EGG HARBOR TOWNSHIP PUBLIC SCHOOLS
CURRICULUM

HONORS (HN) PHYSICS II
High School

Length of Course:	Full Year
Elective / Required:	Refer to Program of Studies
Schools:	High School
Student Eligibility:	Grades 11 -12
Credit Value:	5 credits
Date Submitted:	September 2016
Date Approved:	

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DISTRICT MISSION STATEMENT

Our mission in the Egg Harbor Township School District is to partner with the student, family, school, and community to provide a safe learning environment that addresses rigorous and relevant 21st Century standards and best practices which will develop academic scholarship, integrity, leadership, citizenship, and the unique learning style of students, while encouraging them to develop a strong work ethic and to act responsibly in their school community and every day society.

SCIENCE – PHILOSOPHY

We believe that ALL students regardless of race, ethnicity, socio-economic status, religious background, and/or any other classification are deserving of a holistic science education. This holistic approach would include an education that will allow them to fully discover themselves, their strengths and weaknesses, and benefit from science instruction.

> Scientific literacy assumes an increasingly important role in the context of globalization. The rapid pace of technological advances, access to an unprecedented wealth of information, and the pervasive impact of science and technology on day-to-day living require a depth of understanding that can be enhanced through quality science education. In the 21st century, science education focuses on the practices of science that lead to a greater understanding of the growing body of scientific knowledge that is required of citizens in an ever-changing world (NJCCCS-Science).

Science curricula are designed to reinforce 21st Century Learning, to maximize rigor, relevance, and relationships, and to engage students individually through differentiated instruction.

SCIENCE - STATEMENT OF PURPOSE

Education exists for the purpose of enabling each individual to realize and maintain her/his full potential. Scientifically literate students possess the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity.

> Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition,

> understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts, learning science is important for everyone, even those who eventually choose careers in fields other than science or engineering (NJSLS-Science)
>
> All students engage in science experiences that promote the ability to ask, find, or determine answers to questions derived from natural curiosity about everyday things and occurrences. The underpinning of the revised standards lies in the premise that science is experienced as an active process in which inquiry is central to learning and in which students engage in observation, inference, and experimentation on an ongoing basis, rather than as an isolated a process. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others in their community and around the world. They actively develop their understanding of science by identifying their assumptions, using critical and logical thinking, and considering alternative explanations (NJCCCS-Science).

Our school district provides an extensive science program, which will enable students to succeed and compete in the global marketplace using the New Jersey Student Learning Standards in Science as well as the Next Generation Science Standards.

INTRODUCTION

The most precious resource teachers have is time. Regardless of how much time a course is scheduled for, it is never enough to accomplish all that one would like. Therefore, it is imperative that teachers utilize the time they have wisely in order to maximize the potential for all students to achieve the desired learning.

High quality educational programs are characterized by clearly stated goals for student learning, teachers who are well-informed and skilled in enabling students to reach those goals, program designs that allow for continuous growth over the span of years of instruction, and ways of measuring whether students are achieving program goals.

THE EGG HARBOR TOWNSHIP SCHOOL DISTRICT CURRICULUM TEMPLATE

The Egg Harbor Township School District has embraced the backward-design model as the foundation for all curriculum development for the educational program. When reviewing curriculum documents and the Egg Harbor Township curriculum template, aspects of the backward-design model will be found in the stated enduring *understandings/essential questions, unit assessments,* and *instructional activities*. Familiarization with backward-design is critical to working effectively with Egg Harbor Township's curriculum guides.

GUIDING PRINCIPLES: WHAT IS BACKWARD DESIGN?
WHAT IS UNDERSTANDING BY DESIGN?

"Backward design" is an increasingly common approach to planning curriculum and instruction. As its name implies, "backward design" is based on defining clear goals, providing acceptable evidence of having achieved those goals, and then working 'backward' to identify what actions need to be taken that will ensure that the gap between the current status and the desired status is closed.

