Platte County

HOME OF THE PIRATES

SCIENCE CURRICULUM

SEVENTH GRADE

Board Approval Date: pending
May 2024

7 Science: Force and Motion

Overview

Grade: 6

Quarter(s): 1 - 2

Pacing: 9 weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
6-8.PS2.A.1	APPLY physics principles to DESIGN a solution that minimizes the forces of an object during a collision and DEVELOP an EVALUATION of the solution.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
4.PS2.A.1 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	Students who go on to take physical science will engage with: **9-12.PS2.A.1** Analyze data to support and verify the concepts expressed by Newton's 2nd law of motion, as it describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Unit Supporting Standards Code	Unit Supporting Standards Description
6-8.PS2.A.2	Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK (s)	DESE Expectation(s) Unwrapped
6-8.PS2.A.1	Apply physics principles to design a solution that minimizes the forces of an object during a collision and develop an evaluation of the solution.	3	**SCIENCE AND ENGINEERING PRACTICES** **Constructing Explanations & Designing Solutions** • Apply scientific ideas or principles to design an object, tool, process, or system **CROSSCUTTING CONCEPTS** **Systems and System Models** • Models can be used to represent systems and their interactions, such as inputs, processes and

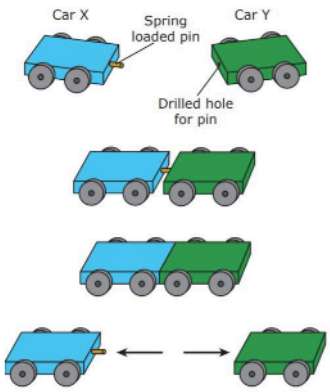
			outputs, and energy and matter flow within a system. **<u>DISCIPLINARY CORE IDEAS</u>** **Forces and Motion** ● For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first but in an opposite direction (Newton's 3rd Law)
DESE Questions Examples:	Students observe a video of two astronauts on the International Space Station (ISS) demonstrating a scientific principle. The ISS is in a microgravity environment. That means that astronauts experience weightlessness in the ISS. The students observe one astronaut push on the second astronaut's back while both are floating near each other. As a result of the push, both astronauts move away from each other in opposite directions. Figure 1 shows the astronauts inside the ISS floating near each other. Figure 2 shows the astronauts moving away from each other. **Figure 1** **Figure 2**  To better understand the ISS demonstration, the students constructed two cars from wood blocks. A hole was drilled into a side of each block. A spring attached to a pin was inserted into one block and used to exert an initial force after the cars were released. The setup is shown in Figure 3. **Figure 3**  The students changed some variables and repeated the investigation several times. Table 1 shows the average data collected.	

Table 1: Observed Data

Trial	Mass (kg)		Distance (m)	
	Car X	Car Y	Car X	Car Y
1	0.15	0.15	1.50	1.50
2	0.15	0.30	1.80	0.75
3	0.30	0.15	0.75	1.80
4	0.30	0.30	0.75	0.75

1. Identify the key parts of the system.
2. At this point, which trial demonstrates the best solution to minimize the impacts of the collision?
3. What would happen in this system if you increase the surface friction?
4. What would happen in this system if you increase the stiffness in the spring?
5. What would happen in this system if you added oil on the wheels?

"Unwrapped" Content (nouns) (students need to know)	"Unwrapped" Skills (VERBS) (students need to be able to do/possible evidence)	"Unwrapped" Understanding (students need to understand/big ideas)
• physics principles • solution • forces • collision • solution	**Given a problem involving a collision between objects, students would:** **DESIGN** • a solution that would minimize the force of an object. **DESCRIBE and/or IDENTIFY:** • Criteria • Constraints • Physics principles involved in determining the solution to the given problem **EVALUATE:** • A possible solution	**DISCIPLINARY CORE IDEAS** **Forces and Motion** • For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first but in an opposite direction (Newton's 3rd Law)

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• Collision • Minimize • Criteria • Constraint • Force	• Solution • Evaluate

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

4	**Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.** • **To be completed in the 2024-2025 School Year**
3	**Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.** •
2	**Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.** •
1	**Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.** •

Additional Information

Professional Resource Suggestions	Instructional Resources

DESE
• MO Performance Level Descriptors
• Item Specifications
• Science Curriculum Hub
	District Provided:
	• Savvas Topic 10
	• Gizmos
	  ○ Fan Physics
	  ○ Crumple Zones
	Other:
	• MO Leap Blocks

Unit Designer Notes	**Content Limits/Assessment Boundaries:** • Tasks should be limited to vertical or horizontal interactions in one direction **ClarificationStatement:** • Newton's third law of motion states that for every action, there is an equal but opposite action. Using this principle, design a solution that would

	minimize the force of an object during a collision and evaluate the proposed solution. (Examples include collisions between cars,between a car and a stationary object, etc.)

