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correlated to

South Carolina
Earth Science Course Competencies & Inquiry Standards
for Grades
9–12

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OBJECTIVES	PAGE REFERENCES
I. Inquiry	
Inquiry is not an isolated unit of instruction and should be embedded throughout the content areas. The nature of science and technology is incorporated within this area.	
A. Identify Questions and Concepts that Guide Scientific Investigations.	
Experimental design should demonstrate logical connections between a knowledge base and conceptual understanding.	
1. Formulate a testable hypothesis based on literary research and previous knowledge.	SE: 11, 48, 352, 488, 642, 852, 928 TWE: 11, 48, 352, 488, 642, 852, 928
2. Identify and select experimental variables (independent and dependent) and controlled conditions.	SE: 12, 18, 121, 181, 200, 239, 350, 385, 401, 471, 486, 523, 577, 747, 843 TWE: 12, 18, 121, 181, 200, 239, 350, 385, 401, 471, 486, 523, 577, 747, 843
B. Design and Conduct Investigations	
Prior knowledge about major concepts, laboratory apparatus, laboratory techniques, and safety should be used in designing and conducting a scientific investigation.	
1. Design a scientific investigation based on the major concepts in the area being studied.	SE: 92, 378, 570, 676, 704, 798, 929 TWE: 92, 378, 570, 676, 704, 798, 929
2. Select and use appropriate instruments to make the observations necessary for the investigation, taking into consideration the limitations of the equipment.	SE: 20, 42, 70, 114, 140, 174, 204, 232, 258, 292, 406, 516, 594, 618, 826 TWE: 20, 42, 70, 114, 140, 174, 204, 232, 258, 292, 406, 516, 594, 618, 826
3. Identify technologies that could enhance the collection of data.	SE: 22, 72, 116, 324, 354, 466, 752, 854, 884 TWE: 22, 72, 116, 324, 354, 466, 752, 854, 884

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OBJECTIVES	PAGE REFERENCES
4. Select the appropriate safety equipment needed to conduct an investigation (e.g., goggles, aprons, etc.).	This objective is addressed throughout. See, for example: SE: 12–13, 20, 70, 121, 140, 174, 181, 232, 292, 329, 406, 471, 516, 523, 577, 805, 618, 826 TWE: 12–13, 20, 70, 121, 140, 174, 181, 232, 292, 329, 406, 471, 516, 523, 577, 805, 618, 826
5. Suggest safety precautions that need to be implemented for the handling of materials and equipment used in an investigation.	SE: 12–13, 20, 70, 121, 140, 174, 181, 232, 292, 406, 471, 516, 523, 577, 805, 618, 826, 910–911 TWE: 12–13, 20, 70, 121, 140, 174, 181, 232, 292, 406, 471, 516, 523, 577, 805, 618, 826, 910–911
6. Describe the proper response to emergency situations in the laboratory.	SE: 12–13, 910 TWE: 12–13, 910
7. Conduct a laboratory investigation with repeated trials and systematic manipulation of variables.	SE: 53, 121, 181, 211, 271, 299, 329, 413, 471, 495 TWE: 53, 121, 181, 211, 271, 299, 329, 413, 471, 495
8. Identify possible sources of error inherent in an experimental design.	The opportunity to address this objective is available. See the following: SE: 12, 14–16, 20–21 TWE: 12, 14–16, 20–21
9. Organize and display data in useable and efficient formats, such as tables, graphs, maps, and cross sections.	SE: 18, 88, 172, 200, 217, 253, 283, 350, 360, 486, 502, 526, 610, 665, 728, 843 TWE: 18, 88, 172, 200, 217, 253, 283, 350, 360, 486, 502, 526, 610, 665, 728, 843

