SCIENCE — Integrated Science II

C0ourse #: SC-08 | **Grade Level:** 8
Course Name: Integrated Science II | **Level of Difficulty:** Average
Prerequisites: See Counselor | **1 year**

Strand 1: Inquiry Process

"Science as inquiry is basic to science education and a controlling principle in the continuing organization and selection of students' activities. Students at all grade levels and in every domain of science should have the opportunity to use scientific inquiry and develop the ability to think and act in ways associated with inquiry…" **(National Science Education Standards, 1995).**

Inquiry Process establishes the basis for students' learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.

Concepts

Concept 1: Observations, Questions, and Hypotheses
Formulate predictions, questions, or hypotheses based on observations. Locate appropriate resources.

Concept 2: Scientific Testing (Investigating and Modeling)
Design and conduct controlled investigations.

Concept 3: Analysis and Conclusions
Analyze and interpret data to explain correlations and results; formulate new questions.

Concept 4: Communication
Communicate results of investigations.

Students should know and be able to…

Concept Number	Concept	PO No.	Performance Objective	Vocabulary	Notes/Integration/ Resources
S1C1	**Observations, Questions, and Hypotheses**	**1**	***Formulate questions based on observations that lead to the development of a hypothesis. (See M08-S2C1-01)*** • direct observation, and/or observations made by others (e.g., research)	observation, inference, . . . question (scientific) hypothesis (–ses)	(See M08-S2C1-01)
		2	**Use appropriate research information, not limited to a single source, to use in the development of a testable hypothesis. (See R08-S3C2-03 and W-E8-01)** • multiple sources can include internet, newspaper articles, encyclopedias, textbooks, personal observation, etc.	testable observation, inference, . . . question (scientific) hypothesis (–ses)	(See R08-S3C2-03 and W-E8-01)

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Concept Number	Concept	PO No.	Performance Objective	Vocabulary	Notes/Integration/ Resources
S1C1 (cont.)		**3**	**Generate a hypothesis that can be tested.** • Hypothesis written as a statement including independent and dependent variables (cause and effect). e.g. The amount of acceleration on an object depends on its mass.	testable observation, inference, . . . question (scientific) hypothesis (–ses)	
S1C2	**Scientific Testing (Investigating and Modeling)**	**1**	***Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry.***		
		2	**Design a controlled investigation to support or reject a hypothesis.** • Question based on and/or refined by observations/research • Hypothesis (see SC08-S1C1- P03) Experimental Design • Identify variables (independent, dependent, and controlled variables) materials needed step-by-step instructions	controlled investigation support variable reject controlled variable independent variable (cause) dependent variable (effect)	SC08-S1C1- P03)
		3	**Conduct a controlled investigation to support or reject a hypothesis.** • Results Data tables/graphs and or qualitative observations Analysis of results • Conclusion State whether hypothesis is supported or rejected and why/why not based on analysis State ideas for further investigations, where possible	controlled investigation support variable reject controlled variable independent variable (cause) dependent variable (effect)	

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S1C2 (cont.)		**4**	***Perform measurements using appropriate scientific tools (e.g., balances, microscopes, probes, micrometers).*** (See M07-S4C4-PO1, PO3) • linear • volume • mass (not same as weight) • temperature	metrics linear volume mass temperature	(See M07-S4C4-PO1, PO3)
		5	***Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs.***	trend analyze	

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S1C3	**Analysis and Conclusions**	**1**	***Analyze data obtained in a scientific investigation to identify trends. (See M08-S2C1-08)***	trend analyze	***(See M08-S2C1-08)***
			• Identify patterns in the data		
		2	***Form a logical argument about a correlation between variables or sequence of events (e.g., construct a cause-and-effect chain that explains a sequence of events).***	correlation	
		3	**Interpret data that show a variety of possible relationships between two variables, including:** **• positive relationship** **• negative relationship** **• no relationship**	positive relationship negative relationship no relationship	
			• Using a data table or graph		
		4	**Formulate a future investigation based on the data collected.**		
			• In the conclusion, state one or more ideas for future investigations, where possible. (See S1C2)		

