Active Physics Correlation to South Carolina's Physics Frameworks

Module	Communication			Home			Medicine			Predictions			Sports			Transportation		
Chapter	**C1**	**C2**	**C3**	**H1**	**H2**	**H3**	**M1**	**M2**	**M3**	**P1**	**P2**	**P3**	**S1**	**S2**	**S3**	**T1**	**T2**	**T3**

Key: H=History of Science, N=Nature of Science, P=Science in Social and Personal Perspectives, T=Technology — major categories of the National Science Education Standards that have been integrated in content areas.

Note: Bold face type indicates text directly from the National Science Education Standards.

Correlation Key:

X" Coverage = Secondary concept of the activity or problem. Students gain a basic understanding or introduction of the concept.

"O" In-depth coverage = primary concept that is the focus of the activity or problem. Students gain thorough understanding of the concept.

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.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2.Identify and select experimental variables (independent and dependent) and controlled conditions.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O

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.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2.Select and use appropriate instruments to make the observations necessary for the investigation, taking into consideration the limitations of the equipment.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3. Identify technologies that could enhance the collection of data.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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4.Select the appropriate safety equipment needed to conduct an investigation (e.g., goggles, aprons, etc.).	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.Suggest safety precautions that need to be implemented for the handling of materials and equipment used in an investigation.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
6.Describe the proper response to emergency situations in the laboratory.	O	O	O	O	O	X	O	O	X	O	O	O	O	O	O	O	O	O
7. Conduct a laboratory investigation with repeated trials and systematic manipulation of variables.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
8. Identify possible sources of error inherent in an experimental design.																		
9.Organize and display data in useable and efficient formats, such as tables, graphs, maps, and cross sections.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
10.Draw conclusions based on qualitative and quantitative data.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
11.Discuss the impact of sources of error on experimental results.	X	X	X	X	X	X	X	X	X	O	O	O	X	X	X	X	X	X
12.Communicate and defend the scientific thinking that resulted in conclusions.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O

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.

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1.Select and use appropriate technologies (e.g., computers, calculators, CBL's) to enhance the precision and accuracy of data collection, analysis, and display.	X	X	X	X	O	X				X	X	X	O	X	O	O	O	O
2. Discriminate between data that may be valid or anomalous.																		
3.Select and use mathematical formulas and calculations to extend the usefulness of laboratory measurements.				O	O	O				O	O	O	O	O	O	O	O	O
4.Draw a "best fit" curve through data points.										O	O	O	O	X	O	O	O	O
5. Calculate the slope of the curve and use correct units for the value of the slope for linear relationships.													O		O	O	O	O
6. Calculate interpolated and predict extrapolated data points.													O		O	O	O	O
7. Perform dimensional analysis calculations.				O									O	O	O	O	O	O
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.										O	O	O						

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2.Develop explanations and models that eliminate bias and demonstrate the use of ethical principles. (P)										O	O	O						
3. Revise explanations or models after review.										X	X	X						
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.										O	O	O						
2.Select and defend, based on scientific criteria, the most plausible explanation or model.										O	O	O						
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.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2.Develop a presentation to communicate the process and conclusion of a scientific investigation.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
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.**																		
I. Analyze how science and technology explain and predict relationships.										O	O	O	X					
a.Defend the idea that conceptual principles and knowledge guide scientific and technological inquiry.										O	O	O						

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b.Explain how historical and current scientific knowledge influences the design, interpretation, and evaluations of investigations.										O	O	O						
1.Discuss the reasons scientists and engineers conduct investigations.																		
2.Defend the use of technology as a method for enhancing data collection, data manipulation, and advancing the fields of science and technology.											O							
3.Explain how mathematics is important to scientific and technological inquiry.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
4. Explain why scientific models and explanations need to be based on historical and current scientific knowledge.												O						
5.Understand that scientific explanations must be logical, supported by the evidence, and open to revision.	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X
(PHYSICS)																		
A. Motions and Forces																		
1. Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F=ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.																		

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a. Trace the historical development of the understanding of forces including the contributions of Galileo, Isaac Newton, Benjamin Franklin, and Charles-Augustin de Coulomb. **(H, N)**												O						
b. Predict the motion of an object in terms of Newton's three laws of motion.											O		O	O	O	O	O	O
c. Solve uniformly accelerated, linear motion problems quantitatively and graphically.											O		O	O	O	O	O	O
d. Cite evidence to justify the use of auto safety devices, including seat belts, air bags, bumpers and head rests, in terms of Newton's laws. **(P, T)**																	O	
2. Gravitation is a universal force that each mass exerts on any other mass. The strength of the gravitational attractive force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.																		
a. Describe quantitative changes in gravitational attraction in terms of changes in distances between masses.												O						O
b. Describe quantitative changes in gravitational attraction in terms of changes in the masses.												O						O
3. The electric force is a universal force that exists between any two charged objects. Opposite charges attract while like charges repel. The strength of the force is proportional to the charges, and, as with gravitation, inversely proportional to the square of the distance between them. Between any two charged particles, electric force is vastly greater than the gravitational force. Most observable forces such as those exerted by a coiled spring or friction may be traced to electric forces acting between atoms and molecules.																		