Building on the concept of backward design, Grant Wiggins and Jay McTighe (2005) have developed a structured approach to planning programs, curriculum, and instructional units. Their model asks educators to state goals; identify deep understandings, pose essential questions, and specify clear evidence that goals, understandings, and core learning have been achieved.

Programs based on backward design use desired results to drive decisions. With this design, there are questions to consider, such as: What should students understand, know, and be able to do? What does it look like to meet those goals? What kind of program will result in the outcomes stated? How will we know students have achieved that result? What other kinds of evidence will tell us that we have a quality program? These questions apply regardless of whether they are goals in program planning or classroom instruction.

The backward design process involves three interrelated stages for developing an entire curriculum or a single unit of instruction. The relationship from planning to curriculum design, development, and implementation hinges upon the integration of the following three stages.

Stage I: Identifying Desired Results: Enduring understandings, essential questions, knowledge and skills need to be woven into curriculum publications, documents, standards, and scope and sequence materials. Enduring understandings identify the "big ideas" that students will grapple with during the course of the unit. Essential questions provide a unifying focus for the unit and students should be able to answer more deeply and fully these questions as they proceed through the unit. Knowledge and skills are the *"stuff"* upon which the understandings are built.

Stage II: Determining Acceptable Evidence: Varied types of evidence are specified to ensure that students demonstrate attainment of desired results. While discrete knowledge assessments (e.g.: multiple choice, fill-in-the-blank, short answer, etc…) will be utilized during an instructional unit, the overall unit assessment is performance-based and asks students to demonstrate that they have mastered the desired understandings. These culminating (summative) assessments are authentic tasks that students would likely encounter in the real-world after they leave school. They allow students to demonstrate all that they have learned and can do. To demonstrate their understandings students can explain, interpret, apply, provide critical and insightful points of view, show empathy and/or evidence self-knowledge. Models of student performance and clearly defined criteria (i.e.: rubrics) are provided to all students in advance of starting work on the unit task.

Stage III: Designing Learning Activities: Instructional tasks, activities, and experiences are aligned with stages one and two so that the desired results are obtained based on the identified evidence or assessment tasks. Instructional activities and strategies are considered only once stages one and two have been clearly explicated. Therefore, congruence among all three stages can be ensured and teachers can make wise instructional choices.

At the curricular level, these three stages are best realized as a fusion of research, best practices, shared and sustained inquiry, consensus building, and initiative that involves all stakeholders. In this design, administrators are instructional leaders who enable the alignment between the curriculum and other key initiatives in their district or schools. These leaders demonstrate a clear purpose and direction for the curriculum within their school or district by providing support for implementation, opportunities for revision through sustained and consistent professional development, initiating action research activities, and collecting and evaluating materials to ensure alignment with the desired results. Intrinsic to the success of curriculum is to show how it aligns with the overarching goals of the district, how the document relates to district, state, or national standards, what a high quality educational program looks like, and what excellent teaching and learning looks like. Within education, success of the educational program is realized through this blend of commitment and organizational direction.

INTENT OF THE GUIDE

This guide is intended to provide teachers with course objectives and possible activities, as well as assist the teacher in planning and delivering instruction in accordance with the New Jersey Core Curriculum Content Standards. The guide is not intended to restrict or limit the teacher's resources or individual instruction techniques. It is expected that the teacher will reflectively adjust and modify instruction and units during the course of normal lessons depending on the varying needs of the class, provided such modified instruction attends to the objectives and essential questions outlined below.

N.J.A.C. 6A:8-3.1 Required Curriculum Components

Code Language	Evident in Curriculum YES/NO	Comments
Interdisciplinary Connections	**Yes**	**Via lab activities. STEM units in development 1 per marking period**
A pacing guide	**Yes**	**By Unit approximately 2-4 units per marking period**
A list of core instructional materials, including various levels of text at each grade level	**Yes**	**Suggested Activities Labs**
Benchmark assessments	**Yes**	**Teacher-developed and common via pre/post and benchmark assessments**
Modifications for special education students, for ELLs in accordance with N.J.A.C. 6A:15, and for gifted students. (As appropriate) – See Appendix A	**Yes**	**As directed by student's Individual Education Plan**

Unit Name: Waves and Sound **Time Frame:** 4 weeks (15-16 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2

Country: USA

Course/Grade: 11-12

State/Group: NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will determine how mechanical waves (including sound) transfer energy and describe and solve problems involving wave interactions.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS PS4-1 – [Content Statement] - Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Mathematical and computational thinking at the 9-12 level builds on K-8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-PS4-1)
- The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1)
- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS4-1)

HS PS4-2 – [Content Statement] - Evaluate questions about the advantages of using a digital transmission and storage of information.