OBJECTIVES	PAGE REFERENCES
10. Draw conclusions based on qualitative and quantitative data.	SE: 12, 35, 63, 110, 138, 172, 283, 423, 458, 560, 610, 665, 766 TWE: 12, 35, 63, 110, 138, 172, 283, 423, 458, 560, 610, 665, 766
11. Discuss the impact of sources of error on experimental results.	The opportunity to address this objective is available. See the following: SE: 12, 14–16, 20–21 TWE: 12, 14–16, 20–21
12. Communicate and defend the scientific thinking that resulted in conclusions.	SE: 12, 20, 70, 114, 140, 174, 232, 292, 406, 516, 618, 826 TWE: 12, 20, 70, 114, 140, 174, 232, 292, 406, 516, 618, 826
C. Use Technology and Mathematics to Improve Investigations and Communications.	
Scientific investigations can be improved through the use of technology and mathematics. While it is acknowledged that the SI system is the accepted measurement system in science, opportunities to use the English System are encouraged.	
1. Select and use appropriate technologies (e.g., computers, calculators, CBL's) to enhance the precision and accuracy of data collection, analysis, and display.	SE: 352, 488, 642, 852 TWE: 352, 488, 642, 852
2. Discriminate between data that may be valid or anomalous.	The opportunity to address this objective is available. See the following: SE: 12, 14–16, 20–21 TWE: 12, 14–16, 20–21
3. Select and use mathematical formulas and calculations to extend the usefulness of laboratory measurements.	SE: 35, 44, 94, 206, 253, 380, 542, 586, 637, 644, 665, 770, 791, 810, 843 TWE: 35, 44, 94, 206, 253, 380, 542, 586, 637, 644, 665, 770, 791, 810, 843

OBJECTIVES	PAGE REFERENCES
4. Draw a "best fit" curve through data points.	The opportunity to address this objective is available. See the following: SE: 200, 217, 253, 350, 401, 486, 843 TWE: 200, 217, 253, 350, 401, 486, 843
5. Calculate the slope of the curve and use correct units for the value of the slope for linear relationships.	The opportunity to address this objective is available. See the following: SE: 18, 35, 200, 217, 253, 283, 350, 401, 486, 843 TWE: 18, 35, 200, 217, 253, 283, 350, 401, 486, 843
6. Calculate interpolated and predict extrapolated data points.	SE: 18, 35, 172, 200, 217, 253, 283, 350, 401, 423, 486, 502, 610, 843 TWE: 18, 35, 172, 200, 217, 253, 283, 350, 401, 423, 486, 502, 610, 843
7. Perform dimensional analysis calculations.	SE: 14–15, 20–21, 931–932 TWE: 14–15, 20–21, 931–932
D. Formulate and Revise Scientific Explanations and Models Using Logic and Evidence	
Scientific explanations and models are developed and revised through discussion and debate.	
1. Construct experimental explanations or models through discussion, debate, logic, and experimental evidence.	SE: 121, 153, 181, 211, 239, 299, 329, 359, 471, 495, 523, 747, 833, 924–927, 928–932 TWE: 121, 153, 181, 211, 239, 299, 329, 359, 471, 495, 523, 747, 833, 924–927, 928–932
2. Develop explanations and models that eliminate bias and demonstrate the use of ethical principles. **(P)**	SE: 121, 153, 181, 211, 239, 299, 329, 359, 471, 495, 523, 747, 833, 924–927, 928–932 TWE: 121, 153, 181, 211, 239, 299, 329, 359, 471, 495, 523, 747, 833, 924–927, 928–932

