

Unit 1: Engineering and Technology

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Title Section

Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

Science: Grade 1

Unit 1: Engineering and Technology

Belleville Board of Education

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Unit Overview

Kids are born scientists. They want to know WHY: Is the sun a star? How do magnets work? It's our job to encourage their curiosity, creativity, and exploration while preparing them for careers in science, technology, engineering, and math.

Unit 1 Performance Expectations:

K-2 ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2 ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps its function as needed to solve a given problem.

K-2 ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Throughout Unit 1, students will develop skills to

- define and identify problems.
- define and identify examples of technology.
- describe how people understand problems and use technology to solve problems.
- explore and apply a design process.

Unit Vocabulary: engineer, problem, solution, technology, design process

Unit Project: Pocket Lock-It

Lesson 1:

In Lesson 1, students will begin exploring, identifying, and naming simple problems. The lesson continues with students exploring how engineers make and use technology to solve everyday problems. Finally, students will use what they learned to define a problem, gather information about it, and build something to solve the problem.

Essential Question: How do engineers use technology?

Can You Explain It? (Lesson 1 Engagement Question): What is the problem?

Hands-On Activity: Solve the Headphones Problem

Lesson 2:

In Lesson 2, students focus on a design process that engineers use to solve problems. The lesson begins with students exploring simple problems in the natural world, and how they can be solved through the development of a new or improved object or tool. As they explore a design process, students compare and test the shape and stability of objects to determine if they work as intended and are related to their function(s). Lastly, students develop and test simple models to solve problems through a design process, and communicate those solutions.

Essential Question: How can we solve a problem?

Can You Solve It? (Lesson 2 Engagement Question): The Pulling Dog Problem

Hands-On Activity: Protect the Legs!

Online Interactive Activity: Marshmallow Launcher

Enduring Understanding

Unit 1 Performance Task: Students will build two solutions and analyze data to determine which materials will keep a model house from blowing down.

(Refer to Scoring Rubric TE page 35)

By the end of Lesson 1, students will be able to use what they have learned to define a problem, gather information about it, and build something to solve the problem.

By the end of Lesson 2, students will be able to develop and test simple models to solve problems through a design process, and communicate those solutions.

Assessments

Pre-Assessment

Assessment Guide, Unit Pretest

Formative Assessment

Interactive Worktext, Apply What You Know, Lesson Check and Self Check

Summative Assessment

Online Assessment

Essential Questions

Essential Questions for Unit 1 Project:

Students can be prepared for their Unit 1 Project by asking the following questions:

- What are some ways to keep an object in place?
- How can examining the way one object is made help to solve a different problem?
- What evidence can be collected to show a problem has been solved?

Essential Questions:

- How do engineers use technology?
- What is an engineer?
- What is technology?
- How can we solve a problem?
- What is Mia's problem? How can you understand the problem to solve it?
- How would you design a leash to solve the problem of a dog pulling during a walk?

Exit Skills

By the end of Grade 1, Science Unit 1, the students should be able to:

- effectively communicate what the problem is
- explain what steps need to be taken to determine how to solve the problem
- name the steps in a design process
- write how they use the steps to develop a solution to the problem

New Jersey Student Learning Standards (NJSLS-S)

SCI.K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
SCI.K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
SCI.K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Interdisciplinary Connections

Lesson 1:

Connections to Math

1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Connections to English Language Arts

W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

Lesson 2:

Connections to Math

1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each...

Connections to English Language Arts

W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.

LA.W.1.2	Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
LA.W.1.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
MA.1.MD.C.4	Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Learning Objectives

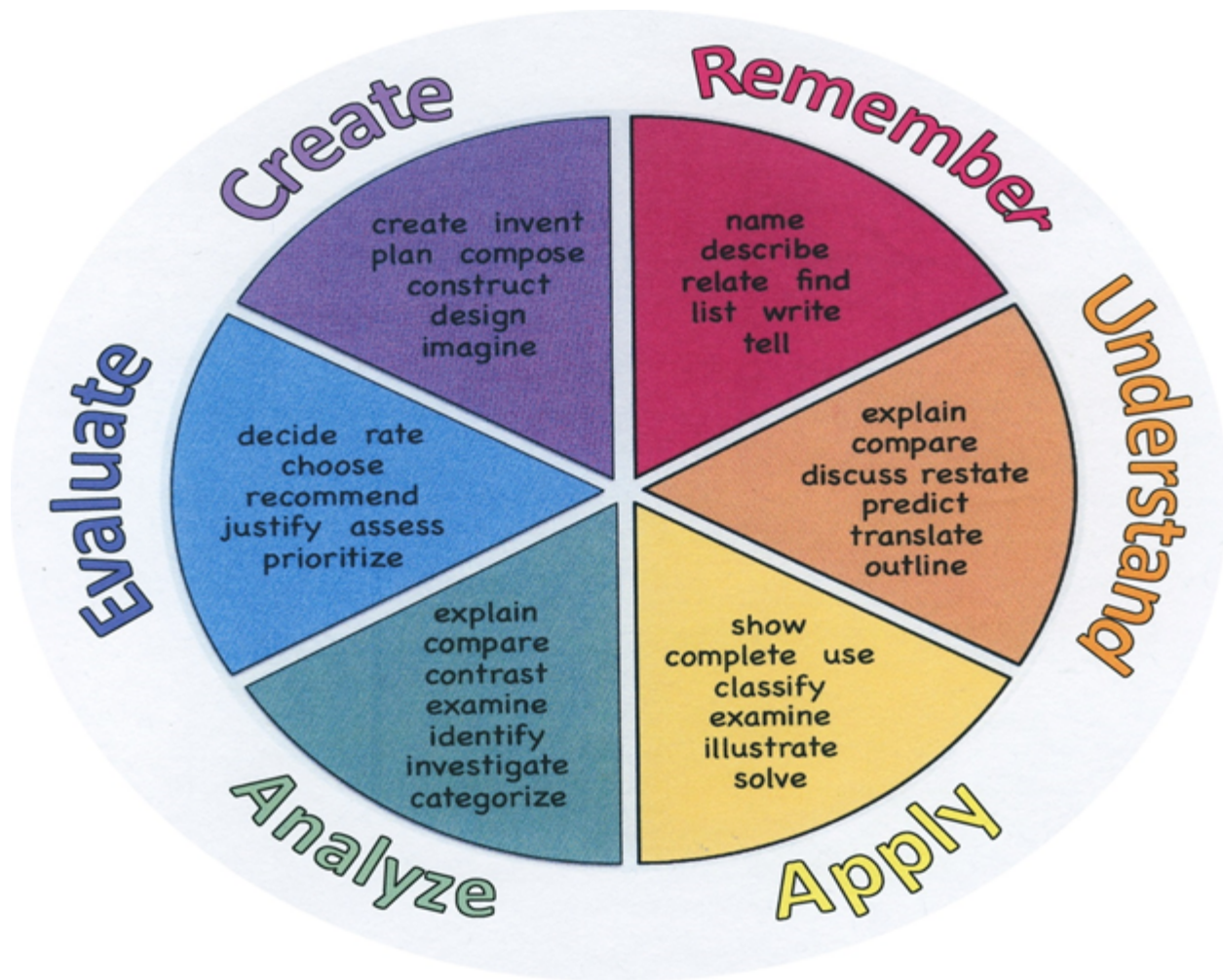
Effective Learning Objectives Used in Lesson Planning:

- SWDAT explore how engineers make and use technology to solve problems
- SWDAT to develop and test simple models to solve problems through a design process
- SWDAT effectively communicate those possible solutions
- SWDAT work collaboratively to define a problem, gather information about it, and build something to solve the problem
- SWDAT make observations, ask questions, and follow a design process to develop solutions in order to prevent a cat from scratching the furniture

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
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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	Subtract			
	Generalize				
	Predict				



Suggested Activities

Vocabulary Game- Guess the Word

Hands-On Activities: Solve the Headphones Problem & Protect the Legs!

Interactive Activity: Marshmallow Launcher

Unit Project

Take It Further

- Transportation Timeline
- Solve a Paw-blem

Evidence of Student Learning - Checking for Understanding (CFU)

In addition to the assessments provided with the Houghton Mifflin Harcourt Science Series, teachers may use different formative and informative assessments to guide their instruction. Below is a checklist of possible assessment strategies to be used to check for understanding in Science.

- 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 Science Dimensions Text

Professional Development Video

Equipment Kits (includes consumable and non-consumable materials)

Safety Kit

The Science and Engineering Practices Online Handbook

Science and Engineering Leveled Readers (On Level, Extra Support, Enrichment)

HMH Player app

Home Letters (Online)

Ancillary Resources

Safety in Science Rules

Online Resources

Technology Infusion

www.hmhco.com/classroom/classroom-solutions/digital-and-mobile-learning/ed

3D Evaluation Rubric

Computer-Based Assessments

HMH Field Trips

Online Videos and Animations

Online access to Science and Engineering Leveled Readers (includes On Level, Extra Support, and Enrichment)

Online Glossary

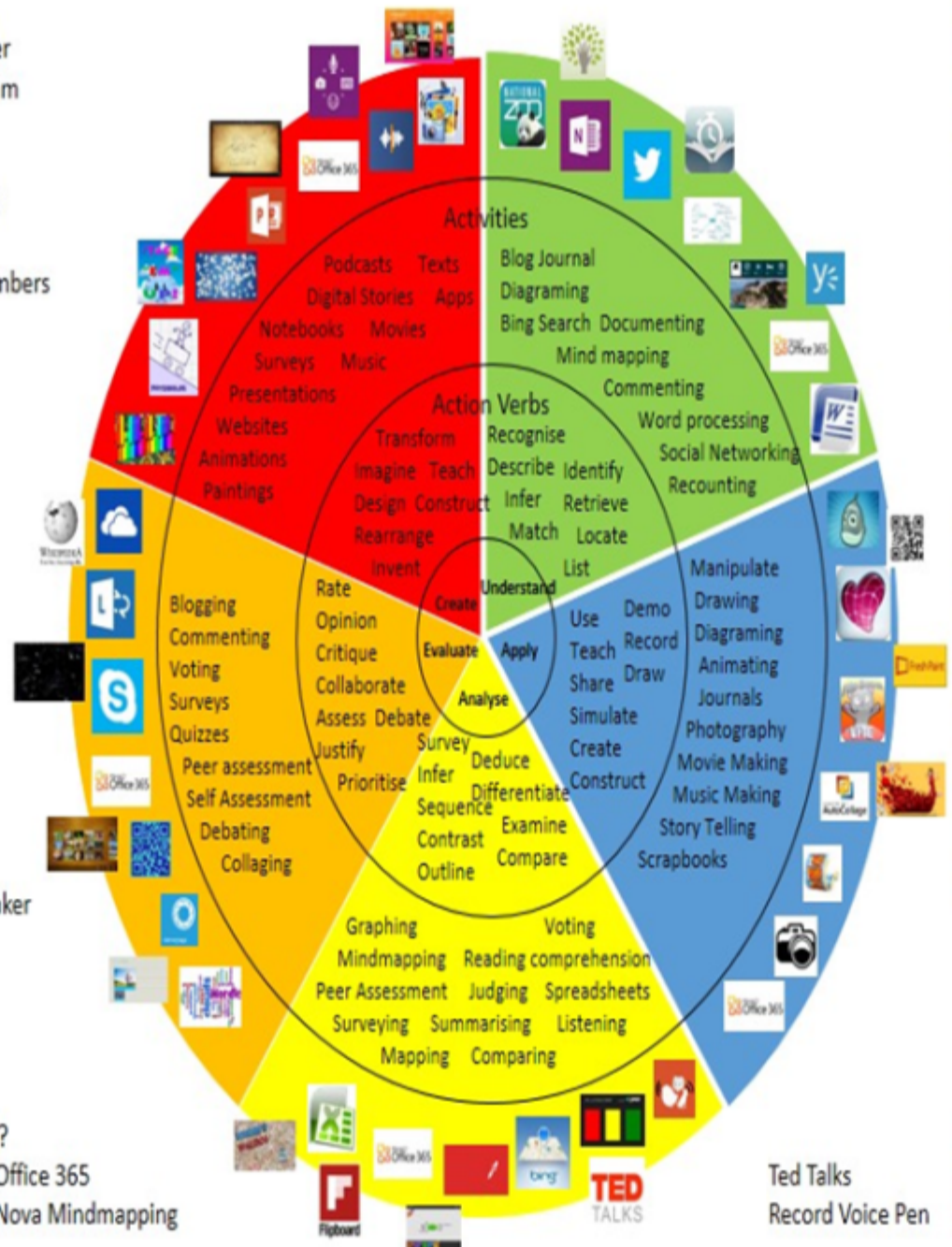
Win 8.1 Apps/Tools Pedagogy Wheel

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



Alignment to 21st Century Skills & Technology

- Mathematics; Critical Thinking and Problem Solving
- Science and Scientific Inquiry (Next Generation); Critical Thinking and Problem Solving
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics; Information Literacy
- World languages; Information Literacy
- Technology; Life and Career Skills
- Visual and Performing Arts; Creativity and Innovation

- English Language Arts; Creativity and Innovation

21st Century/Interdisciplinary Themes

Connection to Life Science: Structure and Function

Ask students if they think engineers even look to nature to get ideas for solutions. Have them identify a tool in the classroom or at home that may have been inspired by something in nature.

Connection to Physical Science: Electromagnetic Radiation

Ask students what problem someone would have if they plan on taking their pet for a walk in the evening.

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

21st Century Skills

Collaboration (Build on Prior Knowledge, Small Groups, Discuss Collaborating and Communicating, Think, Draw, Pair, Share)

Claims, Evidence, and Reasoning

Careers in Science & Engineering (Packaging Engineer)

