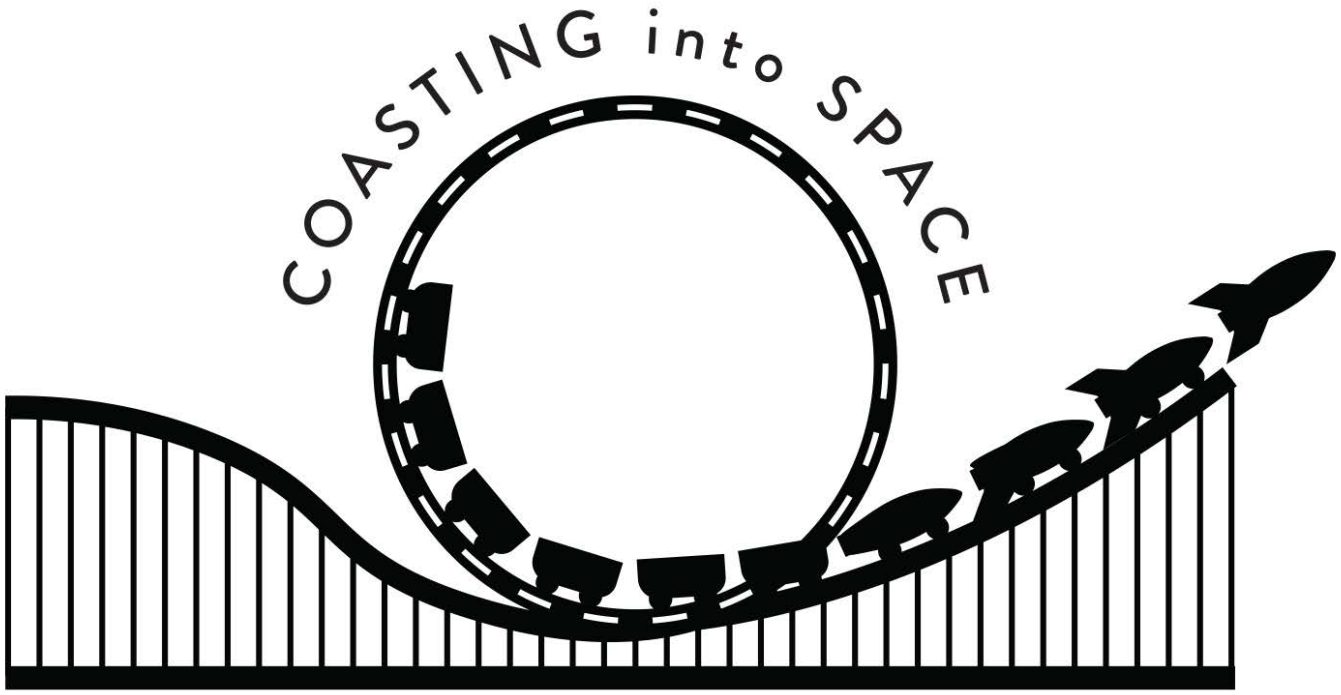

Summer 2019

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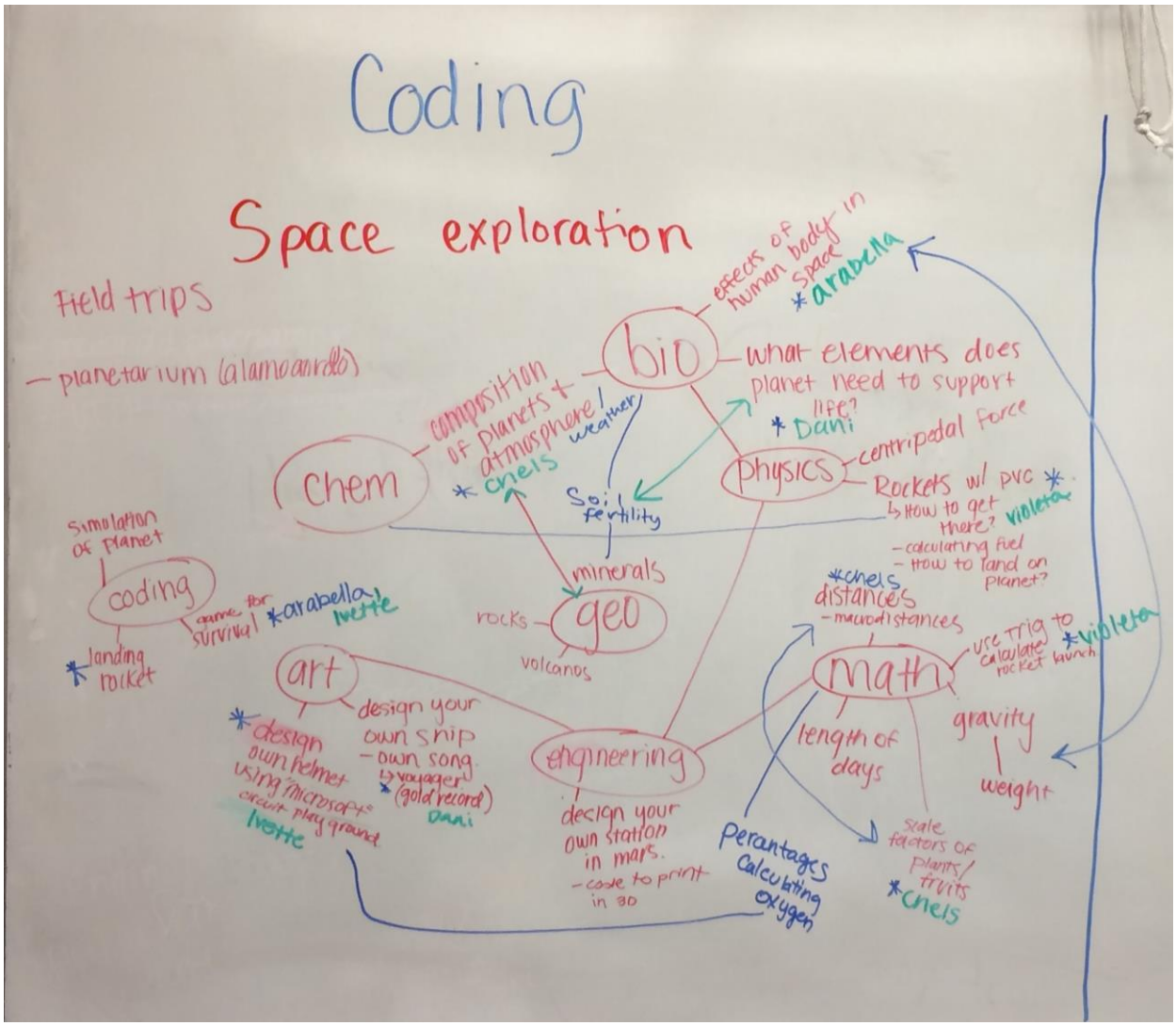
Concept Map


Coding
Space exploration
Field trips
- planetarium (alamoarrdo)
bio
effects of human body in space
*arabella
what elements does planet need to support life?
*Dani
chem
composition of planets + atmosphere/weather
*chels
soil fertility
physics
centripedal force
Rockets w/ PVC *
How to get there? violeta
- calculating fuel
- how to land on planet?
minerals
geo
rocks
volcanos
coding
simulation of planet
*landing rocket
game for survival *arabella, ivette
art
*design own helmet using "microsoft" circuit play ground ivette
design your own ship
- own song
voyager (gold record) Dani
engineering
design your own station in mars.
- code to print in 3D
math
*chels distances
- macro distances
use trig to calculate rocket launch *violeta
length of days
gravity
weight
perantages calculating oxygen
scale factors of plants/fruits
*chels

Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00- 8:15	**Students Arrive**	**Students Arrive/Team builder**	**Students Arrive/ Team Builder**	**Students Arrive/ Team Builder**	**Students Arrive**
8:15- 8:30	Introduce ourselves, the camp, PRETEST	Body Systems- Arabella	Mission Impossible- Violet	Create a 3D rocket- Chandra	Field Trip
8:30-8:45					
8:45-9:00	Team builder				
9:00-9:15	Scale factor - Chelsie		Rocket Launch- Violet	Landing Rocket- Abby	
9:15-9:30					
9:30-9:45		Can we take it with us- Chandra			
9:45-10:00					
10:00-10:15					
10:15-10:30					
10:30-10:45		Habitable worlds- Dani			
10:45-11:00					
11:00-11:15	Lunch	Lunch	Lunch	Lunch	Lunch
11:15-11:30					
11:30-11:45	Composition- Chelsie	Habitable worlds- Dani	Golden Record- Dani	Landing Rocket- Abby	Field Trip
11:45- 12:00					
12:00- 12:15				Coding-Ivette	
12:15- 12:30					
12:30-12:45	Coding- Ivette	Team Builder- Abby	Coding- Ivette		
12:45-1:00		Coding- Ivette			
1:00-1:15				Teambuilder	
1:15-1:30				POSTTEST	
1:30-1:45	Body Systems- Arabella			Field trip discusion	
1:45-2:00	Clean up/Journals	Clean up/Journals	Clean up/Journals	Clean up/Journals	

Lesson Plan

Name of Lesson: Scale Factors of Planets

Learning (TEKS) Objective:

- 111.26. Grade 6th grade (b)

(5) Proportionality. The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:

(A) represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions;

- 111.27 Math 7th grade (b)

(5) Proportionality. The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships. The student is expected to:

(C) solve mathematical and real-world problems involving similar shape and scale drawings.

Student Outcome (*Students will be able to…)*

- Students will understand proportionality through scale factors and similar shapes by relating it to the real-world. This will give them a better understanding of the planets in our solar system.

Day of the Week and Time:

- Monday @ 9:00am – 11:00am

Total Length of Lesson:

- 2 hours

Materials *(per 1 class of 25 students):*

- Activity 1:
  - Bell-ringer (25 needed)
  - 1 pencil per student (25)
  - Mnemonic Device activity (Have them write it in their notebooks)
- Activity 2:
  - Watermelon, grapefruit, lime, grape, apple, popcorn kernel, popped popcorn, pea

  (Watermelon: Jupiter, grapefruit: Saturn, apple: Uranus, lime: Neptune, grape: Earth, Popped popcorn: Venus, popcorn kernel: Mercury, pea: Mars **ONLY 1 OF EACH FOOD ITEM PER CLASSROOM
  - "Scale Factors- Food Edition" worksheet: (8 needed: 1 per group)
- Activity 3:
  - 25 Popsicle sticks (numbered) (#1- 8, #2- 8, #3- 8, #4-1)
  - Meter stick (8) *paper meter stick
  - PLANET Stick name tags pre-labeled (40 total per class)
  - A large outdoor area
  - 8 "JUMP TO MARS" worksheets (1 per group)
  - 8 Pencils (1 per group)
- Teambuilder:
  - 2 beach balls with questions about planets & themselves (18 total for all camps)

Advanced Preparation *(day before, morning of…)*

- Pre-label PLANET sticky name tags: Starting point, Planet 1, Planet 2, Planet 3, Planet 4 (8 of each)
- Pre-cut meter sticks
- Label popsicle sticks 1-3 (8 of each needed) & 4 (1 needed)

- Have the desks arranged for group work (7 groups of 3 desks clustered together & 1 group of 4)
- Project the PowerPoint

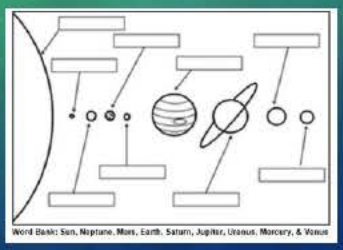
Instructional Delivery	**Notes to Teacher:**
Activity 1: Intro & Student Attempt Duration: 24 minutes **Give an intro to the camp! Ask the students to get out the given "bell-ringer" blank sheet with planets and a word bank. Have them write the names of the planets in the provided boxes. **(4 minutes)** Once they have completed the "bell-ringer" go over the correct answers for the "bell-ringer" and discuss why Pluto isn't a planet anymore. (**6 minutes)** Next, we will go over what a mnemonic device is and provide an example. **(4 minutes)** *Example to be provided: **M**y **V**ery **E**ducated **M**other **J**ust **S**erved **U**s **N**oodles Each student will create their own mnemonic device in their notebook, discuss with their group to pick the best one/create one together, and each group will share aloud the mnemonic device they created. **(3 min to create their own & 4 minutes to discuss with their group to pick their favorite mnemonic device, 3 minutes for groups to present the chosen mnemonic device.)** ****On the worksheet the order is incorrect on purpose. The correct answer is Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, & Neptune *The students must switch the order of S & J**	**"About sixty years ago brave men and women all around the world were trailblazers in space exploration. This week you will join their ranks by exploring and learning about space. You're going to build and launch rockets, analyze different planets to see which ones we can survive on, make sure that we can land safely when we reach our destination, and much more! But before we go into the great big universe, we have to explore our solar system."** **Pluto is no longer considered a planet because it is classified as a "dwarf planet." It doesn't satisfy the third criteria, because it hasn't cleared the neighborhood around its orbit.** **-The three criteria of the IAU for a full-sized planet are:** **1. It is in orbit around the Sun.** **2. It has enough mass to assume hydrostatic equilibrium (a nearly round shape).** **3. It has "cleared the neighborhood" around its orbit.** **Go over: a mnemonic device is a phrase used to help people remember important information. In our case the planets of the Solar System with the order of words corresponding to increasing order of planets.** **Have students write the mnemonic device handout that is projected in their notebooks, so they can create their own.**

	The order of the planets for the mnemonic device is incorrect on purpose. Ask the students if they notice anything wrong with the order & have them change it to the correct order.
Activity 2: Scale Factors of Planets- Food Edition Duration: 40 minutes Give each group a "Scale Factors of Planets- Food Edition" worksheet, assign each group a planet and have them pick a popsicle stick with numbers for jobs for this activity. As soon as everything is passed out go over the roles for each number. The students will work as a group (7 groups of 3, 1 group of 4). As a group the students must decide which piece of food represents which planet, provide an explanation on why they chose that planet, and write their answers on the worksheet. Once all the groups have chosen sticks explain which roles are assigned to each number and what they are expected to do. Give the students time to work on the worksheet. Once all the groups have chosen the food items, we will go over the order, and when each planet is named the group that was assigned to it must provide their reasoning for the piece of food chosen. *If the class agrees then it will be placed in the correct spot at the front of the classroom. If another group picked the same fruit for their planet, we will have a "debate" and as a class decide which fruit is the best choice. **25 MINUTES TOTAL**	**Explain the instructions for the activity very clearly and have the students pick popsicle sticks.** **Activity Roles that must be explained:** **-1:Writer—records answers** **-2:Inspector & Planet Model—the person that goes up to look at the fruits & Places the fruit in the correct spot when their planet is called** **-3:Representative—person who raises hand when voting & provides fruit choice** ****For the group with 4 people** **-4:Planet Model—places the fruit in the correct spot when their planet is called**
Once every group has presented their reasonings, get ready to go outside. (The kids will remain in the same groups when they go outside.) **ROLES: (Groups with 3 members) ● 1- Gatherer & Writer: gather PLANET sticky name tags, meter stick, "Jump to Mars" worksheet, a pencil, and read worksheet/count & record the number of jumps ● 2- Measurer: Measure the planet distances & place PLANET sticky name tags ● 3- Jumper: Jump the distances **ROLES: (Group with 4 people) ● 1- Gatherer: gather PLANET sticky name tags, meter stick, "Jump to Mars" worksheet, and a pencil ● 2- Measurer: Measure the planet distances & place PLANET sticky name tags ● 3- Jumper: Jump the distances ● 4- Writer: Read worksheet/count & record jumps ***5 minutes to explain new roles & get materials**	**Explain the new roles.** **Explicitly explain what a meter stick is. (Show them what it is.)** ****Make sure you grab the two beach balls with the**

***3 minutes for the students to review the worksheet and ask any questions** **10 minutes (to get everyone outside)**	**questions on them and take them outside with you!**
Activity 3: "JUMP TO MARS ACTIVITY Duration: 25 minutes The students will remain in the same groups when they get outside. Students will place planets on the ground according to the measurements provided at the top of the worksheet. They must measure the distances using the paper meter stick. Once the "planets" are placed the jumper will begin to jump to planets based on the clues given on the worksheet. The jumps will be recorded and at the end of the activity go over how many jumps it should have taken on average to get to each planet. Once the discussion is over move on to the evaluate activity. **25 MINUTES TOTAL**	**Once the students have completed the jumps ask each group how many jumps it took them to get to each planet. They will most likely have different jump amounts for each planet and that is okay. Have a discussion on the amount it should have taken and explain that one very large jump is roughly equal to one meter.** **This means depending on the size of their jumps their number may be higher or lower than the correct estimate.** **This can spark a discussion. Once the discussion is over move on to the evaluate activity.**
Activity 4: Beach ball activity Duration: 22 minutes Have the students split into two groups (1 group of 12 (groups 1-4), 1 group of 13 (groups 5-8) *with a teacher in each group). There will be a beach ball with questions about the planets (information we have gone over already) and about themselves. We will toss the ball around and have each student answer at least one question. **12 minutes** Students will collect the materials and go inside. Once we are in the classroom the materials will be put away. **10 minutes** **22 MINUTES TOTAL**	

SCALE FACTORS

BELL-RINGER



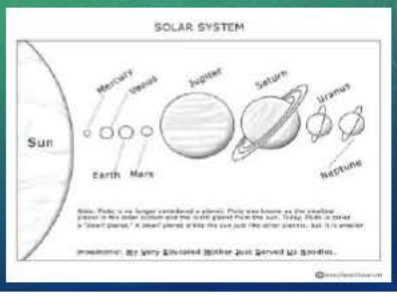
Word Bank: Sun, Neptune, Mars, Earth, Saturn, Jupiter, Uranus, Mercury, & Venus

TIMER

https://www.online-stopwatch.com/countdown-timer/

*Set the timer for four minutes.

CORRECT BELL-RINGER ANSWERS



MNEMONIC DEVICE

- What is a mnemonic device?
- Mnemonic device example:

My Very Educated Mother Just Served Us Noodles

Do you see anything wrong with the order of planets?

You try!

Make a mnemonic device to remember the planets in our solar system in order from the sun.

- Mercury
- Venus
- Earth
- Mars
- Saturn
- Jupiter
- Uranus
- Neptune

Write the correct order in your notebook!

MNEMONIC DEVICE

- You will have three minutes to create your own mnemonic device.

TIMER

https://www.online-stopwatch com/countdown-timer/

*Set the timer for three minutes.

MNEMONIC DEVICE

- You will have four minutes to discuss with your group to pick your favorite mnemonic device or create a new one.

TIMER

https://www.online-stopwatch com/countdown-timer/

*Set the timer for four minutes.

MNEMONIC DEVICE

- You will have three minutes for your group to present the chosen mnemonic device.

TIMER

https://www.online-stopwatch.com/countdown-timer/

*Set the timer for three minutes.

SCALE FACTORS – FOOD EDITION

- As a group you must decide which piece of food represents each planet, provide an explanation on why you chose that piece of food, and write answers on the worksheet.
- Pick a popsicle stick with a number on each for this activity.
- We will go over the roles next.

SCALE FACTORS – FOOD EDITION

**ROLES: (Groups with 3 members)
-1: Writer—records answers
-2: Inspector & Planet Model—the person that goes up to look at the fruits & places the fruit in the correct spot when planet is called
-3: Representative—person who raises hand when voting & provides fruit choice

**ROLES: (Group with 4 people)
-1: Writer—records answers
-2: Inspector —the person that goes up to look at the fruits
-3: Representative—person who raises hand when voting & provides fruit choice
-4:Planet Model—places the fruit in the correct spot when their planet is called

SCALE FACTORS – FOOD EDITION INSTRUCTIONS

- The "Inspector" is the only student allowed to go to the front of the room and look at the fruit up close.
- Once the group has chosen a food item for a planet the "Writer" will write your answers on the worksheet.
- We will go over the order. When each planet is named the group that was assigned to it must have their "Representative" provide reasoning for the piece of food chosen.
- If the class agrees then the "Planet Model" will place the food item in the correct spot at the front of the classroom.

**If another group picked the same fruit for their planet, we will have a debate and as a class decide which fruit is the best choice. The "Representative" will give the group opinion for each group.

TIMER

https://www.online-stopwatch.com/countdown-timer/

*Set the timer for twenty-five minutes.

GET READY TO GO OUTSIDE!

**ROLES: (Groups with 3 members)
1- Gatherer & Writer: gather PLANET sticky name tags, meter stick, "Jump to Mars" worksheet, a pencil, and read worksheet/count & record the number of jumps
2- Measurer: Measure the planet distances & place PLANET sticky name tags
3- Jumper: Jump the distances

**ROLES: (Group with 4 people)
1- Gatherer: gather PLANET sticky name tags, meter stick, "Jump to Mars" worksheet, and a pencil
2- Measurer: Measure the planet distances & place PLANET sticky name tags
3- Jumper: Jump the distances
4- Writer: Read worksheet/count & record jumps

GET READY TO GO OUTSIDE!

You will have three minutes to review the worksheet and instructions.

TIMER

https://www.online-stopwatch.com/countdown-timer/

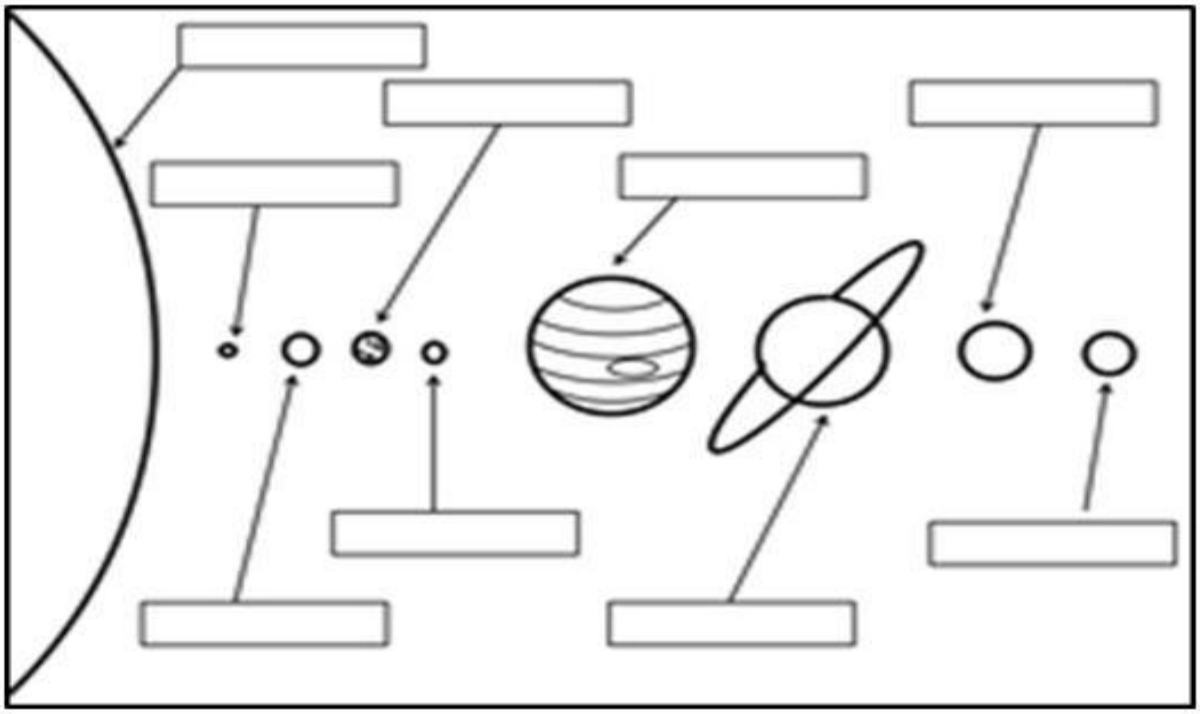
*Set the timer for three minutes.

GET READY TO GO OUTSIDE!

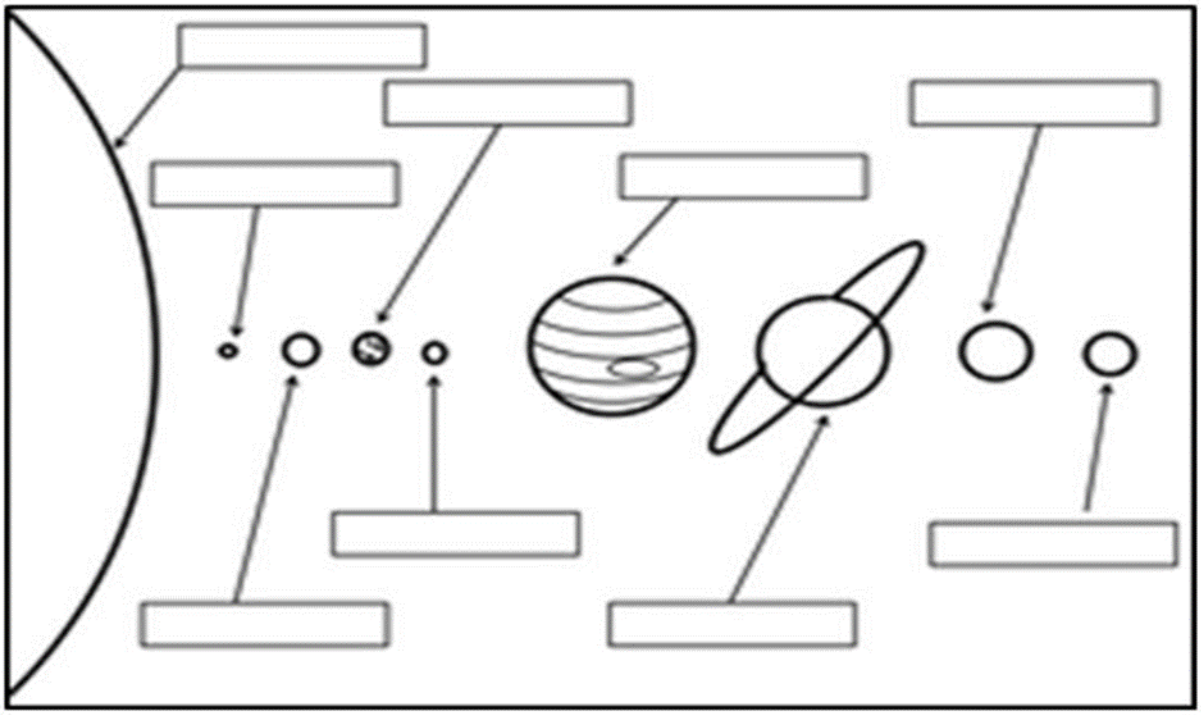
Do you have any questions about the activity before we go outside?

GET READY TO GO OUTSIDE!

LET'S GO OUTSIDE!
REMEMBER TO GRAB ALL OF THE MATERIALS NEEDED.



Word Bank: Sun, Neptune, Mars, Earth, Saturn, Jupiter, Uranus, Mercury, & Venus



Word Bank: Sun, Neptune, Mars, Earth, Saturn, Jupiter, Uranus, Mercury, & Venus

Scale Factors of Planets- Food Edition

Planet	Object	Justification
Mercury		
Venus		
Earth		
Mars		
Jupiter		
Saturn		
Uranus		
Neptune		

"JUMP TO MARS"
Names of group members:

The chart below provides the distances of planets. Make sure you measure carefully using the meter stick. You will need to use large jumps in this activity. When writing the total of jumps from one planet to the next you must add all the previous jump totals from the starting point.
Example: Total jumps to planet 1 from the starting point = 4, and it took 8 jumps to get to planet 2 from planet 1. The total jumps to get to planet 2 from the starting point is 12.

	Scaled Average Distance from Sun (reduced by a factor of 10 billion)
Starting Point	0 m
Planet 1	5.8 m
Planet 2	10.8 m
Planet 3	15.0 m
Planet 4	22.8 m

I'm the one star in your solar system. Everything revolves around me. Some may say I'm egocentric. Just guess my name to start this game, Then you may surely enter……	Star's Name: _____ Total Jumps: _____
I'm a small gray planet closest to the sun. My name is _____	Total Jumps: _____
I'm the second planet to the sun and some say the sister planet to Earth. I am named after the Roman goddess of love & beauty. It reaches almost 900 degrees here! My name is _____	Total Jumps: _____
I am home to billions just like you. From space I look green and blue. I had an entire day dedicated to me in April. _____	Total Jumps: _____
I'm reddish-rust, with rocks and dust And a 24-hour day. I'm _____ and there are many movies about people using space travel to come my way.	Total Jumps: _____

Answers for JUMP TO MARS: Teacher's copy

	Scaled Average Distance from Sun (reduced by a factor of 10 billion)	Approximate Total Number of Jumps from Sun
Sun	0 m	0
Mercury	5.8 m	6
Venus	10.8 m	11
Earth	15.0 m	15
Mars	22.8 m	23

***At the end of the activity ask the groups what the order of the planets should be and how many jumps it took them to get to each planet.**
They will most likely have different jump amounts for each planet and that is okay. Have a discussion on the amount it should have taken and explain that one large jump is roughly equal to one meter. This means depending on the size of their jumps their number may be higher or lower than the correct estimate.

**Questions for the beach balls:

1) What is the largest planet in our Solar System?
2) What happens to the temperature as you travel away from the sun?
3) How long do you think it would take to get to Mars? (300 days when Mars is at its closet point)
4) Are the planets really in a straight line like they are in this activity?
5) What is your dream job?
6) What is your favorite TV show?
7) What is the coolest adventure you have been on?
8) Why did you want to participate in this camp?
9) Do you have any pets?
10) If you could have an endless supply of any food what would it be?
11) What is your favorite thing to do in the summer?
12) If there was a movie made about your life, who would play you?

Lesson Plan

Name of Lesson: Planet Composition: atmosphere, weather, and geology

Learning (TEKS) Objective:

- 112.19 Earth & Space Science 7th grade (b)

(9) Earth and space. The student knows components of our solar system. The student is expected to:

(A) **analyze the characteristics of objects in our solar system** that allow life to exist such as the **proximity of the Sun**, presence of water, and **composition of the atmosphere;**

Student Outcome (*Students will be able to…)*

- Students will understand the similarities and differences between Earth and Mars.

Day of the Week and Time:

- Monday @ 11:30-12:30 pm

Total Length of Lesson:

- 55 minutes

Materials *(per 1 class of 25 students):*

- 25 Computers with internet access
- 25 foldables
- 25 pencils
- Whiteboard
- 25 instructions sheets
- 12 whiteboard markers (black, red, dark green, dark blue, purple, pink, orange, brown, light green, yellow, light blue, maroon)

Advanced Preparation *(day before, morning of…)*

- Draw a T-chart on the whiteboard: one side labeled Earth and the other Mars
- Have the PowerPoint projected on the board
- Have the foldables already folded

Instructional Delivery	**Notes to Teacher:**
Activity 1: Intro & T-chart Duration: 14 minutes Walk around and pass out the foldable as you introduce the topic. Once each student has their foldables you are going to want to write the titles and walk around to show them what the foldable should look like. Ask students to think about what they know about Earth and Mars. The students will write their facts about each planet on the front of the foldable. Think-pair-share method will be used. Once they are done writing their facts have them pair-up with a partner and share their information. (Students will remain paired-up. There may be one group of three students.) **7 minutes** As a class compare Earth and Mars on the whiteboard in the classroom using a T-chart. The students will utilize the "rainbow brain drop" method, where each pair of students will be given a different color and must write at least two facts about each planet on the board. (Assign half of the pairs to write facts on Earth 1st and the	**You are going to want to write the titles on the paper and walk around the room, so they know exactly what to do.** **Walk around the room and give each pair a different color of marker and each student a laptop (sit it to the side) while they discuss their facts.** **Tell them they can go up to the board as soon as they have two important facts.**

other half to write facts about Mars, then switch. **7 minutes**	
Activity 2: Foldable Activity **Duration: 35 minutes** Students will each use a computer to access: https://mars.nasa.gov/#red_planet/2 & https://solarsystem.nasa.gov/planets/earth/in-depth/ . Tell each student to open the foldable from the bell ringer and use it to gather information from the website on both planets. *Instructions: Students will access each website and record information on the inside of the foldable provided. The headers you will search for to find the information needed on each website are in **bold**. **Mars: ● What is the distance from the sun? **(Click "Dashboard")** ● What is the weather in °F and °C right now? Provide high and low. **("Dashboard")** ● What is the Atmosphere composed of? List them. **(Click on "Atmosphere")** ● How many Martian Moons are there? Name them and provide what the names mean. **(Click "The Planet" then "Martian Moons")** ● Name four facts about geology that Earth and Mars have in common. **(Click on "The Planet" then "Geology")** ● Name three geological facts Mars has that Earth doesn't. **("Geology")** ● Write down at least three Mars facts. **(Click on "The Planet" then "Mars facts—Find out more")** ● How many days are in a year? **("Mars Facts—Find out more")** **Earth ● What type of planet is Earth? **(Quick Facts)** ● How many days are in a year? **(Quick Facts)** ● What does the word "Earth" translate to? ● What is Earth's distance from the sun? Provide miles, kilometers, & AU. **(Size and Distance)** ● What is Earth's tilt in degrees? **(Orbit and Rotation)** ● What percentage of Earth's surface is covered in water? **(Kid-Friendly Earth)** or **(Surface)** ● What is the atmosphere composed of? **(Atmosphere)** ● Name one fact about Earth that you didn't already know. Now that the students have completed the exploration, we will look at the board and go over the answers they wrote down. If they decide they want	**Provide the instructions clearly. State that this is an individual and silent activity.** **Tell the students to once again write Earth on one side and Mars on the other. You must explain that the middle section is where the information that Earth and Mars share should be placed.**

to take something off/add and clear up any misconceptions.	
Activity 3: Questions about these planets Duration: 8 minutes	**If there is time have a few students answer the questions aloud once everyone has finished and put everything away.**
Students will be given a quick quiz at the end of the lesson to see if they can answer 3 questions about Earth & Mars. They will write their answers in their notebooks and begin to cleanup- put away computers, foldables, & return markers. QUESTIONS TO ANSWER: *Now that you know the facts about Earth and Mars, do you think there could be life on Mars? *Earth and Mars are what type of planets? *What is one of the most interesting facts about Mars that you learned today? **8 minutes**	

PLANET COMPOSITION

BELL- RINGER ACTIVITY

What do you know about Earth and Mars?

I want you to write facts about each planet on the front of the foldable.

*One flap of the foldable will be labeled Earth and the other side Mars.

You will have four minutes to write your facts.

TIMER

https://www.online-stopwatch.com/countdown-timer/

*Set the timer for four minutes.

THINK-PAIR-SHARE

Pair-up with the person next to you and discuss the facts you wrote down.

If your partner has a fact you would like to add to your own foldable go ahead and add it.

You will have three minutes to discuss with your partner.

TIMER

https://www.online-stopwatch.com/countdown-timer/

*Set the timer for three minutes.

T-CHART

As a class we will compare Earth and Mars on the whiteboard using a T-chart.

Each pair of students must write at least two facts about each planet on the board.

(Half of the pairs write facts on Earth 1st and the other half write facts about Mars, then switch.)

TIMER

https://www.online-stopwatch.com/countdown-timer/

*Set the timer for seven minutes.

ACCESS WEBSITES

Students will each use a computer to access:

https://mars.nasa.gov/#red_planet/2 &

https://solarsystem.nasa.gov/planets/earth/in-depth/ .

INSTRUCTIONS

You will select a laptop, login, and access each website. Once you have accessed the websites you will record information on the inside of the foldable used for the bell-ringer.

Open the foldable and write Earth on one side and Mars on the other.

The headers you will search for to find the information needed on each website are in bold.

QUESTIONS TO ANSWER:

**Mars

- •You must include at least three **(Mars facts—Find out more)**
- •How many days are in a year? **(Mars Facts—Find out more)**
- •Four facts about Geology that Earth and Mars have in common
- •Three Geological facts the Mars has different than Earth
- •How many Martian Moons are there? Name them.
- •What is the Atmosphere composed of? List them.
- •What is the distance from the sun? **(Click Dashboard button)**
- •What is the weather in °F and °C right now? **(Dashboard)**

QUESTIONS TO ANSWER:

**Earth

- What type of planet is Earth? **(Quick Facts)**
- How many days are in a year? **(Quick Facts)**
- What does the word "Earth" translate to?
- What percentage of Earth s surface is covered in water? **(Kid-Friendly Earth)** or **(Surface)**
- What is Earth s distance from the sun? Provide miles, kilometers, & AU. **(Size and Distance)**
- What is the atmosphere composed of? **(Atmosphere)**
- What is Earth s tilt? **(Orbit and Rotation)**
- Name one fact about Earth that you didn t already know.

TIMER

https://www.online-stopwatch.com/countdown-timer/

*Set the timer for 30 minutes.

LET'S DISCUSS YOUR ANSWERS

Now that you have researched Earth and Mars, is there any information you want to change, add, or remove from the T-chart we created earlier?

QUESTIONS TO ANSWER IN YOUR NOTEBOOK

1. Now that you know the facts about Earth and Mars, do you think there could be life on Mars?
2. Earth and Mars are what type of planets?
3. What is one of the most interesting facts about Mars that you learned today?

TIMER

https://www.online-stopwatch com/countdown-timer/

*Set the timer for 5 minutes.

PUT EVERYTHING AWAY

Once you are done answering the three questions please put away the computers, markers, and your foldables.

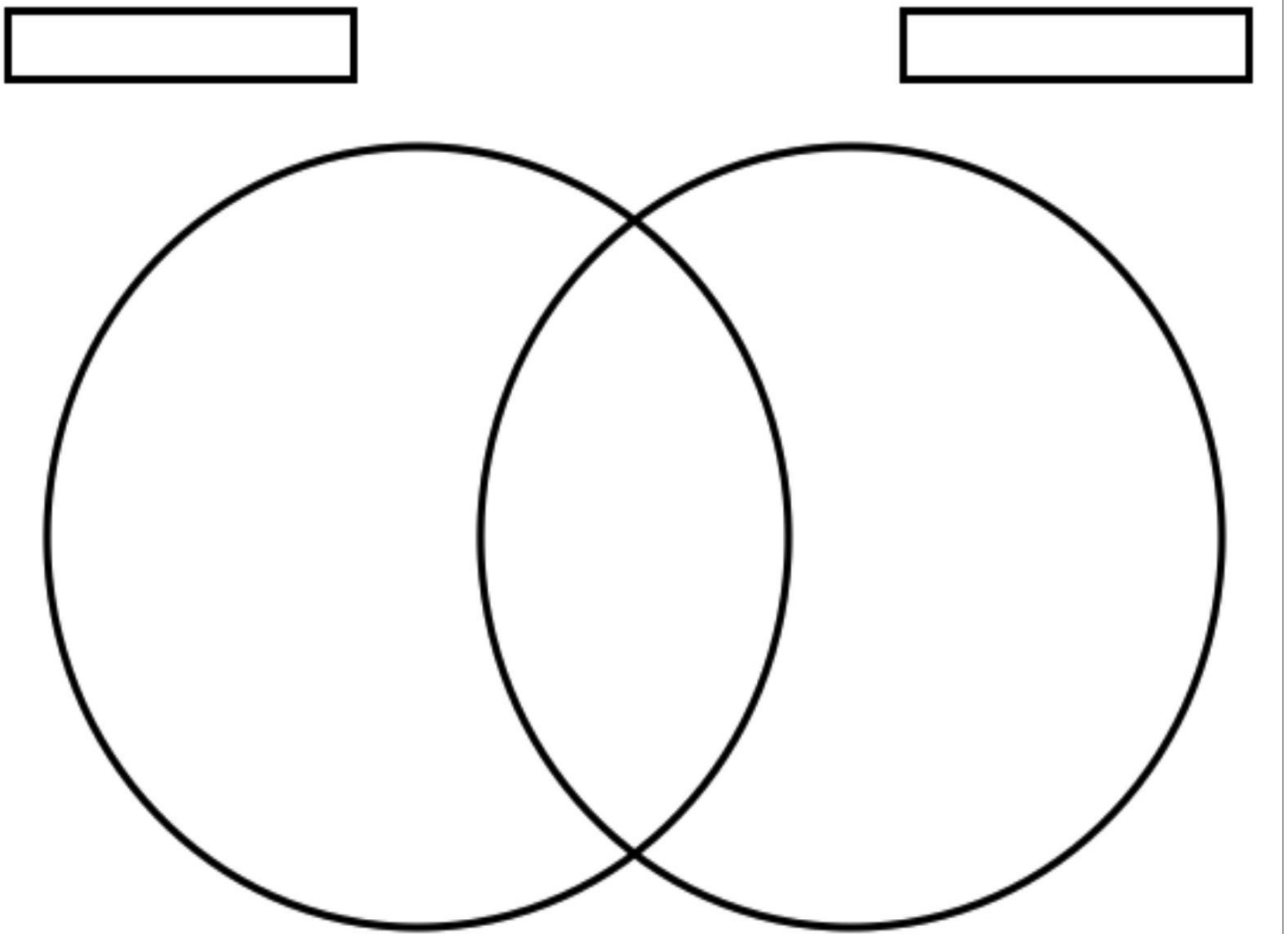
Students will access each website and record information on the inside of the foldable provided. The headers you will search for to find the information needed on each website are in **bold**.

**Mars:

- What is the distance from the sun? **(Click "Dashboard")**
- What is the weather in °F and °C right now? Provide high and low. **("Dashboard")**
- What is the Atmosphere composed of? List them. **(Click on "Atmosphere")**
- How many Martian Moons are there? Name them and provide what the names mean. **(Click "The Planet" then "Martian Moons")**
- Name four facts about geology that Earth and Mars have in common. **(Click on "The Planet" then "Geology")**
- Name three geological facts Mars has that Earth doesn't. **("Geology")**
- Write down at least three Mars facts. **(Click on "The Planet" then "Mars facts—Find out more")**
- How many days are in a year? **("Mars Facts—Find out more")**

**Earth

- What type of planet is Earth? **(Quick Facts)**
- How many days are in a year? **(Quick Facts)**
- What does the word "Earth" translate to?
- What is Earth's distance from the sun? Provide miles, kilometers, & AU. **(Size and Distance)**
- What is Earth's tilt in degrees? **(Orbit and Rotation)**
- What percentage of Earth's surface is covered in water? **(Kid-Friendly Earth)** or **(Surface)**
- What is the atmosphere composed of? **(Atmosphere)**
- Name one fact about Earth that you didn't already know.



Lesson Plan

Name of Lesson: Coding (Scratch) - Day 1

Learning (TEKS) Objective:

Technology Applications (8.1.B) and Art (8.2.A)

Technology Applications: The student is expected to: create, present, and publish original works as a means of personal or group expression.

Art: The student is expected to: create artworks integration themes found through direct observation, personal experience, and imagination.

Student Outcome (*Students will be able to…)*

Students will be able to understand and create art that will lead them to have a deeper understanding of how coding is a precise sequence of instructions.

Day of the Week and Time:

Monday on the last hour before leaving.

Total Length of Lesson:

This lesson will take 1 hour to complete.

Materials *(per 1 class of 30 students):*

30 pieces of paper where students will write a program as well as draw (on their notebooks)

30 pencils used to write program

30 color pencils packs to help the students color their drawing

Instructional Delivery	**Notes to Teacher:**
Activity 1: Engage **Duration: 5 min**	**Use guided open-ended questions to lead the students to the desire information.**
The teacher begins by asking the class if anybody ever heard about programming and robotics. What is a robot? Does a robot really understand what people say? What about coding? The students speak about their experiences and their opinions. The teacher concludes the lesson by specifying that robots and coding are created with ***precise sequence of instructions***. During this time also mention the coding needed to go into space. EX: "NASA uses many languages and it varies on the basis of its uses and where it is used. The programmes written for some calculation and for some scripting are written in mostly using **python**. The programmes for ground instruments and ground control are written using C"	

EX: “Margaret Hamilton was responsible for the **code** that took us to the **Moon!** Also, Katie Bouman was responsible for the code that got us the first ever picture of a black hole this year!”	
Activity 2: Explore Duration: 10 min The teacher introduce the activity and explains to the pupils that they are going to guide each other toward making drawings without letting the others see the original image; some children will pretend to be a drawing machine. Maybe do a small example with them.	**Model the activity.**
Activity 3: Explain Duration: 15 min Students in pairs. Each pair choose an two images from the worksheet (image has to do with something in space. EX: Star, Planet, Rocket, etc.). The students will decide individually the algorithm and then the “program” code for other student to draw.	**During this activity students in pairs are only writing precise instructions.**
Activity 4: Elaborate Duration: 15 min Students swap programs with their partner and draw one another's image	**Students will now draw the image of their partner in this activity.**
Activity 5: Evaluate Duration: 15 min Show there work and Discuss about their experience and reflections on precise sequence of instructions.	**Students will present now.**

Lesson Plan

Name of Lesson: Coding (Scratch) - Day 2

Learning (TEKS) Objective:

Technology Applications (8.1.B) and Art (8.2.A)

Technology Applications: The student is expected to: create, present, and publish original works as a means of personal or group expression.

Art: The student is expected to: create artworks integration themes found through direct observation, personal experience, and imagination.

Student Outcome (*Students will be able to…)*

Students will be able to understand and explore a coding website that will lead them to have a deeper understanding of coding.

Day of the Week and Time:

Tuesday on the last hour before leaving.

Total Length of Lesson:

This lesson will take 1 hour to complete.

Materials *(per 1 class of 30 students):*

30 printed pieces of paper for entrance ticket

30 pieces of paper for vocabulary foldable

30 pencils used to write

30 color pencils packs to help the students color

30 notecards used to write down information about scratch

30 laptops for scratch

Advanced Preparation *(day before, morning of…)*

Make sure that all laptops work and are charged. Make sure you have the entrance ticket paper printed.

Instructional Delivery	**Notes to Teacher:**
Activity 1: Engage **Duration: 15 min**	**Groups of 4 needed**
The lesson will begin by having the students work independently in a coding puzzle (attached). However when every student from a group of 4 come together with their independent solved puzzle it should form the word code. This is an entrance ticket.	

https://www.teacherspayteachers.com/Product/Hour-of-Code-Coding-Puzzles-Unplugged-2910169	
Activity 2: Explore **Duration: 7 min** A random group will be picked to come up to the front of the classroom and show their puzzle and explain how they got it. (Discussion to see if everyone got the same answer).	**You can do 1 or 2 groups of presentation depending on how long the students take during presentation.**
Activity 3: Explain **Duration: 15 min** The teacher will handout pieces of paper for foldable which students will use to write down some basic coding vocabulary that the teacher will explain. Vocabulary words: code, block-based programming, loop, input, output, run a program. I will attach a PowerPoint on google drive.	Foladable was arelady made for every student.
Activity 4: Elaborate **Duration: 15 min** Now the teacher will introduce Scratch to the class and will have the whole class create their own Scratch account. Have the students write down their Name, Username, and Password in a Notecard that they will give to the teacher just in case they forget it the next few days. All students should have the same password and similar usernames: Usernames: Initial of first name and if they have a middle name initial could be included and last name EX: imfalcon or ifalcon Passwords: **CodingSpace#1**	Scratch Website: https://scratch.mit.edu/ Video to help demonstrate how to sign into Scratch: https://www.youtube.com/watch?v=SB-NbFBE1HM
Activity 5: Evaluate **Duration: 8 min** Students will now explore the website and see some specific tutorials to get to know how to use the website. They should start choosing one tutorial for the next lesson.	Some good tutorials: https://scratch.mit.edu/projects/editor/?tutorial=all (Make sure to create an account yourself to be able

Tutorials to tell them to look up and choose one from these: Make a Clicker Game, make a chase game, animate a character, and create a story. This tutorials for them to look up will be in a PowerPoint as a list to show them and as well as they should write them on their notebook as check them off as they complete (tell them to write a one to two sentence summary about them in their notebook). **The PowerPoint will be on google drive and it will its called** **Tutorials.**	to open up all the links)

CODING VOCABULARY

CODE

The language that programmers create and use to tell a computer what to do.

BLOCK-BASED PROGRAMMING

Any programming language that lets users create programs by manipulating "blocks" or graphical programing elements, rather than writing code using text.

LOOP

The action of doing something over and over again.

INPUT

A way to give information to a computer.

OUTPUT

A way to get information out of a computer.

RUN PROGRAM

Makes the computer execute the commands you've written in your program.

TUTORIALS TO LOOK AT

REMEMBER TO PICK ONE OF THESE AT THE END TO WORK ON TOMORROW

TUTORIALS

- ❑ Make a Clicker Game
- ❑ Make a Chase Game
- ❑ Animate a Character
- ❑ Create a Story

Lesson Plan

Name of Lesson: Coding (Scratch) - Day 3

Learning (TEKS) Objective:

Technology Applications (8.1.B), Technology Applications (8.1.A), Art (8.2.A), Music (8.1.B)

Technology Applications: The student is expected to: create, present, and publish original works as a means of personal or group expression.

Technology Applications: The student is expected to: identify, create, and use files in various formats, including text, raster and vector graphics, video, and audio files.

Art: The student is expected to: create artworks integration themes found through direct observation, personal experience, and imagination.

Music: The student is expected to: describe in detail intervals, music notation, musical instruments, voice, and musical performances, using standard terminology.

Student Outcome (*Students will be able to…)*

Students will be able to understand and explore a coding website that will lead them to have a deeper understanding of coding.

Day of the Week and Time:

Wednesday on the last hour before leaving.

Total Length of Lesson:

This lesson will take 1 hour to complete.

Materials *(per 1 class of 30 students):*

30 printed pieces of paper for entrance ticket

30 pencils used to write

30 color pencils packs to help the students color

30 laptops for scratch

Advanced Preparation *(day before, morning of…)*

Make sure that all laptops work and are charged. Make sure you have the entrance ticket paper printed.

Instructional Delivery	**Notes to Teacher:**
Activity 1: Engage **Duration: 15 min**	

The lesson will begin by having the students work independently in a coding maze which works as entrance ticket.	**The coding maze I created for this lesson will be on google drive.**
Activity 2: Explain **Duration: 35 min** Students will now work on creating a code by following one of the tutorials they saw last lesson. Instructions on how to follow a tutorial will be on a PowerPoint. **You can find it on google drive and its called Tutorial Instructions.**	**If the students finish early you can have them do this:** Additionally students will find a space themed coding on scratch and will do specific edits (chose by the teacher) to see how it affects the code. These specific edits will also be in the PowerPoint.
Activity 3: Evaluate **Duration: 10 min** Some random students will show their coding and discuss it in front of the whole classroom.	**Students will present now.**

Name: _____
Date: _____

CODING MAZE

			FINISH		
					
					
					
	START				

Command	Color
Move Right -----→	Color the Square Red
Move Left ←-----	Color the Square Blue
Move Up	Color the Square Yellow
Move Down	Color the Square Green
FINISH	Color the Square Purple
START	Color the Square Orange

TUTORIAL INSTRUCTIONS

1. Open the tutorial you chose from yesterday.
2. Split your screen in half with the tutorial opened in one side and your code on the other side.
3. Look and listen to the tutorial when the tutorial does a single activity pause it and do it yourself on your code.
4. Continue Step 3 with every single activity the tutorial does until your code is done.

FINISHED EARLY?

If you finished early with your tutorial do the following activity:

1. On scratch look up a space code and choose one.
2. Now click on the "See inside" button
3. Now edit the code with the following edits.
4. EDIT 1: Go into sounds and edit the sound or sounds.
5. EDIT 2: Click on a character then click on costumes and edit the character.
6. EDIT 3: Click on stage and then click on backdrops and edit the backgrounds.

Lesson Plan

Name of Lesson: Coding (Scratch) - Day 4

Learning (TEKS) Objective:

Technology Applications (8.1.B), Technology Applications (8.1.A), Art (8.2.A), Music (8.1.B)

Technology Applications: The student is expected to: create, present, and publish original works as a means of personal or group expression.

Technology Applications: The student is expected to: identify, create, and use files in various formats, including text, raster and vector graphics, video, and audio files.

Art: The student is expected to: create artworks integration themes found through direct observation, personal experience, and imagination.

Music: The student is expected to: describe in detail intervals, music notation, musical instruments, voice, and musical performances, using standard terminology.

Student Outcome (*Students will be able to…)*

Students will be able to understand and explore a coding website that will lead them to have a deeper understanding of coding.

Day of the Week and Time:

Thursday on the last hour before leaving.

Total Length of Lesson:

This lesson will take 1 hour to complete.

Materials *(per 1 class of 30 students):*

30 printed pieces of paper for entrance ticket

30 pencils used to write

30 color pencils packs to help the students color

30 laptops for scratch

Advanced Preparation *(day before, morning of…)*

Make sure that all laptops work and are charged. Make sure you have the entrance ticket paper printed.

Instructional Delivery	**Notes to Teacher:**
Activity 1: Engage **Duration: 15 min**	

The lesson will begin by having the students work independently in a retrieve coding puzzle.	**The retrieve puzzle I created for this lesson will be on google drive.**
Activity 2: Explain **Duration: 25 min**	**The coding instructions I created for this lesson will be on google drive.**
Each student will be given a paper with the basic instructions of a code they will create. This will have students all create the same code but with their own personal changes that will make it have their personality like background changes or character changes. Code students will create with their own changes: https://scratch.mit.edu/projects/294447533/	
Activity 3: Elaborate **Duration: 20 min**	**Students can look up (tutorials from scratch) anything to help them accomplish their goals.**
Students will now have time to edit anything else they want to include into the space survival game code.	

Name: _____
Date: _____

Retrieve Space Coding

KEY:

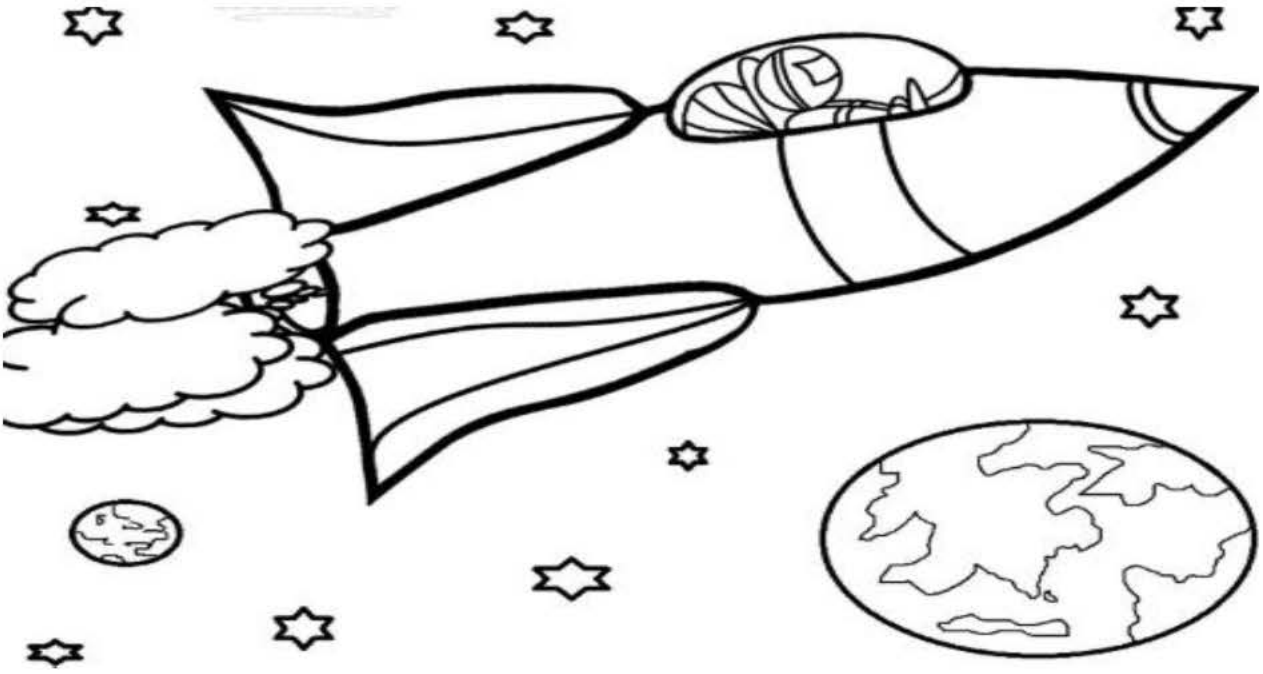
1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M

14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Problems:

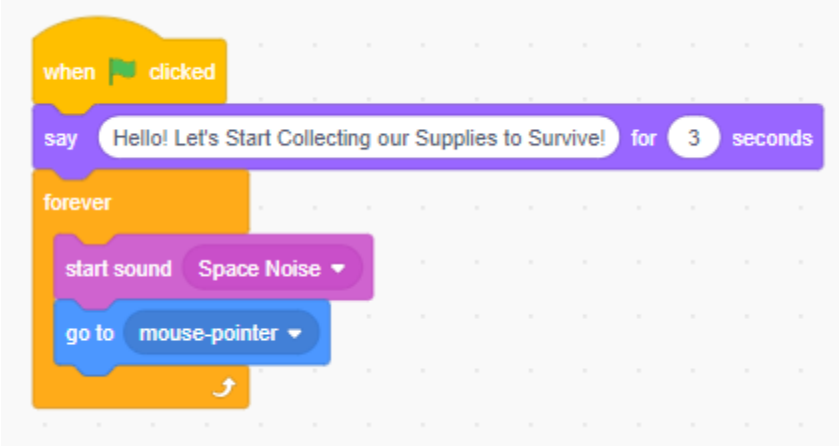
16	8	4	2	1
0	1	1	0	1
0	0	0	0	1
1	0	0	1	0
1	0	0	1	1

16	8	4	2	1
1	0	0	1	1
1	0	0	0	0
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1

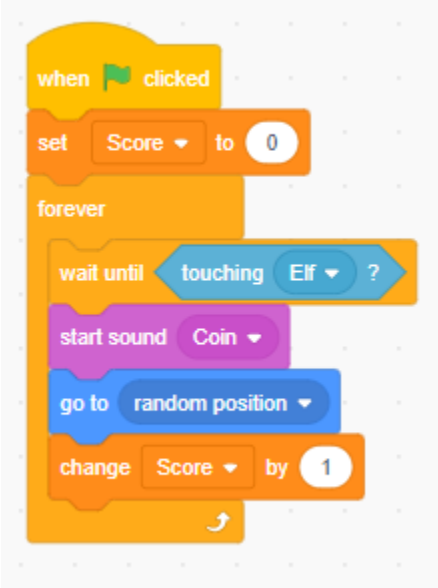


Coding: Space Survival Game

1. First, choose a space themed background. 
2. Second, delete the cat character from the coding (unless you want the cat to be your character for the game).
3. Third, choose a character for your game. 
4. Fourth, input the following code into your character.



5. Fifth, go back into the coding and add another character in this case you will look for survival items like food. 
6. Sixth, if desired adjust your survival item to make it smaller.
7. Seventh, input the following code into you your survival item.



8. Eighth, repeat step 5 through step 7 at least 2 more times (more if you desire).

Finally, don't forget to title and save your code!

Lesson Plan

Name of Lesson: Body Systems Stations

Learning (TEKS) Objective:

- **Biology (7.12 B) "Students will understand the relationship between living organisms and their environment."**
- **Biology (112.34.c.10) "The student is expected to describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals."**

Student Outcome (*Students will be able to…)*

- **Students will be able to explore the major body systems by creating visual representations of each. Students will also explore how each body system would be affected by space and anti-gravity.**

Day of the Week and Time:

- **Tuesday 9:15 am-10:15 am**

Total Length of Lesson:

- **1 hour**

Materials *(per 1 class of 25 students):*

- ***30 Sheets of paper for foldables***
- ***30 sheets of cardstock***
- ***Pre-cut construction paper (red, white, brown)***
- **Straws (60, 2 per student)**
- **Water balloons (60, 2 er student)**
- **Red licorice strands (60, two per each student)**
- **Fruit Loops (1 gallon size bag)**
- **Gummy Life Savers (1 large bag + 1 small bag)**
- **Oven mitts (2 total)**
- **Filled balloons (4 total) (2 sets of 4)**
- **30 toothpicks**
- **Container of modeling clay**
- **Task cards for each station (8 total) (2 sets of the 4 stations)**
- **Marker boxes w/scissors and glue**
- **Tape dispenser**
- **projector with laptop for PP**

Advanced Preparation *(day before, morning of…)*

- **Make sure that each station has enough resources for up to 30 students to participate**
- **30 Foldables and:**
  - **Respiratory System: 60 water balloons, 60 bendy straws, bundle of pre-cut construction paper, 5 scissors**
  - **Nervous System: ballon w/ rice, balloon w/ beans, balloon w/ flour, balloon w/ sand, oven mitt**
  - **Circulatory System: 1 pack of modeling clay, 30 toothpicks**

○ **Skeletal System: 30 twizzler pull-a-parts, big size bag of lifesavers, big size bag of fruit loops**	
Instructional Delivery	**Notes to Teacher:**
Opening **Duration: quick, 2 minutes** • **Begin the lesson by asking students what major body systems they are aware of and their purposes** • **Instruct the students that they will have 12 minutes at 4 different stations in which they will be able to create visual representations of body systems.** • **Tell them to think about how a lack of gravity might affect these systems as they go through the stations.** • **Let the students know that they will be answering questions at each station on their foldables.** *****Grouping: we are going to double the number of stations. So there will be 2 sets of the 4 stations going on at the same time, to reduce the number of kids at each.**	*Let the students know that you will be having a discussion with them at the end about space's effect on body systems, so if they don't know how space might affect certain systems, its okay-- just tell them to give it their best guess.*
Station 1: Nervous System **Duration: 12 minutes** • **In groups ,of 2 students will put on oven mitts and feel the different balloons to try and see if they can tell what material is inside of them** • **Next, students will take off the oven mitts and try again. The point is for students to see how much their sense of touch is dulled by the mitts (*which are meant to mimic a space suit!)*** • ***Students will record their guesses on their foldables***	*Instructions for students to complete each activity are listed on the task cards. (It is essential to read through them beforehand and have an example ready for the students to reference).*
Station 2: Circulatory System **Duration: 12 minutes** • **Each pair of students will take a small lump of modeling clay and stick one toothpick to it. They will place this on the inside of their wrist and observe how many times it "jumps" in a minute, to create a visual representation of their heartbeat.** • **Students will be prompted to think about what activities in their daily lives cause their heart rate to increase and how anti-gravity might affect their usual heart rate.**	*Students might have a little difficulty seeing the toothpick "jump" so they might have to increase their heart rate by running in place, doing jumping jacks, etc.*
Station 3: Respiratory System **Duration: 12 minutes** • **Students will be creating a small construction paper cutout of an outline of the upper part of the human body with water balloon lungs that are connected to straws. Students should be able to expand the "lungs" by blowing into the straws.** • **Students will also be prompted to consider how the effects of space might alter the way their lungs work.**	

Station 4: Skeletal System **Duration: 12 minutes** ● **In this station, students will be creating a spinal cord with twizzlers, gummy lifesavers and fruit loops.** ● **Students will string gummy lifesavers and fruit loops on the twizzler strand in an alternating pattern.** ● **Students will be instructed to create a second spinal cord with only fruit loops, to illustrate the importance of intervertebral discs (to provide cushion)** ● **Explain to students that the lifesavers are like intervertebral discs that provide cushion and flexibility; fruit loops are like vertebral discs that provide structure and rigidity.** ● **Students will be prompted to consider how space might affect their skeletal system**	
Closing Discussion **Duration 5-7 minutes** ● **Instructor will show PowerPoint on the effects of space on the human body systems and discuss them with students to see if they hypothesized correctly.** **Students will complete their foldable.**	

EFFECTS OF SPACE ON THE HUMAN BODY

RESPIRATORY SYSTEM

On Earth:

- Provides oxygen to all the other major body systems
- Takes in O2 releases CO2

In Space:

- Low concentrations of oxygen can cause black outs
- Special machines must be used to supply oxygen to the space ship
- Lungs eventually adapt to the new levels of oxygen

NERVOUS SYSTEM

On Earth:

- Provides communication between our body and the outside environment

In Space:

- Because a suit needs to be worn for protection astronauts cannot have their sense of touch
- Could you still tell what was in the balloons while wearing an oven mitt?

SKELETAL SYSTEM

On Earth:

- Provides structure to the body
- Also provides protection to the rest of the organs

In Space:

- Use it or lose it!
- No pressure means bones become much weaker in space!
- Bones lose calcium
- Exercise MUST be done!

CIRCULATORY SYSTEM

On Earth:

- Heart pumps blood through veins
- Blood and nutrients get cycled throughout the body

In Space:

- Without gravity to weigh down on us blood flows more to the head
- Less pressure means heart rate is lower
- Ventricles in heart may even become smaller
- Blood pressure goes down

Respiratory System

Circulatory System

Nervous System

Skeletal System

Glue this side down into your notebooks!

☺

Respiratory System

Circulatory System

Nervous System

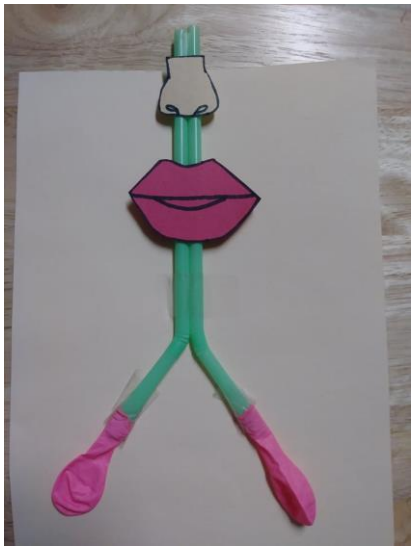
Skeletal System

Traits of System in Space:	How do you think being in space might affect the respiratory system?		Traits of System on Earth:
Traits of System in Space:	How many times did the toothpick move up in one minute? What are some daily activities that might increase your heart rate?	How do you think being in space might change the way your heart beats?	Traits of System on Earth:
Traits of System in Space:	Guess what is in each balloon (while wearing oven mitts) 1. 2. 3. 4.	Guess what is in each balloon (without oven mitts) 1. 2. 3. 4.	Traits of System on Earth:
Traits of System in Space:	Which spinal cord was easier to bend? Which spinal cord would be better to have? Why?	What affect do you think space would have on the skeletal system?	Traits of System on Earth:

Respiratory System

In this station, each student will take a sheet of cardstock, construction paper, tape, 2 straws and 2 balloons to create a model of the respiratory system.

Straws = **Trachea** Balloons = **Lungs**



Instructions:

1. Take construction paper and draw a nose and mouth. Cut these out and set aside.
2. Lay down two straws next to each other, facing away from each other. (bendy part down). Tape these together.
3. Tape the balloons to the end of each straw. Make sure the tape is tight around the straw.
4. Tape the straws down to the cardstock.
5. Take your nose and mouth cut outs and tape them to the straws
6. Your model is complete! Try expanding the "lungs" by blowing through the straws!

Questions:

1.How do you think being in space might affect your respiratory system?

Skeletal System Table

At this station, each person will pick up 1 twizzler strand, 10 lifesavers and 10 fruit loops to create a model of the **spinal cord.**

- Twizzler strand = spinal cord
- Gummy lifesavers = intervertebral discs (provide cushion)
- Fruit loops = vertebral discs (provide structure)

Instructions:

1. Take a twizzler strand and tie a knot at the end of it.
2. Add the lifesavers and fruit loops onto the strand in an alternating pattern (1 fruit loop, 1 lifesaver, 1 fruit loop, 1 lifesaver…) to make your candy spinal cord.
3. Next, take another twizzler strand and make a new spinal cord, but this time put nothing but fruit loops on it (20 fruit loops)
4. Try moving/ bending both spinal cords around.
5. You may eat your "spinal cord" when you are done!

Questions:

1. Which spinal cord was easier to bend?
2. Which spinal cord would be better to have? Why?
3. What affect do you think space would have on the skeletal system?

Nervous System Activity

In this station you will test your sense of touch (controlled by the nervous system) with a teammate. Each pair of students will take one oven mitt and a set of 4 balloons (1-4).

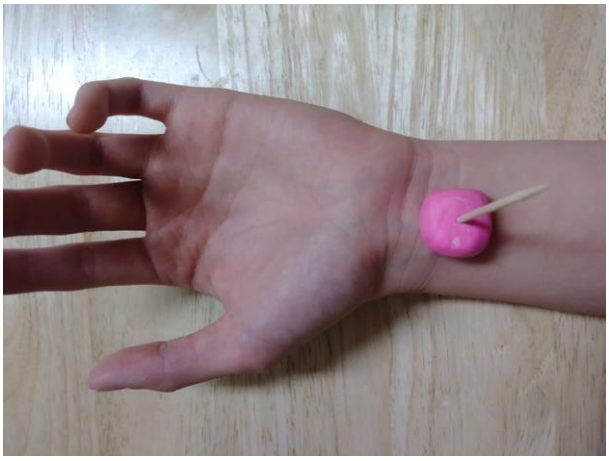
Astronauts cannot always use their sense of touch, because they have to be covered and protected by their space suits! In this activity the oven mitt will resemble a space suit.

Instructions:

1. Put on the oven mitt and try to guess what is in each of the balloons by feeling them (you have to keep the oven mitt on!).
2. Write down your guesses in your foldable.
3. Now you can take off the oven mitt and feel each balloon again.
4. Do you have a better idea of what is in each? Write your new answers in the foldable.

Circulatory System Activity

In this station, you will work with a partner to make a simple device that will make your heart beat easy to see.



Instructions:

With your partner, take a piece of clay and stick one toothpick into it.

Place this little device on the inside of your wrist. It will move up every time your heart beat pulses.

(If you are having some difficulty seeing your heartbeat, you might have to increase your heart beat by running in place.)

Questions:

1. How many times does it move up in one minute?
2. What are some daily activities that you do that might make your heart rate increase?
3. How do you think being in space might change the way your heart beats?

Lesson Plan

Name of Lesson: Can We Take It With Us?

Learning (TEKS) Objective:

- Math: 7.11(A) model and solve one-variable, two-step equations and inequalities and 7.11(B) determine if the given value(s) make(s) one-variable, two-step equations and inequalities true

Student Outcome (*Students will be able to…)*

- Students will try to find the maximum weight they can take with them on a trip following certain requirements. First students will do this by trial and error, then they will learn how to write and solve an equation that will help them solve the problem.

Day of the Week and Time:

- Tuesday @ 930am - 1030am

Total Length of Lesson:

- 1 hour

Materials *(per 1 class of 25 students):*

- 25 "Can We Take It With Us?" Worksheets
- 2 "Shopping Example" Worksheets for the teachers
- 10 cups
- Bag of skittles (each pair should have 59 skittles)

Advanced Preparation *(day before, morning of…)*

- Acquire skittles
- Make sure the worksheets are printed
- Sort out 10 cups full of skittles to place in the front of the class

Instructional Delivery	**Notes to Teacher:**
Activity 1: Intro & Student Attempt **Duration: 15 minutes** Explain to the students: "If we are going on a trip into space, not only do we have to think about the effects on our bodies but also what are we going to eat, how many people can come with us, what supplies do we need, how much is all of this going to weigh. Essentially, what can we take with us?!" Everything we take with us has weight/mass and a rocket can only carry so much! Pass out the "Can we take it with us?" sheet and go over the requirements with the students. Skittles will be at the front of the class & students will come to the front & count out 59 skittles. Students should be working with a partner to see how they can travel with the requirements given while staying within the boundaries of 59 skittles. Once students have done 1 trial, have them try again aiming to get closest to the maximum payload without going over. <u>Note</u>: Kids can eat the skittles once done with the activity. For sanitary purposes, offer the idea that students should reuse any skittles they grab the first time so numerous hands are not on all the skittles.	**Explain the importance of maximization.** **EXAMPLE STATEMENT: "If we are taking a trip to space and have limited resources, we want to maximize those resources. Space explorations are extremely expensive so we want to use everything given to us. Get as close to the maximum number as you possibly can!"**

Activity 2: Payload Equation **Duration: 30 minutes**	**Explain the importance of the inequality: meaning we can have less than 59 skittles but not more than. REITERATE maximization here!** **POSSIBLE WORDING: Everything is dependent on the number of humans the number of days they are on the trip EXCEPT THE MEDICAL KIT .** **"Each human is represented by 3 skittles so, h * 3 = 3h."**
Explain to the students that an equation can be used as a representation of their space trip. To further help their understanding of this, use the Shopping Example first as a walk-through for the coming activity. After reviewing, give the students time to try to write an equation that reflects their trip. Once they have had time to go figure it out themselves, walk them through the process of creating the equation. REMEMBER: the equation is an equality, there are 2 variables (# of days and # of humans) that need to be included and medical kits are an addition item that does not affect the # of humans/days BUT is still a requirement. - human = h * 3 - food = h * 3 * d * 1 - tools = h * 2 * 2 - medical kit = 1 * m * 5 - FINAL EQUATION = 3h + 3hd + 4h + 5m <= 59 → 7h + 3hd + 5m <= 59	
Activity 3: Students Use Equation **Duration: 15 minutes**	
Instruct the students to now use the equation to try to solve the problem and also, compare their success to the trial and error stage. - FINAL OUTCOME = 5 days, 2 humans with 3 medical kits <u>Optional</u>: Give the students a new number to try to reach & see what they come up with!	

SHOPPING LIST

1 top - $15

1 pair of pants - $30

1 pair of boots - $40

1 pair socks - $5

set of undergarments - $10

15t + 30p + 40b + 5s + 10u <= 100

ANSWER: 1 of each thing or a combination of things

****

Explain to the kids that this is an example to help with next activity.

So you are going into outer space & need to pick out some things to wear while you are gone .

You cannot spend more than $100 but want to maximize your options.

Keep in mind that you are in outer space so what are your necessities? Prioritize!

Let the kids come up with their own theories and ideas then explain them to you.

Can we take it with us?

We're planning a trip to space! But a rocket can only carry so much, this is called the spacecraft's payload. The limit for our spacecraft is 59 skittles (in reality we use kilograms!). The goal is to get as close to the limit of 59 skittles without going over!

There are a few requirements!

1. The trip must be a minimum of 3 days long.
2. There must be a minimum of 2 humans.
3. Each human must have 3 meals per day.
4. Each human must have 2 tools.
5. There must be a minimum of 1 medical kit.

	Trial 1	Trial 2	Trial 3
Length of Mission	_____ days	_____ days	_____ days
Humans on mission (3 skittles each)	____humans x 3 skittles = _____ skittles	____humans x 3 skittles = _____ skittles	____humans x 3 skittles = _____ skittles
Food (1 skittle per meal)	___humans x ___days x 3 meals x 1 skittle = _____ skittles	___humans x ___days x 3 meals x 1 skittle = _____ skittles	___humans x ___days x 3 meals x 1 skittle = _____ skittles
Tools (2 skittles per tool)	___humans x 2 tools x 2 skittles = _____ skittles	___humans x 2 tools x 2 skittles = _____ skittles	___humans x 2 tools x 2 skittles = _____ skittles
Medical Kits (5 skittles per kit)	____medical kit x 5 skittles = _____ skittles	____medical kit x 5 skittles = _____ skittles	____medical kit x 5 skittles = _____ skittles
Total # of skittles	_____ skittles	_____ skittles	_____ skittles

Lesson Plan

Name of Lesson: Habitable Worlds

Learning (TEKS) Objective: Organisms & Environments 8th - 11(A) investigate how organisms and populations in an ecosystem depend on and may compete for biotic factors such as food and abiotic factors such as quantity of light, water, range of temperatures, or soil composition

Student Outcome (*Students will be able to…)*
Students will be able to analyze a fictional solar system and select a planet most likely to support life as we know it and describe what makes a planet habitable.

Day of the Week and Time:
Tuesday 11:00am-1:00pm
(11:30am-12:00pm lunch)

Total Length of Lesson: 120 minutes

Materials *(per 1 class of 25 students):*

- Crash Landing Student Activity Sheet
- Beads
- aquarium river sand
- wire mesh
- Dish soap
- Water
- Food coloring
- Internet
- Powerpoint
- Projector
- Paper
- Pencils
- Scissors
- Dice
- Paper Towels
- Popsicle sticks

Advanced Preparation *(day before, morning of…)*

Morning of:
Tape each planet card on 7 tables
Tables 1-4 should have 1 mesh, 1 blank copy paper, 1 cup of sand and beads
Make sure to mix beads and sand in cup together well
(table 1 & 2 have less than 10 beads, table 3 & 4 have more than 10 beads)
Tables 5, 6 & 7 should have cups filled half ways with dishsoap or water
(table 5 has yellow dishsoap and 1 bead, table 6 has red water and 1 dice, table 7 has blue dishsoap and 1 bead)
Use food coloring to add color to dish soap, color does not matter as long as each liquid is different colors
There should be construction paper on tables 1,2,3 & 4 so students can pour sand on it.
(You might have to tape down the construction paper, it might be rolled or folded)
There should be paper towels and popsicle sticks available for tables 5, 6 & 7

Instructional Delivery	Notes to Teacher:
Activity 1: Brainstorm **Duration: 12 mins** Say we will be talking about habitable worlds Tell students they will be going on a space trip across the galaxy Groups of 3 (5 mins) 1. Students brainstorm the things they would need to survive on an extended trip into space Ask: What makes a planet habitable? What conditions need to exist in order for life to survive? Some prompting questions include: What temperature range is good for life? What sort of atmosphere does life need? Does life need liquid water? What do organisms need in order to eat? Do organisms need light? Does it matter how massive the planet is? (2 mins) After students have agreed what they need to survive, pick on groups to share what they think	Students will brainstorm in their notebooks Slide 2 Slide 3
Activity 2: **Mini lesson** **Duration: 18 mins** Show youtube video on powerpoint (4:12 mins) Students will create a foldable. Pass out foldable templates students will cut on outline and fold along the lines. Students will fill out foldable by putting in the hexagon, "A habitable world needs…" Student will have to write on each flap. Each flap will be a topic: **When closing foldable, title should be on outside and information should be inside where numbers are at** 1. Temperature 2. Habitable Zone 3. Atmosphere 4. Density of Atmosphere 5. Tectonics Tell students they will only write whats in RED. Show powerpoint Close foldable up and paste on journal. At 11:25am Tell students this is where we will stop and continue after lunch	Read off of powerpoint to talk about previous questions Slides 4-9 Students will fill out foldable Slide 5- foldabe

Activity 3: **Lab activity** **Duration: 45 mins**	Slide 11
Once students are back from lunch and settled in their seats, inform students that something has gone terribly wrong on their well-packed space ship. They will need to crash land in the nearest planetary system. Script you can say: (You can google sirens to play when students settle down in their seats) HOUSTON THERES A PROBLEM! A meteoroid has hit your spaceship! Luckily, you are passing through the Abbidon B-20 System, which consists of a sun-like star surrounded by seven planets, some of which have moons. Your ship has barely enough fuel and guidance ability to allow you to select a nearby place to crash-land. At the tables there are profiles of each of the planets and moons in the Abbidon B-20 System. The information is sketchy, but it's all your sensors had time to collect before going off-line due to the damage caused by the meteoroid. Good luck. You'll be going from station to station to test samples obtained from planets in the Abbidon B-20 system to see where we can crash land!! Instruct the teams to decide on which planet or moon to crash. Tell students to record their selections and the reasons why they chose that planet or moon on the back of their student activity sheets. Procedures: 1. There will be stations set up with materials 2. Students will have to go through station to station to figure out what planet is habitable 3. Students will have 5 minutes at each station to determine if planet is habitable or not 4. Students will write down what they think of each planet on their notebooks. Tell them when they go to each planet to write down what planet it is and write why planet is habitable, why planet is not habitable, notes from planets 5. Students will determine what planet they want to land on 6. STUDENTS WILL REMAIN IN THE SAME GROUPS AS BRAINSTORM ACTIVITY. **Students take foldables to stations to refer back to**	Slide 12

Stations:

1. Planet 1
    a. Tectonics: Active volcanoes and seismic activity detected
    b. Atmosphere: <10 pieces
    c. Average Temperature: 651 degrees C
    d. Description: Thick clouds surround the planet. No surface is visible through the clouds
2. Planet 2
    a. Tectonics: No activity detected
    b. Atmosphere: <10 pieces
    c. Average Temperature: 10 degrees C
    d. Description: Polar ice caps, dry riverbends and many craters can be seen from orbit
3. Planet 3 **
    a. Tectonics: Active volcanoes and seismic activity detected
    b. Atmosphere: >10 pieces
    c. Temperature: 30 degrees C
    d. Description: Liquid water oceans over much of the surface. Volcanic island chains make up most of the dry land
4. Planet 4 **
    a. Tectonics: Active volcanoes and seismic activity detected
    b. Atmosphere: >10 pieces
    c. Temperature: 2 degrees C
    d. Description: Cold oceans, covered with ice along much of the globe. Some open water around equator.
5. Planet 5
    a. Gas Giant with on large moon
    b. Tectonics: Many volcanoes and hot springs on surface. Temperatures in hot spots can be up to 600 degrees C. Other spots away from volcanic heat can get as low in temperature as 145 degrees C.
    c. Density: Test to see if the die will float
    **Dish soap (mix with YELLOW food coloring) **
6. Planet 6
    a. Gas giant with four large, rocky satellites (moons). Moons have no appreciable atmosphere. Ice detectable on one.
    b. Density: Test to see if the die will float
    **Water (mix with RED food coloring) **
7. Moon
    Moon. Covered in water ice. Ice appears cracked and re-frozen in parts, indicating a potential liquid ocean underneath. Surface temperature -100 degrees c.
    a. Density: Test to see if the die will float
    **Dish Soap (mix with BLUE food coloring) **

To test for atmosphere:

So if we are to inhabit another planet we would most likely use resources that are already there (like water, oxygen, methane, etc.) but it may be poisonous or harmful so all of that would have to be filtered. To show students this in a macroscopic way, we can have them filter soil/dirt at each station. Each station will have a “sieve” made out of wire mesh of a certain size. Then, each station would have its own particle size mixed with maybe colored sand or something. Parameters: <10 pieces caught is unsafe and >10 is safe. We will experiment with them beforehand so we make sure to put "safe" particles with the planets that should be inhabitable. To test for density in atmosphere: So atmospheres are also important to inhabiting other planets, lack of atmosphere is pretty bad but too heavy (or dense) of an atmosphere is also not desirable. To test for density in this planet, drop dice or bead in cup with liquid. The dice will float with the safest atmosphere. Take dice out and clean it with paper towel.	
Activity 4: Discussion Duration: 15 mins	
Check to see if students' reasoning for choosing a habitable planet makes sense. Tell the students one of the helpers is the captain and they (as a group) will have to try and convince the captain to land on the planet they chose. (Will have 5 mins to prepare their argument!) Helper decides who has the best argument.	Slide 13

HABITABLE WORLDS

BRAINSTORM

- You are going on a space trip!!!
- What are some of the things you would need to survive on an extended trip into space?

QUESTIONS TO THINK ABOUT

- What makes a planet habitable?
- What conditions need to exist in order for life to survive?
- What temperature range is good for life?
- What sort of atmosphere does life need?
- Does life need liquid water?
- What do organisms need in order to eat?
- Do organisms need light?
- Does it matter how massive the planet is?

WHAT MAKES A PLANET HABITABLE?

- https://www.seeker.com/videos/space/how-long-could-you-survive-on-other-planets

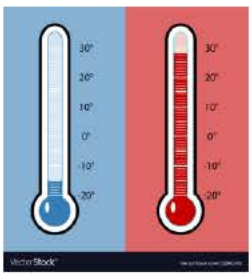
FOLDABLE

- Cut on the outline and fold along the lines
- Write in the hexagon ON BLANK SIDE "A habitable world needs…"
- Titles go where numbers are on the tabs:
  1 Temperature
  2 Habitable zone
  3 Atmosphere
  4 Density of Atmosphere
  5 Tectonics
- Information goes on the inside of the tabs

ONLY WRITE WHATS IN RED ON THE FOLLOWING SLIDES

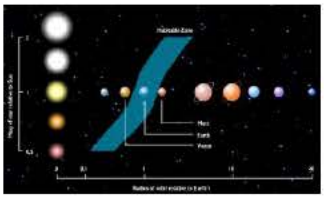
1. TEMPERATURE

- Humans are comfortable at 10C to 30C (14F to 86F)
- But can range from -40C to about +40C (-40F to 104F)



2. HABITABLE ZONE

- The area in a stellar system where the temperatures of planets can support liquid water and therefore hold the highest chance to sustain life
- Only planets within the Habitable zone can sustain life.



3. ATMOSPHERE

- Layer of gas surrounding earth.
- These are the percentages of gases that helps sustain life on earth

Gases	Percentages
**Oxygen	20.95%
**Carbon	0.04%
Nitrogen	78.09%
Argon	0.93%
Other gases	Small amounts

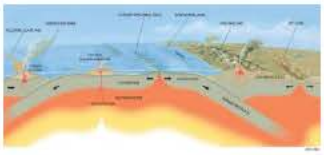
4. DENSITY OF ATMOSPHERE

- Is affected by temperature pressure and amount of water vapor in the air
- Too much density is bad and too little density is undesirable!

Low density	High Density
Higher elevations = more atmospheric pressure = low density Low density = hard to breathe!	Lower elevations = less atmospheric pressure = high density High density = will slow down objects moving through it

5. TECTONICS

- Two of the things that make Earth unique in our solar system are that it has plate tecton cs – with the surface broken up nto a number of tectonic plates that drift around moving continents and causing earthquakes – and life.
- Earth has volcanic activity and seism c activity that helps sustain life.



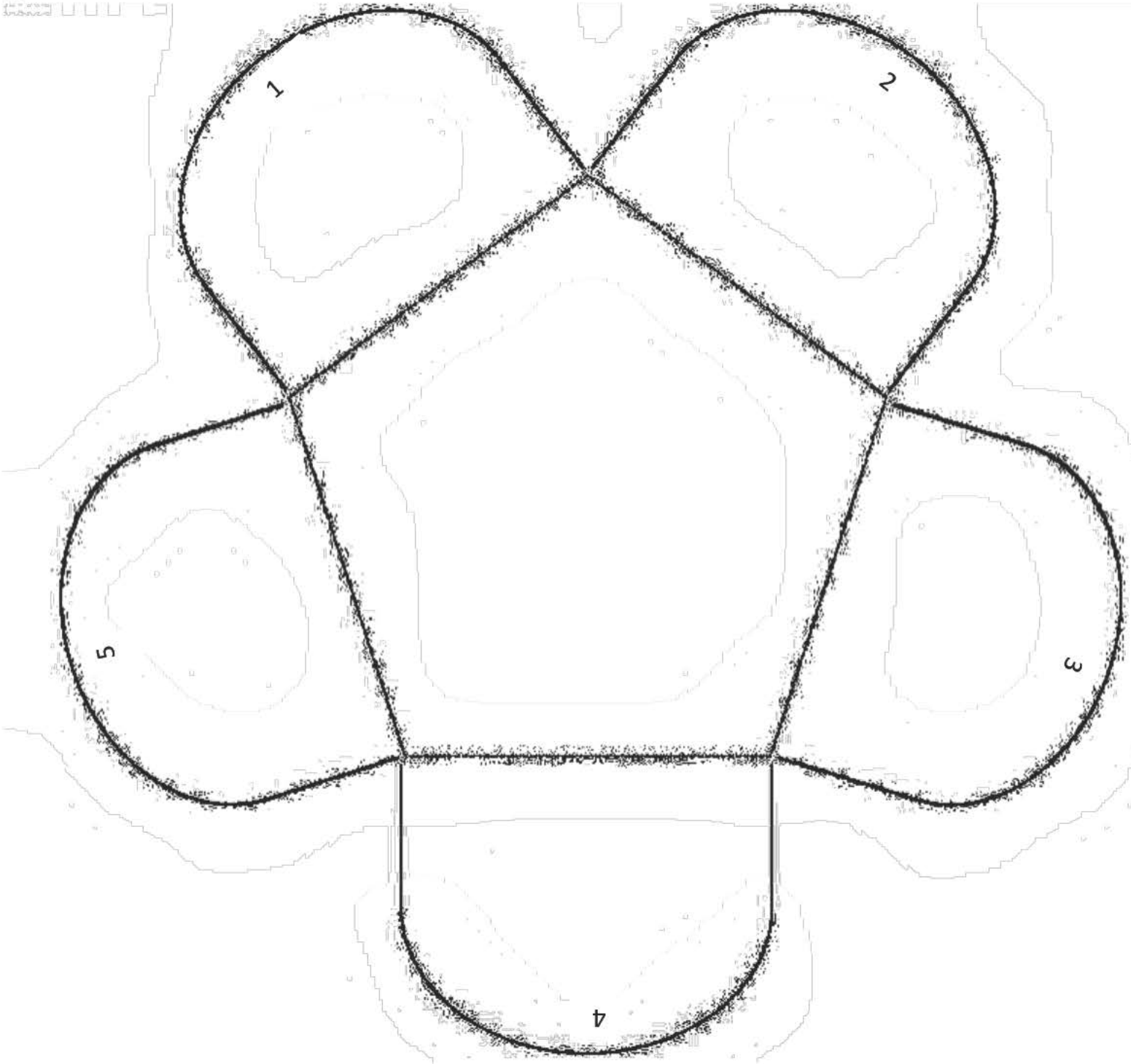
HOUSTON THERE'S A PROBLEM!

A meteoroid has hit your spacesh p! Luckily you are passing through the Abbidon B-20 System which consists of a sun-like star surrounded by seven planets some of which have moons. Your ship has barely enough fuel and gu dance ability to allow you to select a nearby place to crash-land. At the tables there are profiles of each of the planets and moons in the Abbidon B-20 System. The informat on s sketchy but it's all your sensors had time to collect before going off-line due to the damage caused by the meteoroid. Good luck.

TESTING SAMPLES

- You'll be going from station to station to test samples obtained from planets in the Abbidon B-20 system to see which planet is safe so we can crash land!!
- Timer for stations (5 mins): https://www.online-stopwatch.com/eggtimer-countdown/

TELL THE CAPTAIN WHERE TO LAND!


1
2
3
4
5

Names:_____

Is it a Habitable World?

	Is there tectonic activity detected? (Y/N)	Is the atmosphere or density safe to live in? (Y/N)	Is the temperature safe to live in? (Y/N)	Other important information about planet or moon
Planet 1				
Planet 2				
Planet 3				
Planet 4				
Planet 5				
Planet 6				
Moon				

CUT EACH ONE OUT AND TAPE ON TABLES!!!

Planet 1

- Tectonics: Active volcanoes and seismic activity detected
- Atmosphere: LOOK AT *** FOR DIRECTIONS
- Average Temperature: 651 degrees C

Description: Thick clouds surround the planet. No surface is visible through the clouds

***To test for atmosphere:
So if we are to inhabit another planet we would most likely use resources that are already there in the atmosphere (like oxygen, carbon, nitrogen, etc.) but it may be poisonous or harmful so all of that would have to be filtered. You will be filtering the "atmosphere" by pouring the cup of sand on to the metal mesh ON THE WHITE PAPER and move the mesh around until there's no sand and only beads are left. Once you are done, place sand back in the cup with beads inside.

Parameters: <10 pieces caught is unsafe and >10 is safe.

Planet 2

- Tectonics: No activity detected
- Atmosphere: LOOK AT *** FOR DIRECTIONS
- Average Temperature: 10 degrees C

Description: Polar ice caps, dry riverbends and many craters can be seen from orbit

***To test for atmosphere:
So if we are to inhabit another planet we would most likely use resources that are already there in the atmosphere (like oxygen, carbon, nitrogen, etc.) but it may be poisonous or harmful so all of that would have to be filtered. You will be filtering the "atmosphere" by pouring the cup of sand on to the metal mesh ON THE WHITE PAPER and move the mesh around until there's no sand and only beads are left. Once you are done, place sand back in the cup with beads inside.

Parameters: <10 pieces caught is unsafe and >10 is safe.

Planet 3

- Tectonics: Active volcanoes and seismic activity detected
- Atmosphere: LOOK AT *** FOR DIRECTIONS
- Temperature: 30 degrees C

Description: Liquid water oceans over much of the surface. Volcanic island chains make up most of the dry land

***To test for atmosphere:
So if we are to inhabit another planet we would most likely use resources that are already there in the atmosphere (like oxygen, carbon, nitrogen, etc.) but it may be poisonous or harmful so all of that would have to be filtered. You will be filtering the "atmosphere" by pouring the cup of sand on to the metal mesh ON THE WHITE PAPER and move the mesh around until there's no sand and only beads are left. Once you are done, place sand back in the cup with beads inside.

Parameters: <10 pieces caught is unsafe and >10 is safe.

Planet 4

- Tectonics: Active volcanoes and seismic activity detected
- Atmosphere: LOOK AT *** FOR DIRECTIONS
- Temperature: 2 degrees C

Description: Cold oceans, covered with ice along much of the globe. Some open water around equator.

***To test for atmosphere:
So if we are to inhabit another planet we would most likely use resources that are already there in the atmosphere (like oxygen, carbon, nitrogen, etc.) but it may be poisonous or harmful so all of that would have to be filtered. You will be filtering the "atmosphere" by pouring the cup of sand on to the metal mesh ON THE WHITE PAPER and move the mesh around until there's no sand and only beads are left. Once you are done, place sand back in the cup with beads inside.

Parameters: <10 pieces caught is unsafe and >10 is safe.

Planet 5

- Gas Giant with on large moon
- Tectonics: Many volcanoes and hot springs on surface. Temperatures in hot spots can be up to 600 degrees C. Other spots away from volcanic heat can get as low in temperature as 145 degrees C.
- Density: Test to see if the die will float (LOOK AT *** FOR DIRECTIONS)

*** To test for density in atmosphere:

So atmospheres are also important to inhabiting other planets, lack of atmosphere is pretty bad but too heavy (or dense) of an atmosphere is also not desirable. To test for density in this planet, drop dice in cup with liquid. The dice will float with the safest atmosphere. Take dice out and clean it with paper towel.

Planet 6

1. Gas giant with four large, rocky satellites (moons). Moons have no appreciable atmosphere. Ice detectable on one.
2. Density: Test to see if the die will float (LOOK AT *** FOR DIRECTIONS)

*** To test for density in atmosphere:

So atmospheres are also important to inhabiting other planets, lack of atmosphere is pretty bad but too heavy (or dense) of an atmosphere is also not desirable. To test for density in this planet, drop dice in cup with liquid. The dice will float with the safest atmosphere. Take dice out and clean it with paper towel.

Moon

a. Moon. Covered in water ice. Ice appears cracked and re-frozen in parts, indicating a potential liquid ocean underneath. Surface temperature -100 degrees c.
b. Density: Test to see if the die will float (LOOK AT *** FOR DIRECTIONS)

*** To test for density in atmosphere:

So atmospheres are also important to inhabiting other planets, lack of atmosphere is pretty bad but too heavy (or dense) of an atmosphere is also not desirable. To test for density in this planet, drop dice in cup with liquid. The dice will float with the safest atmosphere. Take dice out and clean it with paper towel.

Lesson Plan

Name of Lesson: Mission Impossible

Learning (TEKS) Objective:
2.33. Astronomy 6B

Student Outcome (*Students will be able to…)*
Students will be able to relate distance to fuel usage of a rocket by making a scale model of the solar system with distances from that planet to earth.

Day of the Week and Time:
Wednesday 8:15 am - 9:00 am

Total Length of Lesson:
45 minutes

Materials *(per 1 class of 25 students):*

- **25 - 1 ½ yard pieces of receipt paper**
- **Markers**
- **Drawing of Mars**
- **Drawing of Moon**
- **Drawing of Earth**
- **Tape**
- **Stickers of 11 different colors**

Advanced Preparation *(day before, morning of…)*

Sketch out a drawing of Mars, the Moon, and Earth

Instructional Delivery	**Notes to Teacher:**
Activity 1: Gas - First Things First **Duration: 10 min**	
Start off with a little background information on the NASA Saturn V <u>Interesting things about the Saturn V</u>: 1. Specifically built for a mission to the moon 2. It's taller than the statue of liberty (363 feet - 30 feet taller than statue of liberty) 3. When fully fuelled, it weighs more than 400 elephants 4. Remember Apollo 13? It was a Saturn V rocket. Put up your drawing of the Earth on one side of the room, and place Moon in the middle of the classroom (maybe on a desk or an open laptop). Say, "We know that Saturn V had a special mission right? To take people to the moon. The Saturn V was built pretty tough, so I'm wondering if it would have been able to make it to other planets? "	

Ask students: **If we are wondering if Saturn V can make it to other planets, what are some factors that should be taken into consideration?** The answer you are looking for is fuel. Either way, make sure to give proper validation to any answers that are given. If the word fuel doesn't come up, pose the following scenario. If the word fuel comes up jump past the following scenario to the ******* I just finished my class at UTEP and I'm driving back home. All of a sudden my car starts slowing down and I hear a *clunk clunk, clunk clunk* noise. Ask: **What's happening to my car?** I've just run out of gas!! Ask and wait for responses: **What do I do if I've run out of gas?** Answers may include, can call for help, ask for a ride to the nearest gas station, call for a tow truck. Now, think of this same exact type of scenario but in space! **** My mission was to go from Earth to the Moon and back. I think to myself, We've already accomplished this mission a couple of time so I'm just gonna pass the moon and go straight to Mars. Tape drawing of Mars on the opposite side of the classroom from the Earth. Ask: **Do you guys think I'm gonna make it?** Maybe. But will I make it back home? Probably not.	
Activity 2: Pocket Solar System Duration: 20 min On the board write that the distance between Earth and the moon is 238,855 miles. Tell the students that the Saturn V uses roughly 4 gallons per mile. Ask: **How do I figure out how much total gallons the Saturn V used on its mission?** Multiply 238,855 x 4 On a one way trip to the moon, the Saturn V used 955,420 gallons of gas. Our mission is to investigate the different distances from Earth to the other planets, to see if we can make it there and back. Transition into the pocket solar system will be something like the following: Ask a student: Think about the closest store to your house. About how many minutes does it take you to get there (drive, walk, whatever)? Students will give an answer. Teacher: It's easy to know how far something is when you go to there regularly or can see it with your eyes. Now, I don't know about you guys but	**This distance will be given in A.U. later on in the lesson.** **Pocket Solar system:** https://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=392

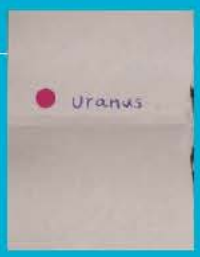
I've never been to outerspace and I've never seen a planet close up. This makes it difficult to even imagine the distances between the planets, Right? On Monday, we learned about scale factor. We were able to scale down the sizes of the planets. We are going to do something similar but instead of scaling down the size of the planets, we are going to scale down the distance between the planets to help us achieve our mission. We are going to make a pocket solar system. Pass out the register paper and stickers to every student. <u>To make a pocket solar system.</u> Take the strip of receipt paper. On one end stick a **Yellow** sticker for the sun and a **Purple** sticker for the Pluto/Kuiper Belt. Fold the paper in half. Place a **Dark Pink** sticker for Uranus. Fold the paper back into half and then in half again. On the Pluto end, place a **Blue** crease for neptune, and the other new fold (close to the sun) place a **Light Pink** sticker for Saturn. All our other planets are going to go between the Sun and Saturn. Fold the Sun to Saturn's crease. Place an **Orange** sticker here for Jupiter Fold the Sun to Jupiter, and this will be the asteroid belt. Place a **white** sticker here. Fold the sun to the asteroid belt. Place a **Red** sticker for Mars here. Now comes our last two folds. Fold the Sun to Mars. Fold that section in half again. You should have three new creases. Place a **Green** sticker for Earth on the crease closest to Mars. On the next crease, place a **Brown** sticker for venus. The last crease between the sun and Venus, place a **Gray** sticker for Mercury. That's it!!	**Each color of sticker belongs to a different planet. There are 11 different stickers.** Sun - Yellow Mercury - Gray Venus - Brown Earth - Green Mars - Red Asteroid Belt - White Jupiter - Orange Saturn - Light pink Uranus - Dark pink Neptune - Blue Pluto/Kuiper Belt - Purple **I have prepared a power point with the step by step as an extra resource. You don't have to use it!**
Activity 3: Distances from Earth to other Planets Duration: 15 min Now that students have the Solar System, they can see the distances between each of the planets. Teacher will do the following example with the class. Students will follow the link below.	

Tell students to go to this website: https://theplanets.org/distances-between-planets/ Once at the website, students will scroll down to where it says “Planetary Distance Calculator” Example: In one drop down box they will find Earth. In the other drop down box, they will select Mars. Click on ‘Calculate’ They will be using the A.U. unit. Once students have the distance, they will write this distance next to the planet Mars on their pocket solar system. Once students have all the distances from earth to other planets, let students know that the distance from the Earth to the Moon in AU is 0.00257. Now that they have all this information, ask them **Which planets do you think our Saturn V would make it to?** If some say yes, ask why? If some say no, ask why? There are a few things we have to think about before we launch ourselves into space, right? If time permits, students are able to do the calculations of fuel usage for each planet or they decorate their pocket solar system.	Just in case they ask, an A.U. is an astronomical unit. 1 AU is about 149.6 million kilometers

Take the strip of receipt paper.

On one end place a **Yellow** sticker for the sun

On the other end place a **Purple** sticker for Pluto/Kuiper Belt.



Fold the paper in half.

Place a **Dark Pink** sticker for Uranus.

Fold the paper back into half and then in half again.

On the Pluto end, place a **Blue** sticker on the new crease for neptune

Find the sun.

On the new fold (close to the sun) place a **Light Pink** sticker for Saturn.

All our other planets are going to go between the Sun and Saturn.

Fold the Sun to Saturn's crease.

Place an **Orange** sticker here for Jupiter

Fold the Sun to Jupiter.

This will be the asteroid belt.

Place a **white** sticker here.

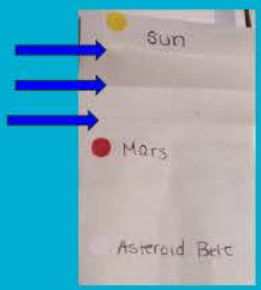
Fold the sun to the asteroid belt.

On this new crease, place a **Red** sticker for Mars.

Now comes our last two folds.

Fold the Sun to Mars. Fold that section in half again.

You should have three new creases.



Place a **Green** sticker for Earth on the crease closest to Mars.

Notice how there are two more creases?

On the next crease, place a **Brown** sticker for venus.

Notice how there is one more crease?

The last crease between the sun and Venus, place a Gray sticker here for Mercury.

You're done!

Let's find some distances!

Distances from Planets to Earth

The order will be according to the order of the planets (only the planets not the asteroid belt) on the Pocket Solar System.

Earth to Neptune

The distance between Earth and Neptune is 29.09 AU. That's approximately 4,351,400,000 km or 2,703,959,960 miles.

Earth to Uranus

The distance between Earth and Uranus is 18.21 AU. That's approximately 2,723,950,000 km or 1,692,662,530 miles.

Earth to Saturn

The distance between Earth and Saturn is 8.52 AU. That's approximately 1,275,000,000 km or 792,248,270 miles.

Earth to Jupiter

The distance between Earth and Jupiter is 4.2 AU. That's approximately 628,730,000 km or 390,674,710 miles.

Earth to Mars

The distance between Earth and Mars is 0.52 AU. That's approximately 78,340,000 km or 48,678,219 miles.

Earth to Venus

The distance between Earth and Venus is 0.28 AU. That's approximately 41,400,000 km or 25,724,767 miles.

Earth to Mercury

The distance between Earth and Mercury is 0.61 AU. That's approximately 91,691,000 km or 56,974,146 miles.

Lesson Plan

Name of Lesson: Rocket Launch

Learning (TEKS) Objective:
111.28 12F : Analyze situations to determine if they represent financially responsible decisions and identify the benefits of financial responsibility and the costs of financial irresponsibility

111.41 9A: Determine the lengths of sides and measures of angles in a right triangle by applying the trigonometric ratios sine, cosine, and tangent to solve problems

Student Outcome (*Students will be able to…)*
Students will have learned how and why it is important to keep a budget. Students will also be able to use the trigonometric function, tangent, to solve for the height of a rocket.

Day of the Week and Time:
Wednesday 9:00 am - 11:00 am

Total Length of Lesson:
2 hours

Materials *(per 1 class of 25 students):*

- **9 copies of the Rocket Budget/Launch Hand-Out (7 groups of 3 and 2 groups of 2)**
- **9 - 12 inch long pieces of polyethylene foam pipe insulation (½ - inch size pipe)**
- **9 - Rubber bands (size 64)**
- **9 - 5x5 squares cut in half diagonally (18 diagonals - 9 will have a 1 ½ inch slit from the top to the center and the other 9 will have a 1 ½ inch slit from the base to the center)**
- **36 - 8-inch plastic cable wraps (zip ties)**
- **9 - 30 inch pieces of string**
- **9 - 10 inch pieces of string**
- **Goggles**
- **Scissors**
- **9 Quadrant patterns**
- **1 set of Because Life Happens Cards**

Advanced Preparation *(day before, morning of…)*

Remind yourself how to build the rocket.
Make sure you know where you are going to take your students to launch their rockets.
(Students will not be taking home rocket)

Fins will need to have a slits cut. Half will have a slit cut 1.5 inches from the base and 1.5 inches from the top. Each rocket will have one of each cut.

On handout, fins will be a set number of 1 pair per rocket. Make sure you mark it in before or mention for them to do it when you pass out the handout.

Instructional Delivery	**Notes to Teacher:**
Activity 1: Budgeting for wants and needs **Duration:**	

Show the following picture to the class. This is a picture of the NASA Saturn V Rocket.

As you are showing the picture, ask the students to tell you the different things they observe about the rocket?
This can include things that are seen (colors, design, surrounding) and unseen (engine, rocket fuel, lights)

Ask students: **What does a rocket absolutely need to have to make it launch and why?**As they tell you their answers, ask them why that part is important?

Some examples may include but are not limited to:
Launch pad - Rocket needs a place to launch that can sustain massive amounts of heat.
Fuel - The rocket isn't going anywhere without fuel.
Rocket body - you can't have a rocket without a rocket.
Engines - Help propel the rocket upward.
Fins on a rocket - provides stability during flight.
Astronaut crew -

Next, say: **If the total cost to build the Saturn V was $62 million dollars, how much do you think each of these parts cost individually?**
Acknowledge the different ideas that students give you for a cost. After they have given you all their ideas, share with them the following numbers. They don't need to remember these numbers as they will be given to them later on.

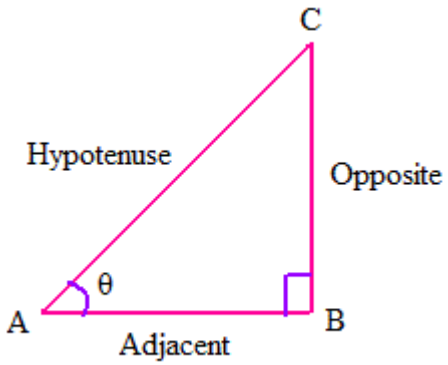
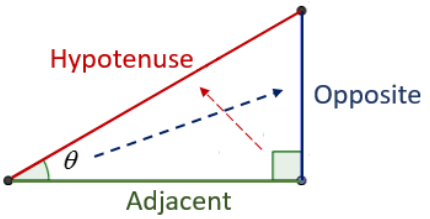
Did you know….?
A NASA launch can cost at least $500 million.
The rocket engine of the Saturn V costs no less than $30 million.
The Saturn V held 800,000 gallons of fuel which was about $200,000

ask the students: **Why is important to keep a good budget when building a rocket?**

Image is found through this link.
https://www.nasa.gov/centers/johnson/rocketpark/saturn_v.html

Students may have a lot of different ideas. Instill the idea that a budget is important to remind us of our priorities. Ask if any one knows what a priority is. Ask: **When building a rocket, what is more important? Making sure it has a proper engine, or making sure that it looks pretty?** As students give you their replies, direct them back to the picture of the Saturn V. Ask: **What can a rocket have that isn't necessary for it to fly properly?** The name of the rocket USA The paint on the rocket - More paint means more weight which means more fuel will be used for the launch. This rocket has some black on it, but other rockets may have different colors like orange, or red. **These things may not be necessary but why would they be nice to have?** To make it look nice Others can know that it's from the USA	**Definition of priority: a thing that is regarded as more important than another.**
Activity 2: Building on a budget **Duration:** Tell students that they are going to be building a rocket which will be launched. After they collect data from their launch, they will then calculate the height of their rocket. Students have been given a budget of $600,000,000. Let students know when they are calculating their budget to keeping in mind the discussion that took place about what a rocket needs and doesn't need. Hand out NASA Rocket Budget worksheet (1 per group). Walk through the handout with the students. Item column - different things that Rockets have or may use Price column - price for each of the items. Number of Items column - they will write how many of each item they will be purchasing. (Notice that some of these are fixed. More than one of these items is not necessary) Total column - The total amount spent for each item. This total should not exceed $600,000,000. The flow of this activity will go as follows: 1. Students will complete their budgets and get them approved 2. They will pick a "Because Life Happens" card and will make the needed adjustments to their budgets. 3. Wait for all groups to finalize their new budgets. have been approved, they can gather the materials for their rockets. 4. When all groups are ready to start building, do it together step by step.	**This link will take you to the video of how to construct the rocket. The only thing that was added was an additional zip tie at the end of the rocket. This stops the string from becoming caught inside the rocket body after the first launch.** **https://www.jpl.nasa.gov/edu/teach/activity/foam-rocket/** **Because Life Happens - You've just finished your chores and your mom hands you a crisp 5 dollar bill. You finally have enough money to buy that video game you wanted. Then, you accidentally knock over a**

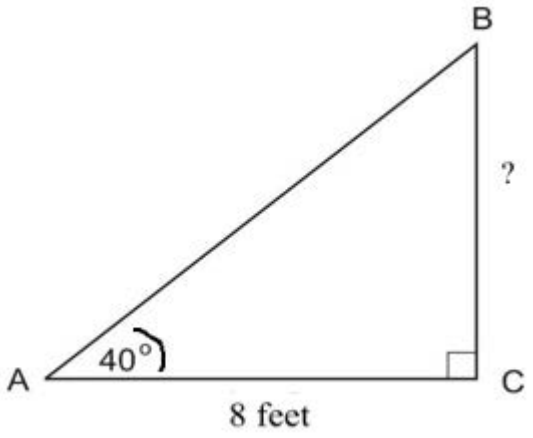
The following is a list of the items and their prices: Astronaut (1) -------- ----------$70,000 Astronaut food (for 1 person)---------- $1,500,000 Rocket body (foam pipe) –---------- $30,000,000 Frame (Rubber band & plastic ties) ---------- $12,000,000 Oxidizer (string) –---------- $5,000,000 Fins (two pieces of paper which make 4 fins) ----------$15,000,000 Rocket fuel (800,000 gallons) –---------- $200,000 One Launch ---------- $500,000,000 Rocket Art ---------- $5,000,000 The teacher will be the one to approve the budget. Once all groups budgets have been approved, have each group randomly pick a "Because Life Happens" card. Groups will adjust their budgets and have them approved. Once a groups final budget is approved they will collect their supplies and if they have purchased "Rocket Art" they can start decorating their rocket until all groups have finished to start building the rocket as a class. Once all groups are finished, the rocket building will begin. After all the rockets have been built and any Rocket Art added, let students know that they are ready to launch their rocket.	**glass and it shatters on the floor. So you have to give back the $5 which set your plans back a couple of weeks.** **On a separate document are the instructions for building the rocket and launching**
Activity 3: Rocket Launch **Duration:** Show students the order in which they will collect data and be prepared to solve for the distance their rocket traveled up. Show power point "Building and Launching a Rocket" for step by step instructions for the class using their group members. The following is the process that the teacher will model. 1. Partner #1 will stand in launching position. 2. Partner #2 will measure 5 meters (~ 16 feet) from Partner #1 3. Partner #3 will trace the rocket with the quadrant pattern 4. Partner #1 will launch their rocket at a 90 degree angle. 5. Partner #3 will follow the height of the rocket with their finger. Stop following the rocket when it starts descending and freeze! 6. Partner #2 will record the angle. 7. Repeat Steps 1-3 for each launch. Partners will switch roles with each launch. Let students know that you are going to be outside for 10-15 minutes. They wont have a set number of launches. They will keep switching roles and launching and gather their three best launches. **This will help students gain confidence with the way the rocket is launched and any dud launchings can just be ignored.**	**When modeling, the teacher will be recording "actual" numbers to use as an example when calculating flight distance. The example will use a launching degree of 40 and a distance of 3 meters (~10 feet).** **Students will keep launching and gather their three best launches. This will give students a chance to get the feel of launching for better results.**

Ask students for the steps of this activity before going outside to make sure they know what they are expected to do. Proceed to line up and go outside. Once students complete their model launches, return to the classroom and learn how to calculate flight distance of their rocket.	
Activity 4: Calculating Distance **Duration:** Tell students that we are now going to solve for the height of their rockets. Before we do that, we have to make sure we understand certain parts of a right triangle. Draw a right triangle on the board. Label the vertices A, B, and C, just like in the image below. Have them tell you which side the hypotenuse is, first. For the other two sides, they might say they are the legs which is totally right but we are going to use different names for them. Ask: **On this triangle, where would the person who is measuring the degree of the rocket be?** In the following triangle, the person who is measuring the degree of the rocket would be where the letter A is. We will show this by using this symbol for angle, theta. In the classroom example my theta would be 40 degrees. For opposite and adjacent sides, look at the degree (theta). The opposite side is on the opposite side of theta. Subsequently, the adjacent side is next to (adjacent to) theta.  When using Trigonometry, we use different sides of the triangle depending on what we are looking for. In our rocket launching we are only going to use what is called a Tangent Function. Tangent Functions use the opposite side and the adjacent sides of a triangle.  TOA $\text{Tan}\,\theta = \frac{\text{Opposite}}{\text{Adjacent}}$	**Students will use their three best launches to calculate height.**

On the board write the tangent function and its ratio.

Using the example from the beginning, find the height as a class.
Leave this example on the board so that students can refer back to it.

Example



This triangle will have the hypotenuse, opposite, and adjacent labeled to help them fill in the ratio for tangent later on.

Going back to my drawn triangle. Go over the things that you know and fill in the triangle.
Things I know:

1. My launch degree was 40 degrees. Ask: **Where should I put my 40 degrees?**
2. The distance between me and my partner was 8 feet. Ask: **Where should I write in the 8 feet?**
3. Ask: **What am I trying to solve for?** since we don't have a value for the opposite side of the triangle, we are going to use the letter x.

Go back to the tangent ratio written on the board.

$$tan\ \square = \frac{opposite}{adjacent}$$

Reminding them that theta is the degree, have them help you fill in the values for the ratio

$$tan\ 40 = \frac{x}{8}$$

Ask: How do I solve for the x (hypotenuse).

Multiply by 8 on both sides of the equation

$$(8)\square\square\square 40 = \frac{x}{8}\ (8)$$

Remind them that this is a one step equations if the tan (40) is throwing them off a little.

Evaluate the value of the hypotenuse $$8tan40 = x$$ $$6.71 \approx x$$ Ask: **What does this value mean?** (That is the height of your rocket) Tell them they are going to do the exact same steps with the data that they collected. Leave the example on the board so they can refer back to it. Have all the groups write their best height on the board. Offer a prize to the group with the highest height. If you have time left over, go on to youtube and look for videos of ro kets being launched.	**[** **They might need help finding tan on their calculators.**

Building on a Budget

Item	Price	Number of Items	Total
Rocket Body	$30,000,000	1	$30,000,000
Rocket Fins (2)	$15,000,000		
Rocket Frame	$12,000,000	1	$12,000,000
Oxidizer	$5,000,000	1	$5,000,000
Astronaut(s)	$70,000		
Rocket Fuel	$200,000	xxxxxxxx	$200,000
Rocket Launch	$500,000,000	3 for 1	$500,000,000
Astronaut Food	$1,500,000		
Rocket Art	$5,000,000	xxxxxxxxx	

Grand Total: $ _____

Rocket Launch Data

Test Launch	Distance (feet)	Degree	Height (feet)
1			
2			
3			
4			

Because Life Happens	Because Life Happens
Because Life Happens	Because Life Happens
Because Life Happens	Because Life Happens
Because Life Happens	Because Life Happens
Because Life Happens	Because Life Happens

On your first engine test, your Oxidizer burn up. With another test just weeks away, you will need to buy a brand new Oxidizer	The government cut your budget. You now have $563,300,000 for rocket building supplies.
Your first launch proved unsuccessful and too much damage was made to the body of the rocket. Adjust your budget for a new rocket body.	The warehouse where you kept your food burnt down. You will need to purchase additional food for you Astronauts.
Because of a couple of setbacks, it is taking longer to construct your rocket. Your budget must now allow $35,000,000 overtime pay for your workers.	The government increased your budget. You now have an additional $1,570,000.
Your contractor has found the best deal on steel rocket fins.	You are cleared for take off!
You found enough rocket fuel for an extra launch	A very generous donation just came in. This donation has allowed you to buy a nozzle for your rocket.

Rocket Launch

Partner 1

Tie both ends of your string together using a double knot.

Partner 1. Hold rubber band.

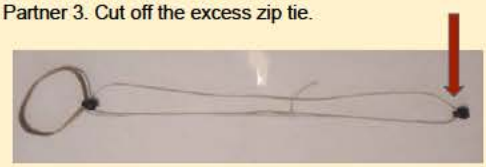
Partner 2. Hold String

Partner 3. Get a zip tie and tie the rubber band a string together. Cut off the excess zip tie.

Partner 1. Grab the string

Partner 2. Tie a second zip tie to the other side of the string.

Partner 3. Cut off the excess zip tie.



Partner 2. Grab rocket body.

Partner 3. Feed the string into the foam rocket.

Partner 1. Hold the rocket body.
Partner 2. Hold the rubber band at the top so that only a little rubber band is showing.
Partner 3. Tie a zip tie around the top of the foam. Tie it tight!!

Partner 1. Grab your fins and nest them together.

Partner 1. Grab rocket

Partner 2. Grab fins

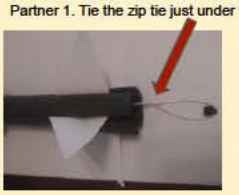
Partner 3. Open up the rocket slits

Parter 2. Slide fins into the slits of the rocket.

Partner 2. Grab rocket and make sure the fins are all the way in the slits.

Partner 3. **Important** Make sure your string is not sticking out one of the slits of the rocket and hold the slits so that they are closed.

Partner 1. Tie the zip tie just under the fins. Tie it tight!!!!



Partner 1. Cut out quadrant pattern

Partner 3. Hole punch a hole just above the "cm" like in the picture and fold on the dotted line

Partner 2. Grab the shorter string that was passed out and tape it to the back of the quadrant pattern.

Nice team work!!!

Now comes the fun part!

Round 1

Partner 1. Launcher

Partner 2. Measurer/Recorder

Partner 3. Tracer

Partner 1. Launch rocket at a **90 degree angle** (straight up).

Hold the rubber band with index finger or thumb.

Pull down string.

Let string go.

Partner 2. Measure out 5 meters (~16.4 feet) from Partner 1 in any direction.

Make sure you stay a safe distance from other groups.

Partner 3. Stand at the end of the 3 yards.

Hold the quadrant pattern and point it toward Partner 1.

With the quadrant pattern, follow the height of the rocket. **Make sure and follow the top of the rocket.**

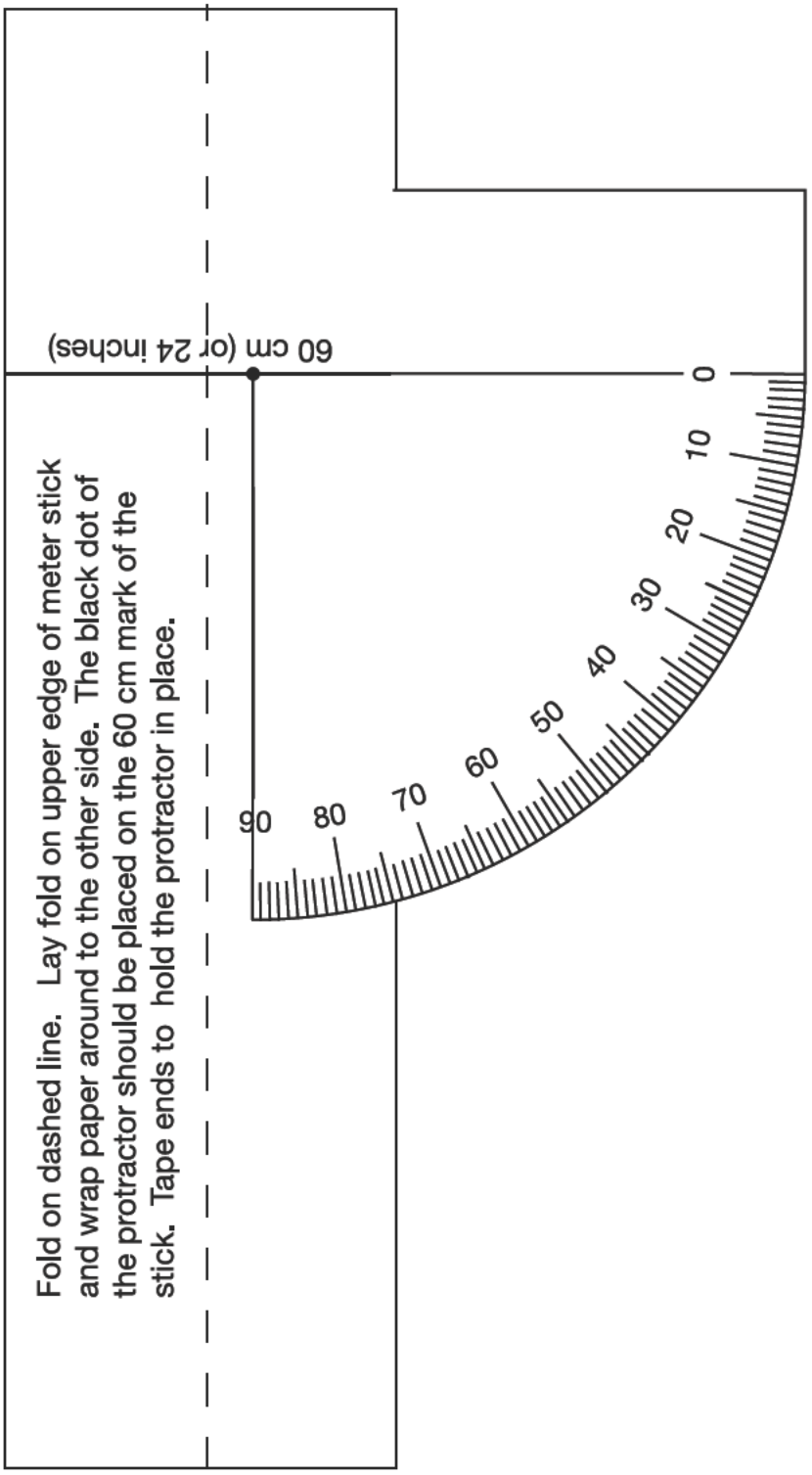
As soon as the rocket starts descending, stop following it and freeze!!!

Partner 3. Look at the quadrant pattern and record the degree that it is showing on your worksheet.

Switch Roles and Repeat!

Launcher Quadrant Pattern

(Actual Size)



Lesson Plan

Name of Lesson: Remaster the Golden Record

Learning (TEKS) Objective: TECH 8th - 6(D) understand and use software applications, including selecting and using software for a defined task

Student Outcome (*Students will be able to…)*
Students will be able to create a golden record using art materials and coding software

Day of the Week and Time:
Wednesday 12:00pm-1:15pm

Total Length of Lesson: 75 mins

Materials *(per 1 class of 25 students):*

- Computers
- Markers
- Construction paper
- Scissors
- Tape
- Glue
- Pencils
- Internet
- Powerpoint
- projector

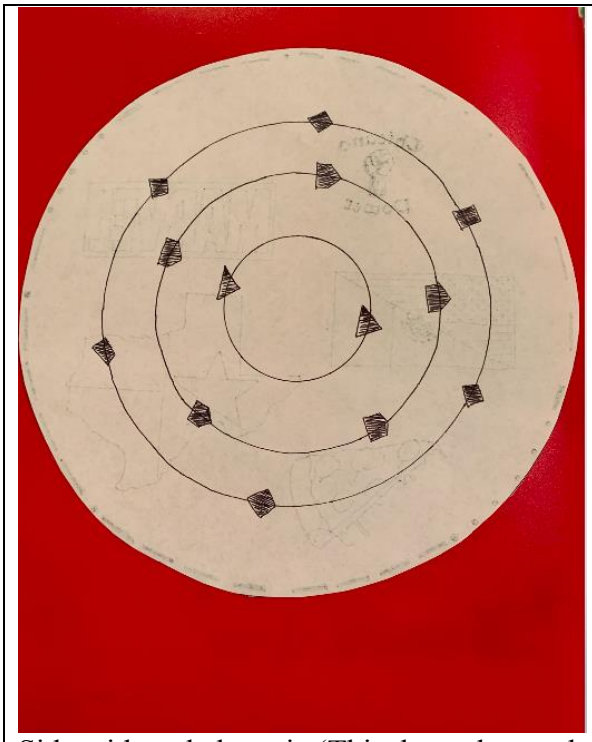
Advanced Preparation *(day before, morning of…)*

Have all materials out for golden record.

- Construction paper, scissors, markers, tape, glue, pencils, computers

Instructional Delivery	**Notes to Teacher:**
Activity 1: Mini lesson on goldenrecord **Duration: 4 mins**	Slide 1 & 2 Begin by projecting powerpoint
Say, "Who knows what is the Golden Record?" Call on some students. If they don't know what it is, say we will be talking about the golden record. Say Nearly 40 years ago, two **Voyager** spacecraft left Earth. The craft carried golden records containing sounds and images portraying the diversity of life and culture on Earth. These **recorded artifacts** included a diagram of DNA, greetings in 55 languages, a map of our solar system's position relative to stellar landmarks, Louis Armstrong's "Melancholy Blues," and even the sound of a kiss.The Golden Record is an interstellar greeting and time capsule. Its intended recipient? Any intelligent extraterrestrial life form—or future human—who may find it. Play youtube video on powerpoint (2:54 mins)	
Activity 2: Quick write **Duration: 3 mins**	Slide 3 Students will write this down on their journals
Question: If you had to choose pieces of media (including images, videos, music, sound) to represent yourself, what would they be? How do they explain what it means to be you? What message do you hope they convey to the recipient?	

Activity 3: Creating Golden Record **Duration: 40 mins**	Slide 4
Activity: Students will create their own golden record. -Must have at least 5 images (have guidelines) -Students will use construction paper, markers, color pencils, etc. (MUST BE COLORED ON BOTH SIDES) -Must have coded music (lines, shapes) -Must have Morse code encoded (can include birthday, name, place of birth, etc.) Note for teacher: Students should cut out record first then take all of them to computer lab with their records and decorating materials. Students will decorate in the computer lab. How to cut out record: Fold paper in half, draw a semi-circle and cut. (10 mins max) Coding instructions: 1. On summer camp website, click "students links", scroll down to golden record then click "made with code" 2. Scroll down to "MUSIC MIXER" and click "Start mixing" 3. Click on "Object" and drag it to the yellow outline 4. Click on "Generators" and drag it to the yellow outline 5. Click on "Shapes" and drag it to the area that says "sound and shape" 6. Click on "Variables" and drag both of the boxes to the "number of notes" and set speed" area 7. Click on "Music mixer" to change the genre of music 8. Click on "Sound of shape" to change the sounds 9. Click on "number of notes" to add notes to the music 10. Click on "set speed to" to change the speed of the music 11. Mess around with the different genres, sounds, number of notes and speeds to make a song! 12. To add more sounds, drag "sound ring" to the music mixer where it says "Add more sound rings?" Say record should reflect who they are and what they like. Don't only have brand names like nike, converse, mcdonalds, etc. Let students know they should have things included such as glasses if they wear glasses, American flag, Mexican flag, Chinese flag, your birth date in morse code, etc, things that represent them and their culture. **Students need to draw and cut out circle for record**	Teacher gives activity instructions first. Teacher will tell students they will explain how to code. Teacher will pass out computers/tablets. Teacher will say coding instructions out loud so all students should follow along. Teacher should walk around to make sure students are on the same page. Once coding instructions are given, remind students they have to create a song and have the coded drawing on their golden record. Put timer up on the board and remind students how much time they have left to create their record.



Side with coded music (This depends on what they encoded on website should look something like this, with rings and shapes on them)

Side that reflects student. -I put Morse code around the edge, but students can do it how they like. (Mine isn't colored but students must be colored!

Activity 4: Share & Discussion **Duration:** 10 mins	
Students will have a chance to show their finished product of the golden record to class. (students can volunteer to show their golden record and also play their song from computer) Discussion. Do you think it's a good idea to send something in outer space so that extra-terrestrials can know about us? Why or why not?	Slide 5 Tell students they can volunteer to share their record. After a few people share, ask discussion question have at least 1 min at the end to clean up and time the students.

THE GOLDEN RECORD

WHAT'S THE GOLDEN RECORD?

- 0 years ago two Voyager spacecraft left Earth
- The craft carried golden records containing sounds and images portray ng the di ers ty of l fe and culture on Earth.
- These r__ rd d__ rtif__ n included
  - a diagram of DNA greetings n 55 languages
  - a map of our solar system's position relati e to stellar landmarks
  - Louis Armstrong's "Melancholy Blues "
  - E on the sound of a kiss.
- https://www.youtube.com/watch?v=YVkUvmDQ3HY

QUICK WRITE:

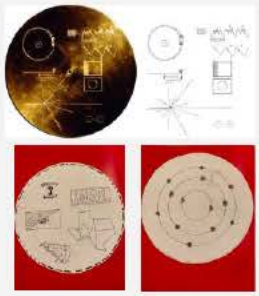
- If you had to choose pieces of media (including images, videos, music, sound) to represent yourself, what would they be?
- How do they explain what it means to be you? What message do you hope they convey to the recipient?

ACTIVITY GUIDELINES:

- Side 1: Must have AT LEAST 5 images
- Side 1: Must have Morse code encoded (can include birthday name place of birth etc.)
- Side 2: Must have coded music (Rings & shapes)
- Use construction paper markers color pencils etc. **MUST BE COLORED ON BOTH SIDES**

→→→→→→→→→→→→→→→→→→

- This is an example of what your record should look like. One side has images and Morse code other side has coded music.
- YOURS MUST BE COLORED!!



DISCUSSION.

- Do you think it's a good idea to send something in outer space so that extra-terrestrials can know about us? Why or why not?

Lesson Plan

Name of Lesson: Create a 3D Rocket

Learning (TEKS) Objective: Science B.2.

(2) Scientific investigation and reasoning. The student uses scientific practices during laboratory and field investigations. The student is expected to:

- (A) plan and implement comparative and descriptive investigations by making observations, asking well defined questions, and using appropriate equipment and technology;
- (B) design and implement experimental investigations by making observations, asking well defined questions, formulating testable hypotheses, and using appropriate equipment and technology;
- (C) collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers
- (D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and
- (E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

Student Outcome (*Students will be able to…)*

- Students will learn about the physics of science by creating a 3D rocket. Students will use the scientific method (hypothesis, experiment, observations, analyze, share & discuss) to understand the significance of fins on a rocket.

Day of the Week and Time:

- Thursday @ 8:15am - 9:00am

Total Length of Lesson:

- 45 minutes

Materials *(per 1 class of 25 students):*

- 50 Two pieces of paper (2 per student)
- 10 Scissors (2 per group of 5 students)
- 25 Drinking straws
- 10 rolls Scotch tape (2 per group of 5 students)
- 25 copies of 3D Rocket Chart

Advanced Preparation *(day before, morning of…)*

- Sort out all the materials listed above

Instructional Delivery	Notes to Teacher:
Activity 1: Why Do Rockets Have Fins? Duration: 5 minutes Begin this activity with a discussion on why rockets have fins. Let the students give you answers and supporting evidence for their evidence. Next, ask the question, what would happen if rockets did not have fins & again let them answer and give evidence to support themselves.	**Show the pictures provided in the folder of a rocket with and without fins.**
Activity 2: Create ! Duration: 35 minutes Now, students will create their own 3D rocket using the method. In groups of 5, they will do the following: - Step 1: Create a hypothesis (does my rocket need fins to fly, how many fins if so, etc) - Step 2: Experiment using trials (Trial 0 - no fins, Trial 1,2,3,4 - add fins) - Step 3: Observe what happens in the trials and record the data - Step 4: Analyze data & draw a conclusion - Step 5: Discuss & share findings with group members Each student will create their own rocket with 2 sheets of paper and a straw. They will test their rockets by understanding the importance of having fins. Use the handout for students to record results from their trial, self explanatory. IMPORTANT: Students should not be aiming their rockets at fellow students. Try to launch from the same starting point and in the same direction every time for accurate data.	**Refer to the "Instruction Manual" for how to build the rocket.** **POSSIBLE ISSUES:** **If the paper that represents the rocket is too loose, it will fall apart or not do as well. Explain the importance of making it fit nicely & even.**
Activity 3: Final Discussion Duration: 5 minutes As a class, you will discuss the findings from their experiment. Revisit the original question of why rockets have fins but this time give a final answer to wrap up the lesson. FINAL REMARKS: Rockets have fins to remain stable when they fly. They need to stay pointed in the same direction when they fly forward, without spinning or tumbling, which could cause them to crash; this is the purpose of the fins. You should have seen that your finless rocket flew straight at first but quickly spiraled out of control. It might have tumbled through the air and fluttered to the ground, almost like a leaf falling from a tree. This is because the rocket did not have fins to keep it stable. If it started turning just a little bit, then it would start turning even more rapidly until it completely lost control. In contrast, your other rockets that had fins should have flown straight, and traveled much farther as a result. The fins are the rockets stability!	

Procedure

- Cut one piece of paper into four smaller rectangles, by cutting it in half lengthwise and widthwise. This will allow you to make four rockets.

Wrap one of the paper rectangles around a pencil to form a cylinder, with the long edge of the paper along the length of the pencil.

Tape the cylinder closed so it does not unravel (but do not tape it to the pencil).

- Slide the cylinder off the pencil. Pinch one end of the cylinder shut and seal it with tape. (This is the "front" end of your rocket.) Leave the other end open. This will be your first rocket, with no fins.

- With plenty of room in front of you—and no obstructions, such as furniture or people—prepare to launch your first rocket! Slide it over a drinking straw. Aim the straw forward, then blow into it as hard as you can. Watch your rocket as it flies. *How far does it go? Does it fly straight or does it tumble in midair?*

- Launch your rocket a few more times to see if it flies the same way. If you would like to record your rocket flight distances, be sure to launch it from the same place each time, and measure to the landing spot with a tape measure.

- Make another paper rocket following the previous steps. Remember to pinch one end and tape it shut. For this rocket, however, you will make fins. Cut out two right triangles (with a 90-degree angle in one corner) from the other piece of paper to make the fins.

- Tape the fins to the side of your cylinder, toward the open end (the base, or bottom, of your rocket).

- Repeat these steps for the other rockets you make. One with no fins, then 1 fin, then 2, then 3, then 4.

3D ROCKET CHART

My Hypothesis is: _____

	Trial 0	Trial 1	Trial 2	Trial 3	Trial 4
# of Fins	_____ fins	_____ fins	_____ fins	_____ fins	_____ fins
Shape of Fins					
Did my rocket fly?	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO
How far did my rocket go?	_____ meters	_____ meters	_____ meters	_____ meters	_____ meters
What did I notice?					

After trial & error, my conclusion is: _____

Lesson Plan

Name of Lesson: Landing on a planet

Learning (TEKS) Objective:

- **Science (8.6.C)**

The student is expected to: investigate and describe applications of Newton's three laws of motion

Student Outcome (*Students will be able to…)*

- **Students will be able to actively demonstrate understanding of Newton's three laws of motion by using their knowledge to safely 'land' an egg using a student made rover**

Day of the Week and Time:

- **Thursday 9:30 am - 12:30 pm** (lunch 11:30-12)

Total Length of Lesson:

- **2 hours 30 minutes**

Materials *(per 1 class of 25 students):*

Activity 1:

- **30 Laptops**

Activity 2:

- **30 sheets of paper**
- **30 scissors**
- **40 marbles**
- **10 small marble sized paper balls (1 per group)**
- **10 plastic plates (1 per group)**
- **around 10 ounces of flour (1 per container)**
- **10 rulers with indents in middle (1 per group)**
- **10 Newton's Laws of Motion card sheets**

Activity 3:

- **10 eggs (1 per group with extra eggs in case of breakage)**
- **10 sandwich resealable plastic bags (1 per group with 3 extra)**
- **1 roll of masking tape**
- **2 pack of 25 party balloons**
- **14 4.5x6 in. craft foam sheets (cut into 3 equal pieces)**
- **20 16 oz plastic cups**
- **10 Egg-Lander worksheet (1 per group)**

- **projector with laptop/ computer for videos**

Advanced Preparation *(day before, morning of…)*

- **Prepare the foam sheets**
  - **cut sheets into 3 equal pieces**
- **Prepare marble activity per group**
  - **Put flour in containers, Cut up Laws of Motion card sheet, Make marble sized paper balls, Put flour in each container, 4 marbles per group, 1 ruler per group,**
- **Put eggs in resealable plastic bag**

Instructional Delivery	Notes to Teacher:
Activity 1: Rocket Coding Game **Duration: 15 min** • Say that after building and launching rockets, the next step is to land the rocket. Students will then play the starch coding game to get a feel of how rockets land in space (15 min)	• The link for the game is on PP slide 2 and is also on a document that can be shared with the students
Activity 2: Laws of Motion Lesson **Duration: 23 min** • Pass out a sheet of white paper and while demonstrating instruct students to fold it into a tri-foldable with an inch left on the bottom. Instruct students to take notes while the video is playing, with the law on top half and an example on the bottom half. (3 min) • Play the video, pausing at each of the laws allowing the students to write down the law and the examples (10 min) • Group up students into 10 groups of 3. Pass out marble activity materials to each group. Instruct students to each pick a card and demonstrates what their cards say. Encourage students to discuss why the demonstration matches the law. Once done, have students clean up and return the materials. (10 min)	• Foldable final product is shown on PP slide 3 • Laws of motion video link is in PP slide 3 • Simple instructions for marble activity on PP slide 4
Activity 3: Egg-cellent Lander **Duration: 112 min** • Students will then watch a video showing how rovers have landed on Mars. (2 min) • Have students work with their group of 3 from Activity 2. Explain the activity to the students and pass out the materials that all groups will receive (worksheet, egg, resealable bag, 3 pieces of tape). (5 min) • Students will then work in their groups to plan and build their lander using the stipulations found on the worksheet. (60 min) • Once the building time is up, have students clean up before going to lunch (10 min) • After lunch have students pick up landers and proceed outside for launching (7 min) • One student from each group will drop their lander from 5 ft off the ground (10 min) • When all landers have been dropped, have students check the condition of the eggs. Each group will present their lander design and explain what they believed worked, what did not work, and what they would change if given the chance. (8 min) • Once every group has presented, go back inside (7 min) • Throw away eggs and any last minute clean up. (3 min)	• This video has no sound, so during this time, the teacher should explain what is happening. A basic outline is provided on the video link document. (PP slide 5) • Basic instructions for lander activity on PP slide 6

Landing on a Planet

Landing Simulation

- Landing safely is a very hard thing to do!
  - To see just how hard it is, you're going to play a game and see how well you can land a rocket.

Timer (15 minutes): https://www.online-stopwatch.com/countdown-timer/

Newton's Three Laws of Motion

- https://youtu.be/KvPF0cQUW7s

Motion Marble Activity

- Marble Activity
  - Each student picks a card and does what the card says
  - After each card, discuss why the action matches the law

Timer (10 minutes): https://www.online-stopwatch.com/countdown-timer/

Rover Landing

- Before landing rockets, we land rovers.
- https://youtu.be/kSbAUtyO7xo?t=10

Egg-cellent Lander

- In groups, you will be designing and building a lander with the goal of protecting an egg when dropped.
  - You will get an egg in a resealable bag and 3 pieces of tape to start with
  - You can only use 8 additional items
  - Have fun and be creative!!

Timer (60 minutes): https://www.online-stopwatch.com/countdown-timer/

1st Law of Motion:	**2nd Law of Motion:**	**3rd Law of Motion:**
Place 1 marble of the indent of the ruler, leave it and notice what it does. Now gently push the marble and stop it with you hand.	Take 1 marble and the small paper ball. Using the container filled with flour, drop both objects at the same time. Look at the indents left by both objects.	Place 1 marble in the middle of the indent of the ruler. Gently push another marble towards the one on the ruler.

1st Law of Motion:	**2nd Law of Motion:**	**3rd Law of Motion:**
Place 1 marble of the indent of the ruler, leave it and notice what it does. Now gently push the marble and stop it with you hand.	Take 1 marble and the small paper ball. Using the container filled with flour, drop both objects at the same time. Look at the indents left by both objects.	Place 1 marble in the middle of the indent of the ruler. Gently push another marble towards the one on the ruler.

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1st Law of Motion:	**2nd Law of Motion:**	**3rd Law of Motion:**
Place 1 marble of the indent of the ruler, leave it and notice what it does. Now gently push the marble and stop it with you hand.	Take 1 marble and the small paper ball. Using the container filled with flour, drop both objects at the same time. Look at the indents left by both objects.	Place 1 marble in the middle of the indent of the ruler. Gently push another marble towards the one on the ruler.

Outline for Rover Landing Video Explanation:

- Beginning to 28 sec
  - The rover is beginning its descent onto Mars and it catches on fire because of how fast it is falling
- 28 sec to 45 sec
  - A parachute is deployed to help aid the rover's landing by helping slow it down so it does not crash and break during impact
- 45 sec to 59 sec
  - The bottom of the craft is blown off and the rover (protected by an outer casing- or another layer) is dropped while still attached to the craft
- 59 sec to 1 min 50 sec
  - Balloon like objects are inflated to cushion the fall and protect the rover when it reaches to planets surface
  - Thrusters are ignited to slow down the fall of the craft, much like the game you played earlier today.
  - Once the craft is at a safe often distance from the planets surface, it releases the rover.
  - Since the balloon like objects are protecting the rover, the rover proceeds to bounce until it rolls to a stop
- After the end of the video
  - When the rover stops, the balloons deflate and the walls come down.
  - The rover then moves off the base and starts doing what it is programmed to do

Egg-cellent Lander

In teams, build an egg-lander with the goal of protecting an egg when dropped from 5 feet. You will be given an egg in a plastic bag and three pieces of tape to start off with, but you are **only** allowed to use an **additional 8 items** to build your lander. (1 balloon = 1 item, 1 piece of tape more than first 3 = 1 item, 1 piece of foam = 1 item, 1 cup= 1 item, etc.)

Team Members: _____ _____

_____ _____

_____

1.) Write down what 8 items you are using

1.	2.
3.	4.
5.	6.
7.	8.

2.) Draw and label your lander design your below. Don't forget to name your lander!

- Should we live on Mars? Why or why not?

- If you could bring anything to outer space, what would it be?

- If you could create your own planet, what would it be like and what would you name it?

- What was one thing you learned today that you did not know before?

- Besides planets and aliens, what else do you think is out in space?

- What was your favorite part of the day/ camp?

- Should we look for life out in space?

- Come up with your own constellation and write a story explaining it.

Team Builder

Name of Team Builder: Day 2: Cup stacking game

How does your team builder connect to the overall theme?

Since this is the first day this team builder helps the students learn how cooperation works in general, but additionally how astronauts how to learn to cooperate with one another.

Day of the Week and Time

Afternoon??

Total Length:

15-minute team builder.

Materials (per 1 class of 25 students):

- **Red Plastic Cups (42 cups)**
- **String (1 pack)**
- **Rubber bands (25 rubber bands)**

Advanced preparation

- **Attach the string to the rubber band.**

Description	Notes to Teacher:
Students must cooperate with team members to create a pyramid stack of cups. Each person in the group holds onto one of the strings attached to the rubber band, and as a group, they use this device to pick up the cups (by expanding and contracting the rubber band) and place them on top of each other in order to build a pyramid.	

Team Builder

Name of Team Builder: Day 1: Name Game

How does your team builder connect to the overall theme?

Students are allowed to get to know each other and memorize each other's names

Day of the Week and Time

Monday when students come in.

Total Length:

15-minute team builder.

Materials (per 1 class of 25 students):

- **1 ball per class**

Advanced preparation

- **None.**

Description	Notes to Teacher:
Students will be asked to get into a circle. You can ask them to hold hands at arms length, then let go, so that they are even spaced. Camp leaders may join the circle as well. You begin by explaining the rules: • You must toss the ball to someone in the circle (you cannot just pass the ball to the person next to you) • You have to say the name of the person you are tossing it to before you throw it. • If you do not know the person's name, ask them! Then say their name and throw the ball. • This is also a memory game so you have to keep track of who the ball has thrown to. • Students have to say the name of each student that has been called in correct order before throwing the ball to the next student. (If they can't remember or get the order wrong, the game has to start over) • Once everyone has participated once, have the students start the game over, keeping the same order, but going as fast as they can. • If time permits, you can start another game and add another ball to the game a while after the first been added. The challenge is to keep track of the two sequences at the same time.	

Team Builder

Name of Team Builder: Day 3: Telephone Game

How does your team builder connect to the overall theme?

Students learn about how astronauts communicate.

Day of the Week and Time

Wednesday when students come in.

Total Length:

15-minute team builder.

Materials (per 1 class of 25 students):

- **50 stariphone cups**
- **String (1 pack)**

Advanced preparation

- **Attach the string to the cups.**

Description	Notes to Teacher:
Since the only communication with Earth that astronauts have is through radio, students can create a simple cup phone with Styrofoam cups and string to relay an important message to team members until it reaches the last team member in line.	

Team Builder

Name of Team Builder: Day 4: Lift-Off Game

How does your team builder connect to the overall theme?

Students are able to learn how much force and power is needed for lift-off.

Day of the Week and Time

Thursday when students come in.

Total Length:

15-minute team builder.

Materials (per 1 class of 25 students):

- **28 binder rings**
- **String (1 pack)**
- **28 Tennis balls**
- **28 stariphone cups**

Advanced preparation

- **Attach the string to the binder rings.**

Description	Notes to Teacher:
Multiple, long pieces of string are connected to a binder ring so that each student is holding at least one string. An object such as a tennis ball is placed on top of the binder ring with the goal of the students using team work to move together in order to stand up and lift the tennis ball without it falling off. If students can successfully lift the tennis ball off the ground, then a more challenging object can be placed on the center ring, such as a cup or a stuffed animal.	

Integumentary System: How much force weighs down on your skin?

Instructions:

1. Choose one person from your group to be the person covered in paper.
2. Choose the size you feel most comfortable with (small, medium, large)
3. Tape the pieces of paper together around your teammate
   *** Please be respectful of personal space!***
4. Next, find the surface area for each of the pieces of paper that you used on your teammate, then add them together:

   Remember: Surface area: length x width

   Surface area of head:
   Surface area of arm 1:
   Surface areas of arm 2:
   Surface area of torso:
   Surface area of leg 1:
   Surface area of leg 2:

   Add all of these values to get the **total surface area:_____**

5. Once you have found out the total surface area, multiply that number by pressure:

   Pressure: 14.7 pounds/in^2

   Total surface are x Pressure: _____

   Whatever crazy number you end up with, is the amount of force that your skin protects you from every day! How awesome is that?

Moon Landing Survival

Scenario

- You are a member of a space crew scheduled to meet with a mother ship on the lighted side of the moon. However, due to mechanical difficulties, your own ship was forced to land at a spot 200 miles from the meeting point.
- During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile trip.
- 15 items are listed as being intact and undamaged after landing.

Instructions

- Your task is to rank them in terms of their importance for your crew.
- Place the number 1 by the most important item, the number 2 by the second most important, and so on through to number 15 for the least important.

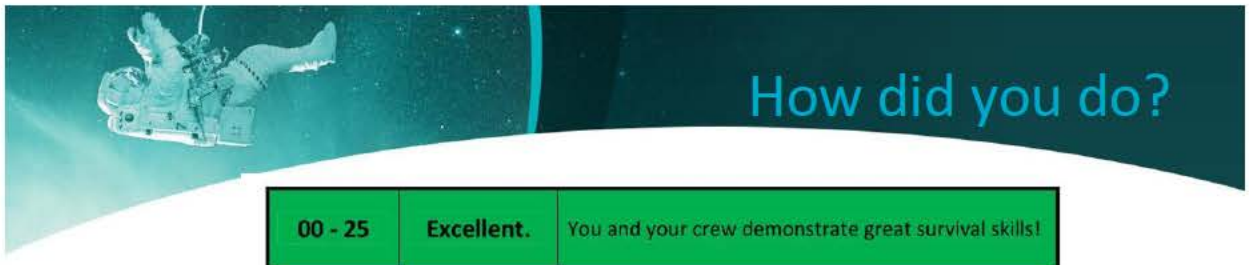
My ranking	Salvaged items	Team ranking
	Box of matches	
	Food concentrate	
	50 feet of nylon rope	
	Parachute silk	
	Two .45 caliber pistols	
	One case of dehydrated milk	
	Two 100-pound tanks of oxygen	
	Stellar map	
	Self-inflating life raft	
	Magnetic compass	
	Five gallons of water	
	Signal flares	
	First aid kit containing injection needles	
	Solar powered FM receiver	
	Portable heating unit	
Score		Score

Calculating Your Score

- To determine how well your group did, you must calculate your score.
- Look at the ranking your team gave each item and look at the ranking NASA gave the same item
- Take the difference between the two. Do this for all 15 items
- Add all of the differences together to get your overall score.