OBJECTIVES	PAGE REFERENCES
3. Revise explanations or models after review.	SE: 121, 153, 181, 211, 239, 299, 329, 359, 471, 495, 523, 747, 833, 924–927, 928–932 TWE: 121, 153, 181, 211, 239, 299, 329, 359, 471, 495, 523, 747, 833, 924–927, 928–932
E. Recognize and Analyze Alternative Explanations and Models	
Scientific criteria are used to discriminate among plausible explanations.	
1. Compare current scientific models with experimental results.	SE: 79, 163, 211, 232, 290, 329, 376, 406, 456, 474, 495, 559, 625, 636, 768, 845 TWE: 79, 163, 211, 232, 290, 329, 376, 406, 456, 474, 495, 559, 625, 636, 768, 845
2. Select and defend, based on scientific criteria, the most plausible explanation or model.	SE: 12, 79, 163, 211, 232, 254, 290, 329, 348, 376, 394, 406, 456, 474, 495, 559, 610, 625, 636, 768, 845 TWE: 12, 79, 163, 211, 232, 254, 290, 329, 348, 376, 394, 406, 456, 474, 495, 559, 610, 625, 636, 768, 845
F. Communicate and Defend a Scientific Argument	
Experimental processes, data, and conclusions should be communicated in a clear and logical manner.	
1. Develop a set of laboratory instructions that someone else can follow.	SE: 72, 378, 570, 676, 704, 798 TWE: 72, 378, 570, 676, 704, 798
2. Develop a presentation to communicate the process and conclusion of a scientific investigation.	The opportunity to address this objective is addressed throughout. See, for example: SE: 5, 18, 77, 110, 153, 177, 271, 283, 413, 423, 523, 586, 625, 699, 711, 791, 805, 843 TWE: 5, 18, 77, 110, 153, 177, 271, 283, 413, 423, 523, 586, 625, 699, 711, 791, 805, 843

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OBJECTIVES	PAGE REFERENCES
G. Understandings about Scientific and Technological Inquiry	
Historical scientific knowledge, current research, technology, mathematics and logic should be the basis for conducting investigations and drawing conclusions.	
1. Analyze how science and technology explain and predict relationships.	
a. Defend the idea that conceptual principles and knowledge guide scientific and technological inquiry.	SE: 18, 63, 110, 172, 217, 283, 350, 423, 502, 560, 610, 665, 401, 728, 791, 843 TWE: 18, 63, 110, 172, 217, 283, 350, 423, 502, 560, 610, 665, 401, 728, 791, 843
b. Explain how historical and current scientific knowledge influences the design, interpretation, and evaluations of investigations.	
1. Discuss the reasons scientists and engineers conduct investigations.	SE: 11–13 TWE: 11–13
2. Defend the use of technology as a method for enhancing data collection, data manipulation, and advancing the fields of science and technology.	SE: 22, 72, 116, 324, 354, 466, 854 TWE: 22, 72, 116, 324, 354, 466, 854
3. Explain how mathematics is important to scientific and technological inquiry.	SE: 44, 94, 206, 380, 542, 644, 770 TWE: 44, 94, 206, 380, 542, 644, 770
4. Explain why scientific models and explanations need to be based on historical and current scientific knowledge.	SE: 5–7, 11–12, 18–19 TWE: 5–7, 11–12, 18–19
5. Understand that scientific explanations must be logical, supported by the evidence, and open to revision.	SE: 7–9, 10–13 TWE: 7–9, 10–13

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OBJECTIVES	PAGE REFERENCES
III. Earth Science	
A. Energy in the Earth System	
1. Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the Earth original formation.	
a. Describe how the decay of radioactive isotopes produces internal heat in the Earth.	SE: 578–579 TWE: 578–579
• Define and give examples of isotopes and explain their role in radioactive decay	SE: 57–58, 562 TWE: 57–58, 562
b. Describe how gravitational forces led to the production of heat in the early history of the Earth and to the differentiation of the Earth into a core, mantle, and crust.	SE: 579 TWE: 579
• Explain the physical concepts of gravitational force and heat production and relate them to the proximity of objects	SE: 579 TWE: 579
• Relate this gravitational property to the formation of the nebula cloud theory	SE: 822 TWE: 822
• Define density	SE: 15 TWE: 15
c. Give evidence that some of that heat is still escaping from the Earth's interior.	SE: 426–428, 480–487, 488–489, 570–571 TWE: 426–428, 480–487, 488–489, 570–571
• Determine the factors that are contributors to heat loss.	SE: 375–376, 426–428, 480–487, 488–489, 570–571 TWE: 375–376, 426–428, 480–487, 488–489, 570–571