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Concept Number	**Concept**	**PO No.**	**Performance Objective**	**Vocabulary**	**Notes/Integration/ Resources**
S1C3 (cont.)		**5**	**Explain how evidence supports the validity and reliability of a conclusion.** • For reliability, compare experimental results to other groups or classes • For validity, determine if the experiment had any investigational errors (see S1C3, P06)	validity reliability evidence	
		6	**Identify the potential investigational error that may occur (e.g., flawed investigational design, inaccurate measurement, computational errors, unethical reporting).** • Flawed investigational design (e.g. uncontrolled variables, too few trials, small sample size) • inaccurate measurement • computational errors • unethical reporting (e.g. copying from others, making up data) • critique		
		7	**Critique scientific reports from periodicals, television, or other media.** • Identify scientific authority • Summarize scientific findings		
		8	***Formulate new questions based on the results of a previous investigation.*** • (See S1C2)		(See S1C2)

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Concept Number	Concept	PO No.	Performance Objective	Vocabulary	Notes/Integration/ Resources
S1C4	**Communication**	**1**	**Communicate the results of an investigation.** • (See S1C2, PO2, PO3)		(See S1C2, PO2, PO3)
		2	***Choose an appropriate graphic representation for collected data:*** • ***line graph*** • ***double bar graph*** • ***stem and leaf plot*** • ***histogram*** ***(See M08-S2C1-03)***	line graph double bar graph stem and leaf plot histograph	***(See M08-S2C1-03)***
		3	**Present analyses and conclusions in clear, concise formats.** **(See W-E6-PO1)** • (See S1C2)	analysis conclusion	(See S1C2)
		4	**Write clear, step-by-step instructions for conducting investigations or operating equipment (without the use of personal pronouns).** • numbered • complete sentences		
		5	***Communicate the results and conclusion of the investigation.*** • (See S1C2, PO3)		(See S1C2, PO3)

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Strand 2: History and Nature of Science

***Knowledge of the nature of science is central to the understanding of the scientific enterprise*" (National Assessment of Educational Progress, 2000).**

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

Concepts

Concept 1: History of Science as a Human Endeavor
Identify individual, cultural, and technological contributions to scientific knowledge.

Concept 2: Nature of Scientific Knowledge
Understand how science is a process for generating knowledge.

Students should know and be able to…

Concept Number	Concept	PO No.	Performance Objective	Vocabulary	Notes/Integration/ Resources
S2C1	**History of Science as a Human Endeavor**	**1**	***Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations (e.g., Watson and Crick [scientists], support Strand 4; Rosalind Franklin [scientist], supports Strand 4; Charles Darwin [scientist], supports Strand 4; George Washington Carver [scientist, inventor], supports Strand 4; Joseph Priestley [scientist], supports Strand 5; Sir Frances Bacon [philosopher], supports Strand 5; Isaac Newton [scientist], supports Strand 5).*** • Strand 4 – Gregor Mendel • Strand 5 – Isaac Newton		
		2	**Evaluate the effects of the following major scientific milestones on society:** **• Mendelian Genetics** **• Newton's Laws**		

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Concept Number	**Concept**	**PO No.**	**Performance Objective**	**Vocabulary**	**Notes/Integration/ Resources**
S2C1 (cont.)		**3**	**Evaluate the impact of a major scientific development occurring within the past decade.** • e.g. genetic engineering, human genome project, stem cell research, automotive safety		
		4	**Evaluate career opportunities related to life and physical sciences.**		
S2C2	**Nature of Scientific Knowledge**	**1**	***Apply the following scientific processes to other problem solving or decision making situations:*** • ***observing*** • ***questioning*** • ***communicating*** • ***comparing*** • ***measuring*** • ***classifying*** • ***predicting*** • ***organizing data*** • ***inferring*** • ***generating hypotheses*** • ***identifying variables***		
		2	***Describe how scientific knowledge is subject to change as new information and/or technology challenges prevailing theories.***		
		3	**Defend the principle that accurate record keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.** • (See S1C3, PO5, PO6)		(See S1C3, PO5, PO6)
		4	**Explain why scientific claims may be questionable if based on very small samples of data, biased samples, or samples for which there was no control.** • (See S1C3, PO6)		(See S1C3, PO6)

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Strand 3: Science in Personal and Social Perspectives

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world – as living creatures, consumers, decision makers, problem solvers, managers, and planners.

Concepts

Concept 1: Changes in Environments
Describe the interactions between human populations, natural hazards, and the environment.