Asking questions and defining problems in grades 9–12 builds from grades K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design. (HS-PS4-2)

HS PS4-3 – [Content Statement] - Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed worlds. Arguments may also come from current scientific or historical episodes in science.

- Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. (HS-PS4-3)
- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-PS4-3)

HS PS4-4 – [Content Statement] - Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

- When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. (HS-PS4-4)

HS PS4-5 – [Content Statement] - Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS4-5)
- Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible. (HS-PS4-4)

- Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. (HS-PS4-2),(HS-PS4-5)

- Photoelectric materials emit electrons when they absorb light of a high-enough frequency. (HS-PS4-5)

- Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. (HS-PS4-5)

ENDURING UNDERSTANDINGS

- Waves transfer energy without transferring matter.

- Mechanical waves require a medium.

- A continuous wave is a regular repeating sequence of wave pulses.

- Interference occurs when two or more waves move through a medium at the same time.

- Sound is a pressure variation transmitted through matter as a longitudinal wave.
- Sound is produced by vibrating objects in matter.

ESSENTIAL QUESTIONS

- How do waves transfer energy?
- How do waves interact?
- How do waves impact our lives?
- Can cell phones ring in space?

KNOWLEDGE AND SKILLS

- Identify how waves transfer energy without transferring matter.
- Contrast transverse and longitudinal waves.
- Relate wave speed, wavelength, and frequency.
- Relate a wave's speed to the medium in which the wave travels.
- Describe how waves are reflected and refracted at boundaries between media, and explain how waves diffract.
- Apply the principle of superposition to the phenomenon of interference.
- Demonstrate knowledge of the nature of sound waves and the properties sound shares with other waves.
- Solve problems relating the frequency, wavelength, and velocity of sound.
- Relate the physical properties of sound waves to the way we perceive sound.
- Define the Doppler shift and identify some of its applications.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups

- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice
- Power point presentations
- Lecture with note taking or guided notes
- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion
- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Thermodynamics **Time Frame:** 2 weeks (7-8 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2

Country: USA

Course/Grade: 11-12

State/Group: NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will determine how work and heat serve to change a system's internal energy. Students will learn a new form of the law of conservation of energy to calculate how machine efficiency is limited.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS PS3-1 - [Content Statement] – Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

HS PS3-2 - [Content Statement] – Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

HS PS3-3 - [Content Statement] – Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

HS PS3-4 - [Content Statement] – Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2),(HS-PS3-5)

Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1)
- At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2) (HS-PS3-3)
- Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1)
- Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4)
- Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3),(HS-PS3-4)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS3-3)
- Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2)

ENDURING UNDERSTANDINGS

- Energy can be transferred to or from a system as heat and/or work, changing the system's internal energy in the process.
- Energy is conserved for any system and its environment as described by the first law of thermodynamics.
- The second law of thermodynamics states that no machine can transfer all of its absorbed energy as work.
- The efficiency of a heat engine depends on the amount of energy lost as heat.

ESSENTIAL QUESTIONS

- Where does heat energy go?
- What happens when a system gets disordered?
- How efficient can our vehicles be?

