Main Objective	Lesson Objectives	State Standards	Assessments
Lab Safety Review skills the students need in order to be safe during laboratory experiments	Review safety rules and procedures	A.12.1	Presentation of rules to peers Safety exam
Chapter 1 Students will be able to graph scientific data and analyze its meaning	1.1 Demonstrate scientific methods; use metric system; evaluate answers using dimensional analysis; perform arithmetic operations using scientific notation 1.2 Distinguish between accuracy and precision; determine the precision of measured quantities 1.3 Graph the relationship between independent and dependent variables; interpret graphs; recognize common relationships in graphs	A.12.1 A.12.1 A.12.1, A.12.6, C.12.1, C.12.3, C.12.4, C.12.5, C.12.6, D.12.7, G.12.2	Worksheets Quizzes Tests Labs
Chapter 2 Students will be able to describe and analyze the concept of motion.	2.1 Draw motion diagrams to describe motion, develop a particle model to represent a moving object 2.2 Define coordinate systems for motion problems, recognize that the chose coordinate system affects the signs of the objects' positions, define displacement, determine a time interval, use a motion diagram to answer questions about an object's position or displacement	A.12.3, A.12.6, D.12.7 A.12.3, D.12.7	Worksheets Quizzes Tests Labs Lab practical

	2.3 Develop position-time graphs for moving objects; use a position-time graph to interpret an object's position or displacement; make motion diagrams, pictorial representations, and position-time graphs that are equivalent representations describing an object's motion 2.4 Define velocity; differentiate between speed and velocity; create pictorial, physical, and mathematical models or motion problems	A.12.3, A.12.6, C.12.3, C.12.5, D.12.7 A.12.3, A.12.5, A.12.6, A.12.7, C.12.1, C.12.3, C.12.5, D.12.7	
Chapter 3 Students will develop an understanding of acceleration as the rate of change of velocity and use this knowledge to explain the motion of an object.	3.1 Define acceleration; relate velocity and acceleration to the motion of objects; create velocity-time graphs 3.2 Interpret position-time graphs for motion with constant acceleration; determine mathematical relationships among position, velocity, acceleration, and time; apply graphical and mathematical relationships to solve constant-acceleration problems 3.3 Define acceleration due to gravity; solve problems involving objects in free fall	A.12.3, A.12.5, A.12.6, A.12.7, C.12.1, C.12.3, C.12.5, D.12.7 A.12.3, A.12.6, C.12.1, C.12.3, D.12.7, G.12.2 A.12.4, A.12.5, A.12.6, A.12.7, C.12.1, C.12.3, C.12.5, D.12.7, D.12.8, G.12.2	Worksheets Quizzes Tests Labs Lab practical
Chapter 4 Students will be able to describe and explain how exerting a net force on an	4.1 Define force; use Newton's second law to solve problems; explain the meaning of Newton's first law	A.12.6, A.12.7, B.12.1, C.12.1, C.12.3, C.12.5, D.12.7, D.12.11, G.12.2	Worksheets Quizzes Tests Labs Lab practical

object can cause the object's velocity to change. Students will also be able to explain the relationship between Newton's laws and velocity.	4.2 Describe how the weight and the mass of an object are related; differentiate between actual weight and apparent weight 4.3 Define Newton's third law; explain the tension in ropes and strings in terms of Newton's third law; define the normal force; determine the value of the normal force by applying Newton's second law	A.12.6 A.12.6, A.12.7, B.12.1, C.12.1, C.12.3, C.12.5, D.12.7, D.12.11, G.12.2	
Chapter 5 Students will mathematically analyze Newton's laws in two dimensions using vectors and use Newton's laws to analyze motion when friction is involved.	5.1 Evaluate the sum of two or more vectors in two dimensions, graphically; determine the components of vectors; solve for the sum or two or more vectors, algebraically, by adding by components of the vectors 5.2 Define friction force; distinguish between static and kinetic friction 5.3 Determine the force that produces equilibrium when three forces act on an object; analyze the motion of an object on an inclined plane with and without friction.	A.12.5, D.12.7 A.12.6, C.12.1, C.12.3, C.12.4, C.12.5, D.12.7	Worksheets Quizzes Tests Labs Lab practical
Chapter 6 Students will use Newton's laws and their knowledge of vectors to analyze motion in two dimensions, the motion of projectiles, and circular motion.	6.1 Recognize that the vertical and horizontal motions of a projectile are independent; relate the height, time in the air, and initial vertical velocity of a projectile using its vertical motion, and then determine the range using the horizontal motion	A.12.6, C.12.3, C.12.5, D.12.7	Worksheets Quizzes Tests Labs Lab practical

	6.2 Explain why an object moving in a circle at a constant speed is accelerated; describe how centripetal acceleration depends upon the object's speed and the radius of the circle; identify the force that cause centripetal acceleration 6.3 Solve relative velocity problems	A.12.4, A.12.6, A.12.7, C.12.1, C.12.3, C.12.5, D.12.7, G.12.2	
Chapter 7 Students will relate Kepler's laws of planetary motion to Newton's Laws of motion	7.1 Relate Kepler's laws to the law of universal gravitation; calculate orbital speeds and periods; describe the importance of Cavendish's experiment 7.2 Solve orbital motion problems; relate weightlessness to objects in free fall; describe gravitational fields; compare views on gravitation	A.12.6, A.12.7, B.12.1, D.12.8, D.12.11, D.12.12 A.12.4, A.12.6, A.12.7, D.12.8	Worksheets Quizzes Tests Labs
Chapter 8 Students will learn how to describe and measure rotational motion and how torque changes rotational velocity.	8.1 Describe angular displacement; calculate angular velocity; calculate angular acceleration; solve problems involving rotational motion 8.2 Describe torque and the factors that determine it; calculate net torque; calculate the moment of inertia 8.3 Define center of mass; explain how the location of the center of mass affects the stability of an object; define the conditions for equilibrium; describe how rotating frames of reference give rise to apparent forces	A.12.6, A.12.7, C.12.1, C.12.3, C.12.5, D.12.7 A.12.6, A.12.7, C.12.1, C.12.5 A.12.4	Worksheets Quizzes Tests Labs Lab practical

Chapter 9 Students will describe momentum and impulse and apply them to the interactions between objects, relate Newton's third law of motion to the conservation of momentum, and explore the momentum of rotating objects	9.1 Define the momentum of an object; determine the impulse give to an object; define the angular momentum of an object 9.2 Relate Newton's third law to conservation of momentum in collisions and explosions; recognize the conditions under which momentum is conserved; solve conservation of momentum problems in two dimensions	A.12.7 A.12.5, A.12.6, A.12.7, C.12.3, D.12.7, D.12.11, G.12.2	Worksheets Quizzes Tests Labs Lab practical
Chapter 10 Students will recognize that work and power describe how the external world changes the energy of a system and by relating force to work explain how machines ease the load	10.1 Describe the relationship between work and energy; calculate work; calculate the work done by a variable force; calculate the power used 10.2 Demonstrate a knowledge of the usefulness of simple machines; differentiate between ideal and real machines in terms of efficiency; analyze compound machines in terms of simple machines; calculate efficiencies for simple and compound machines	A.12.6, A.12.7	Worksheets Quizzes Tests Labs
Chapter 11 Students will learn that energy is a property of an object that can change the object's position, motion, or its environment and the concept of the conservation of energy.	11.1 Use a model to relate work and energy; calculate kinetic energy; determine the gravitational potential energy of a system 11.2 Solve problems using the law of conservation of energy; analyze collisions to find the change in kinetic energy	A.12.6 A.12.6, A.12.7, C.12.3, C.12.5, D.12.10, D.12.11	Worksheets Quizzes Tests Labs Lab practical

Chapter 12 Students will investigate how temperature relates to the potential and kinetic energies of atoms and molecules, how to distinguish heat from work, and to calculate how heat transfers from one object to another.	12.1 Describe thermal energy and compare it to potential and kinetic energies; distinguish temperature from thermal energy; define specific heat; calculate heat transfer 12.2 Define heats of fusion and vaporization; state the first and second laws of thermodynamics; distinguish between heat and work; define entropy	A.12.6, A.12.7, C.12.3, C.12.5, D.12.9 D.12.7, D.12.8	Worksheets Quizzes Tests Labs Lab practical
Chapter 13 Students will explain the expansion and contraction of matter caused by changes in temperature. Students will apply Pascal's, Archimedes', and Bernoulli's principles in everyday situations.	13.1 Describe how fluids create pressure; calculate the pressure, volume, and number of moles of a gas; compare gases and plasma 13.2 Explain how cohesive forces cause surface tension; explain how adhesive forces cause capillary action; discuss evaporative cooling and the role or condensation in cloud formation. 13.3 Relate Pascal's principle to simple machines and occurrences; apply Archimedes' principle to buoyancy; apply Bernoulli's principle to airflow 13.4 Relate the properties of solids to their structures; explain why solids expand when the temperature changes; calculate the expansion of solids; explain the importance of thermal expansion	A.12.6, C.12.3, C.12.5 A.12.6 A.12.5, A.12.6, A.12.7, B.12.1, C.12.5, D.12.11, G.12.2 D.12.11	Worksheets Quizzes Tests Labs

Chapter 14 Students will examine vibrational motion and learn how it relates to waves, determine how waves transfer energy, and describe wave behavior.	14.1 Describe the force in an elastic spring; determine the energy stored in an elastic spring; compare simple harmonic motion and the motion of a pendulum 14.2 Identify how waves transfer energy without transferring matter; contrast transverse and longitudinal waves; relate wave speed, wavelength, and frequency 14.3 Relate a wave's speed to the medium in which the wave travels; describe how waves are reflected and refracted at boundaries between media; apply the principle of superposition to the phenomenon of interference	A.12.6, A.12.7, C.12.3, C.12.4, C.12.5, D.12.7, D.12.9, G.12.2 A.12.6, D.12.7, D.12.9 A.12.4, A.12.6, C.12.1, C.12.3, C.12.5, D.12.9, G.12.2	Worksheets Quizzes Tests Labs Lab Practical
Chapter 15 Students will describe sound in terms of wave properties and behavior, examine sources of sound, and explain the properties that differentiate between music and noise.	15.1 Demonstrate the properties that sound shares with other waves; relate the physical properties of sound waves to our perception of sound; identify some applications of the Doppler effect 15.2 Describe the origin of sound; demonstrate an understanding of resonance, especially as applied to air columns and strings; explain why there are variations in sound among instruments and among voices	A.12.6, D.12.9, D.12.11 A.12.6, C.12.5, D.12.9, D.12.11, G.12.2	Worksheets Quizzes Tests Labs Lab Practical
Chapter 16 Students will understand sources of light and how light illuminates the universe around us.	16.1 Develop the ray model of light; predict the effect of distance of light's illuminance; solve problems involving the speed of light	A.12.6, A.12.7, C.12.3, C.12.5, D.12.9	Worksheets Quizzes Tests Labs

Students will be able to describe the wave nature of light and some phenomena that reveal this nature.	16.2 Describe how diffraction demonstrates that light is a wave; predict the effect of mixing colors of light and pigments; explain phenomena such as polarization and the Doppler effect	A.12.6, A.12.7, B.12.1, C.12.1, C.12.3, C.12.5, D.12.9, D.12.11	
Chapter 17 Students will learn how light reflects off different surfaces and the different types of mirrors and their uses. Students will use ray tracing and mathematical models to describe images formed by mirrors.	17.1 Explain the law of reflection; distinguish between specular and diffuse reflection; locate the images formed by plane mirrors 17.2 Explain how concave and convex mirrors form images; describe properties and uses of spherical mirrors; determine the locations and sizes of spherical mirror images	C.12.3, D.12.9 C.12.3, C.12.4, C.12.5, D.12.9, G.12.2	Worksheets Quizzes Tests Labs Lab Practical
Chapter 18 Students will explain how light changes direction and speed when it travels through different materials and compare properties of lenses and the images they form.	18.1 Solve problems involving refraction; explain total internal reflection; explain some optical effects caused by refraction 18.2 Describe how real and virtual images are formed by single convex and concave lenses; locate images formed by lenses using ray tracing and equations; explain how chromatic aberration can be reduced 18.3 Describe how the eye focuses light to form an image; explain nearsightedness and farsightedness and how eyeglass lenses correct these defects; describe the optical systems in some common optical instruments	C.12.3, C.12.5, D.12.9 C.12.3, C.12.5, D.12.9, G.12.2 D.12.11	Worksheets Quizzes Tests Labs Lab Practical

Chapter 19 Students will identify how interference and diffraction patterns exhibit wave behavior.	19.1 Explain how light falling on two slits produces an interference pattern; calculate light wavelengths from interference patterns; apply modeling techniques to thin-film interference 19.2 Explain how diffraction gratings form diffraction patterns; describe how diffraction gratings are used in grating spectrometers; discuss how diffraction limits the ability to distinguish two closely spaced objects with a lens	A.12.6	Worksheets Quizzes Tests Labs
Chapter 20 Students will observe the behavior of electric charges, analyze how these charges interact with matter, and examine the forces between them	20.1 Demonstrate that charged objects exert forces, both attractive and repulsive; recognize that charging is the separation, not the creation, of electric charges; describe the difference between conductors and insulators 20.2 Summarize the relationships between electric forces, charges, and distance; explain how to charge objects by conduction and induction; develop a model of how charged objects can attract a neutral object; apply Coulomb's law to problems in one and two dimensions	D.12.8, G.12.2 D.12.8	Worksheets Quizzes Tests Labs
Chapter 21 Students will relate electric fields to electric forces and electric potential difference to work and energy. Students will describe how charges are distributed on	21.1 Define an electric field; solve problems relating to charge, electric fields, and forces; diagram electric field lines 21.2 Define electric potential differences; calculate potential difference from the work required to move a charge; describe how charges are distributed on solid and hollow conductors;	A.12.3, D.12.8 D.12.8	Worksheets Quizzes Tests Labs

conductors and how capacitors store electric charges	solve problems pertaining to capacitance		
Chapter 22 Students will explain energy transfer in circuits, solve problems involving current, potential difference, and resistance, and diagram simple electric circuits	22.1 Describe conditions that create current in an electric circuit; explain Ohm's law; design closed circuits; differentiate between power and energy in an electric circuit 22.2 Explain how electric energy is converted into thermal energy; explore ways to deliver electric energy to consumers near and far; define kilowatt-hour	A.12.5 D.12.11, G.12.3	Worksheets Quizzes Tests Labs
Chapter 23 Students will distinguish among series circuits, parallel circuits, and series-parallel combinations, and solve problems involving them.	23.1 Describe series and parallel circuits; calculate currents, voltage drops, and equivalent resistances in series and parallel circuits 23.2 Explain how fuses, circuit breakers, and ground-fault interrupters protect household wiring; analyze and solve problems involving combined series-parallel circuits; explain how voltmeters and ammeters are used in circuits.	A.12.3, A.12.5, C.12.5, G.12.2 A.12.5, D.12.11	Worksheets Quizzes Tests Labs

G.12.4 and H.12.7—ongoing throughout the year

Wisconsin State Standards

By the end of grade twelve, students will:

A.12.1 Apply* the underlying themes* of science to develop defensible visions of the future

A.12.2 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 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

A.12.4 Construct* arguments that show* how conflicting models* and explanations* of events can start with similar evidence*

A.12.5 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

A.12.6 Identify* and, using evidence* learned or discovered, replace inaccurate personal models* and explanations* of science-related events

A.12.7 Re-examine the evidence* and reasoning that led to conclusions drawn from investigations*, using the science themes*

Performance Standards

By the end of grade twelve, students will:

B.12.1 Show* how cultures and individuals have contributed to the development of major ideas in the earth and space, life and environmental, and physical sciences

B.12.2 Identify* the cultural conditions that are usually present during great periods of discovery, scientific development, and invention

B.12.3 Relate* the major themes* of science to human progress in understanding science and the world

B.12.4 Show* how basic research and applied research contribute to new discoveries, inventions, and applications

B.12.5 Explain* how science is based on assumptions about the natural world and themes* that describe the natural world

Performance Standards

By the end of grade twelve, students will:

C.12.1 When studying science content, ask questions suggested by current social issues, scientific literature, and observations* of phenomena, build hypotheses that might answer some of these questions, design possible investigations*, and describe results that might emerge from such investigations

C.12.2 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 Evaluate* the data collected during an investigation*, critique the data-collection procedures and results, and suggest ways to make any needed improvements

C.12.4 During investigations*, choose the best data-collection procedures and materials available, use them competently, and calculate the degree of precision of the resulting data

C.12.5 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*

C.12.6 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 Evaluate* articles and reports in the 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

Performance Standards

By the end of grade twelve, students will:

STRUCTURE OF ATOMS AND MATTER

D.12.1 Describe* atomic structure and the properties of atoms, molecules, and matter during physical and chemical interactions*

D12.2 Explain* the forces that hold the atom together and illustrate* how nuclear interactions* change the atom

D.12.3 Explain* exchanges of energy* in chemical interactions* and exchange of mass and energy in atomic/nuclear reactions

CHEMICAL REACTIONS

D.12.4 Explain* how substances, both simple and complex, interact* with one another to produce new substances

D.12.5 Identify* patterns in chemical and physical properties and use them to predict* likely chemical and physical changes and interactions

D.12.6 Through investigations*, identify* the types of chemical interactions*, including endothermic, exothermic, oxidation, photosynthesis, and acid/base reactions

MOTIONS 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

D.12.8 Understand* the forces of gravitation, the electromagnetic force, intermolecular force, and explain* their impact on the universal system

D.12.9 Describe* models* of light, heat, and sound and through investigations* describe* similarities and differences in the way these energy* forms behave

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

INTERACTIONS OF MATTER AND ENERGY

D.12.11 Using the science themes*, explain* common occurrences in the physical world

D.12.12 Using the science themes* and knowledge of chemical, physical, atomic, and nuclear interactions*, explain* changes in materials, living things, earth's features, and stars

Performance Standards

By the end of grade twelve, students will:

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

GEOCHEMICAL CYCLES

E.12.2 Analyze* the geochemical and physical cycles of the earth and use them to describe* movements of matter

THE ORIGIN AND EVOLUTION OF THE EARTH SYSTEM

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

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

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

Performance Standards

By the end of grade twelve, students will:

THE CELL

F.12.1 Evaluate* the normal structures and the general and special functions* of cells in single-celled and multiple-celled organisms

F.12.2 Understand* how cells differentiate and how cells are regulated

THE MOLECULAR BASIS OF HEREDITY

F.12.3 Explain* current scientific ideas and information about the molecular and genetic basis of heredity

F.12.4 State the relationships between functions* of the cell and functions of the organism as related to genetics and heredity

BIOLOGICAL EVOLUTION*

F.12.5 Understand* the theory of evolution*, natural selection, and biological classification

F.12.6. 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 Investigate* how organisms both cooperate and compete in ecosystems

F.12.8 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 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 Understand* the impact of energy* on organisms in living systems*

F.12.11 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 BEHAVIOR OF ORGANISMS

F.12.12 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

Performance Standards

By the end of grade twelve, students will:

G.12.1 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

G.12.3 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 a major scientific or technological change has had an impact on work, leisure, or the home

G.12.5 Choose a specific problem in our society, identify* alternative scientific or technological solutions to that problem and argue it merits

Performance Standards

By the end of grade twelve, students will:

H.12.1 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 determine the potential impact of the proposal on life in the community and the region

H.12.2 Evaluate* proposed policy recommendations (local, state, and/or national) in science and technology for validity, evidence, reasoning, and implications, both short and long-term

H.12.3 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 Advocate a solution or combination of solutions to a problem in science or technology

H.12.5 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 Evaluate* data and sources of information when using scientific information to make decisions

H.12.7 When making decisions, construct a plan that includes the use of current scientific knowledge and scientific reasoning

Sources: Information adapted from Glencoe Science—Physics Principles and Problems text, 2009

Wisconsin State Science Standards, 2009, http://www.dpi.state.wi.us/standards/sciintro.html