OBJECTIVES	PAGE REFERENCES
• Cite specific examples of locations where heat is being released such as volcanoes and geysers.	SE: 251, 480–487 TWE: 251, 480–487
2. The outward transfer of Earth's internal heat drives convection circulation in the mantle that propels the plates comprising Earth's surface across the face of the globe.	
a. Examine how internal heat produces convection currents that are the driving force for plate tectonics.	SE: 453, 460–463 TWE: 453, 460–463
• Define and demonstrate convection currents.	SE: 460–462, 546 TWE: 460–462, 546
• Describe sea-floor spreading.	SE: 448–452, 453–454 TWE: 448–452, 453–454
• Investigate plate tectonics and the evidence that lead to current thought.	SE: 455–459, 460–463 TWE: 455–459, 460–463
b. Analyze the pros and cons of living in areas affected by natural hazards such as earthquakes, and volcanic eruptions. **(P)**	SE: 481–487, 488–489, 505–507, 511–514, 518, 548 TWE: 481–487, 488–489, 505–507, 511–514, 518, 548
• Determine and defend your position on living in naturally hazardous areas.	The opportunity to address this objective is available. See the following: SE: 481–487, 488–489, 505–507, 511–514, 518, 548 TWE: 481–487, 488–489, 505–507, 511–514, 518, 548

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OBJECTIVES	PAGE REFERENCES
3. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere. Global climate is determined by energy transfer from the sun at and near the Earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the Earth's rotation, and static conditions such as the position of mountain ranges and oceans.	
a. Analyze the effects of atmospheric convection, atmospheric dust and cloud cover, rotation of the Earth, revolution of the Earth, and tilt of the Earth's rotational axis on global climates and seasons.	SE: 361–363, 369–374, 375–377 TWE: 361–363, 369–374, 375–377
• Define convection.	SE: 277, 942 TWE: 277, 942
• Discuss the effects of atmospheric pollution on climate.	SE: 375–377 TWE: 375–377
• Determine the factors that affect seasons.	SE: 370–374 TWE: 370–374
b. Explain the factors that affect geographic variations in climate including distribution of land and water, physiographic (geologic) features, and latitude effects.	SE: 361–363, 364–368 TWE: 361–363, 364–368
• Review major geographic areas such as mountain ranges and bodies of water and their effect on climate.	SE: 361–362, 365–366 TWE: 361–362, 365–366
• Analyze the positions of land and water and determine their influence on climate.	SE: 361–362 TWE: 361–362
c. Relate the transfer of heat energy to the patterns of wind belts.	SE: 305–307 TWE: 305–307

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OBJECTIVES	PAGE REFERENCES
• Define Coriolis Effect.	SE: 305, 942 TWE: 305, 942
• Contrast the Coriolis Effect in the northern and southern hemispheres.	SE: 305 TWE: 305
• Describe the relationship between the rotation of the Earth and the pattern of wind belts.	SE: 305–307 TWE: 305–307
d. Compare and contrast the formation of high- and low-pressure systems, the formation of fronts, and the movement of weather systems across the surface of the Earth.	SE: 308–311 TWE: 308–311
• Classify high- and low-pressure systems.	SE: 310–311 TWE: 310–311
• Define and characterize types of fronts.	SE: 308–310 TWE: 308–310
e. Analyze the pros and cons of living in areas affected by natural hazards such as hurricanes, tornadoes, and other severe weather. **(P)**	SE: 324–339, 344–345 TWE: 324–339, 344–345
• Give characteristics of hurricanes, tornadoes, and other severe weather.	SE: 334–340, 341–344 TWE: 334–340, 341–344
• Differentiate hurricanes, tornadoes, and other severe weather systems.	SE: 334–340, 341–343, 344–346 TWE: 334–340, 341–343, 344–346

