Curriculum for Physical Science with Earth Science

SCIENCE CURRICULUM - Grade 9-12

Physical Science with Earth Science

STANDARD A: Students in Wisconsin will understand that there are unifying themes: systems, order, organization, and interactions; evidence, models, and explanations; constancy, change, and measurement; evolution, equilibrium, and energy; form and function among scientific disciplines.

Wisconsin Standard Number	WISCONSIN PERFORMANCE STANDARD	LEARNING TARGET	Assessment
A.12.1	Students will: apply the underlying themes of science to develop defensible visions of the future.	Understand and use scientific method Understand and use SI system of measurement Understand and use measurement techniques and tools Understand and use graphing Understand and use safety Understand and use knowledge and understanding of newly developed technology	Chapter 1 exam Chapter 1 exam Density Lab Graphing Lab, Chapter1 exam Safety exam and contract Chapter 1 exam and throughout year
A.12.2	Students will: show how conflicting assumptions about science themes lead to different opinions and decisions about evolution, health, population, longevity, education, and use of resources, and show how these opinions and decisions have diverse effects on an individual, a community, and a country, both now and in the future.		
A.12.3	Students will: give examples that show how partial systems, models, and explanations are used to give quick and reasonable solutions that are accurate enough for basic needs.	Understand models are representatives, not exact copies of nature Understand how and when to use models Understand periodic table	Chapter 1 exam and throughout year Chapter 1 exam Chapter 19 exam
A.12.4	Students will: during investigations, choose the best data- collection procedures and materials available, use them competently, and calculate the degree of precision of the resulting data.		
A.12.5	Students will: show how the ideas and themes of science can be used to make real-life decisions about careers, work places, life-styles, and use of resources.	Understand conservation of energy Understand pros and cons of energy sources Understand nuclear energy and decay and how it relates to real life decisions Understand chemistry of soil, water, and atmosphere Understand acids and bases and the interactions of household products	Chapter 5 exam Chapter 16 exam Chapter 16 exam Chapter 17, 21 exam Chapter 24 exam
A.12.6	Students will: identify and, using evidence learned or discovered, replace inaccurate personal models and explanations of science related events		
A.12.7	Students will: re-examine the evidence and reasoning that led to conclusions drawn from investigations, using the science themes.	Understand the process of scientific discovery Understand scientists' contributions to our understanding of the world and culture Describe the relevance of atomic models	Chapter 1 exam Chapter 1 exam Chapter 19 exam

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STANDARD B: Students in Wisconsin will understand that science is ongoing and inventive, and that scientific understandings have changed over time as new evidence is found.

Wisconsin Standard Number	WISCONSIN PERFORMANCE STANDARD	LEARNING TARGET	Assessment
B.12.1	Students will: show how cultures and individuals have contributed to the development of major ideas in the earth and space, life and environmental, and physical sciences.	Understand how various scientists have contributed to scientific discoveries Understand chronological development of scientific discoveries	Chapter 2 exam Chapter 2 exam
B.12.2	Students will: identify the cultural conditions that are usually present during great periods of discovery, scientific development, and invention.		
B.12.3	Students will: relate the major themes of science to human progress in understanding science and the world.	Understand the impact of the development of technology Discuss how science-technology-society themes effect environmental quality and other scientific knowledge	Chapter 2 exam Chapter 2 exam
B.12.4	Students will: show how basic research and applied research contribute to new discoveries, inventions, and applications.	Know the difference between science and technology and the different types of technology Know scientific method is a concept, not a step-by-step process	Chapter 2 exam Chapter 1 exam
B.12.5	Students will: explain how science is based on assumptions about the natural world and themes that describe the natural world.	Describe how the study of science leads to better understanding of natural events	Chapter 2 exam

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STANDARD C: Students in Wisconsin will investigate questions using scientific methods and tools, revise their personal understanding to accommodate knowledge, and communicate these understandings to others.

