Introductory Physical Science & Force, Motion, and Energy - Correlation to Vermont Dept of Education - Grades 5-8 Science Content Standards

Domain	Content Standard	Benchmark	IPS Ch. 1	IPS Ch. 2	IPS Ch. 3	IPS Ch. 4	IPS Ch. 5	IPS Ch. 6	IPS Ch. 7	IPS Ch. 8	IPS Ch. 9	IPS Ch. 10	IPS Ch. 11	IPS Ch. 12	FM&E Ch. 1	FM&E Ch. 2	FM&E Ch. 3	FM&E Ch. 4	FM&E Ch. 5	FM&E Ch. 6	FM&E Ch. 7
Inquiry Experimentation, and Theory	**Scientific Method** **7.1** Students use scientific methods to describe, investigate, explain phenomena, and raise questions in order to: • Generate alternative explanations – hypotheses – based on observations and prior knowledge; • Design inquiry that allows these explanations to be tested; • Deduce the expected results; • Gather and analyze data to compare the actual results to the expected outcomes; and • Make and communicate conclusions, generating new questions raised by observations and readings.	**This is evident when students:** aa. Frame questions in a way that distinguishes causes and effects; identify variables that influence the situation can be controlled;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		bb. Seek, record, and use information from reliable sources, including scientific knowledge, observation, and experimentation;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		cc. Create hypotheses to problems, design their own experiments to test their hypothesis, collect data through observation and instrumentation, and analyze data to draw conclusions; use conclusions to clarify understanding and generate new questions to be explored;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		dd. Describe, explain, and model, using evidence that includes scientific principles and observations;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		gg. Propose, recognize, and analyze alternative explanations; and	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		ii. Work individually and in teams to collect, share, and present information and ideas.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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	Investigations **7.2** Students design and conduct a variety of their own investigations and projects. These should include: • Questions that can be studied using the resources available; • Procedures that are safe, humane, and ethical; • Data that are collected and recorded in ways that others can verify; • Data and results that are represented in ways that address the questions at hand; • Recommendations, decisions, and conclusions that are based on evidence, and that acknowledge references, and contributions of others; • Results that are communicated appropriately to audiences; and • Reflections and defense of conclusions and recommendations from other sources, and peer review.	**This is evident when students:** aa. Design and conduct a controlled experiment;	X	X	X	X	X	X	X	X	X	X	X								
		bb. Design and conduct field work;					X														
		cc. Completely design a physical structure or technological system (e.g., spring scales, bicycle gear shifts, timing of traffic lights;																			
		dd. Complete a data study based on civic, economic, or social issues;																			
		ee. Design a resource or system management plan; or																			
		ff. Illustrate mathematical models of physical phenomenon.																			
	Theory **7.3** Students understand the nature of mathematical, scientific, and technological theory.	**This is evident when students:** aa. Explain theories based upon observations, concepts, principles, and historical perspective;		X				X		X					X	X					X
		bb. Determine the validity of a theory by examining the principles on which it was founded, the constraints that apply to its application, and the body of physical evidence that supports it; and		X				X		X					X	X					X
		cc. Show understanding that new theories develop when phenomena are observed that are not fully explained by old theories.																			

