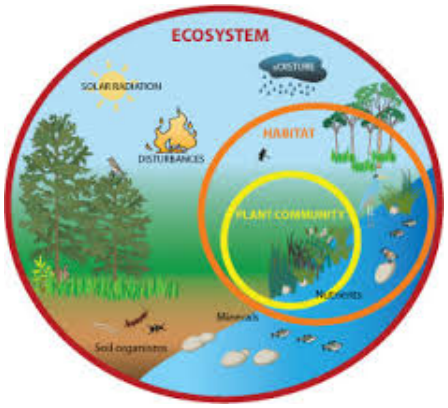
Force and Motion

Curriculum Guide for 5th Grade SDP Science Teachers



Please note: Pennsylvania & Next Generation Science Standards as well as Instructional Resources are found on the SDP Curriculum Engine

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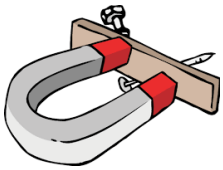
5th Grade Science Curriculum Term 1 (9/5-11/13/17)

Topic: Forces and Motion



Duration: 9-10 Weeks

Performance Objectives

SWBAT:

- correctly utilize measurement tools **IOT** measure an object's movement in terms of speed
- describe an object's speed, velocity, and acceleration **IOT** show how an object's motion and location can change.
- identify patterns of motion **IOT** predict an object's future motion
- describe the forces acting on an object **IOT** determine whether an object will move, change speed, or change direction.
- describe the effects of gravity and friction **IOT** explain how forces affect an object's motion.
- plan and conduct an observation **IOT** provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- show how objects resist changes in motion **IOT** demonstrate the concept of inertia.

Key Terms and Definitions

force: A push or pull exerted on an object in order to change the motion of the object; force has size and direction
motion: An object's change in position relative to a reference point
speed: The distance traveled divided by the time it took to travel
projectile motion: The curved path that an object follows when thrown, launched, or otherwise projected
free fall: The motion of an object when only the force of gravity is acting on it
balanced forces: Two forces acting on an object in opposite directions and of equal sizes
unbalanced forces: Two forces acting on an object that are not equal in size; they cause an object to move, stop, change speed, or change direction.
net force: The combination of all of the forces acting on an object
mass: A measure of the amount of matter in an object
gravity: A force of attraction between objects that is due to their masses
friction: A force that opposes motion between two surfaces that are in contact
velocity: The speed of an object in a particular direction
acceleration: The rate at which velocity changes over time; an object accelerates if its speed, direction, or both change
inertia: The tendency of an object to resist being moved or, if the object is moving, to resist a change in speed or direction until an outside force acts on the object

Essential Questions

How do balanced and unbalanced forces affect the motion of an object?
How can the laws of motion help you predict future motion of an object?

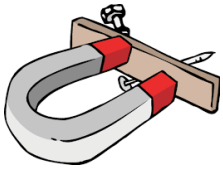
Starting Points

Upon beginning this unit, students should have a basic knowledge of the physics topics of energy (3rd grade unit) and magnetism and electricity (4th grade unit). More specifically, in terms of energy, it will be important for students to have an understanding of the types of energy and how energy can convert from one form to another form. Students should also know the basic properties of magnets and how electricity is formed. Students will use this knowledge in this unit in order to describe how energy and energy transformations can create motion as well as how the forces present in interactions between magnets.

Students should also have a solid understanding of mass (and how it differs from weight) because they will need to understand how mass affects motion by the end of this unit.

5th Grade Science Curriculum Term 2 (11/18-1/29/18)

Topic: Our Universe



Duration: 9-10 Weeks

Performance Objectives

SWBAT:

- identify objects such as planets, moons, stars, and the sun **IOT** describe the main components of our solar system.
- describe the characteristics of different planets **IOT** identify similarities and differences between planets.
- model the movement of the Earth through space **IOT** explain how the Earth rotates and revolves on a constant basis.
- model the rotation of the Earth in space **IOT** explain what causes day and night.
- model the tilt of the Earth's axis and the orbit of the Earth around the sun **IOT** explain what causes seasonal changes on Earth.
- identify lunar phases **IOT** explain the pattern of predictable changes in the observable shape of the moon.
- explain how seasons and distance can affect the appearance of stars **IOT** describe why some stars appear brighter and larger than others.
- explain the characteristics of telescopes **IOT** describe why telescopes are useful to scientists.

Key Terms and Definitions

planet: Any of the primary bodies that orbit the sun; a similar body that orbits another star
moon: A natural object that orbits a planet
sun: The star around which our earth orbits
star: A large celestial body that is composed of gas and that emits light; the sun is a typical star
solar system: A sun and all the objects that move around it

universe: The sum of all space, matter, and energy that exist, that have existed in the past, and that will exist in the future
revolution: The motion of a body that travels around another body in space; one complete trip along an orbit
rotation: The spin of a body on its axis
axis: An imaginary straight line running through the Earth from pole to pole
gravity: A force of attraction between objects that is due to their masses
telescope: An instrument that collects electromagnetic radiation from the sky and concentrates it for better observation
orbit: The path one object takes around another object
lunar cycle: The orbit of the moon around the Earth, during which all of the lunar phases occur
lunar phases: The different appearances of the moon from Earth throughout the month
constellation: A group of stars
model: A pattern, plan, representation, or description designed to show the structure or workings of an object, system, or concept

Essential Questions

What patterns of change are caused by the movement of objects in our solar system?
How can you model the movement of the objects in our universe?
What are the similarities and differences between the characteristics of different objects in our universe?
How does light and energy from the Sun affect objects in our solar system such as planets and moons?

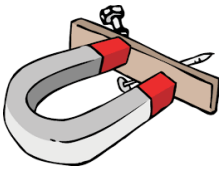
Starting Points

This unit will be student's first major introduction to the universe and solar system. Since students may not have had any formal instruction on these topics before, they may come into the unit with misconceptions about how our solar system works (e.g., the moon lights up on its own). As a result, it is recommended that teachers begin the unit with some type or activity or pre-assessment that will gauge children's prior knowledge and possible misconceptions about topics covered in this unit.

Students should have exposure to and an understanding of cycles (e.g., the water cycle) and repeating patterns that they can apply to concepts in this unit, such as the cycle of seasons throughout the year. Students should also be familiar with how to construct a model of an object or system to explain. Lastly, students should have an understanding of gravity as a force at work in the universe from the Quarter 1 unit on Forces and Motion.

5th Grade Science Curriculum Term 3 (1/30-4/9/18)

Topic: Energy in Ecosystems



Duration: 9-10 Weeks

Performance Objectives

SWBAT:

- differentiate between consumers, producers, and decomposers IOT explain how energy moves through a food web.
- create a model of a food web and food chain IOT explain how the energy plants and animals use comes from the Sun.
- identify a food chain that exists within a given food web IOT describe how energy cycles through ecosystem.
- create food webs for two different ecosystems IOT compare and contrast different ecosystems.
- give examples of predator-prey and symbiotic relationships IOT describe relationships between organisms in an ecosystem.
- identify the major living and nonliving components of an ecosystem IOT explain the relationships between these components, including how matter cycles through the environment.
- explain the process of photosynthesis IOT support an argument that plants get the materials they need for growth mainly from air and water.
- describe how environmental changes can affect an ecosystem IOT predict the impact of certain events on an ecosystem.
- identify ways that humans rely on the environment IOT describe human impact on ecosystems.
- identify biological pests (invasive species) in the environment IOT describe their potential effects on the ecosystem and humans.