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OBJECTIVES	PAGE REFERENCES
4. The hydrosphere is affected by both internal and external sources of energy. Solar energy drives the hydrologic cycle and produces convection in the hydrosphere. The outward transfer of Earth's internal heat drives hydrothermal processes. (Not an NSES Standard)	
a. Describe how solar energy is transferred to ocean currents and waves.	SE: 403–405 TWE: 403–405
• Define and illustrate convection currents.	SE: 403–405 TWE: 403–405
b. Investigate and describe the formation of waves and the effects of the transfer of energy as waves interact with the shore.	SE: 399–400 TWE: 399–400
• Describe the formation of waves and the factors that affect wave size.	SE: 399–400 TWE: 399–400
• Discuss the interaction of the shore and waves.	SE: 163–165, 399–400 TWE: 163–165, 399–400
c. Evaluate the effectiveness of human interventions designed to reduce the effects of rising sea level and waves on coastal erosion.	SE: 163–165 TWE: 163–165
• Contrast the various devices used by humans in an attempt to control the sea.	The opportunity to address this objective is available. See the following: SE: 163–165 TWE: 163–165
d. Examine the influence of heat from the Earth's interior on chemosynthesis in the marine hydrosphere.	The opportunity to address this objective is available. See the following: SE: 427 TWE: 427

OBJECTIVES	PAGE REFERENCES
• Define chemosynthesis	The opportunity to address this objective is available. See the following: SE: 427 TWE: 427
• Analyze the effects of chemosynthesis on marine organisms.	The opportunity to address this objective is available. See the following: SE: 427 TWE: 427
B. Geochemical Cycles	
1. The Earth is a system containing essentially a fixed amount of each stable chemical atom, or element. Each element can exist in several different chemical reservoirs. Each element on Earth moves among reservoirs in the solid earth, oceans, atmosphere, and organisms as part of geochemical cycles.	
a. Illustrate and explain how elements, such as carbon, oxygen, and nitrogen, cycle through the atmosphere, oceans, rocks, and living organisms.	SE: 664–665 TWE: 664–665
• Review the carbon, oxygen, and nitrogen cycles.	The opportunity to address this objective is available. See the following: SE: 664–665 TWE: 664–665
b. Analyze how the use and recovery of fossil fuels impacts the environment. **(T,P)**	SE: 665–667, 686–687 TWE: 665–667, 686–687
• Define fossil fuels.	SE: 686, 944 TWE: 686, 944
• Discuss different mining techniques.	SE: 90, 586, 663, 716–717 TWE: 90, 586, 663, 716–717

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OBJECTIVES	PAGE REFERENCES
• Contrast alternative sources of energy.	SE: 690–697 TWE: 690–697
c. Evaluate the importance of limiting consumption of nonrenewable resources. **(T,P)**	SE: 698–701 TWE: 698–701
• Distinguish between nonrenewable and renewable resources.	SE: 656–657 TWE: 656–657
2. Movement of matter between reservoirs is driven by the Earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life.	
a. Describe how the Earth's internal and external energy drives the physical and chemical changes carbon undergoes as it moves through its geochemical cycle.	The opportunity to address this objective is available. See the following: SE: 664–665 TWE: 664–665
• Review the carbon cycle.	SE: 664 TWE: 664
b. Discuss how these changes affect the reservoirs.	The opportunity to address this objective is available. See the following: SE: 664–665 TWE: 664–665
• Review physical and chemical properties.	This objective falls outside the scope of Glencoe Earth Science: Geology, the Environment & the Universe.

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OBJECTIVES	PAGE REFERENCES
C. The Origin and Evolution of the Earth System	
1. Scientists theorize that the sun, the Earth, and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago. The early Earth was very different from the planet we live on today.	
a. Describe how scientists theorize that the Solar system formed from a nebular cloud of dust and gas.	SE: 793–795 TWE: 793–795
• Explain the nebular theory of the origin of the solar system.	SE: 793–794 TWE: 793–794
• Describe how the planets developed.	SE: 794–795 TWE: 794–795
• Discuss the formation of the Earth's land, atmosphere, and oceans.	SE: 576–579, 580–583, 584–588 TWE: 576–579, 580–583, 584–588
b. Describe changes in atmospheric conditions over time and infer possible causes including the greenhouse effect and ice age cycles.	SE: 375–376, 584–588 TWE: 375–376, 584–588
• Define greenhouse effect.	SE: 375–376, 945 TWE: 375–376, 945
• Explain the role volcanic eruptions, sunlight, and plants played in the formation of the Earth's atmosphere.	SE: 584–586 TWE: 584–586
• Predict the influence of human activities on the atmosphere.	SE: 294, 375–376, 665–668, 725–727 TWE: 294, 375–376, 665–668, 725–727