Wisconsin Standard Number	WISCONSIN PERFORMANCE STANDARD	LEARNING TARGET	Assessment
C.12.1	Students will: when using science content, ask questions suggested by current social issues, scientific literature, and observations of phenomena, build hypothesis that might answer some of these questions, design possible investigations, and de...	Understand lab write-ups Distinguish between quantitative and qualitative data collection Use scientific method to solve problems	Ongoing with each lab Chapter 1 exam Ongoing with each lab
C.12.2	Students will: identify issues from an area of science study, write questions that could be investigated, review previous research on these questions, and design and conduct responsible and safe investigations to help answer the questions.		
C.12.3	Students will: evaluate the data collected during an investigation, critique the data-collection procedures and results, and suggest ways to make any needed improvements.	Understand error analysis Interpolate and extrapolate data Use computer software and problems to collect data	Ongoing with each lab Ongoing with each lab Ongoing with each lab
C.12.4	Students will: during investigations, choose the best data- collection procedures and materials available, use them competently, and calculate the degree of precision of the resulting data.	Understand error analysis Interpolate and extrapolate data	Ongoing with each lab Ongoing with each lab
C.12.5	Students will: use the explanations and models found in the earth and space, life and environmental, and physical sciences to develop likely explanations for the results of their investigations.	Students draw conclusions from experiments.	Ongoing with each lab
C.12.6	Students will: present the results of investigations to groups concerned with the issues, explaining the meaning and implications of the results, and answering questions in terms the audience can understand.		
C.12.7	Students will: evaluate articles and reports in popular press, in scientific journals, on television, and on the Internet, using criteria related to accuracy, degree of error, sampling, treatment of data, and other standards of experimental design	Read critically and develop scientific literacy and comprehension. Use current computer technology to access scientific journals and science related web pages to evaluate current topics.	Global Warming Paper Global Warming Paper

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STANDARD D: Students in Wisconsin will demonstrate an understanding of the physical and chemical properties of matter, the forms and properties of energy, and the ways in which matter and energy interact.

Wisconsin Standard Number	WISCONSIN PERFORMANCE STANDARD	LEARNING TARGET	Assessment
	Structure of atoms and matter		
D.12.1	Describe atomic structure and the properties of atoms, molecules, and matter during physical and chemical interactions	Understand atomic structure and the properties of atoms, molecules and matter during physical and chemical interactions	Chapter 19 exam
		Know that atoms are the fundamental units of matter	Chapter 19 exam
		Classify compounds according to chemical and physical properties	
		Understand how substances, both simple and complex, interact with one another to produce new substances	Chapter 22, 23, 24 exams
		Explain the forces that hold the atom together	Chapter 19 exam
		Know that an element is composed of a single type of atom	Chapter 19 exam
		Know that each element has a unique number of protons called the atomic number	Chapter 19 exam
		Know that electrons occur in levels around the nucleus and that certain numbers of electrons are more stable than other configurations	Chapter 19 exam
		Know that chemical families are groups of elements with similar electron structures	Chapter 19 exam
		Know that atoms interact with one another by sharing or transferring valence electrons	Chapter 22 exam
		Use the kinetic molecular theory to explain states of matter	
		Understand that atoms of a given element consist of isotopes	Chapter 9 exam
		Interpret Periodic Table	Chapter 19 exam
		Apply Lewis Dot structures to bonding	
			Chapter 19 exam
			Chapter 22 exam
D.12.2	Students will: explain the forces that hold the atom together and illustrate how nuclear interactions change the atom.	Know that fission is the splitting of a large nucleus into smaller pieces	Chapter 25 exam
		Understand that fusion is the joining of two nuclei at extremely high temperature and pressure	Chapter 25 exam
		Comprehend radiation, radioactivity, isotopes, half-life, and alpha and beta decay	Chapter 25 exam
		Understand the forces of gravitation and the electromagnetic force.	Chapter 25 exam
D.12.3	Students will: explain exchanges of energy in chemical interactions and exchange of mass and energy in atomic/nuclear reactions.	Know that chemical families are groups of elements with similar electron structures	Chapter 19 exam
		Understand phase changes of matter	Chapter 9 exam
		Know that atoms interact with one another by sharing or transferring electrons that are farthest from the nucleus (called valence e!)	Chapter 22 exam
		Know the law of conservation of energy during chemical and nuclear reactions	Chapter 22, 25 exams
		Explain exchanges of energy in chemical interactions and exchange of mass and energy in atomic/nuclear reactions	Chapter 25 exam
D.12.4	Students will: explain how substances, both simple and complex, interact with one another to produce new substances.	Understand reaction rates, catalysts	Chapter 23 exam
		Understand atomic structure and the properties of atoms, molecules, and matter during physical and chemical interaction	Chapter 23 exam
		Know that atoms interact with one another by sharing or transferring electrons that are farthest from the nucleus (called valence electrons)	Chapter 22 exam
		Compare and contrasts the 4 types of chemical reactions	Chapter 23 exam
		Understand neutralization reactions	
		Identify acids and bases by pH and atomic structure	Chapter 24 exam
		Understand and predict oxidation numbers and the relationship to bonding	Chapter 24 exam
			Chapter 22 exam