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	History of Science, Mathematics, and Technology **7.4** Students understand the history of science, mathematics, and technology.	**This is evident when students:** aa. Examine important contributions made to the advancement of science, technology, and mathematics, and respond to their impact on past, present, and future understanding.				X			X										X		
	Roles and Responsibilities **7.5** Students analyze the roles and responsibilities of scientists, mathematicians, and technologists in social, economic, cultural, and political systems.	**This is evident when students:** aa. Analyze the roles and responsibilities of scientists, mathematicians, and technologists in relation to ongoing research and discoveries that impact society (e.g., the dangers and benefits of nuclear energy).																			
Mathematical Understanding	**Arithmetic, Number, and Operation Concepts** **7.6** Students understand arithmetic in computation, and they select and use, in appropriate situations, mental arithmetic, pencil and paper, calculator, and computer;	**This is evident when students:** d. Estimate, approximate, round off, and/or use exact numbers, as appropriate and necessary in calculation; and	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mathematical Understanding	**Arithmetic, Number, and Operation Concepts**	e. Use knowledge f the place value system to solve problems.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		aa. Consistently and accurately add, subtract, multiply, and divide rational (fractional) numbers, and raises them to whole number powers;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		bb. Interchange fractions, decimals, and percents; know that irrational numbers neither terminate nor repeat when written in decimal form;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		cc. Show a sense of the magnitudes and relative magnitudes of numbers, and the helpful role of scientific notation.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Function and Algebra Concepts **7.8** students use function and algebra concepts.	**This is evident when students:** aa. Discover, describe, and generalize a variety of patterns mathematically;																			X
		bb. Understand variables in simple functions (dependent and independent variable relationships), especially linear, exponential, and simple quadratic functions; represent relationships with tables, graphs, and verbal or symbolic rules; analyze tables, graphs, and rules to determine relationships; and	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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		cc. Explore solutions of unknown quantities in equations.																			
	Statistics and Probability Concepts **7.9** Students use statistics and probability concepts.	This is evident when students: aa. Create and interpret statistical tables (e.g., frequency tables, histograms, scatter plots, stem-and-leaf, and box-and-whiskers) and charts;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		bb. Appropriately use measures of central tendency – mean, median, and mode; understand the significance of frequency and distribution;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		cc. Make conclusions and recommendations based on data analysis, and analyze the conclusions and recommendations of others;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		dd. Find all possible combinations, arrangements, and/or permutations within given constraints; make predictions based on experimental or theoretical probability; recognize equally likely outcomes and determine the probabilities of events; predict the results of a series of trials once the probability of one trial is known; and																			
		ee. Construct sample spaces (e.g., tree diagrams or charts).																			
Mathematical Problem Solving and Reasoning	**Applications** **7.10** Students use concrete, formal, and informal strategies to solve mathematical problems, apply the process of mathematical modeling, and extend and generalize;	**This is evident when students:** a. Solve problems by reasoning mathematically with concepts and skills expected in these grades;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		f. Make sensible, reasonable estimates.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		bb. Formulate and solve a variety of meaningful problems;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		cc. Create and use a variety of approaches, and understand and evaluate the approaches that others use; determine how to break down a complex problem into simpler parts; extract pertinent information from situations;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		dd. Integrate concepts and techniques from different areas of mathematics;																			
		ee. Generalize solutions and strategies to new problem situations; and	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		g. Formulate conjectures and argue (short of formal proof) why they must be or seem to be true.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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Systems	**Analysis** **7.11** Students analyse and understand living and non-living systems (e.g. biological, chemical, electrical, mechanical, optical) as collections of interrelated parts and interconnected systems.	**This is evident when students:** aa. Demonstrate and understand that systems are connected to other systems, and that one system affects how others work;																			
		bb. Demonstrate understanding that systems are effectively designed when specifications and constraints are understood; and																			
		cc. Use physical and mathematical models to express how systems behave given a set of inputs or outputs.																			
Space, Time, and Matter	**Matter, Motion, Forces, and Energy** **7.12** Students understand forces and motion, the properties and composition of matter, and energy sources and transformations.	**This is evident when students:** aa. Observe and measure characteristic properties of matter (e.g, boiling point, melting point, density, buoyancy, simple chemical reactions), and use them to distinguish one substance from another;			**X**	**X**	**X**														
		bb. Provide examples of substances reacting chemically to form new substances with different characteristics, and describe and model the phenomenon with reference to elements and compounds;		**X**	**X**	**X**	**X**	**X**		**X**			**X**								
		cc. Explain the relationships between pressure, volume, and the amount of gas (e.g., soda bottles, auto tires);																			
Space, Time, and Matter	**Matter, Motion, Forces, and Energy**	dd. Observe and demonstrate a qualitative understanding of the relationship between mass, the magnitude of an applied net force, and the resulting change in speed and direction;													**X**		**X**				
		ee. Identify and describe common forms of energy (e.g. light, heat, sound, electricity, electromagnetic waves) and their attributes, sources, and transmission characteristics (e.g., radiation, convection, conduction of heat); and																	**X**	**X**	**X**
		ff. Investigate the relationship between electricity and magnetism (e.g., in electric motors).										**X**	**X**	**X**							
Design and Technology	**Outputs and Impacts** **7.18** Students understand that people control the outputs and impacts of our expanding technological activities in the areas of communication. Construction, manufacturing, power and transportation, energy sources, health technology, and biotechnology.	This is evident when students: c. Use tools and machines in a dafe manner.																			

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		aa. Demonstrate an understanding that people are able to share, compile, use, and misuse technology;																			
		bb. Demonstrate how people create and use tools to observe, measure, create and control;																			
		d. Identify the positive and negative consequences of technology (e.g., nuclear power for generating electricity).				X			X												