Unit 05: Waves NJ NGSS

Content Area: **Science**
Course(s): **Generic Course**
Time Period: **Marking Period 1**
Length: **4**
Status: **Published**

Standards

- 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)
- [From the 3–5 grade band endpoints] Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. (Boundary: The discussion at this grade level is qualitative only; it can be based on the fact that two different sounds can pass a location in different directions without getting mixed up.) (HS-PS4-3)
- 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)
- 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)
- 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)
- 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)
- Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to HS-ESS1-2)
- Energy cannot be created or destroyed–only moved between one place and another place, between objects and/or fields, or between systems. (HS-ESS1-2)

http://www.state.nj.us/education/modelcurriculum/sci/physicsu5.shtml

SCI.9-12.HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
SCI.9-12.HS-PS4-5	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.
SCI.9-12.HS-PS4-3	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.
SCI.9-12.HS-PS4-2	Evaluate questions about the advantages of using digital transmission and storage of

information.

Essential Questions

- What are the ways people interact with waves?
- How can waves help us communicate?

Content / Skills

- Define and apply Hooke's Law (Accelerated)
- Compare and contrast periodic motion and simple harmonic motion (Accelerated & CP)
- Describe and solve SMH problems (Accelerated)
- Define the function and anatomy of waves (Accelreated & CP)
- Compare and contrast mechanical and EM waves (Accelreated & CP)
- Draw parallels between uniform circular, simple harmonic, and wave motion (Accelreated & CP)
- Describe and apply the nature of wave (periodic, SHM) motion (Accelreated & CP)
- Describe and apply the physics of wave reflection and wave interference (Accelreated & CP)
- Describe how waves are reflected and refracted at boundaries between media. (Accelreated & CP)
- Contrast transverse and longitudinal waves. (Accelreated & CP)
- Differentiate between constructive and destructive interference. (Accelreated & CP)
- Describe how brightness of a light is affected by distance. (Accelreated & CP)
- Explain how waves diffract.(Accelreated)
- Compare and contrast reflection and refraction.(Accelreated & CP)
- Solve problems relating frequency, wavelength, and velocity of waves. (Accelreated & CP)
- Recognize the relationship between period and frequency. (Accelreated & CP)
- Define and apply the properties of Sound. (Accelreated & CP)
- Describe and apply the nature of waves as it applies to sound. (Accelreated & CP)
- Relate the physical properties of sound waves to the way we perceive sound. (Accelreated & CP)
- Relate the physical properties of light waves to the way we perceive light.(Accelreated & CP)
- Describe the origin of sound.(Accelreated & CP)
- Explain why there is a variation among instruments and among voices using the terms timbre, resonance, fundamental and harmonic.(Accelreated & CP)
- Identify the componets of the electromagnetic spectrum. (Accelreated & CP)
- Calculate the frequency or wavelength of electromagnetic radiation. (Accelreated & CP)
- Recall the history of the discovery that light has a finite speed. (Accelreated & CP)
- Describe how the brightness of a light source is affected by distance. (Accelreated & CP)
- Distinguish between specular and diffuse reflection of light. (Accelreated & CP)
- Apply the law of reflection for flat mirrors. (Accelreated & CP)
- Describe the nature of images formed by flat mirrors. (Accelreated & CP)
- Draw ray diagram and use the law of the reflection for planar mirrors. (Accelreated)
- Draw ray diagrams to locate images on curved mirrors. (Accelreated)
- Calculate distance and focal lengths using the mirror equations for concave and convex mirrors. (Accelreated)
- Distinguish between real and virtual images. (Accelreated & CP)
- Recognize how additive colors affect the color of light. (Accelreated & CP)
- Recognize how pigments affect the color of reflected light. (Accelreated & CP)

- Explain how linearly polarized light is formed and detected. (Accelerated)
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- Recognize how pigments affect the color of reflected light. (Accelreated & CP)
- Explain how linearly polarized light is formed and detected. (Accelreated)
- Apply the concept that light travels at different speeds in different mediums. (Accelreated & CP)
- Draw ray diagram and use the law of the refraction boundaries. (Accelerated)
- Draw ray diagram and use the lens equation for lenses. (Accelerated)
- Apply the use of lenses to correct vision. (Accelreated & CP)
- Define and apply the concept of critical angle. (Accelerated)
- Define and apply atmosperic refracction, dispersion (including rainbows), and lens aberration. (Accelerated)