7 Science: Energy

Overview

Grade: 7

Quarter(s): 2

Pacing: 9 weeks

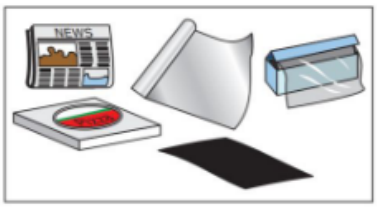
Unit Power Standard(s) Code	Unit Power Standard(s) Description
6-8.PS3.A.4	PLAN and CONDUCT an investigation to DETERMINE the relationship among energy transferred, the type of matter, the mass, and the change in temperature of the sample.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
4.PS3.A.1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.	Students who take high school Physical Science will be engaged with: **9-12.PS3.A2** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).

Unit Supporting Standards Code	Unit Supporting Standards Description
6-8.PS3.A.1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
6-8.PS3.A.2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
6-8.PS3.A.3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
6-8.PS3.A.4	Plan and conduct an investigation to determine the relationship among energy transferred, the type of matter, the mass, and the change in	3	**SCIENCE AND ENGINEERING PRACTICES** **Planning and Carrying Out Investigations** • Plan an investigation, and in the design, identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data are needed to support a claim.

	temperature of the sample.		**DISCIPLINARY CORE IDEAS** **Definitions of Energy** ● Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. **Conservation of Energy and Energy Transfer** ● The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter and the size of the sample. **CROSSCUTTING CONCEPTS** **Scale, Proportion, and Quantity** ● It is critical to recognize what is relevant at different measures of size, time, and energy and how it changes in scale and proportions affect the transfer of energy.
DESE Questions Examples:	A group of students want to create a device that will cook food using energy from the Sun. Their goal is to design a solar cooker that will maximize the rate of cooking. Figure 1 shows the material available to the students which include newspaper, plastic wrap, aluminum foil, black construction paper, and a pizza box. **Figure 1: Available Materials**  1. What measurements would they make to determine the dependent variable? 2. When testing how energy is transferred within the solar cooker, the students find that the temperature of the air in the cooker increases more quickly than the temperature of the food in the cooker. What factors of the matter being measured cause this phenomenon?		
"Unwrapped" Content (nouns) (students need to know)		**"Unwrapped" Skills (VERBS) (students need to be able to do/possible evidence)**	**"Unwrapped" Understanding (students need to understand/big ideas)**

• Investigation • Relationship • Energy transferred • Matter • Mass • Temperature	**Students DESIGN an investigation that DESCRIBES the data to be collected and the evidence to be derived from the data including:** • Initial and final temperature of the materials used in the investigation • Types of matter used in the investigation • Mass of matter used in the investigation	<u>DISCIPLINARY CORE IDEAS</u> **Definitions of Energy** • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. **Conservation of Energy and Energy Transfer** • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter and the size of the sample.

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• Investigation • Energy Transferred • Determine • Matter • Mass	• Relationship • Temperature • Plan • Conduct

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

4	**Student has mastered understanding of the entire standard(s) and makes little to no errors when asked to demonstrate and apply their learning.**
	• **To be completed in the 2024-2025 School Year.**
3	**Student consistently shows understanding for most components of the standard(s) with few errors when asked to demonstrate and apply their learning.**
	•
2	**Student can sometimes show understanding for some of the components of the standard(s), yet there are a few aspects that they are still learning and improving upon.**
	•

1	**Student rarely shows understanding for any component of the standard(s) and are still needing significant teaching to apply their learning.** •

Additional Information

Professional Resource Suggestions	Instructional Resources

DESE
• MO Performance Level Descriptors
• Item Specifications
• Science Curriculum Hub
	District Provided:
	• Savvas
	  ○ Topic 3
	  ○ Topic 4
	• Gizmos
	  ○ Energy Conversions
	  ○ Potential Energy on Shelves
	  ○ Energy Conversion in a System
	Other:
	• MO Leap Blocks

Unit Designer Notes	**Content Limits/Assessment Boundaries:** • Tasks should not require students to calculate the total amount of thermal energy transferred. • Tasks should limit calculations to proportionate thinking **ClarificationStatement:** • Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.

7 Science: Waves and Electromagnetic Radiation

Overview

Grade: 7

Quarter(s): 3

Pacing: 9 weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
6-8.PS4.A.2	DEVELOP and USE a model to DESCRIBE that waves are reflected, absorbed, or transmitted through various materials.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
5.PS4.A.1 Develop a model to describe that objects can be seen only when light is reflected off them or when they produce their own light.	Students who go on to take Physical Science will be engaged with: **9-12.PS4.A2** 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. **9-12.PS4.A1** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. **9-12.PS4.B1** Communicate technical information about how electromagnetic radiation interacts with matter.

Unit Supporting Standards Code	Unit Supporting Standards Description
6-8.PS4.A.1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
6-8.PS4.A.2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through	3	**SCIENCE AND ENGINEERING PRACTICES** **Developing and Using Model** • Develop and use a model to describe phenomena. **DISCIPLINARY CORE IDEAS** **Wave Properties** • A sound wave needs a medium through

	various materials.		which it is transmitted. **Electromagnetic Radiation** ● When light shines on an object, it is reflected, absorbed or transmitted through the object, depending on the object's material and the frequency (color) of the light. ● The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g. air and water, air and glass,) where the light path bends ● However, because light can travel through space, it cannot be considered to only move through matter, like sound or water waves **<u>CROSSCUTTING CONCEPTS</u>** **Structure and Function** ● Structures can be designed to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.

DESE Questions Examples:

Table 1
Velocity of Sound in Various Media

Media	Density (kg per cubic meter)	Velocity (m/s)
Air	1.0	343.0
Pure Water	1,000.0	1,493.0
Sea Water	1,020.0	1,533.0
Glass	2,600.0	4,540.0
Iron	7,870.0	5,130.0
Lead	11,350.0	1,158.0

1. Using the data above, develop a model which explains why the speed of sound is faster in solids and liquids than gasses.
2. Describe the organizations of particles and how the spatial relationships matter for behavior and function.

"Unwrapped" Content (<u>nouns</u>) (students need to know)	**"Unwrapped" Skills (VERBS) (students need to be able to do & DOK)**	**"Unwrapped" Understanding (students need to understand)**
● Model ● Waves ● Reflect ● Absorb ● Transmit ● Material	**DEVELOP models to IDENtIFY relevant components:** ● Type of waves and their amplitude and frequency: ○ Matter ○ Light ● Various materials through which waves are reflected,	**<u>DISCIPLINARY CORE IDEAS</u>** **Wave Properties** ● A sound wave needs a medium through which it is transmitted. **Electromagnetic Radiation** ● When light shines on an object, it is reflected, absorbed or transmitted through the object, depending on the object's material and the frequency (color) of the light.

	absorbed, or transmitted • Relevant characteristics of the wave after it has interacted with a material (frequency, amplitude, wavelength) • Position of the source of the wave **USE models:** • To describe why materials with certain properties are well suited for particular functions (e.g lenses and mirrors, sound absorbers in concert halls, colored light filter, sound barriers next to highways,)	• The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g. air and water, air and glass,) where the light path bends • However, because light can travel through space, it cannot be considered to only move through matter, like sound or water waves

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• absorb • transmit • reflect • waves • frequency • wavelength • amplitude	• Develop • Use • Describe • Material • Model

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

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	•

Additional Information

Professional Resource Suggestions	Instructional Resources

DESE
• MO Performance Level Descriptors
• Item Specifications
• Science Curriculum Hub
	District Provided:
	• Savvas
	  ○ Topic 5
	• Gizmos
	  ○ Waves
	  ○ Ripple Tank
	  ○ Color Absorption
	  ○ Laser Reflection
	  ○ Basic Prism

	Other: • MO Leap Blocks

Unit Designer Notes	**Content Limits/Assessment Boundaries:** • Tasks should be limited to qualitative applications pertaining to light and mechanical waves. **ClarificationStatement:** • Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.

7 Science: Electricity and Magnetism

Overview

Grade: 7

Quarter(s): 4

Pacing: 9 weeks

Unit Power Standard(s) Code	Unit Power Standard(s) Description
6-8.PS2.B.3	CONDUCT an investigation and EVALUATE the experimental design to PROVIDE evidence that electric and magnetic fields exist between objects exerting forces on each other even though the objects are not in contact.

Below Grade/Course Connected Standard(s)	Above Grade/Course Connected Standard(s)
3.PS2.B.1 Plan and conduct investigations to determine the cause and effect relationship of electric or magnetic interactions between two objects not in contact with each other.	Students who go on to take physical science will be engaged with: **9-12.PS2.B.2** Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current

Unit Supporting Standards Code	Unit Supporting Standards Description
6-8.PS2.B.1	Analyze diagrams and collect data to determine the factors that affect the strength of electric and magnetic forces.

Unpacked Standard(s)

Power Standard(s) Code	Power Standard(s) Description	DOK(s)	DESE Expectation(s) Unwrapped
6-8.PS2.B.3	Conduct an investigation and evaluate the experimental design to provide evidence that electric and magnetic fields exist between objects exerting forces on each other even though the objects are not in contact.	3	**SCIENCE AND ENGINEERING PRACTICES** **Planning and Carrying Out Investigations** • Conduct an investigation and evaluate the experimental design (identify variables and controls, what tools are needed, how measurements are taken and recorded, how many trials are needed) to provide evidence that electric and magnetic fields exist between objects. **DISCIPLINARY CORE IDEAS** **Types of Interactions** • Forces that act a distance (e.g. electric, magnetic) can be explained by fields that extend through space

			and can be mapped by their effect on a test object (e.g. a charged object, ball) **<u>CROSSCUTTING CONCEPTS</u>** **Cause and Effect** • May be used to predict phenomena in natural or designed systems (i.e. electric and magnetic fields)

DESE Questions Examples:

Magnet and Paperclip Investigation

Magnet	number of paper clips	distance from the clips (cm)
X	4	1.0
Y	9	0.5

A student did a short investigation regarding the power of magnets. The data from the investigation is listed in the table above.

1. Using the data table, evaluate the investigation
2. Identify the following variables found in this investigation
    a. Independent Variable
    b. Dependent Variable
    c. Constants
    d. Possibly Hypothesis
3. Describe how you can test whether distance or type of magnet causes the difference in the number of paperclips picked up.

"Unwrapped" Content (<u>nouns</u>) (students need to know)	"Unwrapped" Skills (VERBS) (students need to be able to do/possible evidence)	"Unwrapped" Understanding (students need to understand/big ideas)
• investigation • experimental design • evidence • electric and magnetic fields • objects • forces • contact	**Students CONDUCT an investigation to DEMONSTRATE:** • that field exist between objects exerting forces on each other even when not in contact with each other (electric/ magnetic)	**<u>DISCIPLINARY CORE IDEAS</u>** **Types of Interactions** • Forces that act a distance (e.g. electric, magnetic) can be explained by fields that extend through space and can be mapped by their effect on a test object (e.g. a charged object, ball)

New Academic Vocabulary	Scaffolded (Review) Academic Vocabulary
• Investigation • Experimental design • Evidence • Electric Field • Magnetic Field • Magnetic • Contact	• Electric • Forces • Object • Experimental design • Evidence

Assessment

Common Summative Assessment/Demonstration of Understanding

- **Common Unit Assessment to be completed in the 2024-2025 School Year.**

Links to student example of summative assessments/demonstration of understanding

Score 4	Score 3	Score 2	Score 1
Example	Example	Example	Example

Proficiency Scale

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Additional Information

Professional Resource Suggestions	Instructional Resources

DESE
• MO Performance Level Descriptors
• Item Specifications
• Science Curriculum Hub
	District Provided:
	• Savvas Topic 6
	• Gizmos
	  ○ Magnetism
	  ○ Circuit Builder
	  ○ Circuits
	Other:
	• MO Leap Blocks

Unit Designer Notes	**Content Limits/Assessment Boundaries:** • Tasks should be limited to electric and magnetic fields. • Tasks should be limited to qualitative evidence for the existence electrical magnetic fields.

	ClarificationStatement: ● Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences for simulations.