Key Terms and Definitions

Organism: A living thing
Ecosystem: A system of interacting organisms and nonliving factors in an area
Consumer: An organism that eats other organisms
Producer: An organism that is able to produce its own food through photosynthesis
Decomposer: An organism that consumes parts of dead organisms
Herbivore: An organism that eats only plants
Carnivore: An organism that eats only other animals
Omnivore: An organism that eats both plants and animals
Photosynthesis: The process by which producers make energy (food) from water and carbon dioxide in the presence of light
Water cycle: The continuous movement of water between the atmosphere, the land, and the oceans
Food web: All the feeding relationships in an ecosystem
Food chain: A sequence of organisms that eat one another in an ecosystem

Predator: An organism that eats all or part of another organism
Prey: An organism that is killed and eaten by another organism
Symbiosis: A relationship in which two different organisms live in a close area with each other and both usually benefit from the situation
Population: All the organisms of one kind (one species) in a certain area at one time
Habitat: The place where an organism usually lives
Pollution: An undesirable change in the natural environment that is caused by that are harmful to living organisms or by excessive wastes, heat, noise, or radiation
Invasive species: A plant or animal that was not originally living in a specific location and has a tendency to spread. This causes damage to the environment and/or humans.
Toxin: A substance that is produced by one organism and that is poisonous to other organisms

Essential Questions

How do living and nonliving things interact in an ecosystem?
How do living organisms interact with one another in an ecosystem?
How do humans and natural events impact ecosystems?
How does energy cycle in an ecosystem?

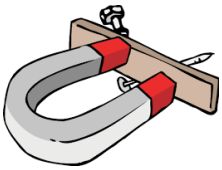
Starting Points

Upon beginning the unit, students should have a solid foundation in life sciences including differentiating between living and non-living things and identifying needs of living things. They should be familiar with common habitats and mechanisms that different living things use for survival. Students should have also studied examples of cycles and patterns in their world (e.g., the water cycle) and be able to identify how those cycles exist in ecosystems.

By the end of the unit, students will understand what makes up and ecosystem and have gained more knowledge on how organisms interact with one another in an ecosystem, including how they depend on each other for food and energy. They will also be able to describe the source of energy for all plants and animals and map the flow of energy using food webs and food chains. Students will also be able to explain how living and non-living components interact with each other and are affected by each other in an ecosystem.

5th Grade Science Curriculum Term 4 (4/10-6/15/18)

Topic: Thinking Like a Scientist



Duration: 9-10 Weeks

Performance Objectives

SWBAT:

- design and describe an investigation **IOT** test the effect of one variable on another.
- ask scientific questions **IOT** describe the problem to be address through an investigation.
- identify independent and dependent variables and controls in an investigation **IOT** design a controlled investigation (fair test).

- use prior knowledge and evidence **IOT** make predictions about the outcome of an investigation.
- gather and visually represent data from an investigation **IOT** analyze the relationship between variables.
- analyze the cause and effect relationship in an investigation **IOT** state an accurate conclusion for the investigation.

Key Terms and Definitions

variable: A factor or condition that can change and might affect the outcome of an experiment
independent variable: In an experiment, the factor that is changed by the scientist
dependent variable: In an experiment, the factor the scientist measures in the experiment and what is affected by changing the independent variable
control: A factor that a scientist keeps constant or the same
investigation: A careful examination or process used to discover facts
controlled experiment/fair test: An experiment that tests only one factor at a time by only changing one variable (the independent variable)
observation: The information a person gets by using their senses
data: Any pieces of information collected through observation or experimentation
hypothesis: A testable idea or explanation that leads to scientific investigation

Essential Questions

How does a scientist design a fair test?
How can changing a variable effect an investigation?
Why does a scientist need to control variables during an investigation?
What makes a good scientific question?

Starting Points

Beginning in Kindergarten, students should have begun to receive an introduction to scientific thinking and the scientific investigation process with an emphasis on the eight Science and Engineering Practices included in the Next Generation Science Standards (NGSS pdf). Throughout each grade, students build on these practices to increase their ability to plan and carry out scientific investigation and analyze and interpret data from these investigations. Before officially entering middle school, it will be important that students have a final formal introduction to this process of scientific thinking, since these are skills they will rely on throughout middle and high school.

By the end of the unit, students will be able to demonstrate that they can ask questions that can be answered through scientific investigation. They will also show that they can plan and carry out an investigation from start to finish, and they will ensure that this investigation is a "fair test" that is only testing one variable at a time. Students will also be able to analyze and display data in order to state a conclusion to their investigation.