Length	Objectives- Physics 2nd Trimester	**Vocabulary**	Chapter &Activities
Unit 1 Mechanical Waves	*P4.4 Wave Characteristics* Waves (mechanical and electromagnetic) are described by their wavelength, amplitude, frequency, and speed. **P4.4A** Describe specific mechanical waves (e.g., on a demonstration spring, on the ocean) in terms of wavelength, amplitude, frequency, and speed. **P4.4B** Identify everyday examples of transverse and compression (longitudinal) waves. **P4.4C** Compare and contrast transverse and compression (longitudinal) waves in terms of wavelength, amplitude, and frequency. *P4.4x Wave Characteristics-Calculations* Wave velocity, wavelength, and frequency are related by **v** = l**f**. The energy transferred by a wave is proportional to the square of the amplitude of vibration and its frequency. **P4.4d** Demonstrate that frequency and wavelength of a wave are inversely proportional in a given medium. **P4.4e** Calculate the amount of energy transferred by transverse or compression waves of different amplitudes and frequencies (e.g., seismic waves). *P4.5 Mechanical Wave Propagation* Vibrations in matter initiate mechanical waves (e.g., water waves, sound waves, seismic waves), which may propagate in all directions and decrease in intensity in proportion to the distance squared for a point source. Waves transfer energy from one place to another without transferring mass. **P4.5A** Identify everyday examples of energy transfer by waves and their sources. **P4.5B** Explain why an object (e.g., fishing bobber) does not move forward as a wave passes under it. **P4.5C** Provide evidence to support the claim that sound is energy transferred by a wave, not energy transferred by particles. **P4.5D** Explain how waves propagate from vibrating sources and why the intensity decreases with the square of the distance from a point source. **P4.5E** Explain why everyone in a classroom can hear one person speaking, but why an amplification system is often used in the rear of a large concert auditorium. *P4.8x Wave Behavior — Diffraction, Interference, and Refraction* Waves can bend around objects (diffraction). They also superimpose on each other and continue their propagation without a change in their original properties (interference). When refracted, light follows a defined path. **P4.8c** Describe how two wave pulses propagated from opposite ends of a demonstration spring interact as they meet. **P4.8d** List and analyze everyday examples that demonstrate the interference characteristics of waves (e.g., dead spots in an auditorium, whispering galleries, colors in	Compression (longitudinal) wave Demonstration spring Diffraction Electromagnetic wave Frequency Hertz Interference Inverse square law Inversely Proportional Mechanical wave Point source Proportional Refraction Seismic wave Sound wave Superimpose Transporting matter and/or energy Transverse wave Vibrations Water wave Wave amplitude Wave medium Wave propagation Wave pulse Wave source Wave speed Wave velocity Wavelength	Chapter Labs, test, HW

	a CD, beetle wings).		
Unit 2 Electromagnetic Waves	*P4.6 Electromagnetic Waves* Electromagnetic waves (e.g., radio, microwave, infrared, visible light, ultraviolet, x-ray) are produced by changing the motion (acceleration) of charges or by changing magnetic fields. Electromagnetic waves can travel through matter, but they do not require a material medium. (That is, they also travel through empty space.) All electromagnetic waves move in a vacuum at the speed of light. Types of electromagnetic radiation are distinguished from each other by their wavelength and energy. **P4.6A** Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. **P4.6B** Explain why radio waves can travel through space, but sound waves cannot. **P4.6C** Explain why there is a time delay between the time we send a radio message to astronauts on the moon and when they receive it. **P4.6D** Explain why we see a distant event before we hear it (e.g., lightning before thunder, exploding fireworks before the boom). *P4.6x Electromagnetic Propagation* Modulated electromagnetic waves can transfer information from one place to another (e.g., televisions, radios, telephones, computers and other information technology devices). Digital communication makes more efficient use of the limited electromagnetic spectrum, is more accurate than analog transmission, and can be encrypted to provide privacy and security. **P4.6e** Explain why antennas are needed for radio, television, and cell phone transmission and reception. **P4.6f** Explain how radio waves are modified to send information in radio and television programs, radio-control cars, cell phone conversations, and GPS systems. **P4.6g** Explain how different electromagnetic signals (e.g., radio station broadcasts or cell phone conversations) can take place without interfering with each other. **P4.6h** Explain the relationship between the frequency of an electromagnetic wave and its technological uses. *P4.8 Wave Behavior-Reflection and Refraction* The laws of reflection and refraction describe the relationships between incident and reflected/refracted waves. **P4.8A** Draw ray diagrams to indicate how light reflects off objects or refracts into transparent media.	Absorption Acceleration Analog Angle of incidence Angle of reflection Angle of refraction Antenna Charges Diffraction Digital Electric field Electromagnetic Wave Energy Frequency Incident wave Infrared waves Interference Law of Reflection Lens Magnetic field Microwaves Modulation Radio waves Ray diagram Reception Reflected wave Reflection Refracted wave Refraction Snell's Law Sound waves	Chapter Labs, test, HW

