.HS.N.Q.A</i>	ESS.04.04.05.b Calculate the impact of the carbon cycle imbalance (due to energy consumption) and assess how this imbalance affects environmental service systems. ESS.04.04.06.a Research and describe the purpose and applications of life cycle assessments to environmental service systems. ESS.04.04.06.b Interpret a life cycle assessment and explain how it can be utilized in environmental service systems to assess the potential ecological impact of an energy source.	
Sustainability (project-based)	ESS.05 Use tools, equipment, machinery, and technology common to tasks in environmental service systems. SS.HS.2.2 Geographic variables influence interaction of people, places, and environments. (i.e. Water pollution, air pollution, etc)	ESS.05.01. Use technological and mathematical tools to map land, facilities, and infrastructure for environmental service systems. ESS.05.02 Perform assessment of environmental conditions using equipment, machinery, and technology Understand the Sustainability Triangle Essential Question: How do Geographic variables influence interaction of people, places, and environments.	ESS.05.01.01.b Apply surveying and mapping principles to a situation involving environmental service systems and identify and explain the use of equipment for surveying and mapping. ESS.05.01.01.c Demonstrate surveying and cartographic skills to make site measurement in order to address concerns and needs within an environmental service system situation. ESS.05.02.01.a Research and summarize methods used to determine water quality (e.g. dissolved oxygen, chemical tests, macroinvertebrates, etc) and determine if a source of water has been contaminated. ESS.05.02.01.b Assess different measurements of water quality to determine their effectiveness and limitations. ESS.05.02.02.a Research and summarize methods and tools used to measure soil health and determine if an area of land has been contaminated (e.g. soil probes, core monolith, soil fertility tests, etc) ES.05.02.02.b Assess different measurements of soil quality (e.g. soil horizons, soil texture, organic	

			matter, soil respiration, etc) to determine their effectiveness and limitations. ESS.05.02.03.a Research and summarize methods and tools used to determine air quality and determine if pollution is present (e.g. CO2 probe, particulate matter sampler, etc) ESS.05.02.03.b Assess different measurements of air quality (e.g ozone, carbon monoxide, particulate matter, etc) to determine their effectiveness and limitations.	
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Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

[CO CTE Academic Standards Resources](#) (Rubrics, integration strategies, etc)

[CDE Colorado Academic Standards Online](#) (Online standards lookup tool)

Standard 1: Oral Expression and Listening

- Prepared Graduate 1: Collaborate effectively as group members or leaders who listen actively and respectfully; pose thoughtful questions, acknowledge the ideas of others; and contribute ideas to further the group's attainment of an objective.
 - Students collaborate to investigate environmental service systems, conduct field assessments, analyze environmental data, and develop solutions to sustainability and resource management challenges.

Standard 2: Reading for All Purposes

- Prepared Graduate 4: Read a wide range of informational texts to build knowledge and to better understand the human experience.
 - Students analyze scientific and technical information related to climate systems, energy consumption, environmental services, sustainability, water quality, soil health, air quality, environmental assessments, and geospatial technologies to develop an understanding of geological and environmental systems.
- Prepared Graduate 5: Understand how language functions in different contexts, command a variety of word-learning strategies to assist comprehension, and make effective choices for meaning or style when writing and speaking.
 - Students develop and apply specialized vocabulary related to geology, climate science, sustainability, environmental service systems, life cycle assessments, cartography, hydrology, soil science, air quality, and environmental monitoring technologies.

Standard 3: Writing and Composition

- Prepared Graduate 7: Craft informational/explanatory texts using techniques specific to the genre.

- Students create scientific summaries, environmental assessments, research reports, sustainability analyses, and technical explanations that communicate findings related to climate systems, environmental quality, and resource management.
- Prepared Graduate 9: Demonstrate mastery of their own writing process with clear, coherent, and error-free polished products.
 - Students develop and revise scientific reports, environmental analyses, research summaries, and technical documents through planning, synthesis, and evaluation of scientific information and environmental data.

Standard 4: Research Inquiry and Design

- Prepared Graduate 10: Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.
 - Students research climate change, carbon cycle imbalances, life cycle assessments, sustainability practices, water quality, soil health, air quality, and environmental service systems by collecting, analyzing, and evaluating scientific data, environmental measurements, and geospatial information to address environmental challenges.

Note: *Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version.*