Unit 2: Forces (Forces and Interactions)

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Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Science: Grade 3

Unit 2: Forces

Belleville Board of Education

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Unit Overview

Unit two focuses on forces. Students will explore how forces work. Students will discover different types of forces. Students will learn about forces that act from a distance.

(Reference HMH Science Dimensions, Unit 2)

Enduring Understanding

- A force is a push or a pull.
- A force can be weak or strong.
- The strength of any force can be changed.
- The direction of a force is applied matters as much as how strong the force is.
- When you push something you use force to move it away from you.
- When you pull you use force to move it toward you.
- Forces change the speed of an object, the direction of an object, or both.
- A simple machine changes the strength or direction of a force.
- You apply a contact force if you push or pull an object by touching it.
- Pairs of forces are either balanced or unbalanced.
- Balanced forces are the same size and strength but act in opposite directions, so there is no motion.
- Unbalanced forces are when one force is stronger than the other and the forces act in difference directions.
- Net force is the sum of all the forces that push or pull an object.
- Fiction is a force that opposes motion between objects that are touching.
- Gravity is the force that pulls things down toward the center of the Earth.
- A magnet is an object that attracts things made from certain metals.

- Electricity is a form of energy.

Essential Questions

- What are forces?
- What are some types of forces?
- What forces act from distance?
- What are balanced and unbalanced forces?
- What forces can cause a given object to move?

Exit Skills

By the end of Unit 2, students will be able to:

- Demonstrate how the strength and direction of a force can change the motions of an object.
- Plan and conduct an investigation about balanced and unbalanced forces.
- Ask and answer questions about forces between objects that are not in contact with each other.
- Evaluate cause and effect relationships between forces and objects.
- Recognize the cause-and-effect relationships between forces and motion.
- Define a simple design problem that can be solved by applying scientific ideas about magnets.

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

SEP - Asking Questions and Defining Problems

SEP - Planning and Carrying Out Investigations

SEP - Engaging in Argument from Evidence

SEP - Obtaining, Evaluating, and Communicating Information

DCI - Forces and Motion

DCI - Types of Interactions

CCC - Cause and Effect

CCC - Interdependence of Science, Engineering, and Technology

NextGen Science Standards

3-PS2-1	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
3-PS2-4.1	Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.
3-PS2-3.1	Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.
3-PS2-1.3	Planning and Carrying Out Investigations
3-PS2-1.PS2.A.1	Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.)
3-PS2-1.PS2.B.1	Objects in contact exert forces on each other.

Interdisciplinary Connections

Connections to Math:

- **MP.2** Reason abstractly and quantitatively.
- **MP.3** Construct viable arguments and critique the reasoning of others.

LA.RI.3.1	Ask and answer questions, and make relevant connections to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
LA.RI.3.3	Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
LA.RI.3.7	Use information gained from text features (e.g., illustrations, maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).
LA.RI.3.10	By the end of the year, read and comprehend literary nonfiction at grade level text-complexity or above, with scaffolding as needed.
LA.W.3.10	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.
LA.SL.3.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
LA.SL.3.1.A	Explicitly draw on previously read text or material and other information known about the topic to explore ideas under discussion.
LA.SL.3.1.B	Follow agreed-upon norms for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
LA.SL.3.1.C	Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.

LA.SL.3.1.D	Explain their own ideas and understanding in light of the discussion.
LA.SL.3.2	Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
LA.SL.3.3	Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.
TECH.8.1.2	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.2.2	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Learning Objectives

In Unit 2, students will demonstrate the ability to:

Lesson 1: What are Forces?

- Evaluate cause-and-effect relationships between forces and objects.
- Recognize force as a push or a pull and demonstrate how its strength and direction can be changed.
- Identify the cause-and-effect relationship between the speed and direction of an object and the strength and direction of the force applied to it.

Lesson 2: What are Some Types of Forces?

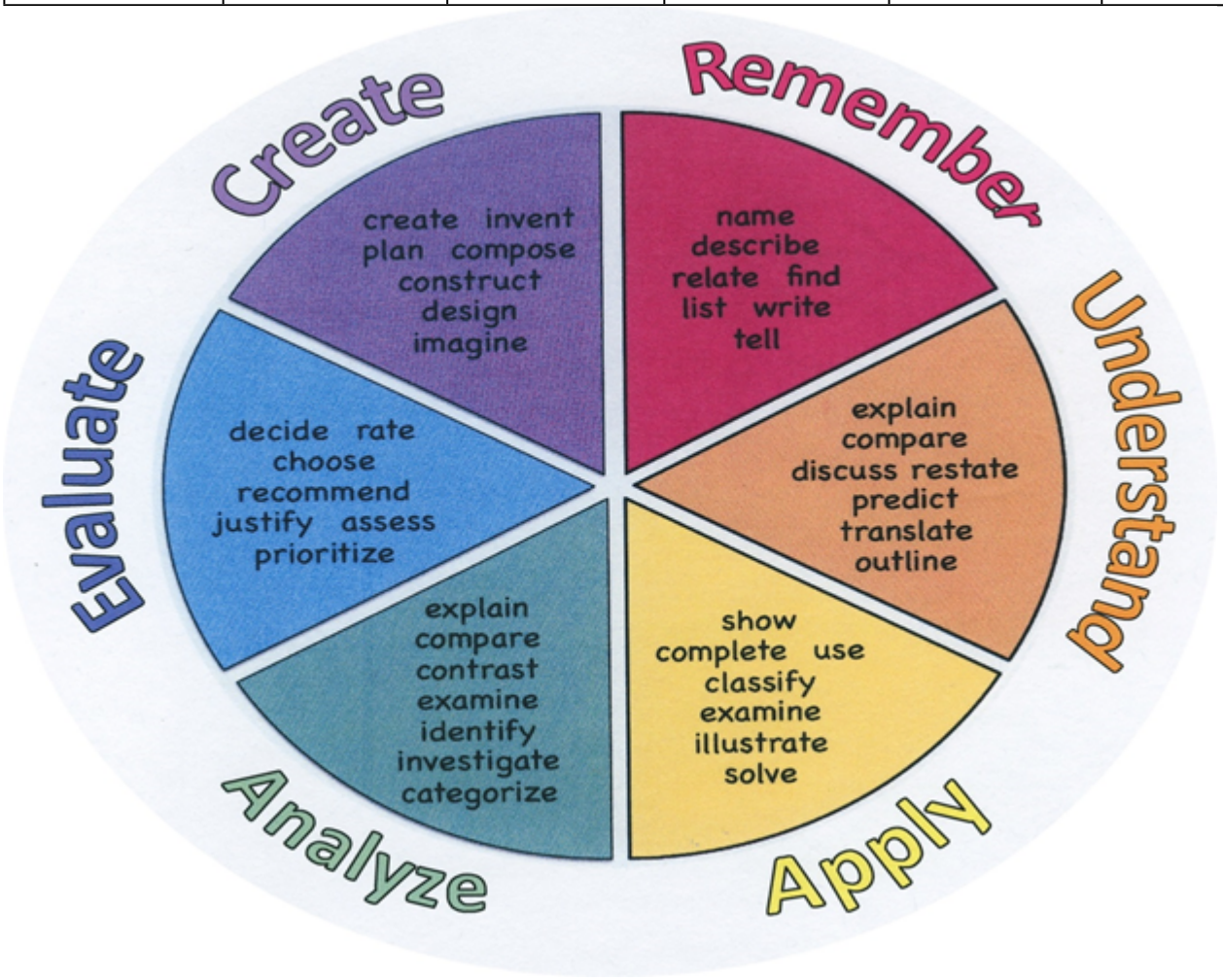
- Determine whether an action uses higher or lower friction strength.
- Analyze how contact forces, including friction, and non-contact forces, such as gravity, act on object, and that objects often have multiple forces acting on them.
- Differentiate between balanced and unbalanced forces.

Lesson 3: What Forces Act From a Distance?

- Gather and analyze evidence that forces such as magnetism and electricity can act on objects without touching them.
- Analyze photographs to determine whether objects are pulling or repelling each other.
- Determine factors that can affect the strength of a force.

