

Course Title: Astronomy

Text: *The Cosmic Perspective*, 2nd Edition, Pearson Education publisher, 2002

Supplemental: Laboratory experiences, etc. provided by instructor.

Course Description:

The course is designed for students whose career goals involve the sciences, engineering, or education. Astronomy is one of the oldest and most misunderstood subjects. Students in Astronomy will investigate the history of astronomy in past and current cultures. The course will investigate the structure and relationship of the earth, our solar system, and galaxy. Students will investigate current theories of the formation of our solar system and the universe. Field trips to see local telescopes are likely. This course is valuable preparation for college and provides understanding of celestial events and their relevance. Topics include:

- Historical Astronomy
- Observational Astronomy
- Seasons and the Calendar
- The Solar System
- Planetary motion
- Earth and Moon
- Eclipses
- Comets and Meteors
- Properties of Stars
- Life Cycle of Stars
- Galaxies
- Cosmology

Prerequisite Courses: Algebra II and Natural Science. Chemistry, Advanced Math, and Physics are also highly recommended.

Grade Level: 12

Course Length: 1 semester

Credit: 1/2

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

11.A.5a Formulate hypotheses referencing prior research and knowledge.

11.A.4e Formulate alternative hypotheses to explain unexpected results.

Student Learning Objective

1. The student will form hypotheses in parts of various activities to extend their prior knowledge.

2. Students will produce alternative hypotheses to historical theories and to current contradictory observed data for theories being debated.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

12.C.4a Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations.

12.C.4b Analyze and explain the atomic and nuclear structure of matter.

12.D.4a Explain and predict motions in inertial and accelerated frames of reference.

12.D.5b Analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system.

12.E.4a Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics).

12.F.4a Explain theories, past and present, for changes observed in the universe.

Student Learning Objective

1. Students will analyze electromagnetic spectra of stars and galaxies to understand stellar and galactic structure and motion.

2. The student will explain how the atomic structure of different elements produce different characteristic spectra.

3. Students will study the motion of planets and Kepler's development of his laws of planetary motion.

3A. Students will explain the orbits and speeds of orbiting bodies in relation to the conservation of angular momentum.

3B. Students will explain the retrograde motion of the planets in the night sky.

4. The student will study Newton's development of his three laws of motion and his Law of Universal Gravitation.

5. Students will explain the formation of different types of planets. Students will compare and contrast the characteristics of different planets, moons, asteroids, and comets.

5A. The student will explain how processes on earth are driven by energy sources and on the other planets and moons.

6. Students will explain the cosmological theories both historically presented and for those currently held for the formation of the universe and the processes ongoing in the universe.

6A. Students will discuss the theories developed for the evolution and interaction of galaxies.

12.F.5a Compare the processes involved in the life cycle of stars (e.g., gravitational collapse, thermonuclear fusion, nova) and evaluate the supporting evidence.

12.F.2b Explain the apparent motion of the sun and stars.

12.F.4b Describe and compare the chemical and physical characteristics of galaxies and objects within galaxies (e.g., pulsars, nebulae, black holes, dark matter, stars).

12.F.5b Describe the size and age of the universe and evaluate the supporting evidence (e.g., red-shift, Hubble's constant).

12.F.2c Identify easily recognizable star patterns (e.g., the Big Dipper, constellations).

6B. Students will explain the phases of the moon, eclipses, and the different length of seasons on earth.

7. The student will explain the steps in the life cycle of stars.

7A. The student will contrast the difference between a nova and a supernova.

7B. The student will contrast the end formation of white dwarfs, neutron stars, and black holes by the different size ranges of stars.

8. The student will explain the observational motion of the sun, stars, and planets from several places on the surface of the earth.

9. The student will describe the physical and chemical characteristics of the various astronomical bodies.

9A. The student will explain the classification of galaxies and the theories of their formation.

10. Students will describe the supporting evidence of the accepted cosmological theories for the size and age of the universe.

11. Students will identify many constellations and asterisms beyond the basics of the Big and Little Dippers, Orion, and zodiac constellations.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories.

