Geneva CUSD 304
Content-Area Curriculum Frameworks
Grades 6-12
Science

Mission Statement	<u>The Mission of Science Education Is:</u> 1) to nurture an active interest in science that continues throughout life. 2) to teach the learning skills and concepts necessary for the scientific process. 3) to develop student understanding of the interrelationships between science, society, and the environment 4) to encourage students to discover and develop their talent in science.
Course Sequence (Grades 6-12)	**6th grade:** Earth Science **7th grade:** Life Science **8th grade:** Physical Science **9th grade:** General Science Earth Science Biology Biology Honors **10th ,11th,12 grade:** Chemistry Chemistry Honors Physics Astronomy Natural Disasters Anatomy and Physiology I and II Horticulture I and II AP Chemistry AP Biology AP Environmental Science

Course Framework

Course Title	**Physics**
Grade Level	11th/12th
Semesters (1-2-3-4)	2
Prerequisite	Algebra I required, (a grade of A or B strongly recommended), Geometry recommended
Course Description	Physics is a laboratory science course that is designed for upper-level science students and involves algebra and a small amount of trigonometry. Strong Algebra skills are expected and assumed as is a high level of student responsibility. Physics should not be considered as a simple continuation of the science curriculum. It should be taken only by those students who intend to major in science or a science-related field in college. Students who are not strong in science should not take physics. Students enrolled in physics are required to have a variety of equipment items including a non-graphing scientific calculator. Areas of study include motion and Newton's Laws, motion in two dimensions, momentum, work, power, simple machines, energy, waves and energy transfer, sound, light, and electricity and magnetism. Topics may also include cosmology and universal gravitation, thermodynamics, states of matter, and nuclear physics.
District-approved Materials and/or Resources	Physics: Principals and Problems Publisher: McGraw Hill ISBN: 0-02-825473-2 Copy write: 1999

Unit Frameworks

Unit of Study: major topics	**Introduction to Physics and Basic Mathematics**	Resources that will support instruction •Teacher made Handouts •Video Tracking Exercises •LAB: GRAPHING EXPERIMENTAL DATA: Hooke's Law •LAB: Paper Tower
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	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. 11.A.4d Apply statistical methods to the data to reach and support conclusions. 11.A.4e Formulate alternative hypotheses to explain unexpected results. 11.A.4f Using available technology, report, display and defend to an audience conclusions drawn from investigations. 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. 11.B.4c Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations) 11.B.4d Determine the criteria upon which the designs will be judged, identify advantages and disadvantages of the designs and select the most promising design. 11.B.4e Develop and test a prototype or simulation of the solution design using available materials, instruments and technology. 11.B.4f Evaluate the test results based on established criteria, note sources of error and recommend improvements. 11.B.4g Using available technology, report to an audience the relative success of the design based on the test results and criteria. 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.5b Select criteria for a successful design solution to the identified problem. 11.B.5c Build and test different models or simulations of the design solution using suitable materials, tools and technology 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. 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.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. 13.B.4a Compare and contrast scientific inquiry and technological design as pure and applied sciences. 13.B.4b Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. 13.B.5e Assess how scientific and technological progress has affected other fields of study, careers and job markets and aspects of everyday life.	
Objectives o **Conceptual** o **Factual** o **Procedural**	•define "physics" and discuss its relationship to other sciences including the similarities between the methodologies and the characteristics of all scientists, while realizing that there is no single correct method in applying and using theory, experiment, the scientific method, and applications •list and discuss various careers and how they depend upon physics and physics and society with regards to benefits of physics research and funding for that research •a careful, planned, consistent, and thoughtful physics problem solving approach and success strategies including definitions, usages, and relationships between basic and derived units in the metric system •demonstrate the ability to use observational and mathematical techniques such as algebra, simple trigonometry, significant digits, scientific notation factor-labeling, parallax, precision, and accuracy and uncertainy in all measured quantities •graphing: data analysis, construction techniques, conclusions and relationships	
Assessments	Performance Tasks •Examinations •Subject Matter Quizzes •Procedural Quizzes •Completion of Assignments •Video Follow-up quizzes •Laboratory Data Sheets •Laboratory Analysis Sheets •Laboratory Summary Sheets	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**Kinematics**	Resources that will support instruction •Teacher Made Handouts •Video Tracking Exercises •Computer-Based Lab: Understanding Motion I: Distance and Time •Computer-Based Lab: Understanding Motion II: Velocity and Time •Computer-Based Lab: Instantaneous Speed versus Average Speed •Computer-Based Lab: Constant Acceleration—Motion Down An Incline •Computer-Based Lab: Position, Velocity, and Acceleration •Computer-Based Lab: Measuring the Acceleration of a Freely Falling Picket Fence •Lab: Addition Of Force Vectors •Lab: Measurement Of Length •Video: Mechanical Universe - Law of Falling Bodies
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	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. 11.A.4d Apply statistical methods to the data to reach and support conclusions. 11.A.4e Formulate alternative hypotheses to explain unexpected results. 11.A.4f Using available technology, report, display and defend to an audience conclusions drawn from investigations. 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. 11.B.4c Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations) 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). 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.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. 13.A.5c Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies.	
Objectives o **Conceptual** o **Factual** o **Procedural**	•construct, interpret, and analyze motion diagrams and the particle model and use them to illustrate and describe motion •select, exemplify, and utilize different coordinate systems and understand how those systems affect the signs of vector quantities •define, exemplify, distinguish between, and utilize scalar and vector quantities including the properties of vectors, how to draw them, uses for them, concurrent and independent effects in one and two dimensions, and graphical and mathematical treatments including vector resolution and appropriate angle referencing •describe the two states of motion for objects, and expand those two states into four categories in order to define, distinguish between, classify, and correctly apply the concepts of displacement, distance, velocity, speed, acceleration, and time to the motion of objects •acceleration due to gravity (free fall): definition, examples, symmetrical nature, mathematical value, and usage	
Assessments	Performance Tasks •Examinations •Subject Matter Quizzes •Procedural Quizzes •Completion of Assignments •Video Follow-up quizzes •Laboratory Data Sheets •Laboratory Analysis Sheets •Laboratory Summary Sheets	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**Dynamic**s	Resources that will support instruction •Teacher Made Handouts •Video Tracking Exercises •LAB: Centripetal Force •Lab: The Inertia Balance - Two Types of Mass •Computer-Based Lab: Acceleration of a Dynamics Cart 1 •Computer-Based Lab: Acceleration of a Dynamics Cart 2 •Computer-Based Lab: Newton's Second Law: Constant Force •Computer-Based Lab: Second Law: Pushing and Pulling A Cart •Computer-Based Lab: Atwood's Machine •Computer-Based Lab: Kinetic Friction •Video: Mechanical Universe - The Apple and the Moon •Video: Mechanical Universe - Moving In Circle •Video: Mechanical Universe - Inertia •Video: Mechanical Universe - Fundamental Forces •Video: Mechanical Universe - Gravity, Elec, Magnetism •Video: Mechanical Universe - Newton's Laws •Video: Mechanical Universe - Harmonic Motion
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	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. 11.A.4d Apply statistical methods to the data to reach and support conclusions. 11.A.4e Formulate alternative hypotheses to explain unexpected results. 11.A.4f Using available technology, report, display and defend to an audience conclusions drawn from investigations. 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. 11.B.4c Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations)	

	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.5a Analyze factors that influence the relative motion of an object (e.g., friction, wind shear, cross currents, potential differences). 12.D.5b Analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system. 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.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). 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. 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.4a Compare and contrast scientific inquiry and technological design as pure and applied sciences. 13.B.4b Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. 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.
Objectives o **Conceptual** o **Factual** o **Procedural**	•define “force” and state the similarities and differences between contact and non-contact (long-range) forces, the three types of forces and examples, their characteristics, locations, relationship between force strength and distance, examples, descriptions, and relative strengths and the artificial differentiation into four forces for study •state and explain Newton’s First Law: the Law of Inertia—its meaning and implications; also the concept of inertia and examples and use of First Law in problem solving •state and explain Newton’s Second Law: the Law of Acceleration—its meaning and implications; use of Second Law in problem solving •state and explain Newton’s Third Law: the Law of Action and Reaction—its meaning and implications; use of Third Law in problem solving; concept of net force and force interactions; tensions in ropes and strings