People in Science & Engineering (Mary Delaney)

- 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

Lesson Vocabulary (engineer, problem, solution, technology)

Leveled Readers (On Level, Extra Support, Enrichment)

Reinforce Vocabulary- Have students draw an illustration of each word and have them write the word beneath the illustration, define it, and use it in a sentence.

RTI/ Extra Support- Supply students with additional images of examples of common problems and technology used to solve these problems. Provide students with context of how these technologies were made to help solve each problem.

Extension- Research on different types of engineers and/or technology

ELL- Point out labels, pictures, captions, and headings throughout the lesson. Discuss real-life connections to content, and provide hands-on examples of materials when possible.

(ELL support resources include a glossary in English and Leveled Readers in Spanish and English)

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

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
- 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: Engineering and Technology

NGSS: (Engineering Design K-2-ETS1-1, 2, 3 Asking questions and defining problems)

Interdisciplinary Connection: Writing (students will write a short paragraph that provides examples of how engineers find and solve problems, use math and science, and ask questions)

Statement of Objective: SWDAT explore how engineers ask questions and gather information to understand problems

Anticipatory Set/Do Now: Begin with a discussion about the technology that students use in their everyday lives. Show lesson video. Define lesson vocabulary- engineer, problem, solution

Learning Activity: List examples of everyday technology students discussed. Have students work in groups to list a way they would make one of the technologies better. Discuss video and what problem Mia had in the video. Discuss what kinds of problems come up in the classroom and how they might be solved. Ask students, "What do engineers need before they look for solutions?". Read aloud pages 4-7, ask guided questions.

Student Assessment/CFU's: Ask students to identify each problem on page 6. Complete "Apply What You Know" in Evidence Notebook.

Materials: Lesson video, laptop, SMART TV, text book

21st Century Themes and Skills: Collaboration, Communication

Differentiation/Modifications: Lesson Video, visuals, small group assistance, model short paragraph writing

Integration of Technology: Lesson video