13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers).

Student Learning Objective

1. Students will explore the historical record of astronomical theories and how they were changed and modified.

2. The student will study how technological advances improved the study of astronomy, especially the history of the telescope and the changes made due to the discoveries of the orbiting Hubble Telescope.

13.A.5d Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims.

3. Students will discuss the need for peer review and repeatability of results, as well as the realization that new knowledge and technology can result from unexpected outcomes.

Student assessments:

Total grade will be determined using these percentages for the following categories.

Exams	60 %
Labs	20 %
Quizzes	10 %
Homework	10 %

The school grading scale is:

A	93 – 100
B	85 – 92
C	77 – 84
D	70 – 76
F	0 – 70

Course Title: Biology

Text: Modern Biology

Supplemental: Supplemental texts will be provided for by the instructor.

Course Description: This course will focus on connecting, biology, the study of life, to the real world. We will study a variety of biological issues while understanding different viewpoints. The course will develop proper lab techniques, particularly with microscopes, with continued emphasis on lab safety. Student will also participate in group projects, class discussions, and other research assignments. Topics will include:

- Structure and function of cells
- Homeostasis and transport
- Acid and protein synthesis
- Chromosomes, Mitosis, and Meiosis
- Genetics
- Inheritance
- Applied Genetics
- Origins of Life
- Evidence and Theory of Evolution
- Speciation
- Human Evolution
- Classification
- Gene Expression

Prerequisite Courses: Natural Science

Grade Level: 10-12

Course Length: 1 year

Credit: 1

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

Student Learning Objective

11.A.4a Formulate hypotheses referencing prior research and knowledge.

1. The student will learn to formulate hypotheses through laboratory experimentation using scientific inquiry.A. Know and apply the concepts, principles and processes of scientific inquiry.

11.A.4b Conduct controlled experiments or simulations to test hypotheses.

2. The students will learn to simulate a controlled experiment with dependent and independent variables using

hypothetical classroom experiments to test created hypotheses.

11.A.4c Collect, organize and analyze data accurately and precisely.

3. The students will learn to properly record observations, modify hypotheses, and present data using various graphs during laboratory experimentation and classroom activities.

11.A.4d Apply statistical methods to the data to reach and support conclusions.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

Student Learning Objective

12.A.4a Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms.

1. By observing *Drosophila* reproduction in lab the student will recognize the effects of genetic inheritance in fruit flies.

12.A.4b Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction.

2. The students will observe physical characteristics of cells and tissues using the microscope during lab, and learn about other cell processes during classroom lecture and projects.

12.A.4c Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry.

3. The students will discuss the significance of evolutionary advancements of organisms, and the progressive sophistication of anatomy and physiology when organisms become more advanced.

12.B.4a Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms.

4. The students will use computers to detect predator prey relationships between organisms to see how populations flux and drop pending on the amount of each organism present. The students will write papers about how pollution affects populations of organisms in oceans.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

Student Learning Objective

13.A.4a Estimate and suggest ways to reduce the degree of risk involved in science activities.

1. The students will discuss proper lab behavior, and suggest ways to make lab safer and more enjoyable for students.

13.A.4d Explain how peer review helps to assure the accurate use of data and improves the scientific process.

2. The students will work in lab groups to reach social and educational goals to improve results of experimentation in laboratory experiments.

13.B.4d Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements

3. The students will take random water samples from area streams or ponds and determine pollution amounts and microscopic organism counts in the water bodies using lab kits.

Course Title: Botany

Text: Miller and Levine Biology

Supplemental: Supplemental texts will be provided by instructor.

Course Description: This course will be a continuation of biology. Our focus will be a detailed study of the plant kingdom. This class will include both lab (inside) and field (outside) work. We will grow plants in the lab to study. Group projects, class discussions, and other research assignments will also be included in the class. Topics will include:

- **Multicellular Algae**
- **Plant Growth and Development**
- **Roots, Stems, and Leaves**
- **Plants with Seeds**
- **Reproduction in Seed Plants**
- **Mosses and Ferns**

Prerequisite Courses: Elective

Grade Level: 10-12

Course Length: 1 semester

Credit: ½ credit

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

Student Learning Objective

11.A.5a Formulate hypotheses referencing prior research and knowledge.

1. The students will learn how to research prior lab experimentation over a particular lab to ensure their hypothesis doesn't replicate one already done.

11.A.5b Design procedures to test the selected hypotheses.

2. The students will test hypotheses over laboratory work that tests different types of fertilizers on various plant species.

11.A.5c Conduct systematic controlled experiments to test the selected hypotheses.

3. The students will conduct controlled experiments previously chosen by instructor to test student hypotheses over fertilizers and plants.

11.A.5d Apply statistical methods to make predictions and to test the accuracy of results.

1. The students will use various graphs to statistically represent results from classroom experimentation.

11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs.

2. The students will apply different amounts of fertilizer to lab plants under controlled conditions to determine if oversaturation of nitrogen can occur in the lab plants.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

Student Learning Objective

12.A.5a Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy).

1. The students will see the effects saltwater and tap water have on a typical plant cell during lab with a microscope.

12.B.5b Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions).

2. The students will discuss the evolutionary advantages angiosperms have gained through evolution over gymnosperms in class.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

Student Learning Objective

13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities.

13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories.

Course Title: Chemistry

Text: *Modern Chemistry*, Holt, Rinehart, & Winston Publishers, 1993 edition

Supplemental: Laboratory experiences, etc. provided by instructor.

Course Description:

The course is designed for students whose career goals are into science, engineering, health professions, and environmental sciences. Students in chemistry will investigate the composition, structure, properties of matter and the chemical changes that matter undergoes. The course will emphasize the importance of chemical reactions in our lives, the development of new products, and their impact on our environment. The course enhances manipulative and critical thinking skills and relies heavily on laboratory work. Areas to be emphasized will include the following:

- Review of the Scientific Method, Metric System, and Scientific Notation
- Laboratory Safety
- Analyzing the Periodic Table
- Atomic Structure
- Chemical Bonding
- Nomenclature
- Molecular Structure and Chemical Formulas
- Balancing and Classifying Chemical Equations
- Gas Laws
- Chemical Calculations involving Mass and Energy
- Research and New Product Development
- Impact on Science and Technology
- Solution Concentrations
- Acids and Bases
- Hydronium Ion Concentration and pH

Prerequisite Courses: Algebra I & Natural Science – Biology recommended

Grade Level: 11 – 12 (10 with Science Department approval) **Course Length:** 1 year

Credit: 1

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

11.A.5a Formulate hypotheses referencing prior research and knowledge.

11.A.5b Design procedures to test the selected hypotheses.

Student Learning Objective

1. The student will form hypotheses in parts of various labs to explain observed data.

2. Students will formulate procedures to test hypotheses such as determine the types of bonds present in unknown materials.

11.A.5c Conduct systematic controlled experiments to test the selected hypotheses.

11.A.5d Apply statistical methods to make predictions and to test the accuracy of results.

3. Students will perform various labs to document for themselves the results of testing hypotheses.

4. Students will analyze their lab results for accuracy and the significance of their results.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

12.C.4a Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations.

12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems.

12.C.4b Analyze and explain the atomic and nuclear structure of matter.

12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures.

12.D.4b Describe the effects of electromagnetic and nuclear forces including atomic and molecular bonding, capacitance and nuclear reactions.

Student Learning Objective

1. Students will use the kinetic theory to explain the movement of gas molecules to explain pressure, temperature, and volume.

1A. Students will also use wave and quantum theory to explain the energy of photons and emission spectra of atoms.

2. Students will distinguish between five types of chemical reactions, including combustion and decomposition reactions.

2A. The student will perform composition and reaction stoichiometric calculations.

2B. Students will explain the process and the products of nuclear decay.

3. The student will be able to explain how neutrons, protons, and electrons make up atoms.

3A. The student will determine the electron orbital configuration for individual elements.

4. The student will compare and contrast the physical and chemical properties of different groups of elements and compounds.

4A. Students will study acid–base differences and define solution concentrations.

5. Students will distinguish between the different types of chemical bonds, the energy involved, and how they form.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories.

13.A.5d Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims.

13.B.4a Compare and contrast scientific inquiry and technological design as pure and applied sciences.

13.B.4e Evaluate claims derived from purported scientific studies used in advertising and marketing strategies.

13.B.5e Assess how scientific and technological progress has affected other fields of study, careers and job markets and aspects of everyday life.

Student Learning Objective

1. The student will explain and use the scientific method.

2. Students will discuss the need for peer review and repeatability of results, as well as the realization that new knowledge and technology can result from unexpected outcomes.

3. Students will compare and contrast the goals and techniques of pure scientific research and applied technological design.

4. The student will give examples in advertising where scientific studies are quoted accurately or manipulated to support marketing.

5. The student will discuss the careers and fields of study in science and technology, and how science and technology impacts all careers and culture.

Student assessments:

Total grade will be determined using these percentages for the following categories.

Exams	60 %
Labs	20 %
Quizzes	10 %
Homework	10 %

The school grading scale is:

A	93 – 100
B	85 – 92
C	77 – 84
D	70 – 76
F	0 – 70

Course Title: Human Anatomy and Physiology

Text: Essentials of Human Anatomy and Physiology

Supplemental: Any supplemental text will be provided by the instructor.

Course Description: Human A & P is designed as the most challenging life science course. We will study ourselves, that is, the structure and function of each system of the human body. Many new names and terms are used and a considerable amount of memorization is required. A few labs will also be included in the course. We will dissect a fetal pig if time permits. Topics will include:

- Integumentary system
- Muscular system
- Nervous system
- Endocrine system
- Digestive system
- Respiratory system
- Skeletal system
- Circulatory system
- Lymphatic system
- Excretory system
- Reproductive system

Prerequisite Courses: Biology (Zoology recommended)

Grade Level: 11-12

Course Length: 1 semester

Credit: ½ credit

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

Student Learning Objective

11.A.5a Formulate hypotheses referencing prior research and knowledge.

1. The students will research a topic given by instructor and formulate a hypothesis with their previous background information about the subject obtained through research.

11.A.5b Design procedures to test the selected hypotheses.

2. The students will design experiments to test hypotheses formed from background information for use in laboratory.

11.A.5c Conduct systematic controlled

3. The students will conduct controlled

experiments to test the selected hypotheses.

experiments that deal with stroke volume, pulse rate during activity, and urine analysis.

11.A.5d Apply statistical methods to make predictions and to test the accuracy of results.

4. The students will graph information obtained through experimentation in lab and present it to class through a professional presentation format.

11.A.5e Report, display and defend the results of investigations to audiences that may include professionals and technical experts.

5. The students will create a science poster over a topic of their choice and present it in class.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

Student Learning Objective

12.A.5a Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy).

1. The students will perform experiments over positive and negative feedback systems in the human body that involve hormones and how environmental factors influence cell function.

12.A.5b Analyze the transmission of genetic traits, diseases and defects.

2. The students will research a genetic disease of their choice that deals with the human body, write a paper, and then present their information to the class.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

Student Learning Objective

13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities.

1. The students will discuss proper lab etiquette and procedures before entering the lab and performing experiments.

13.A.5c Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies.

1. The students will learn to evaluate and determine strengths and weaknesses of experimental design through many diverse experiments over the human body.

Course Title: Modern Physics

Text : *Holt Physics*, Holt, Rinehart, & Winston Publishers, 2002 edition

Supplemental: Laboratory experiences, etc. provided by instructor.

Course Description:

Modern Physics is designed for students wanting a more complete background in the study of Physics, including students seeking careers in the physical sciences, engineering, radiology, and nuclear energy. Modern Physics will build on the fundamental topics taught in first year of Physics. The course will be completed by independent study to develop the student's study and note preparation skills. This course will cover the more advanced areas of physics, which may include the following topics as the student and instructor deem necessary:

- Thermodynamics
- Fluid Mechanics
- Wave Motion
- Sound
- Light and Optics
- Electricity and Magnetism
- Relativity
- Atomic Physics
- Nuclear Physics
- Radioactivity

Prerequisite Courses: Physics and Advanced Math

Grade Level: 12

Course Length: 1 semester

Credit: ½

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

- 11.A.5a** Formulate hypotheses referencing prior research and knowledge.
- 11.A.5b** Design procedures to test the selected hypotheses.
- 11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses.
- 11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results.

Student Learning Objective

1. The student will form hypotheses in parts of various activities to extend prior knowledge.
2. Students will formulate procedures to determine experimental information in several labs.
3. Students will perform various labs to document for themselves the results of testing hypotheses.
4. The student will analyze their lab results for accuracy and the significance of their results.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

12.C.4a Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations.

12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems.

12.D.4a Explain and predict motions in inertial and accelerated frames of reference.

12.D.4b Describe the effects of electromagnetic and nuclear forces including atomic and molecular bonding, capacitance and nuclear reactions.

12.D.5b Analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system.

12.F.5a Compare the processes involved in the life cycle of stars (e.g., gravitational collapse, thermonuclear fusion, nova) and evaluate the supporting evidence.

Student Learning Objective

1. Students will extensively study and apply wave theory, quantum theory, electricity, optics, and the laws of thermodynamics to explain the transformation and transfer of energy.

2. The student will study and analyze nuclear processes including stability, nuclear decay, fission, and fusion and their applications.

3. Students will explain and calculate the motion of objects in inertial and accelerated reference frames.

4. The student will study the effects of electric and magnetic forces. Students will study effects of nuclear reactions and forces, including fission and fusion.

5. Students will analyze and calculate the motion of objects in electric and magnetic fields and from nuclear forces.

6. Students will study thermonuclear fusion and its importance in stellar energy production and the life cycles of stars.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

13.A.5c Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies.

Student Learning Objective

1. Students will discuss the methodologies used to test hypotheses and their application to various types of study.

13.A.5d Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims.

13.B.5b Analyze and describe the processes and effects of scientific and technological breakthroughs.

13.B.5e Assess how scientific and technological progress has affected other fields of study, careers and job markets and aspects of everyday life.

2. Students will discuss the need for peer review and repeatability of results, as well as the realization that new knowledge and technology can result from unexpected outcomes.

3. Students will demonstrate how science and technology improve productivity and lead to new advances.

4. The student will discuss the careers and fields of study in science and technology, and how science and technology impacts all careers and culture.

Student assessments:

Total grade will be determined using these percentages for the following categories.

Exams	60 %
Labs	20 %
Quizzes	10 %
Homework	10 %

The school grading scale is:

A	93 – 100
B	85 – 92
C	77 – 84
D	70 – 76
F	0 – 70

Course Title: Natural Science

Text: *Holt Science Spectrum: A physical Approach*, Holt, Rinehart, & Winston Publishers, 2001 edition

Supplemental: Supplemental materials will be included by the instructor as needed.

Course Description: The course is designed to give a broad understanding of topics important for our technological society and necessary for further studies in the sciences. The course enhances manipulative and critical reasoning skills, relies on basic laboratory work, and emphasizes lab safety. Natural science will be divided into four areas: Chemistry, Environmental Science, Physics, and Space Science. Topics will include:

- Atomic Theory and the Periodic Table
- Chemical Bonding and Reactions
- Acids and Bases
- Organic Chemistry
- Biosphere and Biomes
- Ecosystems: Structures and Relationships
- Populations
- People and the Environment
- Laws of Motion
- Work, Energy, and Power
- Sound and Light
- Electricity and Magnetism
- The solar system
- Earth and Moon
- Stars and Galaxies
- Cosmology

Prerequisite Courses: None – A good math background is required.

Grade Level: 9

Course Length: 1 year

Credit: 1

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

11.A.4a Formulate hypotheses referencing prior research and knowledge.

11.A.4b Conduct controlled experiments or simulations to test hypotheses.