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OBJECTIVES	PAGE REFERENCES
2. Geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Current methods include using the known decay rates of radioactive isotopes present in the rock to measure the time since the rock was formed.	
a. Trace the historical development of relative dating using rock sequences and fossils including the contributions of Hutton (uniformitarianism) and Lyell (crosscutting relationships and inclusions). **(H,N)**	SE: 557–561, 768–769 TWE: 557–561, 768–769
• Operationally define uniformitarianism, cross-cutting relationships, intrusion, unconformities and superposition.	SE: 99, 147, 557, 561, 648, 768–769 TWE: 99, 147, 557, 561, 648, 768–769
• Define relative dating.	SE: 557–561, 768–769 TWE: 557–561, 768–769
• Differentiate between relative dating and absolute dating.	SE: 557–565, 648–649, 768–769 TWE: 557–565, 648–649, 768–769
• Define law of superposition and describe and contrast the three types of unconformities.	SE: 558–561, 648 TWE: 558–561, 648
• Discuss how geologists use rates of erosion and deposition to determine absolute age of rocks.	SE: 564–566, 648–649 TWE: 564–566, 648–649
b. Describe techniques of relative dating using rock sequences and fossils to establish a sequence of geologic events, including the age of fossils.	SE: 562–565, 566–569 TWE: 562–565, 566–569
• Define index fossil.	SE: 568, 946 TWE: 568, 946

OBJECTIVES	PAGE REFERENCES
• Describe how index fossils can be used to determine relative ages of rocks.	SE: 568 TWE: 568
• Describe the process of carbon dating.	SE: 562–563, 648–649 TWE: 562–563, 648–649
• Cite examples of the use of carbon dating.	SE: 562–563, 648–649 TWE: 562–563, 648–649
c. Describe radioactive decay as a means of dating events in the Earth's history.	SE: 562–563 TWE: 562–563
• Review radioactive decay.	SE: 562, 648 TWE: 562, 648
3. Interactions among the solid Earth, the oceans, and organisms have resulted in the ongoing evolution of the Earth system. We can observe some changes such as earthquakes and volcanic eruptions on a human time scale, but many processes such as mountain building and plate movements take place over hundreds of millions of years.	
a. Explain how scientists conclude that processes take place and change occurs, even when the change is too slow to observe directly.	SE: 426–427, 455–459, 528–529, 553–556, 570–571 TWE: 426–427, 455–459, 528–529, 553–556, 570–571
• Describe deformation and the forces that cause it to occur.	SE: 558–560 TWE: 558–560
• Review uniformitarianism.	SE: 557–558 TWE: 557–558
b. Infer from surface features shown on aerial, satellite, and topographic maps the underlying subsurface conditions resulting from past geologic events. **(T)**	SE: 33–34, 37–41, 42–43 TWE: 33–34, 37–41, 42–43

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OBJECTIVES	PAGE REFERENCES
• Demonstrate the use of topographic maps.	SE: 33–34, 42–43 TWE: 33–34, 42–43
c. Infer how interactions between the atmosphere, hydrosphere, and solid Earth result in the formation of sedimentary rocks.	SE: 121–125 TWE: 121–125
• Describe the formation of sedimentary rocks.	SE: 121–125 TWE: 121–125
• Classify sedimentary rocks.	SE: 128–132 TWE: 128–132
d. Predict changes in the Earth's surface based on past and current geologic events (e.g., earthquakes, volcanic activity, mountain building, weathering, erosions, and impact craters). **(N)**	SE: 122–123, 155–161, 162–166, 174–175, 201–202, 481–487, 495–499, 512–515, 528–539, 570–571, 754, 768–769 TWE: 122–123, 155–161, 162–166, 174–175, 201–202, 481–487, 495–499, 512–515, 528–539, 570–571, 754, 768–769
• Explain how geologists determine the history of the Appalachian Mountains.	SE: 532–534 TWE: 532–534
• Investigate the five geologic regions of South Carolina and explain their origins.	The opportunity to address this objective is available. See the following: SE: 522–539 TWE: 522–539
e. Trace the historical development of the theory of plate tectonics including the contribution of Wegener **(H,N)**	SE: 443–447, 455–459, 532, 546 TWE: 443–447, 455–459, 532, 546