KNOWLEDGE AND SKILLS

- Identify how systems both gain and lose energy.
- Contrast between a system and its environment.
- Relate work, pressure and volume change.
- Apply the law of conservation of energy to verify the first law of thermodynamics.
- Relate changes in system energy, heat and work.
- Solve for the efficiency of an engine.
- Demonstrate that the second law of thermodynamics relies on bodies at different temperatures.
- Build a thermometer.
- Heat food to show calorie value.
- Discover different phenomenon in transferring of energy.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice
- Power point presentations
- Lecture with note taking or guided notes
- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion
- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Satellite Motion and Space Dimensions **Time Frame:** 2 weeks (7-8 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2

Country: USA

Course/Grade: 11-12

State/Group: NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will determine how planets and satellites travel in elliptical orbits. Students will determine how far apart objects are in space.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS ESS1-1- [Content Statement] – Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy in the form of radiation.

HS ESS1-2 - [Content Statement] – Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

HS ESS1-4 - [Content Statement] – Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS1-1)

Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical or computational representations of phenomena to describe explanations. (HS-ESS1-4)

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-ESS1-3)

- A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-ESS1-2)
- The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1)
- The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2),(HS-ESS1-3)
- The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of

spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2)

- Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2),(HS-ESS1-3)

- The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2)
- Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2),(HS-ESS1-3)

- Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. *(secondary to HS-ESS1-1)*

ENDURING UNDERSTANDINGS

- Satellite motion is possible due to the radius of curvature.
- Energy is conserved at all points along a satellite's orbit.
- Distances in space are often measure in light years due to the incredible distances.
- Object orbit due to gravitation forces existing between all objects.

ESSENTIAL QUESTIONS

- Why do planets orbit the sun?
- How far away is Pluto?
- Why are orbits elliptical and not circular?

KNOWLEDGE AND SKILLS

- Identify how the radius of curvature of a planet relates to the orbital velocity.
- Relate radius of curvature, satellite mass and escape velocity.

- Calculate the distances between object in space.
- Apply Kepler's laws of motion to explain planetary motion.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

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Unit Name: Light and Optics **Time Frame:** 4 weeks (15-16 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2 **Country:** USA

Course/Grade: 11-12 **State/Group:** NJ

School: Egg Harbor Township High School

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- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

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HS PS4-3 – [Content Statement] - Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed worlds. Arguments may also come from current scientific or historical episodes in science.

- Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. (HS-PS4-3)

HS PS4-5 – [Content Statement] - Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- Solar cells are human-made devices that likewise capture the sun’s energy and produce electrical energy. *(secondary to HS-PS4-5)*
- Photoelectric materials emit electrons when they absorb light of a high-enough frequency. (HS-PS4-5)
- Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for

producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. (HS-PS4-5)

ENDURING UNDERSTANDINGS

- Light is an electromagnetic wave that stimulates the retina of the eye.
- Light travels in a straight line through any uniform medium.
- Materials can be characterized as being transparent, translucent, or opaque.
- White light is a combination of the spectrum of colors, each having different wavelengths.
- The law of reflection states that the angle of reflection is equal to the angle of incidence.
- Refraction is the bending of light rays at the boundary between two media.

ESSENTIAL QUESTIONS

- How can we visualize the path of light?
- How are colors formed?
- How is light polarized?
- How does light interact with matter?

KNOWLEDGE AND SKILLS

- Recognize that light is the visible portion of an entire range of EM frequencies.
- Describe the ray model of light.
- Define luminous intensity, luminous flux, and illuminance.
- Explain the formation of color by light and by pigments or dyes.
- Explain the cause and give examples of interference in thin films.
- Explain the law of reflection.
- Calculate the index of refraction in a medium.

- Distinguish between diffuse and regular reflection and provide examples.
- Explain dispersion of light in terms of the index of refraction.
- Explain total internal reflection.
- Define the critical angle.
- Explain effects caused by the refraction of light in a medium with varying refractive indices.
- Build toys or objects that use optics and light and its characteristics.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice
- Power point presentations
- Lecture with note taking or guided notes

- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion
- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Mirrors and Lenses **Time Frame:** 4 weeks (15-16 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2 **Country:** USA

Course/Grade: 11-12 **State/Group:** NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will locate real and virtual images produced by plane, concave and convex mirrors and lenses.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS PS4-1 – [Content Statement] - Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Mathematical and computational thinking at the 9-12 level builds on K-8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-PS4-1)
- The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1)
- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS4-1)

ENDURING UNDERSTANDINGS

- An object is a source of diverging light rays.
- Wave behaviors such as reflection and refraction are responsible for the functioning of many optical devices.

