Unit 4: Forces and Motion (Physical Science)

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Belleville Public Schools

Curriculum Guide

Science: Grade 6

Unit 4: Forces and 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 oposite in direction (Newton's 3rd Law of Motion)
- The sum of all of the forces acting on an object determine it's motion.
- If the total of all the forces acting on an object is not equal to zero (unbalnced forces), its motion will change. There will be no change if they equals 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 strenght 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 bewteen the amount of mass and the magnitude of it's gravity.
- Forces that act at a distance such as electricity, magneticism, and gravity can be explained by fields that exted through space. They can be mapped by their effect on a test object.

Essential Questions

- Forces exerted by interacting (colliding) objects on each other are equal in magnitude but oposite in direction (Newton's 3rd Law of Motion)
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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.
- Calaculate the effects of opposing forces.
- Gather evidence to explain the behavior of falling objects.
- Design system models to explain the characteristics of force.
- Use sytem models to support the Laws of Motion.
- Record and present data on tables and graphs.
- Use grahic and written illustrations to explain magnetic, electric, and gravitational fields.

New Jersey Student Learning Standards (NJSLS-S & NGSS)

SEP - Asking Questions and Defining Problems

SEP - Developing and Using Models

SEP - Planning and Carrying Out Investigations

SEP - Constructing Explanations and Designing Solutions

SEP - Engaging in Argument from Evidence

SEP - Scientific Knowledge is based on Empirical Evidence

DCI - Forces and Motion

DCI - Types of Interactions

DCI - Developing Possible Solutions

CCC - Cause and Effect

CCC - Systems and System Models

CCC - Stability and Change

CCC - Influence of Science, Engineering, Technology on Society and the Natual World

NextGen Science Standards

6-8.MS-PS2-1	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
6-8.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.
6-8.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.
6-8.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.
6-8.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Interdisciplinary Connections

Complete Do the Math! sections embedded within the Unit

Math: 6.RP.A.3

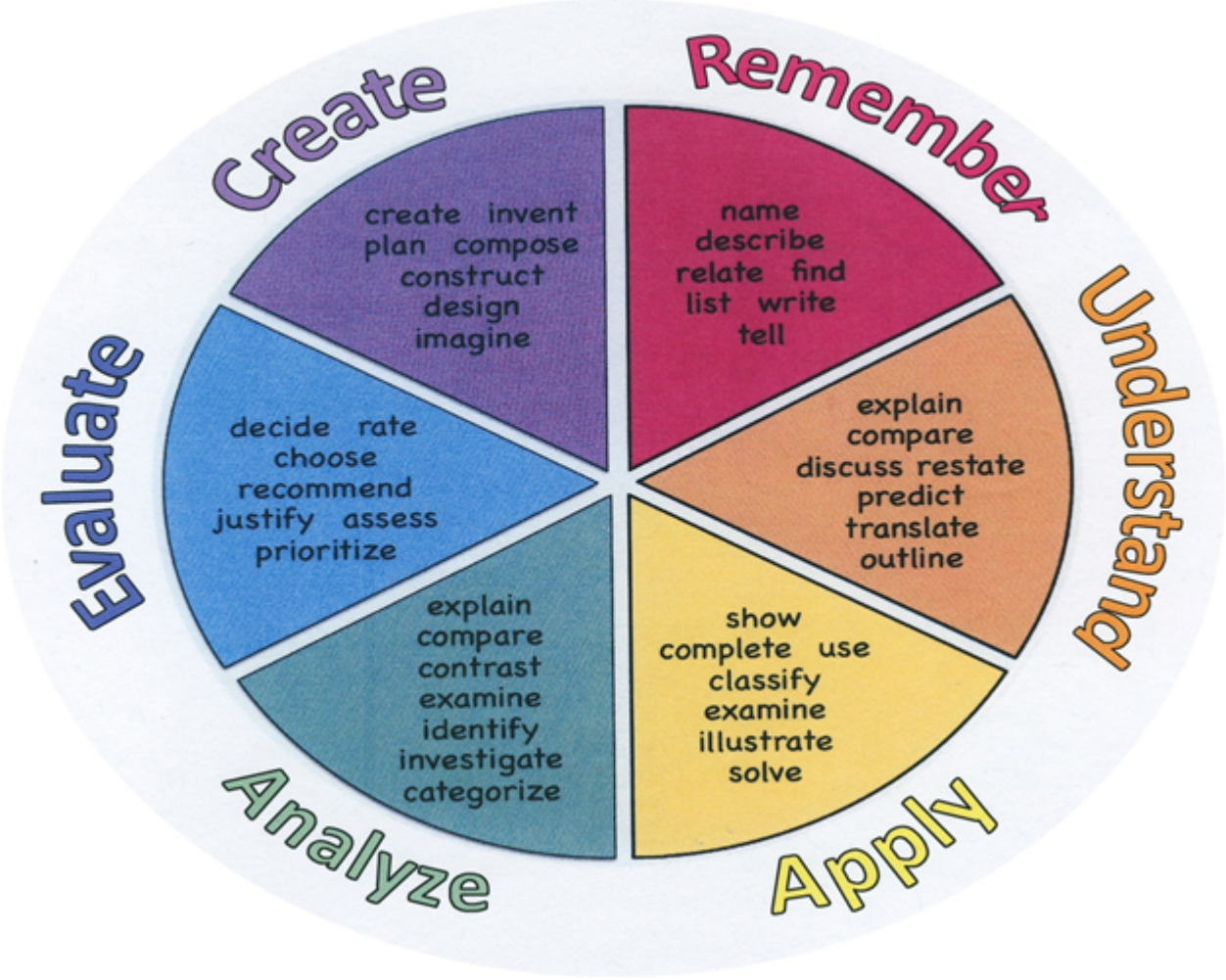
ELA: WHST.6-8.1

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 accelration
- 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 bewteen 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 desacribe motion in terms of speed velocity, and accelration; using illustrations, graphs and models.
- Evaluate competing design slutions 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 magnetc 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 t determine how they interact.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			

	Extrapolate Generalize Predict	Subtract			



Assessment Evidence - Checking for Understanding (CFU)

- Admit Tickets
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics

- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- HMH End-of-Year Test (Benchmark)
- HMH Mid-Year Test (Benchmark)
- HMH Performance-based Assessment (Alternative)
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Outline
- Question Stems
- Quickwrite
- Quizzes (Formative)
- Red Light, Green Light
- Self- assessments
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Unit review/Test prep
- Unit tests (Summative)
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

HMH Science Dimensions: Teacher Edition, Student workbooks, online resources

HMH Equipment & Safety Kits

Ancillary Resources

Science Weekly, Scholastic News, NewsELA, YouTube/TeacherTube, National Geographics Kids, Science Channel

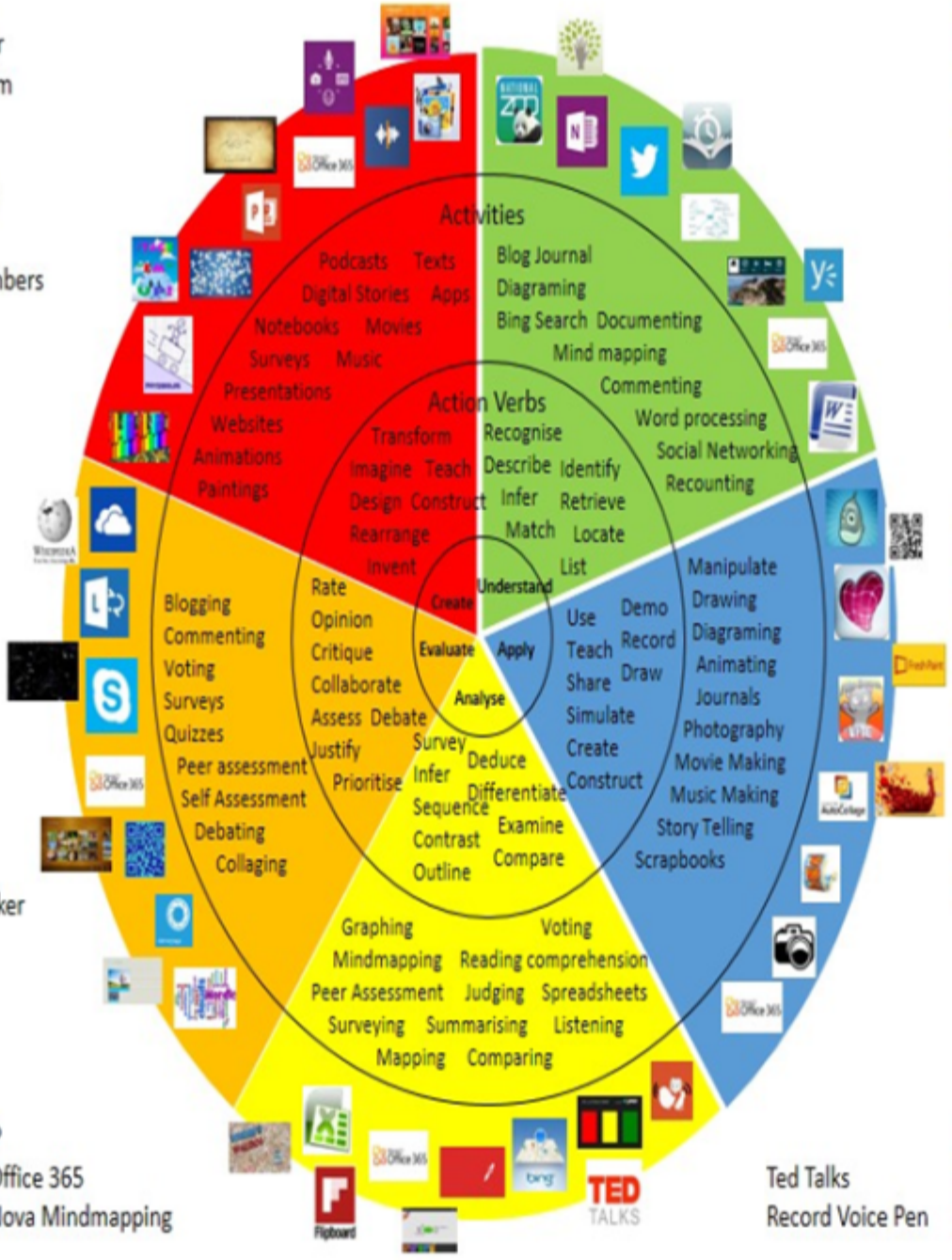
Technology Infusion

- Discovery Education video streams
- YouTube video streams
- BrainPOP video streams
- Khan Academy

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel
Flipboard
Office 365
Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

21st Century Skills/Interdisciplinary Themes

- 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

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health 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
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments

- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

- 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
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- 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 (ELL)

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- 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 workpresented or required
- having peers take notes or providing a copy of the teacher’s notes
- 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 computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

- 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 workpresented 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

Talented and Gifted Learning (T&G)

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge