Course: Honors Physics **Grade: 11th** **Designer(s):**	**Overview of Course**: The course is designed to give students the necessary background in physics as to prepare him/her for college courses. The physics taught will be based on algebra and trigonometry with some calculus applications addressed by the end of the year. These math skills will be reviewed before applying them to solve problems. This course offers the general principles of physics. Students will apply these principals through activities such as laboratory exploration using computer probes, problem solving strategies, hands on activities, and critical thinking discussions. Students interested in a science career or engineering may benefit from this class.

Overarching Big Ideas, Enduring Understandings, and Essential Questions

Big Idea	Standard(s) Addressed	Enduring Understanding(s)	Essential Question(s) in Blue Important Questions in Black
Patterns	**S11.A.3.3**: Compare and analyze repeated processes or recurring elements in patterns.	By looking at a pattern one can relate one subject to the next in order to make predictions, describe, and explain the world around them.	1. From looking at patterns in your data in experiments, what conclusions can be made on physics theory and physics law?
Systems	**S11.A.3.1:** Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.	When looking at systems one is able to see relationships and how these objects are interconnected as a whole.	1. The Earth is a complex system, from its motion, its tides, its weather, and its gravity. Compare the Earth as a system to a physics experiment that we did in class. Explain how the simple experiment represents something from the system of the Earth.
Analysis	**S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.1.1.1:** Compare and contrast scientific theories, scientific laws, and beliefs (e.g., the universal law of gravitation, how light travels,	When looking at scientific data, one can make a hypothesis on an outcome.	1. Looking back at experiments we did in class what types of information did we need to collect in order to make an accurate and precise analysis so that a thorough conclusion can be made?

	formation of moons, stages of ecological succession). **S11.A.1.1.2:** Analyze and explain the accuracy of scientific facts, principles, theories, and laws.		
Exploration	**S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations.	Performing scientific experiments assists with everyday problem solving skills.	1. Pick a problem that you are confronted with, using the scientific method find a solution. What steps did you take? What observations did you make? What type of data did you collect? What conclusion can be made from your data and observations? What are some short falls of this experiment? If you were to do this experiment again what would you change?
Big Ideas, Enduring Understandings, and Essential Questions Per Unit of Study			

(These do NOT "spiral" throughout the entire curriculum, but are specific to each unit.)							
Week of Instruction (Tentative)	**Title of Unit**	**Big Idea(s)**	**Standard(s) Addressed**	**Enduring Understanding(s)**	**Essential Question(s)**	**Common Assessment**	**Common Resource(s)* Used**
Week 1,2	Measurement Mathematical review	**Patterns** Measurement Systems Solving for Variables Scientific Notation Significant Figures Graphing Correlation Graphs	**S11.A.3.1:** Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. **S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **M8.B.1.1.1:** Convert among metric measurements (milli, centi, kilo using meter, liter and gram) (table of equivalency provided on the reference sheet).	• Measurement is a tool that is used every day in real life applications. • Mathematics is a key element of physics that helps one better understand the theory behind physics. • Mathematics is a key element of physics that helps one better understand the theory behind physics. • Graphs can be used to take observations and results in order to analyze data and to make predictions	1. What is a standard of measurement? 2. What multiple of tens does each SI prefix represent? 3. What are the SI units and symbols for length, volume, mass, time, temperature, and density? 4. How can related SI units be converted? 5. What real life objects are measured in the metric system? 6. How do you isolate a variable using algebraic expressions? 7. Why do we express number in scientific notion? 8. What is the purpose of significant figures? 9. What is the difference between accuracy and precision? 10. What are the three main types of graphs and how can to be used? 11. How are the independent and independent variable expressed in a graph?	• **Metric quiz** • **Graphing lab, which includes collection and analyzing data** • **Problem solving exercises** • **Group work, discussion**	

			M8.B.1.1.2: Convert customary measurements up to 2 units above or below the given unit (e.g., inches to yards, pints to gallons) (table of equivalency provided on the reference sheet **M11.D.2.1.2:** Identify or graph functions, linear equations or linear inequalities on a coordinate plane. **M11.D.2.1.3:** Write, solve and/or apply a linear equation (including problem situations). **M8.A.1.1.1:** Represent numbers using scientific notation and/or exponential forms. **M11.D.4.1.1:** Match the graph of a given function to its table or equation. **CHEM.A.1.1.3:** Utilize significant figures to communicate the uncertainty in a quantitative observation. **A1.1.2.1.1:** Write, solve and/or apply a linear equation (including problem situations).		12. How can you analyze data using the various types of graphs? 13. How do the principles of physic apply to our daily life? 14. How can we determine the mathematical relationship from data we obtain in an experiment?		

			A1.1.2.1.2: Use and/or identify an algebraic property to justify any step in an equation solving process (linear equations only). **A1.1.2.1.3:** Interpret solutions to problems in the context of the problem situation (linear equations only). .				
Weeks 3,4,5,6	Motion In One Dimension Horizontally and vertically	**Analysis Patterns Exploration** Displacement Velocity Acceleration Acceleration due to gravity	**S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions)	A motion occurs when an object changes its position. Acceleration describes how velocity of an object is changing with time.	1. How are displacement and distance different? 2. What is the difference between velocity and speed? 3. What are a scalar and a vector? 4. What real life variables are scalars or vectors? 5. How do you calculate velocity, and how is it related to time and displacement? 6. From looking a distance vs. time graph, what conclusions can be drawn? 7. What has to happen in order for an object to accelerate? 8. How are acceleration, time, and velocity related?	• **Graphing Motion Lab using sensors** • **Constant velocity lab using sensors** • **Constant acceleration lab using sensors** • **Group work** • **Discussion** • **Problem solving exercises** • **Kinematics test** • **Bottle rocket project**	

			applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. **S11.C.3.1.3:** Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).		9. How can you calculate acceleration? 10. From looking at a velocity vs. time graphs, what conclusions can be drawn? 11. How can the motion of an object be described in a measurable and quantitative way horizontally? 12. How can the motion of an object be described in a measurable and quantitative way vertically?		

Week 7 & 8	Vector Relative Motion	**Analysis** Systems Vectors	**S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **M11.B.1:** Demonstrate an understanding of measurable attributes of objects and figures, and the units, systems and processes of measurement.	Vectors are a graphical representation of an objects properties or interactions with other objects in order for one to see the actions clearer.	1. How can one add, sub, multiply, and divide vectors? 2. What is the difference between scalars and vectors? 3. Where can vectors be used in everyday life 4. How does a person's frame of reference affect the perceived motion of an object? 5. How would one explain why it takes longer to fly west than it does to fly east in the US? 6. How can relative motion be used to explain perceived velocities and actual velocities?	• **Group Work** • **Discussions** • **Relative Velocity lab** • **Problem exercises** • **Vector test**	
Weeks 9 & 10	Projectile Motion	**Patterns** **Exploration** **Analysis** Vectors Systems Motion in two dimensions	**S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **M11.B.1:** Demonstrate an understanding of measurable attributes of objects and figures, and the units, systems and processes of measurement.	From studying projectile motion one can make predictions and calculations to better predict an objects location and magnitude.	1. How can we use vectors to describe the path of a projectile? 2. How does one use the constant acceleration equations to find the range, maximum height and hang time of a projectile? 3. What are real life examples of projectile motion?	• **Projectile inquiry lab** • **Group work** • **Discussion** • **Problem exercises** • **Bulls Eye Lab** • **Projectile motion test**	

			S11.A.3.3: Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design.				

			S11.A.2.1.3: Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. **S11.C.3.1.3:** Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).				
Weeks 11,12,13, 14,15	Forces	**Systems** **Patterns** **Exploration** **Analysis** Forces Vectors Friction	**S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an	All forces arise from the interactions between different objects.	1. What is a force? 2. How are force and motion related? 3. How are free body diagrams used to determine the net force on an object?? 4. Why is there friction between objects? 5. What is the difference between mass and weight? 6. What is inertia and how is it related to Newton's first law of motion?	✓ **Free body diagrams** ✓ **Force Lab with sensors** ✓ **Friction lab** ✓ **Problem solving exercise** ✓ **Discussion** ✓ **Group work** ✓ **Force test** ✓ **Incline plane test** ✓ **Toothpick Bridge activity**	

			experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations.		7. How can Newton's second law be used to calculate and describe an object's acceleration? 8. According to Newton's third law of motion, how are the forces between interacting objects related? 9. How can understanding various physical properties about motion and Newton's Laws be useful in understanding everyday occurrences? 10. How does Newton's second law explain the effects of air resistance? 11. Explain why friction is so important to everyday life. 12. How can we determine the net force on an inclined plane?		

			S11.C.3.1.3: Describe the motion of an object using variables (i.e., acceleration, velocity, displacement). **S11.A.3.3.3:** Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, and waves).				
Weeks 15, 16, 17	Momentum	**Systems** **Patterns** **Exploration** **Analysis** Momentum Impulse Collisions Conservation of Momentum	**S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions)	All forces arise from the interactions between different objects and all energy and momentum are transferred between the objects.	1. How does one determine an object's momentum? 2. Describe how an object can change its momentum? 3. How are momentum, energy, mass, and velocity related? 4. By changing stopping distances and times, how does it affect the change in momentum and the impulse of that object? 5. How does force affect impulse? 6. How could one explain the conservation of momentum using a real life example? 7. What are the different types of collisions and how do these collisions	• **Egg Lander Activity** • **Impulse demonstration using sensors** • **Momentum Lab** • **Group Work** • **Discussion** • **Problem exercises** • **Momentum test**	

			applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. **S11.C.3.1.1:** Explain common phenomena (e.g., a rock in a landslide, an astronaut during a spacewalk, a car hitting a patch of ice on the road) using an understanding of		differ? 8. What do all the collisions have in common?		

			conservation of momentum. **3.2.12.B2:** Explain how energy flowing through an open **system** can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternate approaches to predict and describe the motion of objects.				
Week 18, 19 & 20	Work and Power Energy	**Patterns** **Exploration** **Analysis** Work Energy Power	**3.2.10.B2:** Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem **S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses,	We observe the effects of energy.	1. What is work? 2. How can work be calculated when force and motion are parallel to each other? 3. How do we know that something has energy? In what ways do we witness the effects of something having energy? 4. What is the relationship between energy and work? 5. What is the difference between kinetic energy and potential energy? 6. How can you calculate kinetic energy? 7. How can you calculate potential energy in all its forms? 8. What are the different forms of potential	• **Power up Lab** • **Conservation of Energy Lab** • **Group Work** • **Discussion** • **Problem Exercises** • **Work and energy test** • **Rube Goldberg machine project**	

			developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.C.3.1.2:** Design or evaluate simple technological or natural systems that incorporate the principles of force and motion (e.g., simple machines, compound machines). **S11.C.3.1.5:** Calculate the mechanical advantage for moving an object by using a simple machine. **S11.C.3.1.6:** Identify elements of simple machines in compound machines.		energy? 9. What is the law of conservation of energy? 10. What are some real life examples of the law of conservation of energy? 11. What is mechanical energy? 12. Why mechanical energy is not always conserved? 13. How are power and energy related? 14. How can one use the law of conservation of energy to explain how a roller coaster works?		

			3.2.10.B2: Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.				
Week 21,22,23	Circular Motion	**Systems Patterns** Centripetal Force Angular Speed Angular Displacement Universal Law of Gravitation Kepler's Laws	**S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the	All objects that move in a circular manor have some sort of force that manipulates it in order to maintain that motion including our planet.	1. How is circular motion related to linear motion? 2. What parallels exist between the quantities, mass, momentum, velocity and force and the rotational analogs of moment of inertia, angular momentum, angular velocity and torque? 3. What is a real life example of centripetal force? 4. How can Newton's Laws be used to explain centrifugal effect? 5. What are some things that affect an objects ability to complete a circular motion? 6. What affects an object gravitational force? 7. What must an object have in order to have a gravitational force? 8. From the law of	• **Centripetal force Lab** • **Kepler's Law Lab** • **Group Work** • **Discussion** • **Problem Exercises** • **Circular motion test**	

			problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. **3.2.12.B1:** Analyze the principles of rotational motion to solve problems relating to angular momentum and torque. **S11.D.3.1.1:** Describe planetary motion and the physical laws that explain planetary motion.		gravitation, what can be determined about a planet? 9. What do Kepler's laws tell us about our planetary motion? 10. How are Kepler's laws of motion and Netwon's laws of motion related? 11. How can rotational quantities be applied to static equilibrium problems?		
Week 24, 25 & 26	Simple Harmonic	**Systems Analysis**	**S11.A.3.3:** Compare and analyze repeated	In simple harmonic motion, restoring force is	1. How does Hooke's law applied to the	**Hooke's Law Lab**	

	Motion Waves	**Exploration** Simple Harmonic Motion Frequency Period	processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw	proportional to displacement and leads to the repetitive motion of objects such as a pendulum and a spring.	stretch of a spring? 2. What is the definition of simple harmonic ? 3. How is frequency and period related? 4. What variables affect the period of a pendulum? 5. What would happen to a pendulum if it were located on some other planet? 6. What types of everyday motion can be classified as simple harmonic motion and why? 7. What variables affect the period of a spring? 8. Is a spring affected by location the same way a pendulum is affected? How do waves transfer energy? 9. What is a wave and how do the various types of waves fundamentally differ from one another? 10. How do transverse waves differ from longitudinal waves? 11. How are wavelength, frequency, and period related? 12. How can you calculate a speed of a	**Pendulum Lab** **Group Work** **Discussion** **Problem Solving exercises** **Harmonic Motion and Waves test**	

			conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. **3.2.P.B1:** Differentiate among translational motion, simple harmonic motion, and rotational motion in terms of position, velocity, and acceleration. Use force and mass to explain translational motion or simple harmonic motion of objects.		wave? 13. Why would one need to know where the crest or trough of a wave is located? 14. What does the amplitude of the wave tell us about the wave? 15. What is the law of reflection? 16. Why do waves change direction when they travel from material to another? 17. How are refraction and diffraction similar and different? 18. What happens when waves interfere with each other? 19. What area real life examples of refraction, reflection, diffraction, and interference?		
Weeks 27 & 28	Sound	**Systems Analysis Exploration** The Nature of Sound Properties of Sound Music Using Sound	**S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to	Sound waves carry energy that can be detected by the ear.	1. How does sound travel through different mediums? 2. What affects the speed of sound? 3. How does your ear enable you to hear? 4. How are amplitude, intensity, and loudness related? 5. How is sound	• **Sound Lab Group Work** • **Discussion** • **Problem Solving exercises** • **Sound Test**	

			explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic.		intensity measured? 6. What is the relationship between frequency and pitch? 7. What is the Doppler Effect? 8. What real life examples provide a visual or auditory example of the Doppler Effect? 9. What is the difference between noise and music? 10. Why does a guitar sound different from a horn, even when both play the same note? 11. How doe string, wind, and percussion instruments produce music? 12. What are beats, and why do they occur? 13. How do the fundamental principles of waves apply to sound? 14. What are some of the factors that affect the design of concert halls and movie theaters? 15. How do some animals use sound waves to hunt and navigate? 16. How does sonar		