	P4.8B Predict the path of reflected light from flat, curved, or rough surfaces (e.g., flat and curved mirrors, painted walls, paper). *P4.8x Wave Behavior — Diffraction, Interference, and Refraction* Waves can bend around objects (diffraction). They also superimpose on each other and continue their propagation without a change in their original properties (interference). When refracted, light follows a defined path. **P4.8e** Given an angle of incidence and indices of refraction of two materials, calculate the path of a light ray incident on the boundary (Snell's Law). **P4.8f** Explain how Snell's Law is used to design lenses (e.g., eye glasses, microscopes, telescopes, binoculars). *P4.9 Nature of Light* Light interacts with matter by reflection, absorption, or transmission. **P4.9A** Identify the principle involved when you see a transparent object (e.g., straw, a piece of glass) in a clear liquid. **P4.9B** Explain how various materials reflect, absorb, or transmit light in different ways. **P4.9C** Explain why the image of the Sun appears reddish at sunrise and sunset.	Speed of light Transmission Ultraviolet light Visible light Wavelength X-rays	
Unit 3 Electric Forces	*P3.1x Forces* Objects can interact with each other by "direct contact" (pushes or pulls, friction) or at a distance (gravity, electromagnetism, nuclear). **P3.1b** Explain why scientists can ignore the gravitational force when measuring the net force between two electrons. **P3.1c** Provide examples that illustrate the importance of the electric force in everyday life. *P3.7 Electric Charges* Electric force exists between any two charged objects. Oppositely charged objects attract, while objects with like charge repel. The strength of the electric force between two charged objects is proportional to the magnitudes of the charges and inversely proportional to the square of the distance between them (Coulomb's Law). **P3.7A** Predict how the electric force between charged objects varies when the distance between them and/or the magnitude of charges change. **P3.7B** Explain why acquiring a large excess static charge (e.g., pulling off a wool cap, touching a Van de Graaff generator, combing) affects your hair. ***P3.7x*** *Electric Charges-Interactions* Charged objects can attract electrically neutral objects by induction. **P3.7c** Draw the redistribution of electric charges on a neutral object when a charged object is brought near. **P3.7d** Identify examples of induced static charges. **P3.7e** Explain why an attractive force results from bringing a charged object near a	charged object conductor contact forces Coulomb's Law direction of a force distribution of electric charge electric charge electric circuit electric force electric generator electric motor electric potential electrical current electrically neutral electromagnetic force electromagnetic wave electron force forces at a distance friction	Chapter Labs, test, HW

	neutral object**.** **P3.7f** Determine the new electric force on charged objects after they touch and are then separated. **P3.7g** Propose a mechanism based on electric forces to explain current flow in an electric circuit. *P3.8x Electromagnetic Force* Magnetic and electric forces are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces and moving magnets produce electric forces (e.g., electric current in a conductor). **P3.8b** Explain how the interaction of electric and magnetic forces is the basis for electric motors, generators, and the production of electromagnetic waves.	gravitational force induction inverse square law inversely proportional like charge magnet magnetic force magnitude of a force magnitude of charge moving electrical charge moving magnet net force opposite charge proportional proton repel/attract static charge Van de Graff generator	
Unit 4 Electric Current	*P4.10 Current Electricity Circuits* Current electricity is described as movement of charges. It is a particularly useful form of energy because it can be easily transferred from place to place and readily transformed by various devices into other forms of energy (e.g., light, heat, sound, and motion). Electrical current (amperage) in a circuit is determined by the potential difference (voltage) of the power source and the resistance of the loads in the circuit. **P4.10A** Describe the energy transformations when electrical energy is produced and transferred to homes and businesses. **P4.10B** Identify common household devices that transform electrical energy to other forms of energy, and describe the type of energy transformation. **P4.10C** Given diagrams of many different possible connections of electric circuit elements, identify complete circuits, open circuits, and short circuits and explain the reasons for the classification. **P4.10D** Discriminate between voltage, resistance, and current as they apply to an electric circuit. *P4.10x Current Electricity — Ohm's Law, Work, and Power* In circuits, the relationship between electric current, **I**, electric potential difference, **V,** and resistance, **R**, is quantified by **V = I R** (Ohm's Law). Work is the amount of energy transferred during an interaction. In electrical systems, work is done when charges are moved through the	Amperage Amperes Charge Circuit Circuit breaker Complete circuit Coulomb Electric company Electric energy Electric power Electrical current Fuse Kilowatt hour (kWh) Kilowatt (kW) Load Moving Electric Charge Ohm Ohm's law Open circuit	Chapter Labs, test, HW

	circuit. Electric power is the amount of work done by an electric current in a unit of time, which can be calculated using **P = I V**. **P4.10e** Explain energy transfer in a circuit, using an electrical charge model. **P4.10f** Calculate the amount of work done when a charge moves through a potential difference, *V*. **P4.10g** Compare the currents, voltages, and power in parallel and series circuits. **P4.10h** Explain how circuit breakers and fuses protect household appliances. **P4.10i** Compare the energy used in one day by common household appliances (e.g., refrigerator, lamps, hair dryer, toaster, televisions, music players). **P4.10j** Explain the difference between electric power and electric energy as used in bills from an electric company.	Parallel circuit Potential difference Resistance Series circuit Short circuit Voltage Work Watt	
Unit 5 Energy & Society	*P4.2 Energy Transformation* Energy is often transformed from one form to another. The amount of energy before a transformation is equal to the amount of energy after the transformation. In most energy transformations, some energy is converted to thermal energy. *P4.12 Nuclear Reactions* Changes in atomic nuclei can occur through three processes: fission, fusion, and radioactive decay. Fission and fusion can convert small amounts of matter into large amounts of energy. Fission is the splitting of a large nucleus into smaller nuclei at extremely high temperature and pressure. Fusion is the combination of smaller nuclei into a large nucleus and is responsible for the energy of the Sun and other stars. Radioactive decay occurs naturally in the Earth's crust (rocks, minerals) and can be used in technological applications (e.g., medical diagnosis and treatment). **P4.12A** Describe peaceful technological applications of nuclear fission and radioactive decay. **P4.12B** Describe possible problems caused by exposure to prolonged radioactive decay. *P4.12x Mass and Energy* In nuclear reactions, a small amount of mass is converted to a large amount of energy, **E = mc**2, where c is the speed of light in a vacuum. The amount of energy before and after nuclear reactions must consider mass changes as part of the energy transformation. **P4.12d** Identify the source of energy in fission and fusion nuclear reactions.	atomic bonding principles atomic configuration atomic energy atomic mass atomic nuclei/nucleus atomic number atomic reaction atomic weight by-product chemical bond $E=mc^2$ matter mechanical energy microwave neutron nuclear decay rate nuclear energy nuclear fission nuclear force nuclear fusion nuclear mass nuclear reaction nuclear stability proton radioactive decay radioactive isotope	Chapter Labs, test, HW

		spontaneous nuclear reaction	