	•the differences and similarities between mass and weight; the two types of mass •frictional force: list, explain, examples, use in problem solving, characteristics, benefits, detriments •simple harmonic motion: description, characteristics, examples and relationship to the acceleration due to gravity •distinguish between centripetal force and centripetal acceleration and apply Newton's Second Law of Motion to them and use them to explain satellite motion as a function of orbital velocity and distance from the earth	
Assessments	Performance Tasks •Examinations •Subject Matter Quizzes •Procedural Quizzes •Completion of Assignments •Video Follow-up quizzes •Laboratory Data Sheets •Laboratory Analysis Sheets •Laboratory Summary Sheets	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**Work, Energy, and Simple Machines**	Resources that will support instruction •Teacher Made Handouts •Video Tracking Exercises •Lab: Pulleys •Lab: The Wheel And Axle •Lab: The Lever •Lab: The Inclined Plane •Lab: Spring Cannon •Lab: The Projectile Launcher •Video: Mechanical Universe - Conservation of Energy •Video: Mechanical Universe - Potential Energy •Video: Mechanical Universe - Entropy •Video: Newton's Dark Secret •Video: Hydraulics
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	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. 11.A.4d Apply statistical methods to the data to reach and support conclusions. 11.A.4e Formulate alternative hypotheses to explain unexpected results. 11.A.4f Using available technology, report, display and defend to an audience conclusions drawn from investigations. 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. 11.B.4c Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations) 11.B.4d Determine the criteria upon which the designs will be judged, identify advantages and disadvantages of the designs and select the most promising design. 11.B.4e Develop and test a prototype or simulation of the solution design using available materials, instruments and technology. 11.B.4f Evaluate the test results based on established criteria, note sources of error and recommend improvements. 11.B.4g Using available technology, report to an audience the relative success of the design based on the test results and criteria. 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.5b Select criteria for a successful design solution to the identified problem. 11.B.5c Build and test different models or simulations of the design solution using suitable materials, tools and technology	

	11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. 12.C.4a Use kinetic theory, wave theory, quantum theory and the laws of thermo-dynamics 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.5b Analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system. 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.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. 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.4b Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. 13.B.5e Assess how scientific and technological progress has affected other fields of study, careers and job markets and aspects of everyday life.	
Objectives o **Conceptual** o **Factual** o **Procedural**	•verbally and mathematically explain work in a scientific sense; and give examples to demonstrate an understanding of the work-energy theorem and the relationship between work and the direction of force •explain and apply the concept of power both verbally and mathematically •list, explain, and exemplify six types of simple machines including the 3 classes of levers and demonstrate an understanding of actual mechanical advantage, ideal mechanical advantage, and efficiency both verbally and mathematically •define, explain, exemplify and complete calculations involving kinetic and potential energy energy •explain and apply the Law of Conservation of Energy including the relationships between kinetic energy and potential energy druing energy transformations •define inelastic and elastic collisions and apply to problems	
Assessments	Performance Tasks •Examinations •Subject Matter Quizzes •Procedural Quizzes •Completion of Assignments	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

	•Video Follow-up quizzes •Laboratory Data Sheets •Laboratory Analysis Sheets •Laboratory Summary Sheets	