OBJECTIVES	PAGE REFERENCES
• Differentiate among continental drift, paleomagnetism, and sea-floor spreading in relation to plate tectonics.	SE: 444–447, 451, 453–459, 464–465 TWE: 444–447, 451, 453–459, 464–465
4. Evidence for one-celled forms of life—the bacteria—extends back more than 3.5 billion years. The evolution of life caused dramatic changes in the composition of the Earth's atmosphere, which did not originally contain oxygen.	
a. Relate the dramatic changes in the composition of the Earth's atmosphere (introduction of oxygen) to the evolution of single-celled life forms.	SE: 585–588, 589–593 TWE: 585–588, 589–593
• List the stages in the formation of the Earth's atmosphere and the life forms that were supported at each stage.	SE: 584–588, 589–593 TWE: 584–588, 589–593
D. The Origin and Evolution of the Universe	
1. The origin of the universe remains one of the greatest questions in science. The big bang theory places the origin between 10 and 20 billion years ago, when the universe began in a hot dense state; according to this theory, the universe has been expanding ever since.	
a. Trace the historical development of scientific theories for the formation of and changes in the universe including the contributions of Copernicus, Kepler, and Galileo. **(H,N)**	SE: 755–757, 758–767, 768–773, 775–779, 791, 858 TWE: 755–757, 758–767, 768–773, 775–779, 791, 858
• Compare and contrast the contribution of early theories about the formation of the universe.	SE: 847–851 TWE: 847–851
b. Discuss the evidence for an expanding universe.	SE: 849–851 TWE: 849–851
• Define Doppler Effect.	SE: 315, 818–819 TWE: 315, 818–819

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CORRELATED TO

SOUTH CAROLINA
EARTH SCIENCE COURSE COMPETENCIES & INQUIRY STANDARDS 9–12

OBJECTIVES	PAGE REFERENCES
• Analyze the electromagnetic spectrum.	SE: 37–39, 747–748, 848 TWE: 37–39, 747–748, 848
• Relate the Doppler effect to red shift.	SE: 842–843 TWE: 842–843
c. Give examples of the technology used to provide evidence about the history and origin of the universe. **(H,N,T)**	SE: 748–751, 828, 842–843, 848, 851, 854–855 TWE: 748–751, 828, 842–843, 848, 851, 854–855
• Differentiate the tools used by scientist to explore the universe.	SE: 37–39, 748–751, 828, 842–843, 848, 851, 854–855 TWE: 37–39, 748–751, 828, 842–843, 848, 851, 854–855
2. Early in the history of the universe, matter primarily the light atoms hydrogen and helium clumped together by gravitational attraction to form countless trillions of stars. Billions of galaxies, each of which is a gravitationally bound cluster of billions of stars, now form most of the visible mass in the universe	
a. Infer how gravity and motion affect the formation of different types of galaxies.	SE: 839–842 TWE: 839–842
• Relate the theories of gravity and motion to the formation of galaxies.	SE: 837–838, 840–842 TWE: 837–838, 840–842
b. Identify the location of our Sun in the Milky Way galaxy.	SE: 833, 835 TWE: 833, 835
• Diagram the Milky Way galaxy.	SE: 833, 835–836 TWE: 833, 835–836

OBJECTIVES	PAGE REFERENCES
3. Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium. These and other processes in stars have led to the formation of all the other elements.	
a. Describe the life cycles of stars.	SE: 822–825, 859 TWE: 822–825, 859
• Define and discuss fusion and relate it to energy production in stars.	SE: 821–822 TWE: 821–822
b. Explain the formation of elements by fusion in stars and supernova explosions.	SE: 821, 825 TWE: 821, 825
• Diagram the formation of elements due to fusion.	The opportunity to address this objective is available. See the following: SE: 821 TWE: 821

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