Unit Name: Innovation **Time Frame:** *22 Days*

Author: Carmelita Graham, Ken Handel, and Kristen Zompa

UNIT

Subject: Science, Technology, Math, Engineering Country: **USA**

Course/Grade: STEM (8TH Grade) State/Group: **NJ**

School: **Fernwood Middle School, Alder Avenue Middle School**

UNIT SUMMARY

Students will be presented with a problem and given the opportunity to come up with innovative strategies to solve real-world problems.

UNIT RESOURCES

Recyled material: Cardboard, Plastic
Fabric strips
Pencil, Paper, Markers
Ruler
Batteries
Popsicle Sticks
PVC Rods
Magnets
Levers, wheel and axel, and pulley devices
3-D Printer

Internet Resource Links:

http://www.iteea.org/i3/files/Unit%20Descriptions.pdf
www.edheads.org

www.howstuffworks.com

STAGE ONE

GOALS AND STANDARDS

LA.6-8.CCSS.ELA-Literacy.RST.6-8.3 - [*Grade Level Standard*] - Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

LA.6-8.CCSS.ELA-Literacy.CCRA.R.7 - [*Anchor Standard*] - Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words

LA.6-8.CCSS.ELA-Literacy.CCRA.W.1 - [*Anchor Standard*] - Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

LA.6-8.CCSS.ELA-Literacy.WHST.6-8.1b - Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

LA.8.CCSS.ELA-Literacy.CCRA.SL1 - [*Anchor Standard*] - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

LA.8.CCSS.ELA-Literacy.CCRA.SL4 - [*Anchor Standard*] - Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

LA.8.CCSS.ELA-Literacy.CCRA.SL5 - [*Anchor Standard*] - Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

TEC.5-8.8.1.8.A.5 - [*Cumulative Progress Indicator*] - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.

TEC.5-8. - [*Content Statement*] - The use of digital tools and media-rich resources enhances creativity and the construction of knowledge.

TEC.5-8.8.1.8.E.1 - [*Cumulative Progress Indicator*] - Gather and analyze findings to produce a possible solution for a content-related or real world problem using data collection technology.

TEC.5-8. - [*Content Statement*] - Information accessed through the use of digital tools assists in generating solutions and making decisions.

TEC.5-8. - [*Content Statement*] - Technology systems impact every aspect of the world in which we live.

TEC.5-8. - [*Content Statement*] - The design process is a systematic approach to solving problems.

TEC.5-8.8.2.8.B.1 - [*Cumulative Progress Indicator*] - Design and create a product using the design process that addresses a real world problem with specific criteria and constraints.

TEC.5-8.8.2.8.B.2 - [*Cumulative Progress Indicator*] - Identify the design constraints and trade offs involved in designing a prototype, (how the prototype might fail, and how it might be improved) by completing a design problem and reporting results in a multimedia presentation.

TEC.5-8.8.2.8.B.3 - [*Cumulative Progress Indicator*] - Solve a science-based design challenge and build a prototype using science and math principles throughout the design process.

TEC.5-8.8.2.8.E.1 - [*Cumulative Progress Indicator*] - Work in collaboration with peers and experts in the field to develop a product using the design process, data analysis, and trends, and maintain a digital log with annotated sketches to record the development cycle.

ENDURING UNDERSTANDINGS

- A design is only as good as the functionality it gives the end user
- The design loop can be used to help automate tasks and make tasks easier for end users

- There are many things to consider when creating a design
- Design expectations are often not reached on the first iteration

ESSENTIAL QUESTIONS

1. What considerations must be taken into account when creating a design?
2. How can the design and building of protypes reduce cost and time for manufacturer?
3. What components must be included in a design to be attractive for the end user?
4. How does the durability of a case impact the value over time of a cell phone or laptop?
5. How does magnetisum work?
6. What is the relationship between speed and design, that enables a vehichle to be more desirable?

KNOWLEDGE AND SKILLS

- Studets will understand that the design process is composed of researching, designing, building, testing, and redesigning.
- Research problems and brainstorm, plan, and test proposed solutions
- Students will understand that 3-dimensional objects can be represented by different 2-dimensional views.
- Students will understand that designs have to be planned according to the end users requirements
- Students will be able to identify a problem and plan, design, and communicate their proposed solution
- Students will be able to communicate their ideas to their groups and present their ideas to their classmates.
- Students will be able to create isometric and orthographic drawings using measurement.
- Students will build on their knowledge of simple machines to design wheels, pulleys, and levers.
- Students will be able to use design software to create 3-dimensional viewings.
- Students will be able to test their designs and reflect on desired and actual outcomes
- Students will be able to keep field notes and log and document their findings in their project journals
- Students will be able to summarize their finidnings to present to an audience

STAGE TWO

PERFORMANCE TASKS

Design Problem/Challenge Activity 1 (Physical Disability):

There are students who have difficulty holding a mouse because they have a missing limb (i.e. no arms, or missing fingers on a hand) what design can be made to make the task of operating a computer mouse a reality for students with these physical challenges.

Design problem/Challenge Activity 2 (Laptop case/cell phone case):

Your school is planning a 1:1 laptop program for students next year, where each students will be given a laptop to use throughout the school day. Some teachers and adminstrators are hesitant about letting the students carry them around throughout the school day, for fear students will drop or break them. You know the value of being able to bring the laptop to every class. Your job is to come up with a laptop case design that will be durable and keep the laptops safe if they are dropped or banged on desk, floors, ect. To convince the teachers and adminstrators to allow students to bring the laptop to each of their classes.

Design Problem/Challenge Activity 3 (Mousetrap Racecar):
DESIGN BRIEF

Situation/ background

You are on school holidays at home, you have been asked to look after your younger brother or sister. Both he/she and you have been given a mousetrap. You and your brother/sister are quite creative, using the materials you have collected from your home or school, create a vehicle which will be propelled by a wooden mouse trap and a piece of string. You have the Internet available for you to research different ideas. You are to design and build a vehicle using the mouse trap and a piece of string. The vehicle will be assessed by the distance it can travel and the time it takes to travel over a 4 meter distance.

Problem Statement

You are to design and build a vehicle that is to be powered by a wooden mouse trap and a piece of string. The mouse trap that you will be given is 1 3/4" wide and 4” long. You will be given one mouse trap. You are to build the vehicle using wheels, axles, pulleys and any other pieces within your collection. The vehicle has to have some sort of trigger device so that the vehicle can be held motionless while the spring is fully sprung.

Design Problem/Challenge Activity 4 (CO_2 Cars):

You are an automotive design engineer in the research and development department of the ACDS Automotive Company. You have been assigned the task of designing the new, fuel efficient, aerodynamically sound, stylish, and futuristic automobile for the company. You will be in charge of the designing, constructing, and testing of the new vehicle. All cars in the company will be compared for excellence in design, craftsmanship, aerodynamics, and the fastest racing time.

Design Problem/Challenge Activity 5 (Bridge Building):

The college campus has a walking bridge that students traditionally use to cross from the parking lot to their dorm. On move-in day many students have heavy loads including televisions, small dressers, refigerators and other items that they need to bring to their dorms. Many parents and students have complained that it takes hours to bring these items in one at a time. The student counsel would like to propose the use of small motor carts with flatbeds attached to the back to move large, cumbersome furniture across the bridge. Your task is to design a model of a bridge that will be able to hold the extra weight and present your findings to the school decision makers.

Design Problem/Challenge Activity 6 (MagLev):

BACKGROUND:

During the 20th century, planes, trains, and automobiles revolutionized the way people traveled from place to place. Now in the 21st century scientist and engineers are looking into more energy efficient methods of transportation that will help to reduce the amount of pollution that is created. Heike Onnes, a Dutch physicist, first discovered superconductivity in 1911. Superconductors are designed to allow electricity to flow without any resistance. This is very important in the design and construction of Maglev Trains. Maglev trains will be able to reach speeds of 300 mph, transport a large number of people, and travel without carrying any fuel on-board.

OTHER EVIDENCE

- Safety quiz
- Design process quiz
- Design of device to support physically challenged students
- Design of cars
- How far and what speed the cars can go
- Design of bridge
  The amount of weight the bridge can hold
- The design of the transportation system
- How far cars can travel on their transportation system
- Ability to present their recommendations and findings to peers, teacher, and a panel of subject-matter experts.

- Ability to be an active participant in a cooperative learning group

STAGE THREE

LEARNING PLAN

- Introduction of Safety
- Introduction of Measurement/Ruler
- Introduction of Design Process
- Research: Prior knowledge, Human interaction, Research on laptops
- Design: Brainstorm, sketches, isometric and orthographic designs
- Building: Creating the product
- Testing: Test and written results
- Redesign: Written description of how to better project, actual design of item
- Documentation: Log their findings in journals, use word-processing software, presentation software, or posters to present their findings
- Presentation of product to classmates, teacher, or subject-matter experts

Students must get 100% on safety quiz in order to build project.

Students must check-in with teacher after each step in design process in order to get next part of the design portfolio.

Classroom observations will be made and documented as students work in their cooperative learning groups.