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 State Count Draw Outline Point Quote Recall Recognize Repeat Reproduce	Interpret Infer Match Paraphrase Represent Restate Rewrite Select Show Summarize Tell Translate Associate Compute Convert Discuss Estimate Extrapolate Generalize Predict	Sketch Solve Use Add Calculate Change Classify Complete Compute Discover Divide Examine Graph Interpolate Manipulate Modify Operate Subtract	Arrange Breakdown Combine Detect Diagram Discriminate Illustrate Outline Point out Separate	Justify Measure Rank Rate Support Test	Plan Produce Role Play Drive Devise Generate Integrate Prescribe Propose Reconstruct Revise Rewrite Transform



Suggested Activities & Best Practices

HMH Science Dimensions, Unit 2 - Lesson 1:

- **Engage:** "Can You Solve It?" lesson
- **Explore/Explain:** "Forces Everywhere", "Strong Enough", "Which Way?" lessons and hands-on activity (Exploration 1, 2, 3)
- **Elaborate:** Take It Further - Simple Machines extension activity
- **Evaluate:** "Lesson Check" and "Lesson Roundup" assessments (formative/summative)

HMH Science Dimensions, Unit 2 - Lesson 2:

- **Engage:** "Can You Solve It?" lesson
- **Explore/Explain:** "Touchy Touchy", "What Are Everyday Forces?" lessons and hands-on activity (Exploration 1, 2,)
- **Elaborate:** Take it Further - People in Engineering extension activity
- **Evaluate:** "Lesson Check" and "Lesson Roundup" assessments (formative/summative)

HMH Science Dimensions, Unit 2 - Lesson 3:

- **Engage:** "Can You Solve It?" lesson and hands-on activity
- **Explore/Explain:** "Magnets Everywhere", "Electricity" lessons and hands-on activity (Exploration 1, 2,)
- **Elaborate:** Take it Further - Electrician extension activity
- **Evaluate:** "Lesson Check" and "Lesson Roundup" assessments (formative/summative)

HMH Science Dimensions, Unit 2 - Performance Task (Moved Without Touching):

- Identify the Problem
- Research
- Brainstorm
- Make a Plan
- Design, Build, and Experiment
- Evaluate and Redesign

HMH Science Dimensions, Unit 2 - Unit Project (Balanced Forces):

- Research and Plan
- Analyze Results
- Restate Question
- Claims, Evidence, and Reasoning

Assessment Evidence - Checking for Understanding (CFU)

- Admit Tickets
- Anticipation Guide

- 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
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes (Formative)
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- 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

HMH Science Dimensions S&E Leveled Readers

- On Level: How Do We Use Machines?
- Extra Support: How Do We Use Machines?
- Enrichment: Building With Machines

Ancillary Resources

- PBS Learning Media (The Art of Forces and Motion)
- Nonfiction books (forces)
- BrainPop Educators (Force)
- https://ngss-assessment.portal.concord.org/

