

COMMUNITY UNIT SCHOOL DISTRICT 200

Physics High School - Grades 10, 11, 12 Intermediate Level – Two Semesters

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

Learning Standard A	Know and apply the concepts, principles, and processes of scientific inquiry
Critical Content	<p>11.A.4a a. formulate hypothesis referencing prior research and knowledge</p> <p>11.A.4b b. conduct controlled experiments or simulations to test hypothesis</p> <p>11.A.4c c. collect, organize, and analyze data accurately and precisely (metric system)</p> <p>11.A.4d d. apply statistical methods and analysis to the data to reach and support conclusions in a qualitative and quantitative manner using basic algebra and graphing techniques</p> <p>11.A.4e e. formulate alternative hypothesis to explain results</p> <p>11.A.4f f. use available technology to report, display, and defend conclusions drawn from investigations</p> <ul style="list-style-type: none">• scientific calculators• Vernier/Pasco interface box• photogate timers• ultrasonic motion sensors• force probes• smart pulleys• projectile motions launchers• light sensors• current/voltage probes• sound sensors• logger pro• data studio• graphical analysis• Microsoft Excel• research resources <p>11.A.5a g. formulate hypothesis referencing prior research and knowledge</p> <p>11.A.5b h. design procedures to test the selected hypothesis</p> <p>11.A.5c i. conduct systematic controlled experiments to test the selected hypothesis</p> <p>11.A.5d j. apply statistical methods to make predictions and to test the accuracy of results</p> <ul style="list-style-type: none">• extrapolate and interpolate data

- construct mathematical models
 - linear
 - quadratic
 - inverse
 - inverse square
- 11.A.5e k. report, display and defend the results of investigations to audiences that may include professionals and technical experts
- present results and conclusions to peers or appropriate audience
 - PowerPoint presentations
 - written lab reports
 - oral lab reports

Learning Standard B	Know and apply the concepts, principles, and processes of technological design
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| Critical Content | <p>11.B.4a a. identify a technological design problem inherent in a commonly used product</p> <ul style="list-style-type: none"> • design and analyze a lab experiment using technological tools <p>11.B.4b b. propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time</p> <ul style="list-style-type: none"> • use interactive software to investigate different simulations • explain lab data through a group presentation <p>11.B.4c c. develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animation)</p> <ul style="list-style-type: none"> • concept mapping, white board presentations, presentation software and oral presentations <p>11.B.4d d. develop and test a prototype or simulation of the solution design using available materials, instruments and technology</p> <ul style="list-style-type: none"> • use interactive software to investigate different simulations • explain lab data through a group presentation <p>11.b.4e e. evaluate the test results based on established criteria, note sources of error and recommend improvements</p> <ul style="list-style-type: none"> • use interactive software to investigate different simulations • explain lab data through a group presentation <p>11.B.4f f. using available technology, report to an audience the relative success of the design based on the test results and criteria</p> <ul style="list-style-type: none"> • present results and conclusions to peers or appropriate audience <ul style="list-style-type: none"> - PowerPoint presentations - written lab reports - oral lab reports <p>11.B.5a g. identify a design that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs</p> <p>11.B.5b h. select criteria for successful design solution to identified problem</p> <ul style="list-style-type: none"> • choose from alternative technologies being aware of |
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- the advantages and disadvantages of each technology
 - scientific calculators
 - Vernier/Pasco interface
 - photo gate timers
 - ultrasonic motion sensors
 - force probes
 - smart pulleys
 - projectile motions launchers
 - light sensors
 - current/voltage probes
 - sound sensors
- 11.B.5c i. build and test different models or simulations of the design solution using suitable materials, tools and technology
- 11.B.5d j. choose a model and refine its design based on the test results
- 11.B.5f k. using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts
 - present results and conclusions to peers or appropriate audience
 - PowerPoint presentations
 - written lab reports
 - oral lab reports

2. State Goal 12

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

Learning Standard C **Know and apply concepts that describe properties of matter and energy and the interactions between them**

- Critical Content 12.C.4a a. use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations
- predict and differentiate between transverse and compressional waves
 - define wavelength, frequency and amplitude of a given wave
 - recognize the electromagnetic spectrum and differentiate between frequency regions within the spectrum
 - investigate light properties including reflection and refraction differentiate between transverse and compressional waves
 - define and explain the properties of light that determine opaque, translucent, and transparent objects
 - predict, investigate and analyze the effect of light on color
 - distinguish between primary and secondary colors of light mixing, versus pigment mixing

Learning Standard D **Know and apply concepts that describe force and motion and the principles that explain them**

- Critical Content
- 12.D.4a a. explain and predict motions in inertial and accelerated frames of reference
- motion-displacement, speed, velocity, acceleration, free fall
 - explain and predict the effect of force on motion in terms of inertia, unbalanced forces and opposing forces
 - Newton’s First Law of motion
 - Newton’s Second Law of motion
 - Newton’s Third Law of motion
 - Horizontal projectile motion
 - Projectile motion at angles
 - explain and predict the effect of gravitational forces on objects.
 - demonstrate and explain the conservation of momentum and impulse.
- 12.D.5a b. analyze factors that influence the relative motion of an object
- identify the different types of energy such as mechanical, nuclear, electrical and chemical
 - define kinetic and potential energy and identify the variables that affect each
 - identify and explain energy transformations such as the relationship between kinetic potential energy
 - understand the relationship between work and change in energy
 - understand the conservation of energy within a system
- 12.D.5b c. analyze the effects of gravitational, electromagnetic and nuclear forces on a physical system
- Newton’s First Law
 - Newton’s Second Law
 - Newton’s Third Law
 - Force Diagrams
 - Vector Analysis
 - Centripetal Force
 - Elastic Collisions
 - Inelastic Collisions
 - Satellite & Planetary Motion
 - Coulomb’s Law
 - Ohm’s Law
 - Voltage
 - Current
 - Power
 - Resistance
 - Capacitance

**3. Subject Expectation
(State Goal 13)**

Understand the relationships among science, technology, and society in historical and contemporary contexts.

Learning Standard A	Know and apply the accepted practices of science
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- Critical Content
- 13.A.5a a. design procedures and policies to eliminate or reduce risk in potentially hazardous science activities, *such as*
 - safety contract
 - safety instruction
 - safety assessment
 - 13.A.5b b. explain criteria that scientists use to evaluate the validity of scientific claims and theories such as
 - sample size
 - class sets of data
 - numbers of trials
 - awareness of limitations of measurement tools
 - 13.A.5c c. explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies
 - 13.A.5d d. explain, using a practical example why experimental replication and peer review are essential to scientific claims
 - homework groups
 - discuss, present or debate a problem or question

Learning Standard B	Know and apply concepts that describe the interaction between science, technology, and society
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- Critical Content
- 13.B.5a a. analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence)
 - 13.B.5b b. analyze and describe the process and effects of scientific and technological breakthrough
 - 13.B.5e c. assess how scientific and technological progress has affected other fields of study, careers and job markets and aspects of everyday life