Concept 2: Science and Technology in Society
Develop viable solutions to a need or problem.

Students should know and be able to…

Concept Number	Concept	PO No.	Performance Objective	Vocabulary	Notes/Integration/ Resources
S3C1	**Changes in Environments**	**1**	**Analyze the risk factors associated with natural, human induced, and/or biological hazards, including:** **• waste disposal of industrial chemicals** **• greenhouse gases** • e.g. liners under landfills • e.g. car emissions	natural human induced biological hazard	
		2	**Analyze possible solutions to address the environmental risks associated with chemicals and biological systems.** • e.g. historical as well as present day. Examples:		

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Concept Number	**Concept**	**PO No.**	**Performance Objective**	**Vocabulary**	**Notes/Integration/ Resources**
S3C2	**Science and Technology in Society**	**1**	***Propose viable methods of responding to an identified need or problem.*** • See S3C2, PO1, PO2 • e.g. community problem role playing		See S3C2, PO1, PO2
		2	***Compare solutions to best address an identified need or problem*** • See S3C2, PO1, PO2 • e.g. community problem role playing		See S3C2, PO1, PO2
		3	***Design and construct a solution to an identified need or problem using simple classroom materials.*** • See S3C2, PO1, PO2 • e.g. bottle biology		See S3C2, PO1, PO2
		4	**Compare risks and benefits of the following technological advances:** **• radiation treatments** **• genetic engineering (See Strand 4 Concept 2)** **• airbags (See Strand 5 Concept 2)** • See S2C1, PO3 • (e.g. human cancer treatment, irradiating foods) (See S4C2, PO1)		See S2C1, PO3 (See S4C2, PO1)

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Strand 4: Life Science

***"The fundamental goal of life sciences is to attempt to understand and explain the nature of life"* (NAEP 2000).**

Life Science expands students' biological understanding of life by focusing on the characteristics of living things, the diversity of life, and how organisms and populations change over time in terms of biological adaptation and genetics. This understanding includes the relationship of structures to their functions and life cycles, interrelationships of matter and energy in living organisms, and the interactions of living organisms with their environment.

Concepts

Concept 1: Structure and Function in Living Systems. No performance objectives at this grade level.
Understand the relationships between structures and functions of organisms.

Concept 2: Reproduction and Heredity.
Understand the basic principles of heredity.

Concept 3: Populations of Organisms in an Ecosystem. No performance objectives at this grade level.
Analyze the relationships among various organisms and their environment.

Concept 4: Diversity, Adaptation, and Behavior.
Identify structural and behavioral adaptations.

Students should know and be able to…

Concept Number	Concept	PO No.	Performance Objective	Vocabulary	Notes/Integration/ Resources
S4C2	**Reproduction and Heredity**	**1**	**Explain the purposes of cell division:** **• growth and repair** **• reproduction** • teach purpose only, <u>not</u> processes of mitosis and meiosis		
		2	**Explain the basic principles of heredity using the human examples of:** **• eye color** **• widow's peak** **• blood type** • eye color – use dark (dominant) and light (recessive) colors widow's peak (dominant) no widow's peak (recessive) blood type – A and B (co-dominant); blood type – O (recessive)	allele dominant recessive heredity	
		3	**Distinguish between the nature of dominant and recessive traits in humans.**		

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Concept Number	Concept	PO No.	Performance Objective	Vocabulary	Notes/Integration/ Resources
S4C4	**Diversity, Adaptation, and Behavior** Teach using Arizona (desert) environments where possible.	**1**	**Explain how an organism's behavior allows it to survive in an environment.** • desert – coping with low water and high heat		
		2	**Describe how an organism can maintain a stable internal environment while living in a constantly changing external environment.** • desert – e.g. cactus storing water, light coloration of plants/animals, lizard (ectotherm) sunning on a rock, rabbit (endotherm) large ears distribute heat	endotherm, exotherm	
		3	**Determine characteristics of organisms that could change over several generations.** • see S4C2, PO2, PO3 and S4C4, PO6 • e.g. offspring (coloration, beak design (Galapagos finches)		see S4C2, PO2, PO3
		4	**Compare the symbiotic and competitive relationships in organisms within an ecosystem (e.g., lichen, mistletoe/tree, clownfish/sea anemone, native/non-native species).** • symbiotic (include mutualism, parasitism, commensalisms)	symbiotic competitive mutualism parasitism commensalism	Good Buddies
		5	**Analyze the following behavioral cycles of organisms:** • **hibernation** • **migration** • **dormancy (plants)** • estivation • e.g. desert animals	hibernation estivation migration dormancy	

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Concept Number	**Concept**	**PO No.**	**Performance Objective**	**Vocabulary**	**Notes/Integration/ Resources**
		6	**Describe the following factors that allow for the survival of living organisms:** **• protective coloration** **• beak design** **• seed dispersal** **• pollination**		

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Strand 5: Physical Science

***The physical science component … should probe the following major topics: matter and its transformations, energy and its transformations, and the motion of things*" (NAEP 2000).**

Physical Science affords students the opportunity to increase their understanding of the characteristics of objects and materials they encounter daily. Students gain an understanding of the nature of matter and energy, including their forms, the changes they undergo, and their interactions. By studying objects and the forces that act upon them, students develop an understanding of the fundamental laws of motion, knowledge of the various ways energy is stored in a system, and the processes by which energy is transferred between systems and surroundings.

Concepts

Concept 1: Properties and Changes of Properties in Matter
Understand physical and chemical properties of matter.

Concept 2: Motion and Forces. No performance objectives at this grade level.
Understand the relationship between force and motion.

Concept 3: Transfer of Energy.
Understand that energy can be stored and transferred. No performance objectives at this grade level.

Students should know and be able to…

Concept Number	Concept	PO No.	Performance Objective	Vocabulary	Notes/Integration/ Resources
S5C1	**Properties and Changes of Properties in Matter**	**1**	**Identify different kinds of matter based on the following physical properties:** • **states** • **density** (qualitative) • **boiling point** • **melting point** • **solubility**		
		2	**Identify different kinds of matter based on the following chemical properties:** • **reactivity** • **pH** • **oxidation (corrosion)** • e.g. baking soda and vinegar vs baking soda and water • e.g. PH or litmus tests • e.g. rust		

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S5C1 (cont.)		**3**	**Identify the following types of evidence that a chemical reaction has occurred:** **• formation of a precipitate** **• generation of gas** **• color change** **• absorption or release of heat** • gas – e.g., baking soda and vinegar • color - unexpected • heat - yeast and hydrogen peroxide releases heat, baking soda and vinegar absorbs heat		
		4	**Classify matter in terms of elements, compounds, or mixtures.** • See S5C1, PO5 • Elements • e.g. O2, C, Na • Compounds • e.g. CO, CO2, H2O, C6H12O6, NaCl • Mixtures • e.g. tossed salad, Kool-Aid, trail mix	elements compounds mixtures	See S5C1, PO5
		5	**Classify mixtures as being homogeneous or heterogeneous.** • See S5C1, PO4 • e.g., homogeneous – Kool-aid; salt water • e.g., heterogeneous – tossed salad, trail mix	homogeneous heterogeneous	See S5C1, PO4
		6	**Explain the systematic organization of the periodic table.** • Historical (Mendeleev) • Organized by increasing atomic number and group/family		

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S5C1 (cont.)		**7**	**Investigate how the transfer of energy can affect the physical and chemical properties of matter.** • e.g. physical properties: liquid water – add energy makes gas (steam), removing energy makes ice • e.g. chemical properties: adding energy to a cake mix bakes the cake causing a change in chemical property		

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S5C2	**Motion and Forces**	**1**	**Demonstrate velocity as the rate of change of position over time.** • See S5C2, PO5		See S5C2, PO5
		2	**Identify the conditions under which an object will continue in its state of motion (Newton's 1st Law of Motion).** • See S2C1, PO1 – Isaac Newton	inertia mass motion force (balanced and unbalanced)	See S2C1, PO1
		3	**Describe how the acceleration of a body is dependent on its mass and the net applied force (Newton's 2nd Law of Motion).**	mass acceleration force	
		4	**Describe forces as interactions between bodies (Newton's 3rd Law of Motion).**		
		5	**Create a graph devised from measurements of moving objects and their interactions, including:** **• position-time graphs** **• velocity-time graphs** • (See S5C2, PO1) • e.g. electric cars (constant velocity)	action reaction	(See S5C2, PO1)

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