Unit Frameworks

Unit of Study: major topics	**Waves, Acoustics, and Optics**	Resources that will support instruction •Teacher Made Handouts •Video Tracking Exercises •Lab: The Ripple Tank •Video: Mechanical Universe - Resonance •Video: Mechanical Universe - Waves •Video: Echoes of War (Radar) •Computer-Based Lab: Sound •Lab: Speed of Sound •Video: Speed of Sound •Computer-Based Lab: Light Intensity versus Position •Computer-Based Lab: Luminous Intensity and Efficiency of Light Bulbs •Video: Mechanical Universe - Maxwell's Equations •Video: Mechanical Universe - Optics
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	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. 11.A.4d Apply statistical methods to the data to reach and support conclusions. 11.A.4e Formulate alternative hypotheses to explain unexpected results. 11.A.4f Using available technology, report, display and defend to an audience conclusions drawn from investigations. 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. 12.A.4a Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. 12.C.4a Use kinetic theory, wave theory, quantum theory and the laws of thermo-dynamics to explain energy transformations. 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. 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.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). 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities. 13.B.4b Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. 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.
Objectives o **Conceptual** o **Factual** o **Procedural**	•list and exemplify the two types of waves and describe their media, particle movements, the three forms of waves and describe their disturbance aspects including general properties and pulse •describe the characteristics and anatomy of waves including but not limited to phase, crest, trough, wavelength, amplitude, frequency, velocity, and period; be able to label a wave diagram •demonstrate an understanding of wave behavior including but not limited to speed, dispersion, damping, behavior at various boundaries, reflection, refraction, resonance, diffraction and both constructive and destructive wave interference •Doppler effect: definition, causes, implications •demonstrate an understanding of heard vs. physical properties with regards to pitch, loudness, and frequency •physiological and psychological effects of noise and sound pressure with evolutionary aspects •relationship between fundamental, harmonics, and overtones and how they relate to sound quality •resonance in open and closed tubes: similarities, differences, lowest resonant frequencies, effect of tube length •complex sound waves: definition, causes, consonance, dissonance •recognize the characteristics of light as a wave including frequency, wavelength, and straight line travel •understand Roemer's and Michelson's methods for measuring the speed of light •the transmission and absorption of light: behavior and mechanisms, transparency, translucency, opacity •the concepts of, calculations involving, and relationships between luminous intensity, flux, and illuminance •the relationship between wavelength, frequency, and color •the basic anatomy and mechanisms of human vision systems •light polarization: definition and explanation, examples, similarities and differences between it and normal light •methods of producing light including atomic excitation and the differences and similarities between fluorescence and phosphorescence

Assessments	Performance Tasks •Examinations •Subject Matter Quizzes •Procedural Quizzes •Completion of Assignments •Video Follow-up quizzes •Laboratory Data Sheets •Laboratory Analysis Sheets •Laboratory Summary Sheets	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**Modern Physics and Cosmology**	Resources that will support instruction •Teacher Made Handouts •Video Tracking Exercises •SETI and the search for extraterrestrial life •Video: The Creation of the Universe •Video: Mysteries of Deep Space
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	11.A.4a Formulate hypotheses referencing prior research and knowledge. 12.C.4a Use kinetic theory, wave theory, quantum theory and the laws of thermo-dynamics to explain energy transformations. 12.C.4b Analyze and explain the atomic and nuclear structure of matter. 12.C.5a Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. 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.4b Describe the effects of electromagnetic and nuclear forces including atomic and molecular bonding, capacitance and nuclear reactions. 12.D.5a Analyze factors that influence the relative motion of an object (e.g., friction, wind shear, cross currents, potential differences). 12.D.5b Analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system. 12.F.4a Explain theories, past and present, for changes observed in the universe. 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.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.5b Describe the size and age of the universe and evaluate the supporting evidence (e.g., red-shift, Hubble's constant). 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.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). 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.4a Compare and contrast scientific inquiry and technological design as pure	

	and applied sciences. 13.B.4b Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. 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.	
Objectives o **Conceptual** o **Factual** o **Procedural**	•the ideas and contributions of modern and past researchers and philosophers such as Lederman, Chadwick, Maxwell, Plato, Einstein, Aristotle, Newton, Lucretius, Rutherford, Fermi, Durac and Gell-Mann concerning early and modern physics •sources of astronomical knowledge and the meaning of various stellar data sources •the basic forces and particles including exotic particles •modern research facilities such as Fermilab and CERN, basics of how they work and the results of that work •antimatter: what it is, how it's generated, what interactions it can have •the history of the universe from today back to femtoseconds after the Big Bang and the explanation for the different states through which the Universe went •the beginnings of astronimical observations including the work and contributions of Brahe, Kepler, Galileo, Einstein, Hubble, and Geller •the meaning of the Red Shift and how it is related to the Doppler Effect •the Hubble Space Telescope current work, early problems, and results it has obtained •various cosmological features, such as supernovae, stars, black holes, quasars, dark matter, nebulae, neutron stars, pulsars, and moons •cosmological processes including stellar collapse and explosion, the expansion of the Universe and theoretical causes, stellar nurseries, black holes, and the formation of asteroids, comets, planets and moons	
Assessments	Performance Tasks •Examinations •Subject Matter Quizzes •Procedural Quizzes •Completion of Assignments •Video Follow-up quizzes	Other Evidence Professional observation and subjective evaluation by teacher.