CEREAL CITY SCIENCE by BCAMSC

FORCES AND INTERACTIONS (3.PS.NGSS)

UNIT AT A GLANCE

ACTIVITY 1 - Observations of Motion: Toy Vehicle

QUESTIONS: How can we describe motion? How can we determine if there are patterns in observed motion?

Time to Complete

Preparation: 20 minutes
Activity: 2 classes
- Lesson 1A: 45–50 min.
- Lesson 1B: 45–50 min.

Phenomena

A toy car strikes a barrier and it changes the direction of the car.

Summary: Students Will...

- Predict the motion of a toy vehicle.
- Make and record observations of the car.
- Record and analyze data for patterns.
- Design an investigation to answer questions about motion of the car.

Students Figure Out How To:

- Make observations and measurements to collect data about the motion of a toy vehicle.
- Raise questions about the direction, distance traveled, and speed of the car.
- Design an investigation to answer questions about the motion of the car.

Practices

Asking Questions and Defining Problems

Planning and Carrying Out Investigations

Analyzing and Interpreting Data

Cause and Effect

Patterns

Performance Expectations (PE) at Lesson Level and Assessment

PE at Lesson Level:
Develop an initial understanding of how to describe motion.
Review understanding of forces and how forces can change motion.
Begin to raise questions and design an investigation.

Formative Assessment:
Class discussion/Science Talk
Data chart
Activity Pages

ACTIVITY 2 - Observations of Motion

QUESTIONS: How do we measure motion? How can we change motion?

Time to Complete

Preparation: 10 minutes
Activity: 3 classes
- Lesson 2A: 45–50 min.
- Lesson 2B: 45–50 min.
- Lesson 2C: 45–50 min.

Phenomena

Design challenge: Design and carry out a plan to change the motion of a car to reach a determined destination and carry a load back to the starting point.

Summary: Students Will...

- Use prior data and observations about the motion of a toy vehicle.
- Design and carry out an engineering plan to solve a problem.
- Revise the engineering plan based on results.

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ACTIVITY 2 - Observations of Motion - *Continued*

Students Figure Out How To:

- Use data and observations to solve problems.
- Use patterns in motion to determine future motion.
- Determine when forces are balanced and unbalanced.

Practices

Asking Questions and Defining Problems

Planning and Carrying Out Investigations

Constructing Explanations and Defining Solutions

Developing and Using Models

Cause and Effect

Performance Expectations (PE) at Lesson Level and Assessment

PE at Lesson Level:
Develop an understanding of how to use observations, patterns, and data to change motion.

Formative Assessment:
Activity pages
Class discussion/Science Talk

Summative Assessment:
Journal Entry
Product Descriptor and Presentations

ACTIVITY 3 - Observing Motion: Cotton Balls and Jumping Frogs

QUESTIONS: How can we find out if patterns in motion can be applied to different objects?

Time to Complete

Preparation: 10 minutes
Activity: 2 classes
Lesson 3A: 45–50 min.
Lesson 3B: 45–50 min.

Phenomena

Different forces move objects in different directions at different speeds. The jumping frog requires a push that will make it move up and out in different directions. Different strengths of force change the motion of the cotton ball.

Summary: Students Will...

- Raise questions for investigation.
- Design and carry out their investigation.
- Determine the forces that affect the motion of the toys.
- Recognize patterns that can be used to predict future motion of the toys.

Students Figure Out How To:

- Collect and organize data.
- Use data to recognize patterns.
- Use patterns to predict future motion.
- Compare and contrast forces used to move a variety of objects.
- Measure distance traveled using metric system.

Practices

Asking Questions and Defining Problems

Planning and Carrying Out Investigations

Analyzing and Interpreting Data

Constructing Explanations

Cause and Effect

Performance Expectations (PE) at Lesson Level and Assessment

PE at Lesson Level:
Use data to predict future motion of a variety of objects.

Formative Assessment:
Activity Pages
Class discussion/Science Talk

Summative Assessment:
Investigation reports
Journal Entry

ACTIVITY 4 - Exploring Motion: Friction

QUESTIONS: How can we find out the effect of friction on motion? How is friction related to balanced and unbalanced forces?

Time to Complete

Preparation: 15 minutes
Activity : 5 classes
Lesson 4A: 50–55 min.
Lesson 4B: 50–55 min.
Lesson 4C: 50–55 min.
Lesson 4D: 50–55 min.
Lesson 4E: 50–55 min.

Phenomena

The snail moves faster or slower depending on the surface it is moving on.

Summary: Students Will...

- Read a story about a problem of motion.
- Make observations of friction using a variety of materials.
- Conduct an investigation to determine the force of friction in a variety of materials.

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ACTIVITY 4 - Exploring Motion: Friction - *Continued*

Students Figure Out How To:

- Relate friction to real-world applications.
- Design an investigation to measure the force it takes to move an object over different surfaces.
- Design an investigation to determine if adding weight will affect the force needed to move an object.

Practices

Asking Questions and Defining Problems

Planning and Carrying Out Investigations

Analyzing and Interpreting Data

Patterns

Cause and Effect

Performance Expectations (PE) at Lesson Level and Assessment

PE at Lesson Level:
Recognize friction as a force that affects motion and use data to predict future motion.

Formative Assessment:
Activity Pages
Class discussion/Science Talk

Summative Assessment:
Journal Entries
Investigation reports (Conclusions)

ACTIVITY 5 - What Goes Up, Must Come Down

QUESTIONS: How can we find out the effect of gravity on motion?

Time to Complete

Preparation: 15 minutes
Activity 5: 2 classes
Lesson 5A: 45–50 min.
Lesson 5B: 45–50 min.

Phenomena

The snail on rollers requires a push to start its motion. The snail stops and needs another push. The snail moves faster down the hill and needs a push up the hill.

Summary: Students Will...

- Continue to read about the problem of motion in the story.
- Design an investigation to explore the effect of gravity on a variety of objects.
- Recognize patterns associated with the force of gravity.

Students Figure Out How To:

- Relate gravity to their everyday activities.
- Design an investigation to determine how gravity affects a variety of objects in motion.
- Use patterns in data to predict future motion.

Practices

Asking Questions and Defining Problems

Planning and Carrying Out Investigations

Analyzing and Interpreting Data

Constructing Explanations

Cause and Effect

Patterns

Performance Expectations (PE) at Lesson Level and Assessment

PE at Lesson Level:
Recognize gravity as a force that affects motion and use data to predict future motion.

Formative Assessment:
Respond to Text
Activity Page

Summative Assessment:
Journal Entries

ACTIVITY 6 - Newton's First Law, First Part

QUESTIONS: How can we determine if objects at rest have forces acting on them?

Time to Complete

Preparation: 20 minutes
Activity 6: 2 classes
Lesson 6A: 45–50 min.
Lesson 6B: 55–60 min.

Phenomena

Place an index card on a cup and a washer on top of the card, flick the side of the card with a sharp force, and observe the motion of the card and washer.

Toys in Space

Summary: Students Will...

- Demonstrate through a simple device (cup, index card, and washer) how a force is necessary for motion.
- Determine if there are examples on Earth that demonstrate Newton's first law.

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ACTIVITY 6 - Newton's First Law, First Part - *Continued*

Students Figure Out How To:

- Use evidence and patterns in evidence to determine the forces that affect motion.

Practices

Constructing Explanations

Analyzing and Interpreting Data

Developing and Using Models

Cause and Effect

Patterns

Performance Expectations (PE) at Lesson Level and Assessment

PE at Lesson Level:
Relate information about motion to determine if there are patterns or "rules" that can apply to all motion on Earth.

Summative Assessment:
Class discussions/Science Talk
Journal Entries

ACTIVITY 7 - Motion at a Distance - Noncontact Forces

QUESTIONS: How can we determine if electricity and magnetism are forces that affect motion?

Time to Complete

Preparation: 5 minutes
Activity 7: 3-4 classes
Lesson 7A: 45–50 min.
Lesson 7B: 20–30 min.
Lesson 7C: 60-65 min.

Phenomena

Paper clips can move without touching the magnet to the paper clip. Two hanging magnets will attract and repel each other.

Rub a balloon on hair or silk and the hair is attracted to the balloon.

The properties of magnets and static electricity can provide a force to move objects without making contact.

Summary: Students Will...

- Demonstrate how magnets can attract and repel some objects depending on their properties.
- Design an investigation to determine the strength and distance necessary to move small objects with a magnet.
- Explore how objects charged due to static electricity attract and repel.

Students Figure Out How To:

- Use data and observations to determine the force of a magnet needed to move an object over a distance.
- Construct explanations regarding the ability of magnets to attract and repel one another.
- Make connections between the charged balloon that attracts hair and the plastic comb that attracts paper dots.

Practices

Developing and Using Models

Constructing Explanations and Designing Solutions

Obtaining, Evaluating, and Communicating Information

Developing and Using Models

Cause and Effect

Performance Expectations (PE) at Lesson Level and Assessment

PE at Lesson Level:
Solve a problem using magnets as a noncontact force.

Formative Assessment:
Class discussion/Science Talk

Summative Assessment:
Activity Pages
Journal Entries

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ACTIVITY 8 - Electric and Magnetic Forces

QUESTIONS: How can electricity be used to make a magnet?

Time to Complete

Preparation: 15 minutes
Activity 8: 2–3 classes
Lesson 8A: 50–55 min.
Lesson 8B: 50–55 min.

Phenomena

Paper clips are attracted to an electromagnet made from a battery, wire, and nail.

Observe an electromagnet in a junkyard.

Design challenge: Identify and solve a problem using the properties of magnets.

Summary: Students Will...

- Build an electromagnet to move objects.
- Solve a problem using magnets as a noncontact force.

Students Figure Out How To:

- Build a model of an electromagnet and analyze the construction to make improvements.
- Apply their information about magnets as a noncontact force to design a device to solve a simple problem.

Practices

Developing and Using Models

Constructing Explanations and Designing Solutions

Cause and Effect

Interdependence of Science, Engineering, and Technology

Performance Expectations (PE) at Lesson Level and Assessment

PE at Lesson Level:
Evaluate an electromagnet and determine how to increase the strength of the magnet.

Summative Assessment:
Journal Entry
Engineering Presentations

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