ESSENTIAL QUESTIONS

- How do waves behave?
- How do images form?
- How do mirrors and lenses work?
- Why can we see?
- How do telescopes and microscopes work?

KNOWLEDGE AND SKILLS

- Explain how concave, convex, and plane mirrors form images.
- Locate images using ray diagrams, and calculate image location, size, and magnification using equations.
- Describe how real and virtual images are formed by convex and concave lenses.

- Locate the image with a ray diagram and find the image location and size using a mathematical model.
- Define chromatic aberration and explain how it can be reduced.
- Build an apparatus that uses optics or lenses.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice
- Power point presentations
- Lecture with note taking or guided notes
- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion

- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Electricity and Charges **Time Frame:** 4 weeks (15-16 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2 **Country:** USA

Course/Grade: 11-12 **State/Group:** NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will classify electrical charge and analyze how charge interacts with matter and solve problems relating to charge, electric fields, and forces.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS PS3-1 - [Content Statement] – Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

HS PS3-2 - [Content Statement] – Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

HS PS3-3 - [Content Statement] – Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2),(HS-PS3-5)

Planning and carrying out investigations to answer questions or test solutions to problems in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS3-4)

Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS3-3)

- Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2)

- These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)

- Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1)
- Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4)
- When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5)

ENDURING UNDERSTANDINGS

- Electrical force fields exist around all charges.
- Current electricity is the continuous motion of electrical charges and how this can be used to do work.
- There are two kinds of electrical charge, positive and negative. Like charges repel; unlike charges attract.
- Electrical charge is not created or destroyed.
- Objects can be charged by transfer of electrons.
- An electric field exists around any charged object.
- Electric potential difference is the change in potential energy per unit charge in any electric field.

ESSENTIAL QUESTIONS

- How is electrical energy stored and transferred?

- How does moving an electric charge do work?
- How do different circuits perform electrical work?

KNOWLEDGE AND SKILLS

- Use Coulomb's law to solve problems relating to electrical force.
- Describe the differences between conductors and insulators.
- Recognize that objects that are charged exert forces, both attractive and repulsive.
- Demonstrate that charging is the separation, not the creation, of electrical charges.
- Define and measure an electric field.
- Solve problems relating to charge, electric fields, and forces.
- Define and calculate electric potential difference.
- Explain how Millikan used electric fields to find the charge of the electron.
- Describe capacitance and solve problems.
- Build different circuit types.
- Build an underwater robot that uses a circuit to move.
- Devise a method to control the circuit and make the robot move.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice
- Power point presentations
- Lecture with note taking or guided notes
- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion
- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Circuits **Time Frame:** 4 weeks (15-16 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2 **Country:** USA

Course/Grade: 11-12 **State/Group:** NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will understand and solve problems involving electric power, and resistance. Describe both a series connection and a parallel connection and state the important characteristics of each.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS PS2-4 – [Content Statement] – Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3)

- Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4)
- Laws are statements or descriptions of the relationships among observable phenomena. (HS-PS2-1),(HS-PS2-4)
- Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4),(HS-PS2-5)
- “Electrical energy” may mean energy stored in a battery or energy transmitted by electric currents. *(secondary to HS-PS2-5)*

HS ETS1-2 - [Content Statement] –Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at different scales. (HS-ETS1-4)

ENDURING UNDERSTANDINGS

- Batteries, generators, and solar cells convert various forms of energy to electric energy.
- In an electric circuit, electric energy is transmitted from a device that produces electric energy to a resistor or other device that converts electric energy into the form needed.
- The current is the same everywhere in a simple series circuit.
- In a parallel circuit, the total current is equal to the sum of the currents in the branches.

ESSENTIAL QUESTIONS

- How is electrical energy created and distributed?
- How do we use series circuits?
- How do we use parallel circuits?

KNOWLEDGE AND SKILLS

- Define power in electric circuits.
- Define resistance and describe Ohm's law.
- Describe both a series connection and a parallel connection and state the important characteristics of each.
- Construct both a series connection and a parallel connection.
- Analyze the difference between a series connection and parallel connection.
- Build circuits.
- Build a circuit for an underwater robot.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice

- Power point presentations
- Lecture with note taking or guided notes
- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion
- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Magnetism **Time Frame:** 2 weeks (7-8 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2 **Country:** USA

Course/Grade: 11-12 **State/Group:** NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will understand how magnetic fields are formed and used.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS PS2-5 – [Content Statement] - Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS2-4)

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5)
- Systems can be designed to cause a desired effect. (HS-PS2-3)
- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2)

HS PS3-5 - [Content Statement] – Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)
- When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5)

ENDURING UNDERSTANDINGS

- Every magnet has a north and south pole.
- Earth has a magnetic field that is strongest at the poles.
- Magnetic forces affect current carrying wires.

ESSENTIAL QUESTIONS

- What causes earth's magnetic field?
- How many times can a magnet be cut in half and still be magnetic?

KNOWLEDGE AND SKILLS

- Explain how magnetic poles affect each other.

- Describe the magnetic field in the space around a magnet.
- Describe how magnetic fields are produced.
- Describe how to make a permanent magnet.
- Describe the magnetic field produced by a current-carrying wire.
- Describe how a magnetic field exerts a force on a charged particle in the field.
- Describe how current is affected by a magnetic field.
- Describe how a galvanometer and a motor work.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice
- Power point presentations

- Lecture with note taking or guided notes
- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion
- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Electromagnetic Induction **Time Frame:** 2 weeks (7-8 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2 **Country:** USA

Course/Grade: 11-12 **State/Group:** NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will understand how magnetic fields and electric fields affect each other and how they are used in our daily lives.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS PS2-5 – [Content Statement] - Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS2-4)

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5)
- Systems can be designed to cause a desired effect. (HS-PS2-3)

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2)

HS PS3-5 - [Content Statement] – Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)
- When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5)

HS ETS1-2 - [Content Statement] –Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS ETS1-3 - [Content Statement] –Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

HS ETS1-4 - [Content Statement] –Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2)

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at different scales. (HS-ETS1-4)

- New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1) (HS-ETS1-3)

ENDURING UNDERSTANDINGS

- Motors turn electrical energy into mechanical energy and generators turn mechanical energy into electrical energy.
- AC current is used buy power supply companies because the voltage can easily be modified to meet the voltage needs on the individual consumer.
- A magnetic field is created in areas where an electric field is changing.

ESSENTIAL QUESTIONS

- How do generators keep the lights on?
- How are magnet fields and electric fields related?
- Do any electric utility companies use DC?

KNOWLEDGE AND SKILLS

- Describe how voltage is induced in a coil of wire.
- State and explain Faraday's law.
- Describe how a generator works.
- Describe how a magnetic field affects a moving charge.
- Describe how a transformer works.
- Explain why almost all electrical energy is sold in the form of alternating current.
- Explain how an electric field creates a magnetic field.

- Describe electromagnetic waves.
- Build a motor.
- Use a motor to move an underwater robot.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice
- Power point presentations
- Lecture with note taking or guided notes
- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion

- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Atomic Nucleus and Radioactivity **Time Frame:** 2 weeks (7-8 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2 **Country:** USA

Course/Grade: 11-12 **State/Group:** NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will understand why elements decay and calculate how long they will be in existence.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS PS3-1 - [Content Statement] – Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

HS PS3-2 - [Content Statement] – Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2)
- At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2) (HS-PS3-3)
- Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. (HS-PS3-1)
- These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)

ENDURING UNDERSTANDINGS

- The neutron is in place to stabilize the nucleus, a nucleus of only protons would completely repel each other.
- The three types of radioactive material are alpha particles, beta particles and gamma rays.
- The external conditions do not appear to change the rate of radioactive decay.
- Uranium was the last natural found element on the periodic table the rest were made by man in the lab.

ESSENTIAL QUESTIONS

- How long do isotopes decay?
- How many elements can man make?