			S11.A.2.1.5: Communicate results of investigations using multiple representations. **3.2.10.B5:** Understand that waves transfer energy without transferring matter. Compare and contrast the wave nature of light and sound. Describe the components of the electromagnetic spectrum. Describe the difference between sound and light waves.		work? 17. How is ultrasound used in medicine?		
Weeks 29	Electromagnetic Spectrum	**Systems Analysis Exploration** Electromagnetic Spectrum Wave Types Speed Frequency Wavelength	**S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables,	Electromagnetic waves transfer energy through matter and through space, which is used in many modern devices.	1. How does a vibrating electric charge produce an electromagnetic wave? 2. What properties describe an electromagnetic wave? 3. How do electromagnetic waves transfer energy? 4. What are the sub divisions of the electromagnetic spectrum? 5. What is an electromagnetic wave and how do the various types of E-M	• **Group Work** • **Discussion** • **Problem Solving exercises** • **E-M test**	

			manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. **3.2.10.B5:** Understand that waves transfer energy without transferring matter.		waves fundamentally differ from one another? 6. How are carrier waves modulated to transmit information? 7. What is the difference between amplitude modulation and frequency modulation? 8. What technologies use radio waves and microwaves from communication?		

			Compare and contrast the wave nature of light and sound. Describe the components of the electromagnetic spectrum. Describe the difference between sound and light waves. **3.2.12.B5:** Research how principles of wave transmissions are used in a wide range of technologies. Research technologies that incorporate principles of wave transmission. **S11.C.2.1.1:** Compare or analyze waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels, and motion.				
Week 30 31& 32	Light	**Systems Analysis Exploration** Behavior of Light Color	**S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output,	Light waves carry radiant energy.	1. How are transparent, translucent, and opaque materials different? 2. What is difference between regular and diffuse reflection? 3. What is the index of refraction of a material?	• **Intensity of light lab** • **Group Work** • **Discussion** • **Problem Solving exercises** • **Light test**	

			and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for		4. Why does a prism split white light into different components? 5. How do you see color? 6. What is the difference between light color and pigment color? 7. What happens when different colors are mixed? 8. What are the practical applications of optical devices? 9. How does a laser produce coherent light? 10. What are some uses for lasers? 11. What is the difference between polarized and unpolarized light? 12. When does total internal reflection occur? 13. What are some real life examples of total internal reflection?		

			consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. **3.2.10.B5:** Understand that waves transfer energy without transferring matter. Compare and contrast the wave nature of light and sound. Describe the components of the electromagnetic spectrum. Describe the difference between sound and light waves.				
Week 33,34,35, 36	Atomic and Nuclear	**Systems** **Analysis** **Exploration** **Radioactivity** **Fission** **Fusion**	**S11.A.3.3:** Compare and analyze repeated processes or recurring elements in patterns. **S11.A.3.1.1:** Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts. **S11.A.2.1.1:** Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures,	Nuclei are divisible and sometimes break apart causing emission of particles or photons. It has various effects on surrounding environment.	1. What is nuclear mass defect? 2. What is binding energy? 3. What is radioactivity? 4. What are the three types of radiation? 5. How is energy released through nuclear fission? Nuclear fusion? 6. In what way does the structure of the nucleus affect the stability of the atom and the type of nuclear decay that occurs? 7. What technological innovations have been produced from the ideas of the modern	▪ **Radiation activity lab Group Work** ▪ **Discussion** ▪ **Problem Solving exercises** ▪ **Atomic and nuclear test**	

			identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design. **S11.A.2.1.2:** Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. **S11.A.2.1.3:** Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits. **S11.A.2.1.4:** Critique the results and conclusions of scientific inquiry for consistency and logic. **S11.A.2.1.5:** Communicate results of investigations using multiple representations. 3.4.12 Apply concepts about structure and properties of matter. Classify and		atomic theory and what effects do these advances have upon our everyday lives?		

			describe in forms, types of chemical and nuclear reactions. Explain how radioactive isotopes can be used to estimate the age of materials.				

***** Some teachers may need to think about the assessments and resources used in order to determine the Big Ideas, Enduring Understandings, and Essential Questions embedded in their courses. At this point in your curriculum mapping, you might want to ignore the "Common Assessments" and "Common Resources Used" columns. However, you may use them if you wish.