

Unit 4 Forces & Motion

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Belleville Public Schools

Curriculum Guide

Physical Science, 6th Grade

Forces & Motion

Belleville Board of Education

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Unit Overview

Unit 4, Forces and Motion, students will encounter:

Part 1 Forces and Motion

- forces as a push or a pull on an object that is at rest or in motion.
- the effect of unbalanced and balanced forces in a system.
- examples of how forces or gravity, friction, and air resistance affect motion.
- equal and opposite forces, and the forces exerted on falling objects.

Part 2 Magnetism and Electricity

- Newton's Laws of Motion
- motion relative to a reference point, speed, velocity, and acceleration.
- how gravitational force causes objects to move.
- relationship between force, mass, and acceleration.
- magnetic domains and how magnets interact.
- magnetic materials and the distance at which magnets attract or repel.
- electric forces and how they affect neutral or charged objects.
- equal and opposite forces, and the forces exerted on falling objects.

Enduring Understanding

- Forces exerted by interacting (colliding) objects on each other are equal in magnitude but opposite in direction (Newton's 3rd Law of Motion)
- The sum of all of the forces acting on an object determine its motion.
- If the total of all the forces acting on an object is not equal to zero (unbalanced forces), its motion will change. There will be no change if they equal zero (balanced forces).
- Position and direction of force and motion must be described in arbitrarily chosen reference points, in order to share information with others.
- Electric and Magnetic forces can be attractive or repulsive.
- The magnitude of the force is dependent on the strength of the charge or current and the distance between objects.

- Gravity is a force of attraction between any two masses.
- There is a direct relationship between the amount of mass and the magnitude of its gravity.
- Forces that act at a distance such as electricity, magnetism, and gravity can be explained by fields that extend through space. They can be mapped by their effect on a test object.

Essential Questions

- Why do some objects move and others stay motionless?
- What would happen if you push a moving object harder?
- How can we use pushing or pulling forces to help us do work?
- How have you experienced gravity?
- Compare and contrast electric and/or magnetic forces.
- How is magnetism used to produce electricity?
- What kind of problems can be solved by applying electric or magnetic force?
- How would the universe be different if one or more of the laws of motion were suspended?

Exit Skills

By the end of Grade 6, Science Unit 3, the student should be able to:

- Use modeling and measurement to predict that the impact of objects will have on each other.
- Draw force diagrams to model relationships between forces and motion.
- Use an image of an object as a system model to identify the types of forces involved in its motion and predict its path.
- Calculate the effects of opposing forces.
- Gather evidence to explain the behavior of falling objects.
- Design system models to explain the characteristics of force.
- Use system models to support the Laws of Motion.
- Record and present data on tables and graphs.
- Use graphic and written illustrations to explain magnetic, electric, and gravitational fields.

New Jersey Student Learning Standards (NJSL-S)

SCI.MS	Forces and Interactions
SCI.5-6.5.1.6.A	Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.
SCI.5-6.5.1.6.B	Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.

SCI.5-6.5.1.6.C	Scientific knowledge builds on itself over time.
SCI.6-8.MS-PS1-1.3.1	students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
SCI.MS-PS2-5	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
SCI.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
SCI.MS-PS2-1	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
SCI.MS-PS2-2	Plan 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.
SCI.MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

Interdisciplinary Connections

LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
LA.RST.6-8.5	Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
LA.RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.

LA.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.6-8.4	Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience.
LA.WHST.6-8.5	With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
LA.WHST.6-8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
LA.WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
LA.WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
LA.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
LA.WHST.6-8.10	Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Learning Objectives

- Explain and the effects of a force or a combination of forces on and object.
- Differentiate the effects of balanced and unbalanced forces on an object on a system.
- Infer the cause and effect relationship between forces and motion and velocity and acceleration
- Analyze different types of interactions to predict how motion will be affected.
- Explain that interactions involving gravity or friction depend on the properties of objects.
- Differentiate between mass and weight in relation to how they relate to gravity.
- Discover way to increase or decrease surface friction.
- Model and describe how unbalanced forces cause change in motion.
- Explain and describe motion in terms of speed velocity, and acceleration; using illustrations, graphs and models.
- Evaluate competing design solutions to a problem involving collisions.
- Identify the variables that effect the strength and direction of magnetic force
- Differentiate between magnetic materials and magnets, in terms of magnetic domains and fields.
- Identify and measure the variables that affect the strength and direction of electric force.
- Investigate and model the effects of electric, magnetic, and gravitational fields on objects.
- Predict the cause and effect relationship between charges and fields.
- Explore electromagnetism and electro magnets to determine how they interact.

Suggested Activities

From HMH Curriculum Activities:

- Engage: Lesson Phenomenons
- Explore/Explain: Hands on Labs and Engineer It
- Unit Projects

- Unit Performance Tasks

From Defined Stem:

- Performance Tasks
- Literacy Tasks
- Constructed Response

Evidence of Student Learning - Checking for Understanding (CFU)

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share

- Top 10 List
- Unit tests

Primary Resources & Materials

HMH Module K Workbook

Laboratory Kits and Materials

Defined Stem

BrainPop

Ancillary Resources

Guest Speakers

Other Internet sources

Outdoor area of school

Laptop Carts for further research

Technology Infusion

- Smart board
- DefinedStem.com
- Document Camera
- Pod-casts video streams
- Discovery Education video streams
- You Tube video streams
- Brain-pop video streams
- Laptops
- Khan Academy
- Power Point presentation
- MS Word

Alignment to 21st Century Skills & Technology

These skills will be aligned to the following core content areas:

- English Language Arts; reading informational text, following procedural steps, orally presenting predictions and opinions, and creating written laboratory reports
- Mathematics; measuring
- Science and Scientific Inquiry (Next Generation); see above
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics; history of science and how the Scientific method has connections to World and American history expansion. Discuss the impact of science on society and what kind of moral questions scientists must address.
- World languages; discussion of root words and linguistic origin of vocabulary words.
- Technology; see above
- Visual and Performing Arts: oral and graphic presentation of procedures, results, and conclusion.

21st Century/Interdisciplinary Themes

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

21st Century Skills

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

Differentiation

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions

- Use manipulatives
- Center-based instruction
- Token economy - Science Dollars
- Guided Notes
- Teacher reads assessments allowed
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Dictation to scribe

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Multiple texts
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
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Lo-Prep Differentiations:

- Exploration by interest
- Flexible grouping
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Varied journal prompts
- Correcting summative and formative assessments
- Retaking the test

Intervention Strategies

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Special Education Learning

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format

- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- Provide Native Language translations when possible
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

Sample Lesson

Unit Name: Forces & Motion

CCSS/NJCCCS: See link

Interdisciplinary Connection: see link

Statement of Objective: SWDAT evaluate the real world application of Newton's Laws of Motion.

Anticipatory Set/Do Now: Hot seat Vocab from Forces and Motion

Learning Activity:

1. Do now
2. SW follow along as directions are orally reviewed again
3. SW complete center activities to demonstrate each of the three laws of motion.
4. SW diagram each station in interactive notebook.
5. Exit Ticket

Student Assessment/CFU's: Do Now activity, Fist to Five, notebook diagrams, exit ticket

Materials: textbook, outline template, fishing line, balloons, straws, plastic cups, index cards, pennies

21st Century Themes and Skills: see link

Differentiation: Centers activity, small group investigation,

Integration of Technology: Smartboard

MA.6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
MA.6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
MA.6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
6-8.MS-PS1-4.2.1	Cause and effect relationships may be used to predict phenomena in natural or designed systems.
SCI.MS-PS2-5	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
SCI.MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
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