KNOWLEDGE AND SKILLS

- Describe the role of neutrons in atomic nuclei.
- Distinguish among the three types of radiation given off by radioactive elements.
- Explain the factors that determine the penetrating power of radiation.
- Describe how external conditions affect radioactive decay rates.
- Explain the effect of radioactive decay on an isotope.
- Identify which elements have been produced through artificial transmutation.
- Explain how scientists can determine the age of carbon containing artifacts.
- Explain how scientists date very old, nonliving things.
- Describe some uses for radioactive isotopes.
- Identify sources of natural radiation.
- Present findings on atomic nature.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test

- Review Activity

STAGE THREE

LEARNING PLAN

- Flashcards and/or drill and practice
- Power point presentations
- Lecture with note taking or guided notes
- Whole and small group discussions
- Laboratory groups
- Inquiry based activities with reflective discussion
- Online models and simulators

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students. In additional to the formal assessment all units will end with a project that requires students to apply scientific and mathematical knowledge to solve a real world problem via an engineering model based on design, test and redesign.

Unit Name: Nuclear Fission and Fusion **Time Frame:** 2 weeks (7-8 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: Honors Physics 2 **Country:** USA

Course/Grade: 11-12 **State/Group:** NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will understand the chain like reaction that occurs during a nuclear explosion.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web simulators: www.pHET.colorado.edu and http://www.mrwaynesclass.com/teacher/index.html
- Online videos: https://www.youtube.com/user/minutephysics and https://www.youtube.com/watch?v=8G1oc5Qq90U&list=PLPyapQSxH6mb62DDbqhnHrXlriWlUjLdY
- Web Physics help: www.physicsclassroom.com

STAGE ONE

GOALS AND STANDARDS

HS ESS1-1- [Content Statement] – Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy in the form of radiation.

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-ESS1-2)
- Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2),(HS-ESS1-3)
- Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2),(HS-ESS1-3)
- Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. *(secondary to HS-ESS1-1)*
- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-ESS1-3)

ENDURING UNDERSTANDINGS

- Nuclear reactions happen when the repulsive forces overcome the attractive forces of a given atom.
- Producing thermonuclear fusion reactions under controlled conditions requires temperatures of hundreds of millions of degrees.
- A breeder reactor converts a nonfissionable uranium isotope into a fissionable plutonium isotope.

ESSENTIAL QUESTIONS

- How is a nuclear bomb created?
- How long will a nuclear reaction occur?

KNOWLEDGE AND SKILLS

- Describe the role of neutrons in causing and sustaining nuclear fission.
- Describe the conditions necessary to sustain a chain reaction.
- Explain how nuclear fission can be controlled in a reactor.
- Describe the radioactivity of plutonium.

- Distinguish between a uranium-based fission reactor and a breeder reactor.
- Describe the equivalence of mass and energy.
- Compare the total mass of the products of fusion to the mass of the nuclei that fused.
- Explain why thermonuclear fusion reactions are so difficult to carry out.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
- Constructed response
- Graphic organizers or models
- Do nows and/or exit slips
- Individual, small, and large group work
- Homework
- Guided practice

OTHER EVIDENCE

- Common assessment quiz
- Common assessment chapter test
- Review Activity

STAGE THREE

LEARNING PLAN

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Unit Name: Fluid and Air Dynamics **Time Frame:** 2 weeks (8-10 lecture days)

Author: Egg Harbor Township High School Science Department

UNIT

Subject: HN Physics 2

Country: USA

Course/Grade: 11-12

State/Group: NJ

School: Egg Harbor Township High School

UNIT SUMMARY

Students will determine how buoyant forces act and help objects float. Students will determine how fluids apply pressure. Students will determine what forces make an airplane fly.

UNIT RESOURCES

- Textbook- Physics 8th Edition (2009), *Cutnell and Johnson*
- Lab Manuals and materials

Internet Resource Links:

- Discovery: www.unitedstreaming.com
- NBC Learn Videos: www.nbclearn.com
- eLibrary science: http://science.bigchalk.com/sciweb/science/do/search
- Web Physics help: www.physicsclassroom.com
- Web simulators: www.pHET.colorado.edu

STAGE ONE

GOALS AND STANDARDS

HS PS2-1 – [Content Statement] - Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Analyzing data in 9–12 builds on K–8 and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-PS2-1)
- Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1)

HS PS2-2 – [Content Statement] – Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to describe explanations. (HS-PS2-2),(HS-PS2-4)
- Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. (HS-PS2-2)
- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2)

HS PS2-3 – [Content Statement] – Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3)

- Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4)
- Laws are statements or descriptions of the relationships among observable phenomena. (HS-PS2-1),(HS-PS2-4)
- If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS-PS2-2),(HS-PS2-3)
- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS2-3)*

HS ETS1-2 - [Content Statement] –Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2)

HS ETS1-3 - [Content Statement] –Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)

HS ETS1-4 - [Content Statement] –Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories.

- Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)
- Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)
- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at different scales. (HS-ETS1-4)

ENDURING UNDERSTANDINGS

- Force is a vector quantity that causes changes in motion.

- Pushing down on a fluid results in the fluid pushing back up.

- The magnitude of a buoyant force for a floating object is equal to the weight of the object.
- The magnitude of a buoyant force for a submerged object is equal to the weight of fluid displaced by the object.
- Pressure is a measure of force exerted over a given area.
- The pressure in a fluid increases with depth.
- Multiple forces are in effect to make an object be able to float or fly.
- Forces can be manipulated to change the air patterns of aircraft.

ESSENTIAL QUESTIONS

- How do steel ships float?
- Why do objects get crushed at different depths?
- What forces are needed to steer an airplane?

KNOWLEDGE AND SKILLS

- Calculate the Buoyant force exerted on a given object.
- Contrast a gas and a liquid.
- Relate pressure, force and area.
- Describe how fluid pressure increases with depth.
- Apply the principle of buoyancy to design and build a cardboard boat capable of carrying your team across the pool.
- Learn all the forces including lift, drag, tension and weight that combine to enable an object to float in air.
- Build a kite taking into account all the forces involved.

STAGE TWO

PERFORMANCE TASKS

- Laboratory investigations within small groups
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- Guided practice

OTHER EVIDENCE

- Common assessment quiz
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- Review Activity

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LEARNING PLAN

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Curriculum Resources - Differentiated Instruction

Special Education Interventions in General Education

Visual Supports
Extended time to complete tests and assignments
Graphic Organizers
Mnemonic tricks to improve memory
Study guides
Use agenda book for assignments
Provide a posted daily schedule
Use of classroom behavior management system
Use prompts and model directions
Use task analysis to break down activities and lessons into each individual step needed to complete the task
Use concrete examples to teach concepts
Have student repeat/rephrase written directions
Heterogeneous grouping

Resources:

Do to Learn:
http://www.do2learn.com/

Sen Teacher:
http://www.senteacher.org/

Intervention Central:
http://www.interventioncentral.org/

Learning Ally:
https://www.learningally.org/

English Language Learners Interventions in Regular Education
Resources:

FABRIC - Learning Paradigm for ELLs (NJDOE)
www.nj.gov/education/bilingual/pd/**fabric**/**fabric**.pdf

Guide to Teaching ELL Students
http://www.colorincolorado.org/new-teaching-ells

Edutopia - Supporting English Language Learners
https://www.edutopia.org/blog/strategies-and-resources-supporting-ell-todd-finley

Reading Rockets
http://www.readingrockets.org/reading-topics/english-language-learners

Gifted and Talented Interventions in Regular Education
Resources:

Who are Gifted and Talented Students
http://www.npr.org/sections/ed/2015/09/28/443193523/who-are-the-gifted-and-talented-and-what-do-they-need

Hoagies Gifted Education Page
http://www.hoagiesgifted.org/programs.htm

21st Century Learning
Resources:

Partnership for 21st Century Learning
http://www.p21.org/

Career Ready Practices (NJDOE)
http://www.nj.gov/education/cte/hl/CRP.pdf