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a.Demonstrate the interactions of like and unlike charges.					O							O						
b. Examine changes in electrostatic attraction in terms of changes in distances between two point charges.					X													
c.Examine changes in electrostatic attraction in terms of changes in the quantities of the charges.					X													
d. Compare the magnitudes of electrical and gravitational forces.					X							O						
e.Discuss the role of static electricity in disruptions and damage to electrical devices. **(N, P, T)**					O													
4.Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. These effects help students to understand electric motors and generators.																		
a. Describe how moving electrical charges produce magnetic fields.					O	O						X						
b.Describe how moving magnets produce electrical fields.					O	O						X						
c. Compare and contrast electrical motors and electrical generators in terms of energy transfers. **(N, T)**					O	O												
d.Examine the effects of the advent of electricity on individuals and society. **(H, N, P, T)**					O	O												
5.Analyze electrical circuits that obey Ohm's Law. (Not an NSES standard)																		

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a. Construct and schematically diagram simple series circuits and parallel circuits.					O													
b. Use an electric meter to measure the voltage and resistance. **(T)**					O	O												
c. Compare and contrast series and parallel circuits.					O	O												
d.Perform calculations using Ohm's Law.					O	O												
e.Explain how fuses, surge protectors, and breakers function. **(T)**					O													
B.Conservation of Energy and the Increase in Disorder																		
1. The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.																		
a. Evaluate transformations between potential and kinetic energies and other forms of energy.													O		O			
b. State and apply quantitative relationships between energy, work, power, and efficiency.						O												
c. Cite or identify examples of how the disorder of matter changes with energy changes. **(N)**																		
2. All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.																		
a. Classify energy types as potential, kinetic, or electromagnetic.						O							O		O			
3. Heat consists of random motion and the vibrations of atoms, molecules, and ions. The higher the temperature, the greater the atomic or molecular motion.																		

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a. Predict and measure the effects of varying the temperature, pressure, and volume of gases. **(N)**																		
b. Assess particle motion and distance as they relate to temperature and phase changes.																		
c. Assess the hazards of handling and storing pressurized gases. **(P, T)**																		O
3. Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation, or convection and the warming of our surroundings when we burn fuels.																		
a. Compare and contrast the environmental impact of power plants that use fossil fuels, water, or nuclear energy to produce electricity. (P, T)																		
c. Interactions of Energy and Matter																		
1. Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.	O	O	O				O	O	O			O						O
a. Identify and show relationships among wave characteristics such as velocity, period, frequency, amplitude, phase, and wavelength.		O					O					O						O
b. Compare and contrast models of longitudinal and transverse waves		O					O					O						O

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c.Give examples of the wave behaviors of reflection, refraction, diffraction, interference, polarization, and Doppler effect.		O					O					O						
b. Compare light and sound in terms of wave models.		O					O					O						O
c. Distinguish between the electromagnetic spectrum, seismic waves, water waves and sound waves based on their properties and behaviors**.**		O					O					O						
f. Describe the energy of a wave in terms of amplitude and frequency.		O					O					O						O
g.. Relate wave behavior to health issues such as skin cancer, cataracts, medical diagnostics, and treatment. (P, T)							X	O	O									
h.Relate wave behavior to communication issues such as cellular phones, satellites, and animal communication. (P, T)	O	O					X					X						O
i.Relate wave behavior to optical and sonic devices such as optic fibers and motion detectors. **(P, T)**							O					X						O
1. Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.																		

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a. Compare and contrast the parts of the electromagnetic spectrum in terms of energy.												O						X
2. Each kind of atom or molecule can gain or lose energy only in particular discrete amounts and thus can absorb and emit light only at wavelengths corresponding to these amounts. These wavelengths can be used to identify the substance.																		
a. Describe how the absorbing and releasing of energy by electrons produces light.												O						X
b. Explain that each element has its own configuration of electrons and has a unique line spectrum that can be used to identify that element.												X						
c. Discuss the application of emitted colors by certain substances in such areas as fireworks and light sources. **(P,T)**		X										X						
3. In some materials, such as metals, electrons flow easily, whereas in insulating materials such as glass they can hardly flow at all. Semiconducting materials have intermediate behavior. At low temperatures some materials become superconductors and offer no resistance to the flow of electrons.																		
Compare insulators, conductors, and semiconductors.				X														
b. Describe the conditions under which superconductivity exists.																		
c. Evaluate the impact of miniaturization of electric circuits upon individuals and society. **(H, P, T)**					X													