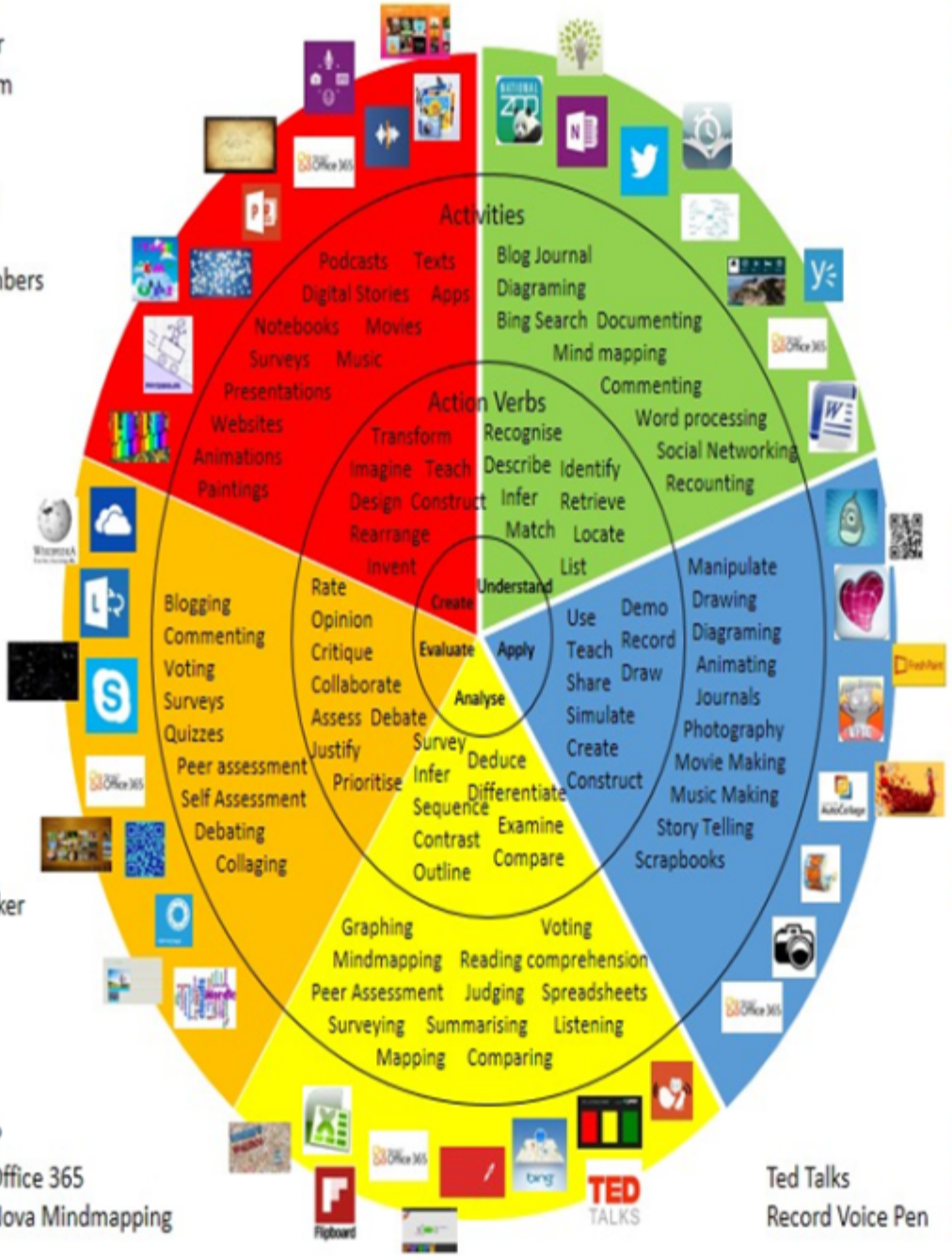
Technology Infusion

- HMH Science Dimensions Digital Components
- StudyJams! (Forces and Motion)
- Bill Nye the Science Guy (Force and Motion)

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 Office 365
Flipboard 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

21st Century Skills & Technology:

- English Language Arts
- Technology
- Mathematics

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

- Information Literacy

21st Century Skills

- Environmental Literacy
- Global Awareness

Differentiation

The following differentiation strategies will be utilized:

- As needed, provide more instruction that is on level or below grade level for the students who are struggling.
- Monitor progress, reteach as needed, and extend student thinking.
- Utilize multiple intelligences teaching strategies.

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)

The following strategies will be employed for students with IEP's and 504's:

- Provide modifications as dictated in the student's IEP/504 plan.
- Check work frequently for understanding.

- Extended time on tests/quizzes

- 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)

The following strategies will be employed for English Language Learners:

- Decreasing the amount of work presented or required.
- 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.

- 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

The following strategies will be employed for At Risk Learners:

- Decreasing the amount of work presented or required.
- Teaching key aspects of a topic. Eliminate nonessential information.
- Tutoring by peers.

- 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)

The following Talented and Gifted adaptations will be employed:

- Higher order, critical & creative thinking skills, and discovery.
- Flexible skill grouping within a class or across grade level for rigor.
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities.

- 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

Sample Lesson

Unit Name: Chapter 1-

NJSLS: See Link Below

Interdisciplinary Connection: See Link Below

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:
Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

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Integration of Technology: