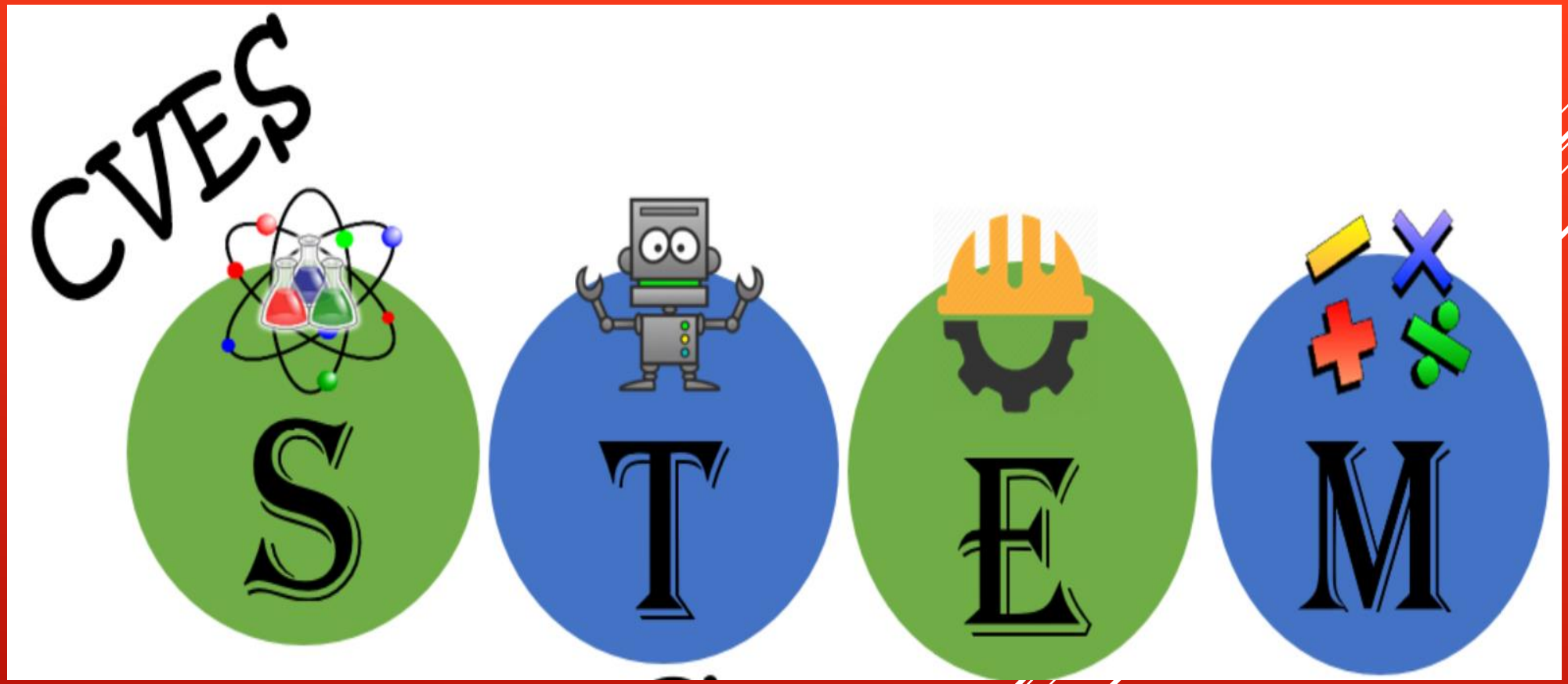


Stem Integration
2nd & 3rd Grade

What is STEM?

The Engineering Design Process

ASK

Define the Problem

Imagine

Brainstorm possible solutions

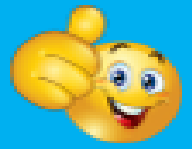
Plan

Think, Sketch, Label

Create

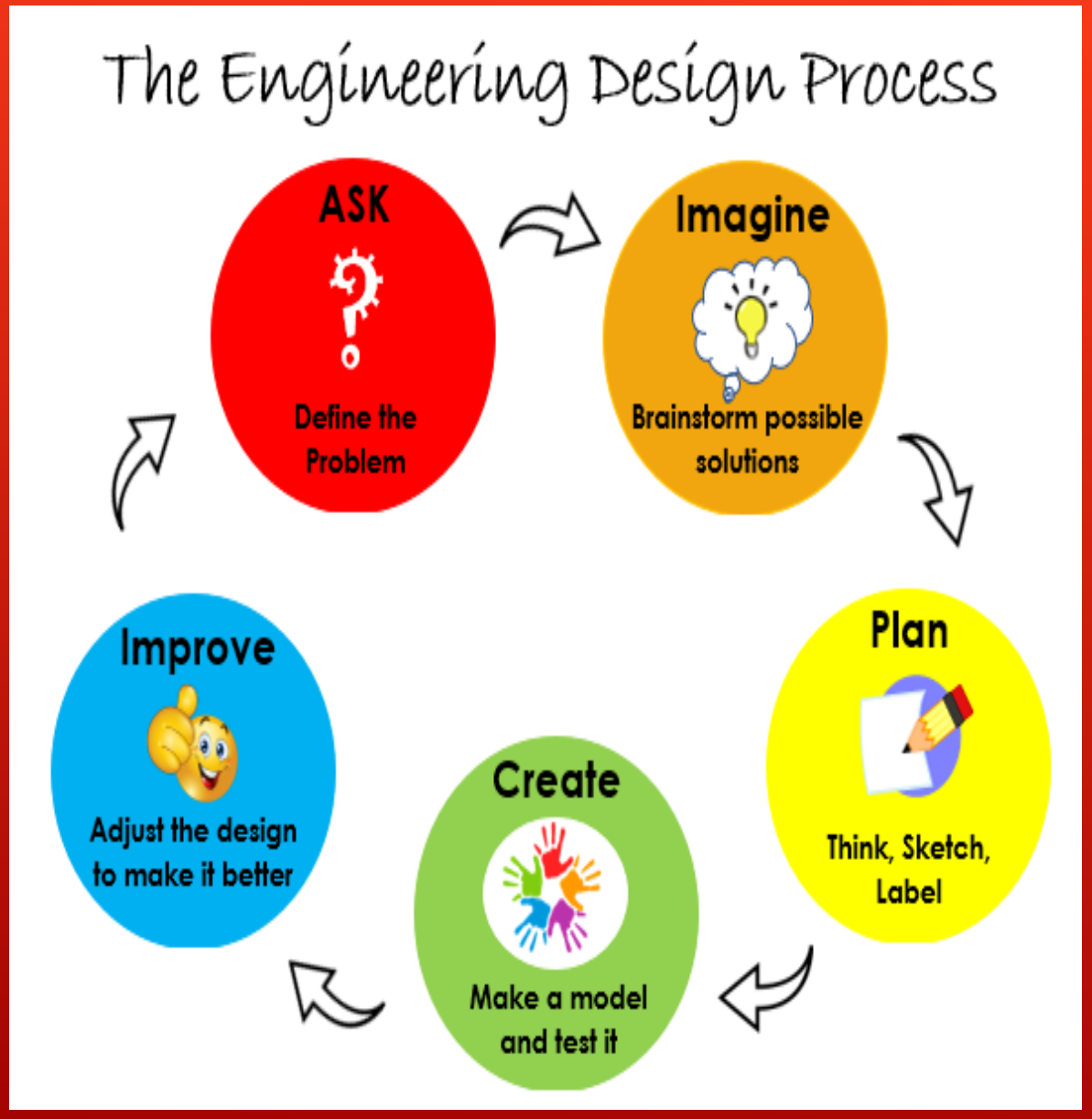
Make a model and test it

Improve



Adjust the design to make it better

STEM and PBL Connection



6 CHARACTERISTICS OF EFFECTIVE STEM CLASSROOM DESIGN

Flexible

Mobile

Integrated

Organized

Flipped

Team Focused

Standards for Mathematical Practice

1. Make sense of problems and preserver in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Science & Engineering Practices

1. Asking Questions and Defining Problems
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
6. Constructing Explanations and Designing Solutions
7. Engaging in Argument from Evidence
8. Obtain, Evaluate, and Communicate

2ND GRADE STEM LESSON

Pumpkin Push or Pull

ASK

Define the Problem

Can you build a structure that you can push or pull to help Farmer Brown deliver the pumpkin?

The farmer was bringing the pumpkins in from the field after he picked them. The trailer he was using broke down. He needs help bringing the pumpkins to the truck so he can take them to the store and sell them.

You need to build a structure that will carry one pumpkin. You can push it or pull it. You can't touch the pumpkin. You can only use the supplies available and spend up to $ 10.

Science Standards

S2P2. Obtain, evaluate, and communicate information to explain the effect of a force (a push or a pull) in the movement of an object (changes in speed and direction).

a. Plan and carry out an investigation to demonstrate how pushing and pulling on an object affects the motion of the object.

b. Design a device to change the speed or direction of an object.

c. Record and analyze data to decide if a design solution works as intended to change the speed or direction of an object with a force (a push or a pull).

Math Standards

MGSE2.MD.8 Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately.

MGSE2.OA.2 Fluently add and subtract within 20 using mental strategies.

Engineering Standards

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 it function as needed to solve a given problem.

Imagine – What do you know about pushes and pulls? How can this help you move the pumpkin?

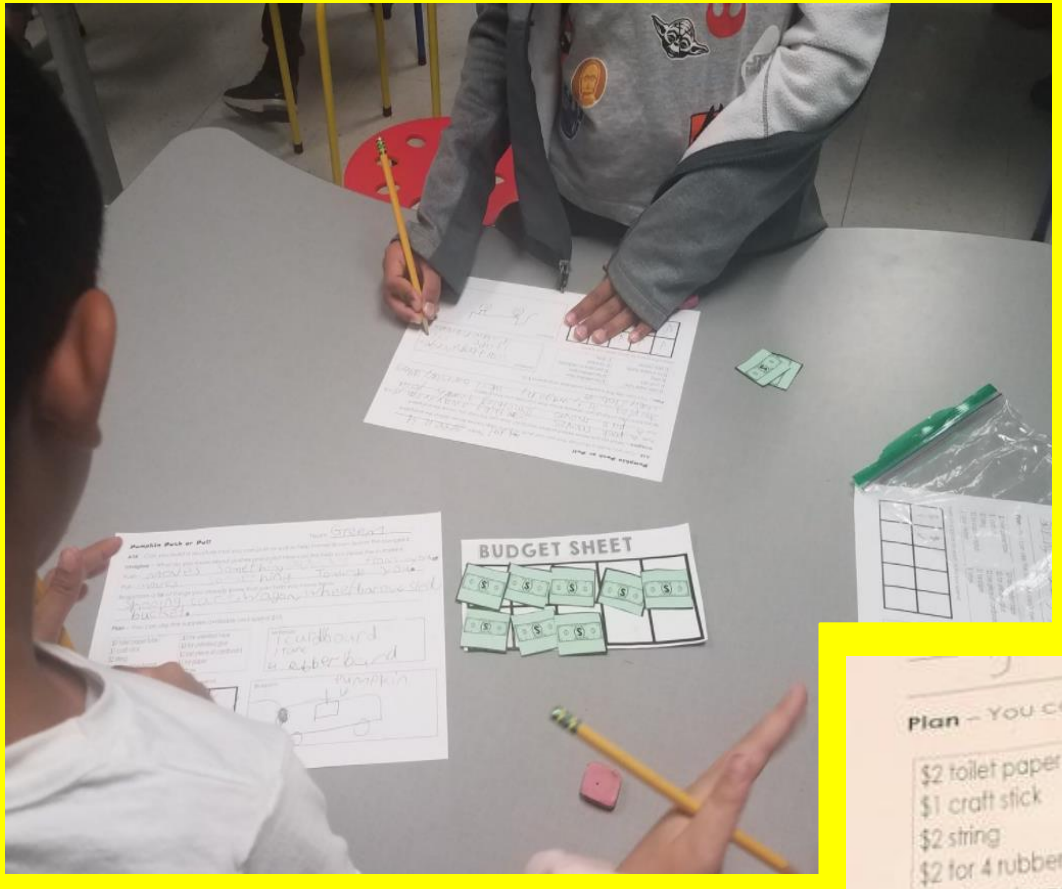
Push - _____

Pull - _____

Brainstorm a list of things you already know that can help you move items.

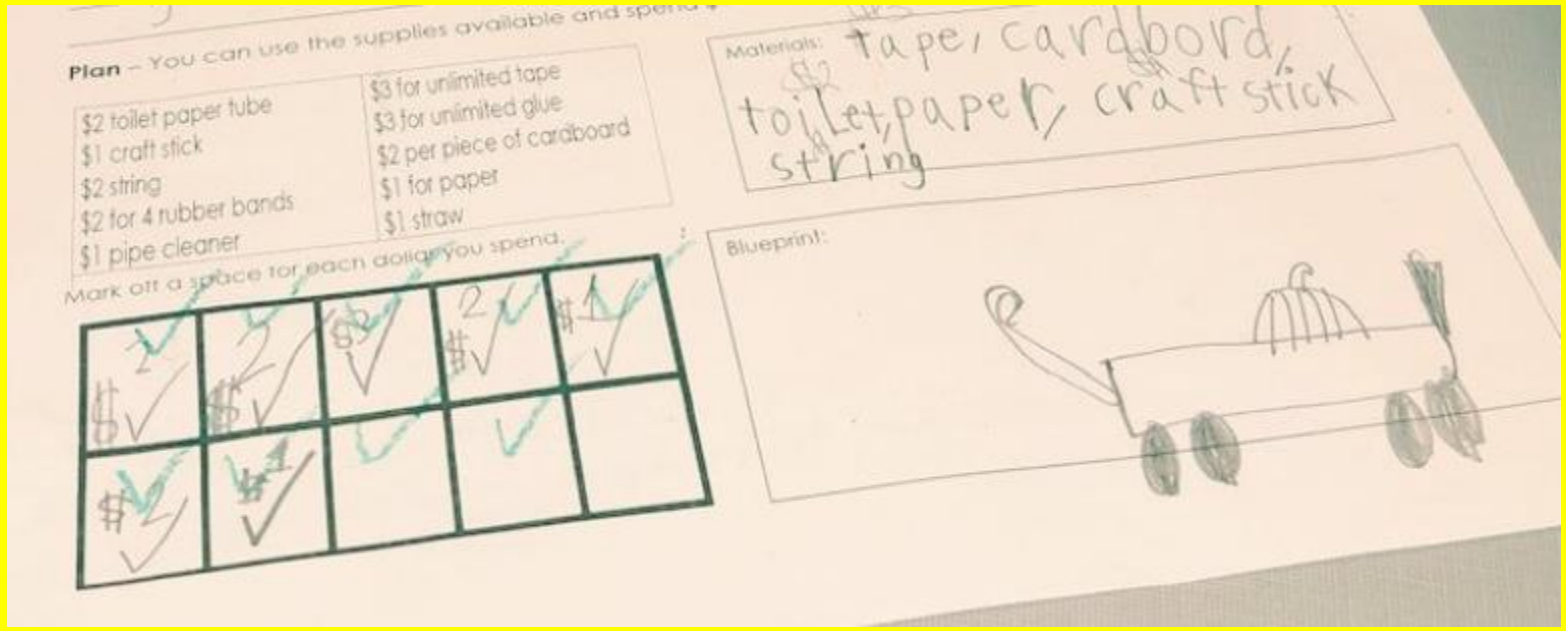
_____

_____



Plan

Think, Sketch, Label



Create

Make a model and test it

Improve

Adjust the design to make it better

1. Did your structure cost $ 10 or less?

2. Did your structure carry the pumpkin?

3. Did you move the pumpkin without touching it?

4. What would you change next time?

3RD GRADE STEM LESSON

Pollution

Solution

Dear Students,

You are Environmental Engineers working to design a water filtration system to remove particles and pollutants from water. These Filtration Stations will help to make water safe to drink and use for people without access to clean water.

Before you create your Filtration Station, you will need to test different materials to find out which ones are the most effective at filtering water. Once you have completed your tests, you will choose the best three materials to use in your system. Don't forget to document your design process so you can share your solution.

How can we, as Environmental Engineers, clean polluted water?

STEM CAREER

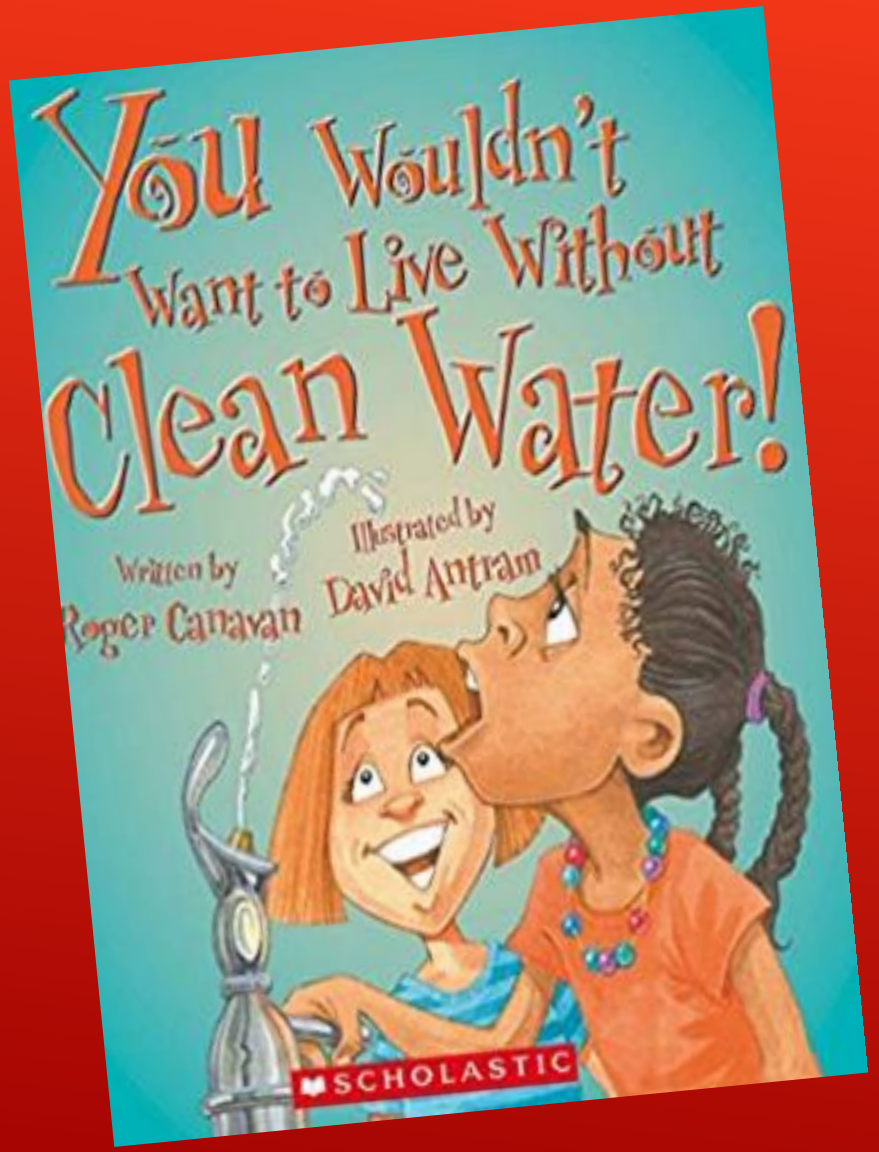
- Environmental engineering applies various scientific principles and ideas to help provide clean water, minimize pollution and improve the environment.
- Environmental engineers work in a number of areas that can relate to air pollution, waste disposal, recycling, global warming, water pollution and other environmental issues.

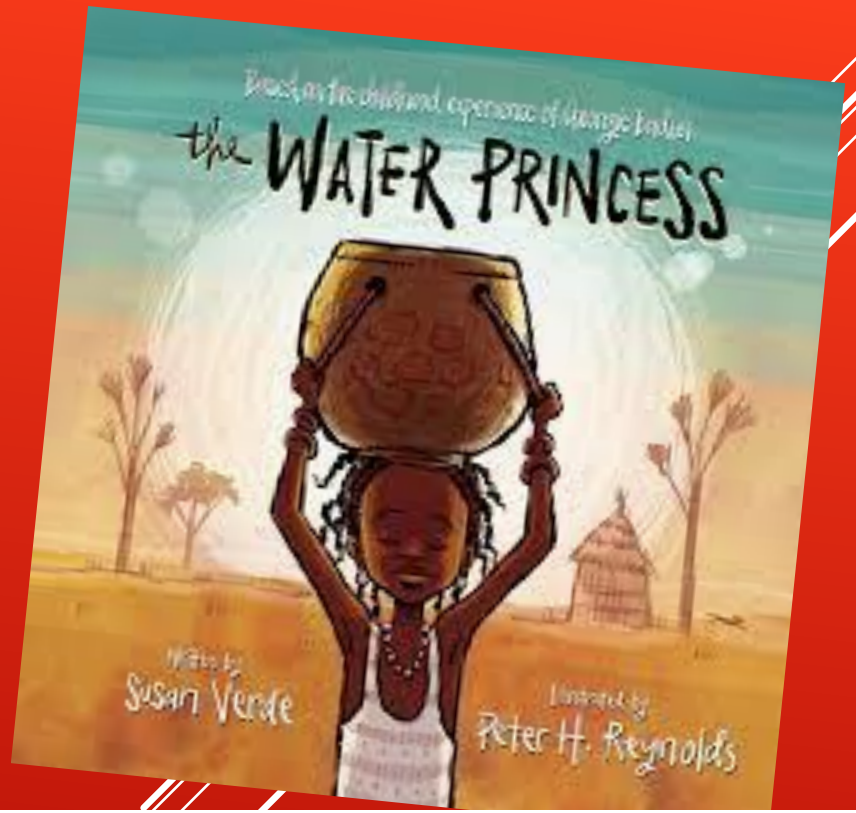
Add Standard	Mathematics
Grade	3rd
Strand	Numbers and Operations in Base Ten
Topic	Addition and Subtraction
Standards	**MGSE3.NBT.2** Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

Add Standard	Science
Grade	3rd
Strand	Life Science
Topic	Pollution
Standards	S3L2. Obtain, evaluate, and communicate information about the effects of pollution (air, land, and water) and humans on the environment. a. Ask questions to collect information and create records of sources and effects of pollution on the plants and animals. b. Explore, research, and communicate solutions, such as conservation of resources and recycling of materials, to protect plants and animals

Add Standard	Next Generation Engineering Standards
Grade	3 - 5
Strand	
Topic	Engineering
Standards	**3-5-ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. **3-5-ETS1-3.** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

LITERATURE CONNECTION



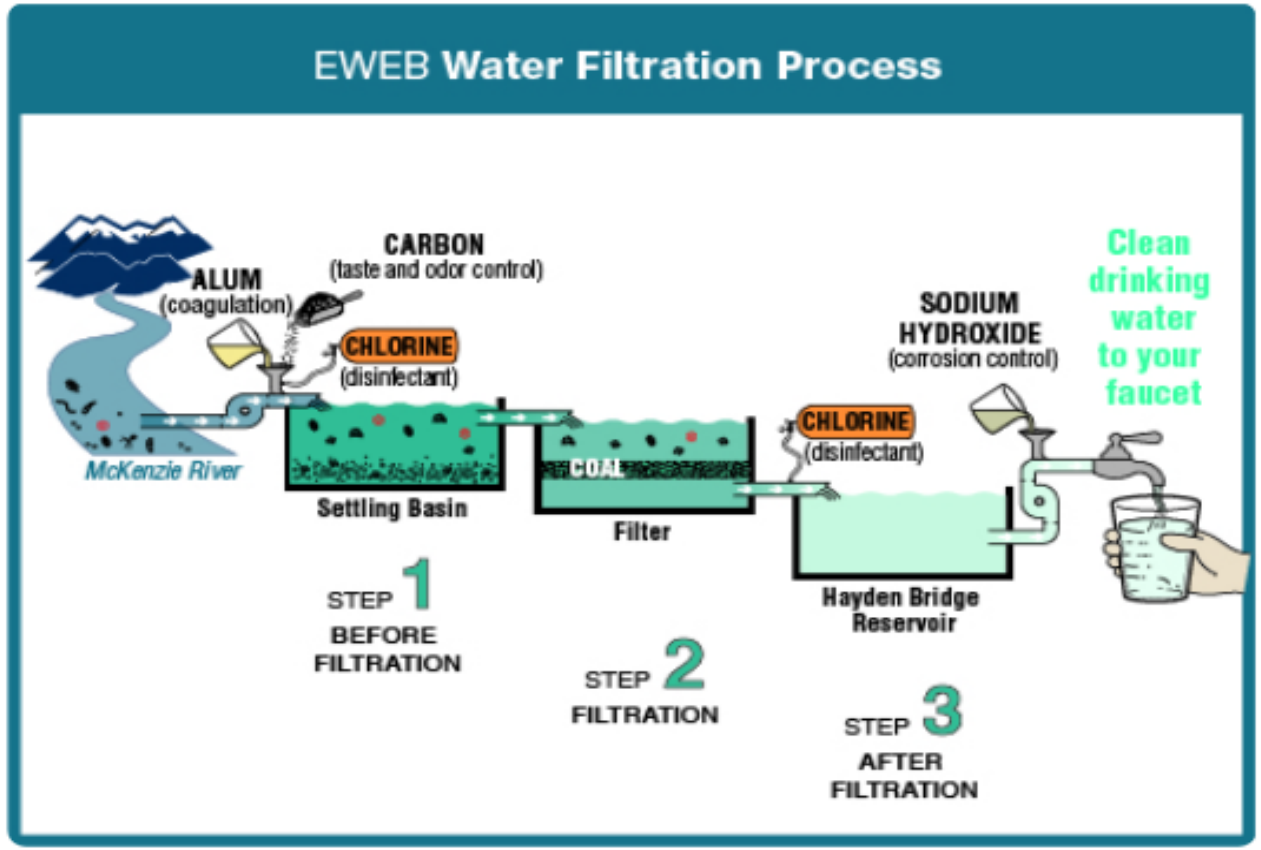


ELA Standards:

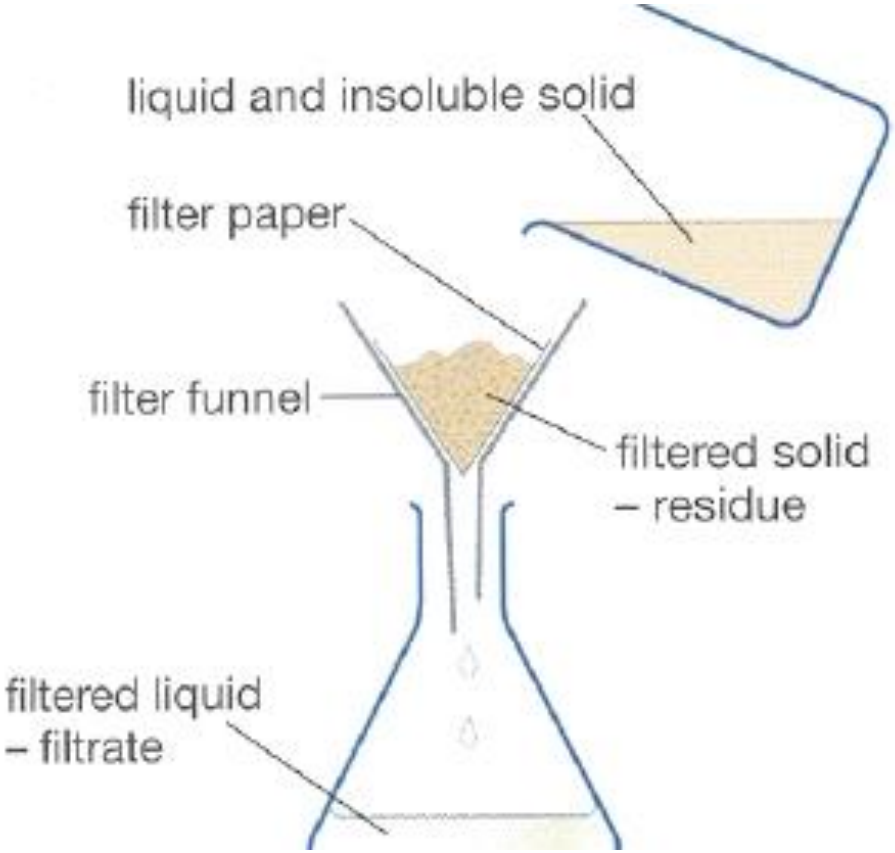
ELAGSE3RL1: Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

ELAGSE3RL2: Recount stories, including fables, folktales, and myths from diverse cultures; determine the central message, lesson, or moral and explain how it is conveyed through key details in the text.

ELAGSE3RL3: Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events.


EWEB Water Filtration Process
ALUM
(coagulation)
CARBON
(taste and odor control)
CHLORINE
(disinfectant)
McKenzie River
Settling Basin
COAL
Filter
CHLORINE
(disinfectant)
SODIUM
HYDROXIDE
(corrosion control)
Hayden Bridge
Reservoir
Clean
drinking
water
to your
faucet
STEP 1
BEFORE
FILTRATION
STEP 2
FILTRATION
STEP 3
AFTER
FILTRATION


Imagine
Brainstorm possible solutions


liquid and insoluble solid
filter paper
filter funnel
filtered solid
– residue
filtered liquid
– filtrate

1. Watch the Water Treatment Plant Animation and Water Filtration Simulation.
2. Test Materials: Record each material you used to filter the water and some observations about how effective it was.

Materials	Observations

Job Labels and Descriptions

Materials Manager I am responsible for making sure each team member lists the materials and the team has all the materials they need when building.	**Banker** I am responsible checking to make sure my team stays within the budget and handle the money.
Test Engineer I am responsible for direct testing and gathering ideas from the group on how to test the team's design.	**Project Planner** I am responsible to help all team members follow the steps and collect digital evidence to document the steps of the engineering design process.

Supply List	Cost	How many?	Total Cost
Clear Plastic Cup (Must Purchase	$3		
Plastic Water Bottle	$3		
Small Paper Cup	$2		
Coffee Filter	$3		
1 piece of Paper Towel	$3		
5 Cotton Balls	$2		
¼ cup of Sand	$3		
¼ cup of Small Rocks	$3		
Straw	$1		
Rubber Band	$1		

Plan:

Which materials will make the best materials?

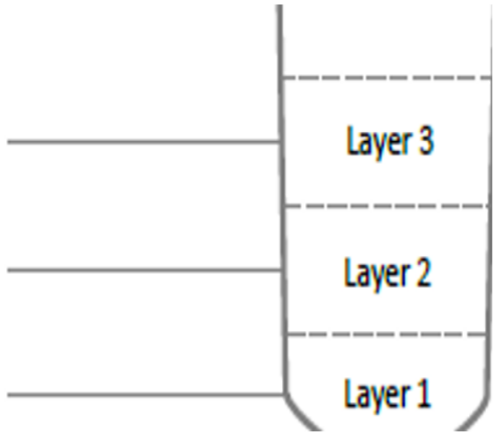
_____

_____

_____

What order should you use your materials in as you filter the water?

Sketch and label YOUR Filtration System idea.



Did each member share their idea? No – finish sharing

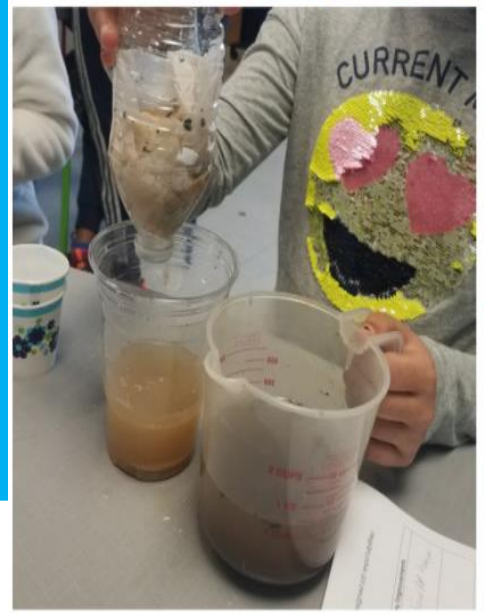
Yes – begin creating budget and team design.

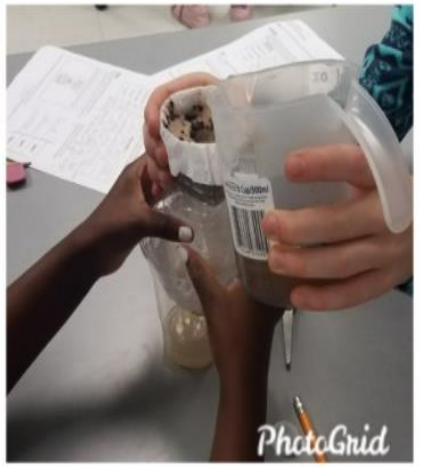
Create

Make a model and test it

Improve

Adjust the design to make it better





Communicate Solution: The project planner will work with the group to share evidence of the design process.

1. Create a Pic Collage.
2. Place collage in Seesaw.
3. Each member of the group will communicate part of the process. Record or type information.
4. Save video to Seesaw portfolios of all group members.

Filtration Station STEM Challenge

Name _____ Engineering Team _____

Standard S3L2		Filter Specialist 3 points	Water Worker 2 points	Sprinkler 1 point	
a. Ask questions to collect information and create records of sources and effects of pollution on the plants and animals. b. Explore, research, and communicate solutions, such as conservation of resources and recycling of materials, to protect plants and animals	Water Filter Design	The filter is unique in design with at least three core materials. The filtered water is cleaner than the original water.	The filter is unique in design with at least two core materials. The filtered water is cleaner than the original water.	The filter is unique in design with only one core material. The filtered water may or may not be cleaner than the original water.	
	Engineering Design Process	The engineer did ALL parts of the process and recorded information completely in the STEM Journal.	The engineer did ALL parts of the process. Some parts may not be recorded completely in the STEM Journal.	The engineer completed only some areas of the process. The STEM Journal is not complete.	
	Communicate Solution	The engineer's explanation of how the water filter was made, how it works, and testing solution is complete and accurate.	The engineer's explanation of how the water filter was made, how it works, and testing solution is complete, but some parts are not accurate.	The engineer's explanation of how the water filter was made, how it works, and testing solution is not complete and/or accurate.	
				Total	

Group Work Self Check

Name _____ Job Title: _____

Rate yourself in each category.

Category	Meets 3	Making Progress 2	Does Not Meet 1
Contributions	I was cooperative and did my part of the work. I offered useful ideas.	I cooperative sometimes. I could have done more. I sometimes offered useful ideas.	I am seldom cooperative. I did not do much work. I rarely offered useful ideas.
Working With Others	I listen to, share with, and support the efforts of others. I do not cause problems in the group.	I usually listen to, share with, and support the effort of others. Sometimes I may be distracted.	I rarely listen to, share with, or support the efforts of others. I was not a good team member.
Focus on the Task	I focused on the task and what needs to be done most of the time. Group members can count me.	I sometime focused on the task and what needed to be done. Other group members sometimes reminded me to stay on task.	I did not focus on the task and what needs to be done. I let others do the work.

Rate how well your team worked together. Circle one below.

We made a great team!	We had a few things to work on, but we were able to solve our own problems.	We had a hard time working together and needed teacher support.

I wish _____

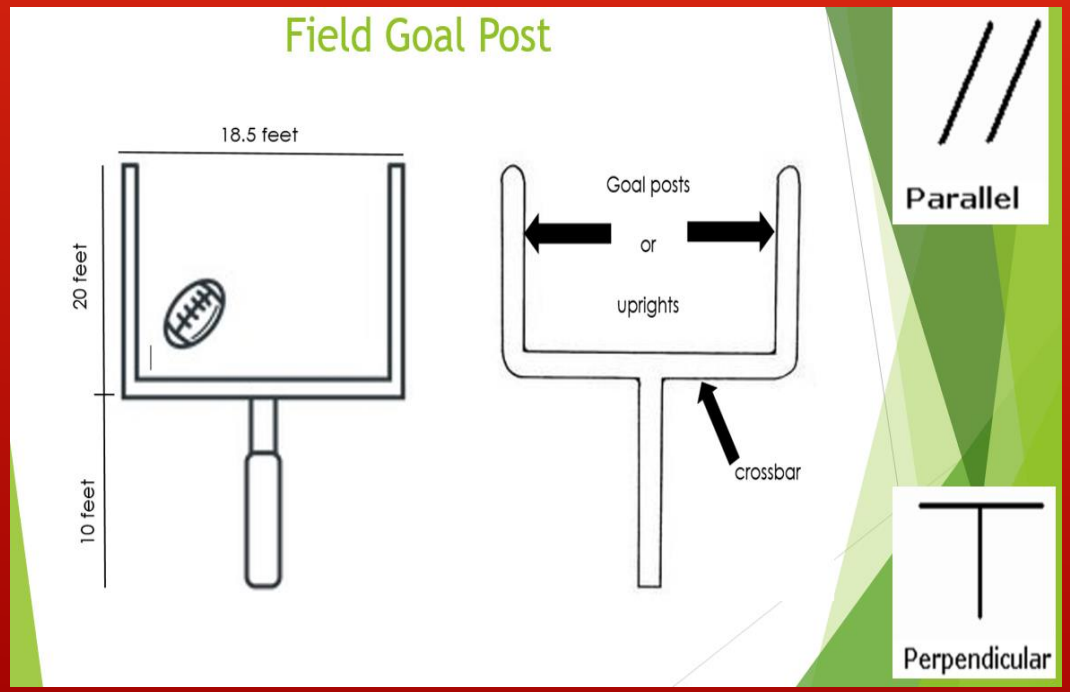
I wonder _____

Next time _____

LET'S BUILD…

The Super Bowl is the last game of the season. The NFL has asked for all of the field goal post in each stadium to be replaced next season. Sportsfield Specialties needs help in order to create enough goal posts for every team by next season.

Your job is to work as a team to design a goal post for the company to present to the NFL.



Construct a Field Goal Post

- Crossbar and uprights must be perpendicular
- Uprights must be parallel
- Field goal post must be free-standing
- Must be10 inches tall and 8 inches wide
- Use only materials provided

Kick (flip) field goals

- Kick (flip) from data chart distances
- Paper football must touch the table or floor before flipping
- Paper football must be between the uprights and above the crossbar to score

Super Bowl STEM – Field Goal
4th Grade

Name_____
Team _____

ASK: How can I design and create a free-standing field goal post? How can I use force to kick (flip) the football to make a field goal?

Imagine: Explore "Football Basics" to learn about the sport and field goal posts.

Plan: Make a sketch and label your goal post.

Materials

___ craft sticks ___ straws

____ paper ____ tape

___ pipe cleaners

Create: Construct your goal post.

Draw your final creation.

Test/Improve:
Does your field goal post stand on its own?
_____

Are the uprights parallel? _____

Are the uprights and crossbar perpendicular? _____

Is the post at least 10 inches tall? _____

Is the post 8 inches wide? _____

Reflect
How did you improve your design?
What changes did you make?

_____

_____

What was the most difficult part of the challenge?

_____

_____

Super Bowl STEM **Name** _____

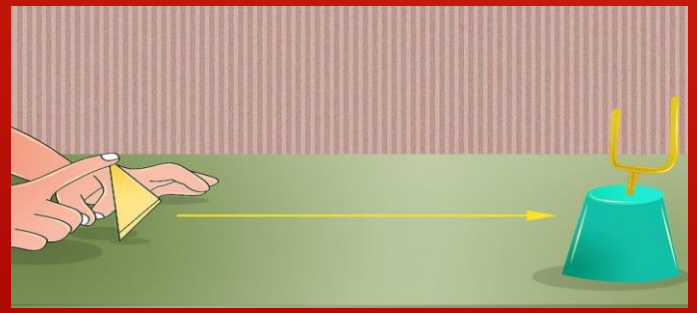
Field Goal SCORECARD

You are a field goal kicker. You are going to kick (flip) the football from different locations on the field. Kick (flip) the paper football 10 times from each location and collect your data. Remember, a field goal is worth 3 points.

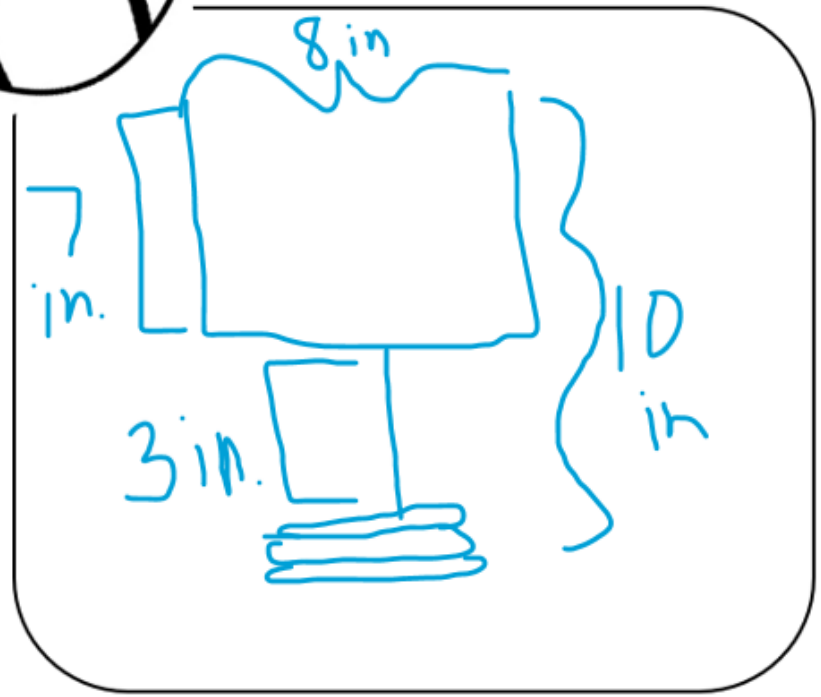
EXAMPLE

Distance from goal post	Tally Marks of field goals	Fraction of field goals missed	Percentage of field goals missed	Fraction of field goals made	Percentage of field goals made	Total Points made (3 points each)
5 inches	Missed		Decimal		Decimal	
	Made		Percentage		Percentage	
10 inches	Missed		Decimal		Decimal	
	Made		Percentage		Percentage	
15 inches	Missed		Decimal		Decimal	
	Made		Percentage		Percentage	
20 inches	Missed		Decimal		Decimal	
	Made		Percentage		Percentage	

What variables (gravity, balanced, unbalanced forces) contributed to your data results?



Plan: Make a sketch and label your goal post.



Materials

- ✓ craft sticks
- ✓ straws
- ✓ paper
- ✓ tape
- ___ pipe cleaners

SHARE YOUR PRODUCT

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