11.A.4c Collect, organize and analyze data accurately and precisely.

Student Learning Objective

1. The student will simulate and test hypotheses during laboratory and classroom time to explain observable data present in labs and hypothetical situations presented in class.

2. Students will conduct lab experiments to develop their hypothesis building skills.

3. Student groups will organize and analyze data, including graphs and tables, from various experiments performed in lab.

11.A.4e Formulate alternative hypotheses to explain unexpected results.

4. Students will discuss results of experiments that do not support the hypothesis, and analyze why the results weren't as expected.

4A. Student will then form alternative hypotheses to be tested.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

12.B.4a Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms.

12.C.3a Explain interactions of energy with matter including changes of state and conservation of mass and energy.

12.C.4a Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations.

12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems.

12.C.4b Analyze and explain the atomic and nuclear structure of matter.

12.C.5b Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures.

12.D.4a Explain and predict motions in inertial and accelerated frames of reference.

12.D.5a Analyze factors that influence the relative motion of an object (e.g., friction, wind shear, cross currents, potential differences).

Student Learning Objective

1. Through classroom work and internet research, the student will apply concepts that describe how living things interact with each other and with their environment.

2. The student will:

- explain energy's role in changes of state,
- use conservation of energy in physical systems,
- use conservation of matter in chemical equations.

3. Students will study relationships between matter and energy using:

- kinetic theory of particles,
- energy transfer by waves, radiation, convection, and conduction,
- particle theory of light and quantized energy

4. Students will classify chemical reactions as synthesis, decomposition, combustion, single displacement, or double displacement.

5. The student will describe the structure of atoms and the differences between elements, including electron orbitals and isotopes.

6. Students will compare the physical and chemical properties of elements and compounds by their atomic and bonding structure.

7. Students will explain the relationship of velocity, acceleration, momentum, force, work, and power.

8. Students will study the effect of frictional forces, including surface friction and air resistance.

12.D.3b Explain the factors that affect the gravitational forces on objects (e.g., changes in mass, distance).

12.D.4b Describe the effects of electromagnetic and nuclear forces including atomic and molecular bonding, capacitance and nuclear reactions.

12.E.4a Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics).

12.E.3b Describe interactions between solid earth, oceans, atmosphere and organisms that have resulted in ongoing changes of Earth (e.g., erosion, El Nino).

12.E.3c Evaluate the biodegradability of renewable and nonrenewable natural resources.

12.F.3a Simulate, analyze and explain the effects of gravitational force in the solar system (e.g., orbital shape and speed, tides, spherical shape of the planets and moons).

12.F.4a Explain theories, past and present, for changes observed in the universe.

12.F.5a Compare the processes involved in the life cycle of stars (e.g., gravitational collapse, thermonuclear fusion, nova) and evaluate the supporting evidence.

12.F.2b Explain the apparent motion of the sun and stars.

12.F.3b Describe the organization and physical characteristics of the solar system (e.g., sun, planets, satellites, asteroids, comets).

9. The student will explain the relationship of mass and distance in Newton's Law of Universal Gravitation

10. Students will explain and classify types of chemical bonds using ionic charge and electron sharing.

11. The student will explain how various earth processes are the result of external energy from the sun and internal energy and forces from the surface and interior of the earth.

12. The student will study earth processes and their interaction and effect on ecosystems.

13. Students will explain the relationship between biodegradability, alternate sources of energy, renewable and nonrenewable resources, and ecosystems.

14. Students will study Kepler's Laws and explain the motion of celestial bodies.

15. Students will explore past theories of solar system dynamics and current theories of formation and evolution of the universe.

16. The student will describe the internal processes and life cycle of a star and the different outcomes dependent on its mass.

17. Students will describe and explain:

- the apparent motion of sun, moon, planets, and stars,
- the phases of the moon,
- lunar and solar eclipses,
- the elliptical orbit of the earth,

which are often misunderstood.

18. The student will describe the different characteristics for all the bodies that are in solar system.

12.F.4b Describe and compare the chemical and physical characteristics of galaxies and objects within galaxies (e.g., pulsars, nebulae, black holes, dark matter, stars).

12.F.5b Describe the size and age of the universe and evaluate the supporting evidence (e.g., red-shift, Hubble's constant).

12.F.2c Identify easily recognizable star patterns (e.g., the Big Dipper, constellations).

19. Students will describe the characteristics of galactic objects, including various types of stars, black holes, dust clouds, and nebulae, and extragalactic structures of clusters and superclusters.

20. Students will explain how data from red shift, cosmic background radiation, support current concepts of the origin, age, size, and expansion of the universe.

21. The student will learn the use of a star finder and will identify major asterisms and constellations.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

13.A.4a Estimate and suggest ways to reduce the degree of risk involved in science activities.

13.A.4b Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data presented and potential sources of error.

13.A.4d Explain how peer review helps to assure the accurate use of data and improves the scientific process.

Student Learning Objective

1. The students will review proper lab procedures and etiquette and will discuss acceptable behavior before doing lab practice.

2. The students will:

- create a terra-aqua ecosystem,
- study the sample,
- record observations,
- determine problems with design,
- modify hypotheses,
- report possible causes of error for the design.

3. The students will learn, through group work investigation using the scientific method, that discussing lab design and procedures will result in less errors

Student assessments:

Total grade will be determined using these percentages for the following categories.

Exams	40 %
Labs	20 %
Quizzes	20 %
Homework	20 %

The school grading scale is:

A	93 – 100
B	85 – 92
C	77 – 84
D	70 – 76
F	0 – 70

Course Title: Physics

Text: *Holt Physics*, Holt, Rinehart, & Winston Publishers, 2002 edition

Supplemental: Laboratory experiences, etc. provided by instructor.

Course Description:

This course teaches necessary critical thinking and reasoning skills for higher education and the work place in our high-tech society. It is designed for students seeking careers in science, engineering, and the health professions. Physics studies the relationship between matter and energy. It is the most fundamental of the sciences, providing an understanding of nature and reality. Physics utilizes advanced math topics including algebra, geometry, trigonometry, and graphical analysis, and emphasizes laboratory work. This course will cover topics including:

- | | |
|---|--|
| <ul style="list-style-type: none">• Linear Motion• Vectors• Forces• Momentum and Impulse• Energy and Power• Gravitation• Rotational Motion• Planetary Motion | <p>As time permits the following will be included:</p> <ul style="list-style-type: none">• Wave Motion• Sound• Light and Optics• Electricity and Magnetism• Introduction to Modern Physical Concepts |
|---|--|

Prerequisite Courses: Algebra II & Natural Science. Chemistry & Advanced Math are recommended.

Grade Level: 11 - 12

Course Length: 1 year

Credit: 1

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

Student Learning Objective

11.A.5a Formulate hypotheses referencing prior research and knowledge.

1. The student will form hypotheses in parts of various labs to explain observed data.

11.A.5b Design procedures to test the selected hypotheses.

2. Students will formulate procedures to determine experimental information in several labs.

11.A.5c Conduct systematic controlled experiments to test the selected hypotheses.

3. Students will perform various labs to document for themselves the results of testing hypotheses.

11.A.5d Apply statistical methods to make predictions and to test the accuracy of results.

11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs.

11.B.5c Build and test different models or simulations of the design solution using suitable materials, tools and technology.

11.B.5d Choose a model and refine its design based on the test results.

4. The student will analyze their lab results for accuracy and the significance of their results.

5. Students will be presented a design problem in one or more labs requiring building, testing, and refining a model, such as an egg drop and building a mobile.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

12.C.4a Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations.

12.D.4a Explain and predict motions in inertial and accelerated frames of reference.

12.D.5a Analyze factors that influence the relative motion of an object (e.g., friction, wind shear, cross currents, potential differences).

12.D.4b Describe the effects of electromagnetic and nuclear forces including atomic and molecular bonding, capacitance and nuclear reactions.

12.D.5b Analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system.

Student Learning Objective

1. Students will use wave theory to explain the energy of photons and the transmission of energy by electromagnetic radiation.

2. The student will explain and calculate the motion of objects in inertial and accelerated reference frames.

3. The student will describe the effects of, and calculate net forces on an object as the result of forces such as friction, electrostatics, and eddy currents.

4. Students will describe and calculate the effects of electric and magnetic field forces, including flux, capacitance, resistance, inductance, and potential differences.

5. Students will analyze and calculate the motion of objects in gravitational, electric, and magnetic fields, involving two and three dimensions, including linear and circular motion.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories.

13.A.5c Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies.

13.A.5d Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims.

13.B.5b Analyze and describe the processes and effects of scientific and technological breakthroughs.

13.B.5e Assess how scientific and technological progress has affected other fields of study, careers and job markets and aspects of everyday life.

Student Learning Objective

1. The student will explain and use the scientific method.

2. Students will discuss the methodologies used to test hypotheses and their application to various types of study.

3. Students will discuss the need for peer review and repeatability of results, as well as the realization that new knowledge and technology can result from unexpected outcomes.

4. Students will demonstrate how science and technology improve productivity and lead to new advances.

5. The student will discuss the careers and fields of study in science and technology, and how science and technology impacts all careers and culture.

Student assessments:

Total grade will be determined using these percentages for the following categories.

Exams	60 %
Labs	20 %
Quizzes	10 %
Homework	10 %

The school grading scale is:

A	93 – 100
B	85 – 92
C	77 – 84
D	70 – 76
F	0 – 70

Course Title: Zoology

Text: Miller and Levine Biology

Supplemental: Supplemental texts will be provided by the instructor.

Course Description: This course will be a continuation of biology. Our focus will be a detailed study of the animal kingdom. Labs will include several dissections including earthworms, crayfish, squid, perch, and frogs. The class will also include group projects, class discussions, and other research assignments. Topics will include:

- Sponges, Cnidarians, Unsegmented Worms
- Mollusks and Annelids
- Arthropods
- Echinoderms
- Fishes and Amphibians
- Reptiles and Birds
- Humans
- Animal Behavior

Prerequisite Courses: Biology

Grade Level: 10-12

Course Length: 1 semester

Credit: ½ credit

State Goals and Objectives:

State Goal 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.

Illinois Learning Standard

Student Learning Objective

11.A.5a Formulate hypotheses referencing prior research and knowledge.

1. The students will research a topic given by instructor and formulate a hypothesis with their previous background information about the subject obtained through research.

11.A.5b Design procedures to test the selected hypotheses.

2. The students will design experiments to test hypotheses formed from background information for use in laboratory.

11.A.5c Conduct systematic controlled experiments to test the selected hypotheses.

3. The students will test hypothesis, record data, and set up a series of new systematic experiments to test hypothesis further.

11.A.5d Apply statistical methods to

4. The students will graph information

make predictions and to test the accuracy of results.

obtained through experimentation in lab and present it to class through a professional presentation format.

STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Illinois Learning Standard

Student Learning Objective

12.A.5a Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy).

1. The students will perform introduce planaria to variety of stimuli to observe organisms ability to respond to environment.

12.A.4b Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction.

2. The students will observe through the microscope various cells from different tissues of dissected organisms to compare morphology or organisms.

12.A.4c Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry.

3. The students will discuss anatomical and physiological evolutionary advancements of organism systems as organisms become more complex in nature.

12.B.5a Analyze and explain biodiversity issues and the causes and effects of extinction.

4. The students will study why organisms become extinct, and then look at human expansion and pollution as probable causes of current animal extinction.

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standard

13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities.

13.A.4d Explain how peer review helps to assure the accurate use of data and improves the scientific process.

13.B.5c Design and conduct an environmental impact study, analyze findings and justify recommendations.

Student Learning Objective

1. The students will work in groups to discuss proper procedures and check lists to go through before during a prairie grass burn.

2. The students will work with lab partners to understand the majority of scientific experimentation is done through collaboration, countless trials, and peer review of results of experimentation.

3. The students will research the devastating effect foreign species of fish or mollusks can have on bodies of water.