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D.12.5	Identify patterns in chemical and physical properties and use them to predict likely chemical and physical changes and interactions	Classify compounds according to chemical and physical properties Know the kinetic molecular theory Know phase changes of matter and phase change diagrams Understand properties of atoms and molecules during physical and chemical reactions Predict density from volume and mass Understand gas laws as an application of the kinetic molecular theory Understand that chemical and physical changes occur at different rates based on the factors such as type of substance, surface area, temperature, and concentration Identify states of matter and characteristics of each state Understand characteristic properties such as boiling point, freezing point, density, solubility, viscosity Understand buoyancy	Chapter 9, 24 exam Chapter 9 exam Chapter 9 exam Chapter 23 exam Chapter 1 exam Chapter 9 exam Chapter 9, 23 exam Chapter 9 exam Chapter 18 exam Chapter 9 exam
D.12.6	Students will: through investigations, identify the types of chemical interactions, including endothermic, exothermic, oxidation, photosynthesis, and acid/base reactions.	Understand reaction rates, catalysts Know that atoms interact with one another by sharing or transferring electrons that are farthest from the nucleus (called valence electrons) Compare and contrast the 4 types of chemical reactions Understand neutralization reactions Identify acids and bases by pH and atomic structure Understand and predict oxidation numbers and the relationship to bonding Differentiate between fast and slow oxidation	Alconox lab Predict ionic and covalent bonding Reaction labs Litmus lab What is the pH lab Predict and write formulas for binary compounds Observe match vs. $AgNO_3$ and Cu
	Motion and Forces		
D.12.7	Qualitatively and quantitatively analyze changes in the motion of objects and the forces that act on them and represent analytical data both algebraically and graphically	Describe changes in the motion of objects and the forces that act on them Understand Newton's Three Laws of Motion Understand interval of time, reference point, air resistance, projectile motion, and circular motion Understand speed, acceleration, and velocity Understand mass, velocity, forces, and momentum Understand simple machines, mechanical advantage Understand work, power relationships Distinguish between potential and kinetic energy Address distinction between weight and mass Represent analytical data both algebraically and graphically Learn the quantitative aspects of motion along a straight line Recognize situations involving acceleration or constant velocity	Chapter 3 exam Chapter 4 exam Chapter 3 exam Chapter 3 exam Chapter 3, 4 exams Chapter 6 exam Chapter 6 exam Chapter 5 exam Chapter 3 exam Chapter 3, 4, 5, 6 exam Chapter 3 exam Chapter 3 exam
D.12.8	Understand the forces of gravitation, the electromagnetic force, intermolecular force, and explain their impact on the universal system	Understand the forces of gravitation and the electromagnetic force Know about electricity, electric circuits, static and dynamic electricity Know about magnetism and electromagnetism Understand the relationships between mass, distance and gravity Heliocentric vs. geocentric models	Chapter 3, 14 exams Chapter 13 exam Chapter 14 exam Chapter 3, 7 exam Chapter 8 exam
D.12.9	Describe models of light, heat, and sound and through investigations describe similarities and differences in the way these energy forms behave	Compare and contrast the various parts of transverse (compressional) and longitudinal waves Identify the forms of heat transfer Distinguish heat from temperature Identify three temperature scales Know wave theory Use current technology to analyze sound, heat and light	Chapter 10 exam Chapter 9 exam Chapter 9 exam Chapter 9 exam Chapter 10 exam Chapter 9, 10, 11 exam
	Conservation of energy and the increase in disorder		
D.12.10	Using the science themes, illustrate the law of conservation of energy during chemical and nuclear reactions.	Know mass is conserved in chemical reactions Understand radioactive decay Understand the relationship between mass and energy	Chapter 23 exam Chapter 25 exam Chapter 5 exam
	Interaction of matter and energy		
D.12.11	Using the science themes, explain common occurrences in the physical world	Understand the Law of Universal Gravitation Describe everyday examples of Newton's three laws of motion Distinguish the three main states of matter and the related phase changes Understand the behavior of fluids Know the gas laws Understands the relationship between mass, volume and density Compare and contrast weight vs. mass Compare and contrast different forms and/or sources of energy	Chapter 7, 8 exams Chapter 4 exam Chapter 9 exam Chapter 9 exam Chapter 1 exam Chapter 3 exam Chapter 16 exam
D.12.12	Using the science themes and knowledge of chemical, physical, atomic, and nuclear interactions, explain changes in materials, living things, earth's feature, and stars.		

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STANDARD E: Students in Wisconsin will demonstrate an understanding of the structure and systems of earth and other bodies in the universe and of their interactions.

Wisconsin Standard Number	WISCONSIN PERFORMANCE STANDARD	LEARNING TARGET	Assessment
	Energy in the earth system		
E.12.1	Using the science themes distinguish between internal energies (decay of radioactive isotopes, gravity) and external energies (sun) in the earth's systems and show how these sources of energy have an impact on those systems	Understand geothermal energy Develop an understanding of how the sun's energy is converted to solar energy absorbed by the earth, absorbed by the atmosphere, and reflected back Understand the forces of earth's gravitation	Chapter 12 exam Chapter 16, 17 exams Chapter 7, 8 exams
	Geochemical Cycles		
E.12.2	Analyze the geochemical and physical cycles of the earth and use them to describe movements of matter	Compare absolute and relative age, understand the laws associated with relative age of rock formation and explain how half-life is used to determine actual age Investigate the rock cycle. Analyze the origin, texture and mineral composition of rocks Trace the path of elements through the rock cycle Relate rock formation to plate tectonics Identify forms of energy that drive the rock cycle	Chapter 20, 21 exam Chapter 20 exam Chapter 20 exam Chapter 20 exam Chapter 12, 20 exams Chapter 20 exam
E.12.3	Using the science themes, describe theories of the origins and evolution of the universe and solar system, including the earth system as a part of the solar system, and relate these theories and their implications to geologic time on earth	Discuss the origin of the sun and its solar system from a huge cloud of dust and gas Understand how the earth's proximity to the sun allows life as we know it to exist Heliocentric vs. geocentric universe models Recognize theories that explain the Earth's origin and place within the solar system Recognize/explain how the Earth is dynamic and ever-changing.	Chapter 8 exam Chapter 7, 8 exams Chapter 8 exam Chapter 7, 8 exam Chapter 7, 8, 12, 17, 21 exams
E.12.4	Analyze the benefits, costs, and limitations of past, present, and projected use of resources and technology and explain the consequences to the environment	Recognize/explain how the Earth is dynamic and ever-changing. Evaluate water resources, impact of growing human population Investigate and analyze environmental issues and solutions.	Chapter 7, 8, 12, 17, 21 exams Chapter 21 exam Chapter 16, 17, 21 exams
	The origin and evolution of the universe		
E.12.5	Using the science themes, understand that the origin of the universe is not completely understood, but that there are current ideas in science that attempt to explain its origin	Introduce students to the big bang theory and how the universe is still expanding, according to this theory	Chapter 26 exam

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STANDARD F: Students in Wisconsin will demonstrate an understanding of the characteristics and structures of living things, the processes of life, and how living things interact with one another and their environment.

Wisconsin Standard Number	WISCONSIN PERFORMANCE STANDARD	LEARNING TARGET	Assessment
	The Cell		
F.12.1	Students will: evaluate the normal structures and the general and special functions of cells in single-celled and multiple-celled organisms.		
F.12.2	Students will: understand how cells differentiate and how cells are regulated.		
	The molecular basis of heredity		
F.12.3	Students will: explain current scientific ideas and information about the molecular and genetic basis of heredity.		
F.12.4	Students will: state the relationships between functions of the cell and functions of the organism as related to genetics and heredity.		
	Biological evolution		
F.12.5	Students will: understand the theory of evolution, natural selection, and biological classification.		
F. 12.6	Students will: using concepts of evolution and heredity, account for changes in species and the diversity of species, include the influence of these changes on science, e.g. breeding of plants or animals.		
	The interdependence of organisms		
F.12.7	Students will: investigate how organisms both cooperate and compete in ecosystems.		
F.12.8	Students will: using the science themes, infer changes in ecosystems prompted by the introduction of new species, environmental conditions, chemicals, and air, water, or earth pollution		
	Matter, energy and organization in living systems		
F.12.9	Students will: using the science themes, investigate energy systems (related to food chains) to show how energy is stored in food (plants and animals) and how energy is released by digestion and metabolism.		
F.12.10	Students will: understand the impact of energy on organisms in living systems.		
F.12.11	Students will: investigate how the complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain an organism.		
	The behaviors of organisms		
F.12.12	Students will: trace how the sensory and nervous systems of various organisms react to the internal and external environment and transmit survival or learning stimuli to cause changes in behavior or responses.		

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STANDARD G: Students in Wisconsin will demonstrate an understanding of the relationship between science and technology and the ways in which that relationship influences human activities.

Wisconsin Standard Number	WISCONSIN PERFORMANCE STANDARD	LEARNING TARGET	Assessment
G.12.1	Students will identify personal interests in science and technology, implications that these interests might have for future education, and decisions to be considered.		
G.12.2	Design, build, evaluate, and revise models and explanations related to the earth and space, life and environmental, and physical sciences	Students will: when making decisions, construct a plan that includes the use of current scientific knowledge and scientific reasoning. Distinguish models from true representations of the real world	Ongoing theme Chapter1 exam and throughout year
G.12.3	Students will analyze the costs, benefits, or problems resulting from a scientific or technological innovation, including implications for the individual and the community.		
G.12.4	Show how major scientific or technological change has had an impact on work, leisure, or the home	Students will: when making decisions, construct a plan that includes the use of current scientific knowledge and scientific reasoning.	Ongoing theme
G.12.5	Students will choose a specific problem in our society, identify alternative scientific or technological solutions to that problem and argue it merits.	Identify problems associated with resource use and propose alternative solutions	Chapter 16, 17, 21 exams

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STANDARD H: Students in Wisconsin will use scientific information and skills to make decisions about themselves, Wisconsin, and the world in which they live.

Wisconsin Standard Number	WISCONSIN PERFORMANCE STANDARD	LEARNING TARGET	Assessment
H.12.1	Students will: using the science themes and knowledge of the earth and space, life and environmental, and physical sciences, analyze the costs, risks, benefits, and consequences of a proposal concerning resource management in the community and		
H.12.2	Students will: evaluate proposed policy recommendations (local, state, and/or national) in science and technology for validity, evidence, reasoning, and implications, both short and long-term.	Understand how science and public policy are related	Global Warming Paper
H.12.3	Students will: show how policy decisions in science depend on social values, ethics, beliefs, and time-frames as well as considerations of science and technology.		
H.12.4	Students will: advocate a solution or combination of solutions to a problem in science or technology.	Uses scientific knowledge to create defensible solutions to societal problems	Chapter 16, 17, 21 exams
H.12.5	Students will: investigate how current plans or proposals concerning resource management, scientific knowledge, or technological development will have an impact on the environment, ecology, and quality of life in a community or region.		
H.12.6	Students will: evaluate data resources of information when using scientific information to make decisions.	Know there are levels of reliability in literature sources Evaluate appropriate sources of data to draw conclusions	Global Warming Paper Global Warming Paper
H.12.7	Students will: when making decisions, construct a plan that includes the use of current scientific knowledge and scientific reasoning.	Use scientific method as a process to develop and investigate a problem and draw valid conclusions Make appropriate decisions based on valid scientific evidence	Ongoing theme of labs Labs and global warming paper