PHYSICS

Key Features

Focus Areas

- forces and motion,
- energy,
- wave properties, and
- electromagnetic radiation.

By the end of Physics studies, students can

- 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.
- Support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
- Use Newton's law of gravitation and Coulomb's law to describe and predict the gravitational and electrostatic forces between objects.
- Provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
- Illustrate that energy can be explained by the combination of motion and position of objects at the macroscopic scale and the motion and position of particles at the microscopic scale.
- Illustrate the forces between two objects and the changes in energy of the objects due to their interaction through electric or magnetic fields.
- Design, evaluate, and refine a solution for improving how digital devices store and transmit information.
- Evaluate how electromagnetic radiation can be described either by a wave model or a particle model, and in some situations one model is more useful than the other.

Home to School Connections

Questions you can ask your learner could include:

- What are Newton's laws of motion?
- How can momentum be transferred?
- What is the purpose of wind turbines? Do we have any in South Carolina?
- How can electromagnetic radiation be used in the medical field?

Questions you can ask your learner's teacher could include:

- What demonstrations are used in class to solidify the understanding of concepts?
- What kind of post-secondary educational and career opportunities could this course inspire my learner to explore?

Activities and learning you can do outside of the classroom to support your learner could include:

- Choose 2 objects to drop from the same height, one object being heavier than the other. Before observing the two objects in free fall, predict which one will fall fastest. Then use a stopwatch to time separately how fast each of the items drops. Finally drop both items at the same time and observe their motion relative to each other.
- Determine the success of a device used for protecting an object from damage. Examples of devices could include football helmets, parachutes, and car restraint systems, such as seatbelts and airbags. Come up with a way to refine the device by modifying one or more parts or all the device to improve performance of the device.
- Use a comb and small pieces of paper to represent Coulomb's Law. The comb becomes charged once it is rubbed against hair, and then will attract the paper of the opposite charge when held above them.
- Identify the following as magnets or electric currents and whether they create
magnetic fields or electric fields: current carrying wires, anti-shoplifting devices, and metal detectors.

- Identify examples of designed conductive materials in your house: wiring in phone chargers, wiring in car speakers, or computer chips. Examples of designed insulating materials could include polystyrene and fiberglass. Discuss the importance of the structure of these items in their specific functions.
- Observe pole vaulting in person or by viewing a video. Draw a diagram representing the transfer of energy through the process of the pole vaulter running, bending the pole to go up and over the bar, and finally down into the mat.
- Identify local structures that are used to convert one form of energy into another form of energy such as windmills, wind turbines, solar cells, and generators. Discuss the purpose of these items in terms of energy.
- Identify familiar design problems such as poor signal strength in rural areas with satellite radio or internet connections, lack of security on social media applications causing personal data theft, and low-quality images (pixelated/fuzzy images, small size). Come up with solutions to these problems and determine how successful the solutions will be at improving signal strength, preventing hacking, and improving image quality.
- When longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelengths (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. Explain how technology applications such as medical imaging devices, tanning beds, and radiation cancer treatments use these wavelengths.

Resources

- Bozeman Science (https://www.bozemanscience.com/)
- CK-12 Foundation (https://www.ck12.org/student/)
- Discus (https://www.scdiscus.org/)
- Exploratorium (https://www.exploratorium.edu/)
- HyperPhysics (http://hyperphysics.phy-astr.gsu.edu/hbase/index.html)
- Khan Academy (https://www.khanacademy.org/)
- PBS LearningMedia (https://scetv.pbslearningmedia.org/)
- Physics Classroom (https://www.physicsclassroom.com/)