NASA's Answers

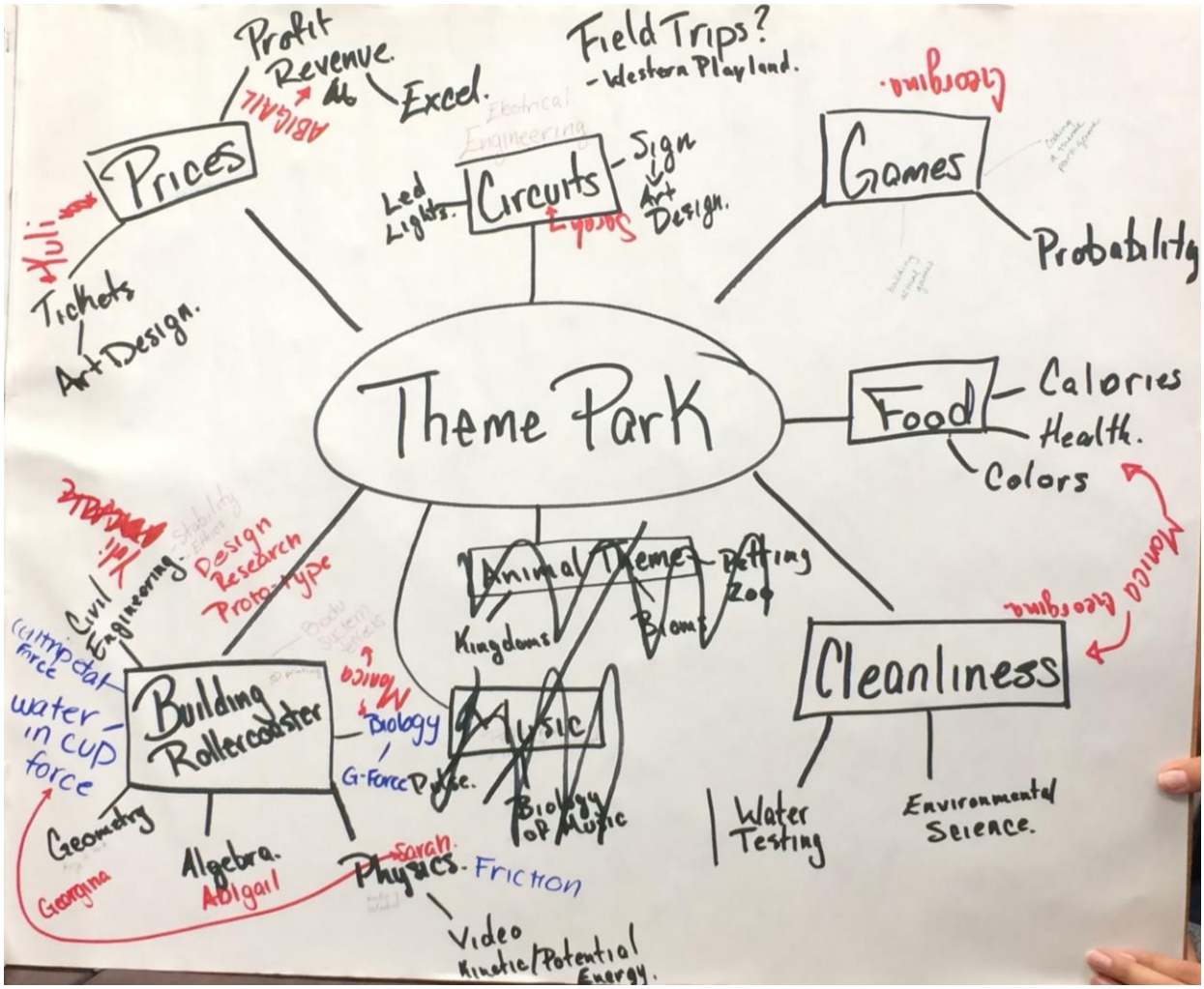
Item	NASA Ranking	NASA's Reasoning
Box of matches	15	Virtually worthless -- there's no oxygen on the moon to sustain combustion.
Food concentrate	4	Efficient means of supplying energy requirements.
50 feet of nylon rope	6	Useful in scaling cliffs and tying injured together.
Parachute silk	8	Protection from the sun's rays.
Portable heating unit	13	Not needed unless on the dark side.
Two .45 caliber pistols	11	Possible means of self-propulsion.
One case of dehydrated milk	12	Bulkier duplication of food concentrate.
Two 100 lb. tanks of oxygen	1	Most pressing survival need (weight is not a factor since gravity is one-sixth of the Earth's -- each tank would weigh only about 17 lbs. on the moon.)
Stellar map	3	Primary means of navigation - star patterns appear essentially identical on the moon as on Earth.
Self-inflating life raft	9	CO_2 bottle in military raft may be used for propulsion.
Magnetic compass	14	The magnetic field on the moon is not polarized, so it's worthless for navigation.
5 gallons of water	2	Needed for replacement of tremendous liquid loss on the light side.
Signal flares	10	Use as distress signal when the mother ship is sighted.
First aid kit, including injection needle	7	Needles connected to vials of vitamins, medicines, etc. will fit special aperture in NASA space suit.
Solar-powered FM receiver-transmitter	5	For communication with mother ship (but FM requires line-of-sight transmission and can only be used over short ranges.)



How did you do?

00 - 25	**Excellent.**	You and your crew demonstrate great survival skills!
26 - 32	**Good.**	Above average results. Yes, you made it!
33 - 45	**Average.**	It was a struggle, but you made it in the end!
46 - 55	**Fair.**	At least you're still alive, but only just!
56 - 70	**Poor.**	Sadly not everyone made it back to the mother ship!
71 +	**Very poor**	Oh dear, your bodies lie lifeless on the surface of the moon!

Concept Map


Theme Park
Prices
Profit
Revenue
Excel.
Tickets
Art Design.
Circuits
Led Lights.
Sign
Art Design.
Games
Probability
Food
Calories
Health.
Colors
Animal Theme
Kingdoms
Biome
Petting Zoo
Building Rollercoaster
Civil Engineering.
Design
Research
Prototype
water in cup force
Geometry
Algebra.
Physics
Friction
Video
Kinetic/Potential Energy.
Biology
G-Force
Music
Biology of Music
Cleanliness
Water Testing
Environmental Science.
Field Trips?
- Western Playland.

Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00-8:15	Students Arrive	Students Arrive	Students Arrive	Students Arrive	Students Arrive
8:15- 8:30	introduce ourselves, the camp, PRETEST	Step Right Up/Georgina	G Force/Monica	Energy/Sarah	Field Trip
8:30-8:45					
8:45-9:00	Team builder				
9:00-9:15	Engineering Design Process/Yuli	Budgeting/Abby		3D Park/Jimmy	
9:15-9:30					
9:30-9:45					
9:45-10:00	Team builder	Team Builder	Centripetal Force/Sarah		
10:00-10:15	Engineering Design Process/Yuli	Budgeting/Abby			
10:15-10:30					
10:30-10:45			Circuits/Sarah		
10:45-11:00					
11:00-11:15	Lunch	Lunch	Lunch	Lunch	Lunch
11:15-11:30					
11:30-11:45	Tickets/Yuli	Popcorn Volume/Monica	Circuits/Sarah	3D Park/Jimmy	Field Trip
11:45- 12:00					
12:00:12:15					
12:15- 12:30					
12:30-12:45					
12:45-1:00	Build a Park/Georgina	Build a Park/Georgina	Build a Park/Georgina		
1:00-1:15					
1:15-1:30				Closing camp- POST TEST	
1:30-1:45				Field Trip Discussion	
1:45-2:00	Clean up/Journals	Clean up/Journals	Clean up/Journals	Clean up/Journals	

Lesson Plan

Name of Lesson: Engineering Design Process

Learning (TEKS) Objective:

- **Technology Applications (7.4D & 8.4D)**

The student is expected to: use multiple processes and diverse perspectives to explore alternative solutions

Student Outcome (*Students will be able to…)*

- **Students will be able to actively practice the engineering design process and distinguish between each step of the engineering design process by actively sorting out different scenarios.**

Day of the Week and Time:

- **Monday 9am-11am (15 min Team Builder @9:45)**

Total Length of Lesson:

- **1 hour and 45 minutes**

Materials *(per 1 class of 25 students):*

- ***13 Students Individual Life Cycle worksheet***
- ***13 Engineering Design Process Cycle***
- ***5 Scenarios***
- ***13 Marshmallow Tower worksheet***
- **1 Engineering Design Process PowerPoint**
- **380 sticks of uncooked spaghetti (15 per pair x2)**
- **72ft of thin string (3ft per pair x2)**
- **260 mini marshmallows (10 per pair x2)**
- **13 white sheets of paper (1 per team)**
- **25 Scissors**
- **13 sheets of assorted construction paper**
- **Projector with a laptop for PP**

Advanced Preparation *(day before, morning of…)*

- **Sort out all materials for Marshmallow Tower.**
  - **1 white sheet of paper, 15 spaghettis, 10 mini marshmallows, 1 jumbo marshmallow & 3ft of thin string**

Instructional Delivery	**Notes to Teacher:**
Activity 1: Cycles **Duration: 10 min** • **This camp is focused on Amusement Parks and throughout this camp we are going to be looking at different parts of the park. I want you to think of a park that you know of or have been too. Can you name it? (Let students tell you names of parks). And in this park what type of activities do they have? (let the students tell you) So lets talk about the rides. How do they make these rides? (wait until someone talks about engineering) So these rides are made by engineers, but how do they make them? (wait until they say they start with a problem or something similar.) So engineers do this and then that and then this so what is it? (it's a cycle) What other types of cycles do you know? Lets talk about your life cycle.**	

• **Say that we are going to be learning about the engineering design process (do not give too much away, as it is their job to discover how the cycle goes). Pass out *Students Individual Life Cycle worksheet* for students to fill out individually - 5 min** • **Once students are done give one or two students to present their life cycle to the class. Break students into pairs (students will be working in these pairs for the remainder of the time). Pass out *Engineering Design Process Cycle*. Have student arrange the engineering design process cycle without any knowledge. (5 min)**	
Activity 2: Engineering Design Process Lesson Duration: 17 min	**The engineering design process steps for cycle are in the PP slides. (slides 4-9)**
• **Regroup, and talk about what each step is in the Engineering Design Process. Build on each of the steps. You do not necessarily have to provide examples, but you can continue to talk about each step. PP (10 min)** • **Have students go back and rearrange the cycle. Include the *Scenarios* and have students arrange them in the correct position based on the description of the engineering design process (7 min)**	
Activity 3: Marshmallow Tower Duration: 68 min	**The problem and materials are on PP slides (slides 11 &12)** **Teacher should pass out supplies while students are planning solutions.** **The steps for the tower are also found in the PP slides (13-19)**
• **Student will then procced to do the marshmallow tower. Pair students up. Let students know that they have just learned about the engineering design process and now they are going to use their knowledge and apply it in the construction of the Marshmallow Tower. Present problem and instructions with materials. Problem and materials are included in the PP (3 min)** • **Define the Problem - Remind students of the engineering design process cycle and have students write down the requirements for the Marshmallow tower in their handout called *Marshmallow Tower worksheet*. (5 min)** • **Plan Solutions - Once again, remind students of the next step in the cycle and give students 5 min to talk in their groups to come up with solutions. They can sketch their model, but they are also required to write down what they are going to be doing. (5 min)** • **Make a model - Once again remind students of the cycle and ask them to make a model. During this step make sure you instruct students to write down the steps that they are going to make their model. Instruct students to place the piece of paper under their structure. Students get 15 min to build structure. (Remind students that we are going to test the model but the time to test the model is not part of their 15 min.) (15 min)** • **Test the model- The next step is to test their model. One by one, test the models by removing the piece of paper under their structure. (Students are going to remove the white paper for their own structure.) During this time ask students to write the outcome of their marshmallow tower (10 min)** • **Reflect once again remind students of the cycle. Asks students to write down what went wrong and what worked. Students should write this down in their worksheet (5 min)**	

• **Go back and redesign structure. Ask students to refer to their worksheet to accomplish this step. Talk about how the engineering cycle has started again. (10 min)** • **Re-Test the Model- Marshmallow Structures competition. (10 min)** • **5 min clean up**	**Students will get a new set of materials. They are not allowed to use the other materials.**

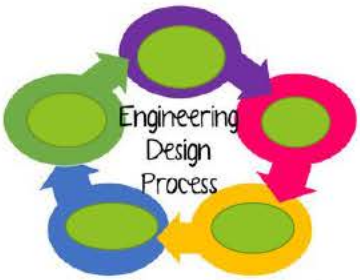
Engineering Design Process

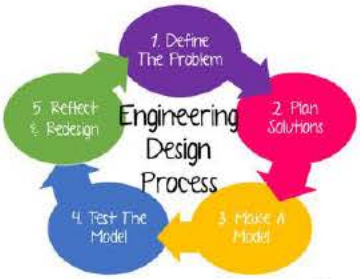
Individual Cycle (5 min)

https://www.online-stopwatch.com/countdown-timer/

Engineering Design Process Cycle (5 min)

https://www.online-stopwatch.com/countdown-timer/





Define the Problem

- What is the problem to solve?
- What do we want to design?
- Who is it for?
- What do we want to accomplish?
- What are the project requirements?
- What are the limitations?
- What is our goal?

Plan Solution

- Brainstorm
- Research
- Wild ideas and build on each other ideas
- Stay focus and have one conversation at a time
- Select one main solution

Make a Model

- Build prototype
- Stay with your main idea

Test the model

- Does it work?
- Does it solve the need?
- Get feedback
- Analyze and talk about what works, what doesn't and what can be improved
- Ethical component

Reflect & Redesign

- Discuss improvements solution
- Make revisions
- Draw new design
- REPEAT the cycle!

Rearrange with Scenarios (7 min)

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Marshmallow Tower Rules

Rules

- You will have 15 minutes to build your structure
- Your entire structure must be built on top of the white paper
- You may only use the materials provided
- At the end of the challenge, no one may be touching the structure, and it can't be leaning on anything
- We will test the structures one by one (Do not touch the structure until your teachers tells you to)
- One team member will remove the white paper and then if your structure is still standing then we will measure your structure
- The team with the tallest structure after removing the paper wins the engineering contract!!

Marshmallow Tower Materials

- 15 sticks of uncooked spaghetti
- 3 ft of thin string
- 10 mini marshmallows

Define the Problem (5 min)

https://www.online-stopwatch.com/countdown-timer/

Plan Solutions (5 min)

https://www.online-stopwatch.com/countdown-timer/

(Make a Model) Build your structure (15 min)

https://www.online-stopwatch.com/countdown-timer/

(Test the Model) Marshmallow Structures competition (10 min)

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Reflect (5 min)

Does it work?
Does it solve the need?
Get feedback
Analyze and talk about what works, what doesn't and what can be improved

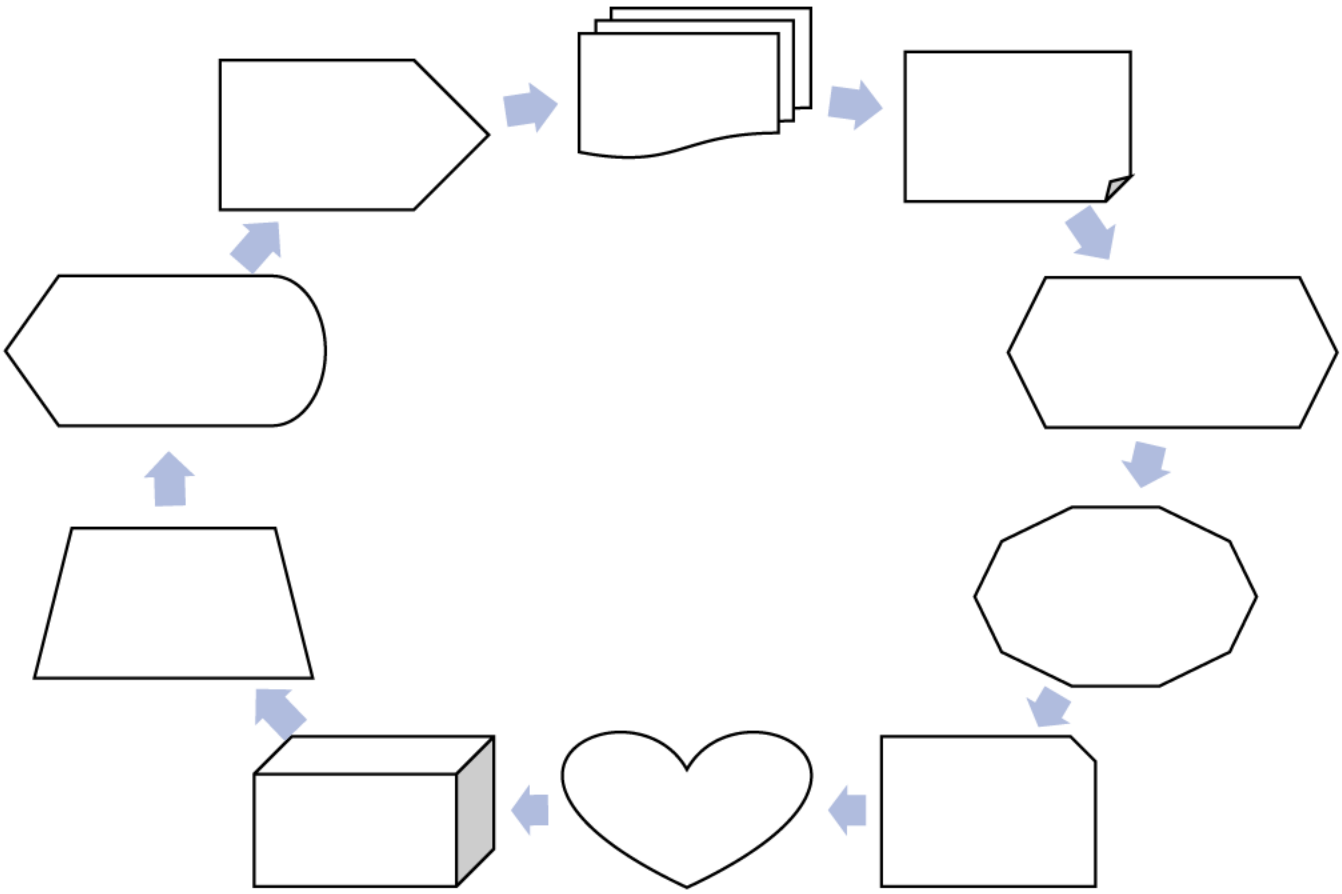
https://www.online-stopwatch.com/countdown-timer/

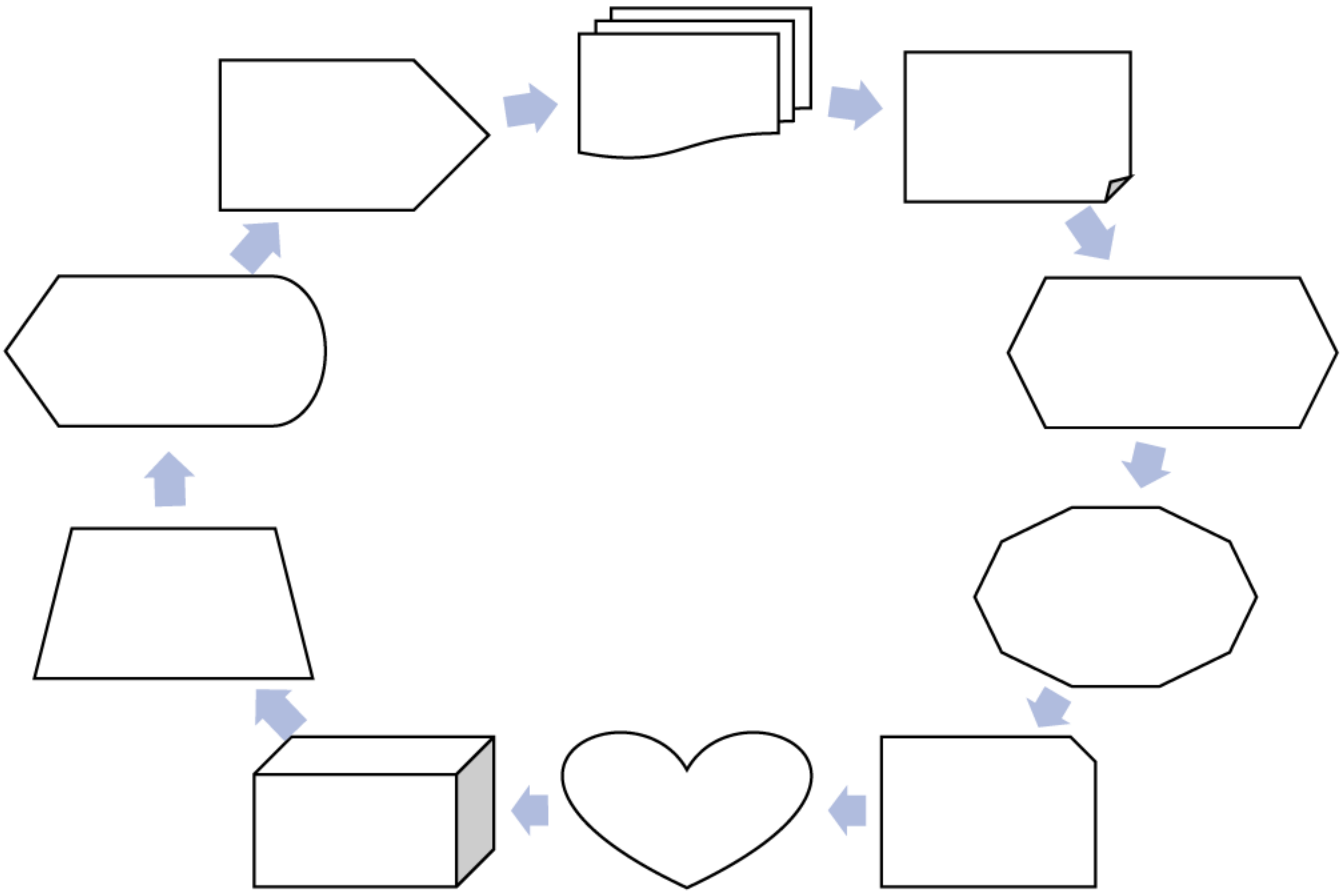
Redesign Structure with new set of materials (10 min)

https://www.online-stopwatch.com/countdown-timer/

(Re-Test the Model) Marshmallow Structures competition (10 min)

https://www.online-stopwatch.com/countdown-timer/





Marshmallow Tower

Define the Problem:	Plan Solutions:
Make a Model:	**Test the Model:**
Reflect:	**Redesign:**

Marshmallow Tower

Define the Problem:	Plan Solutions:
Make a Model:	**Test the Model:**
Reflect:	**Redesign:**

My PowerPoint Notes

Define the Problem:	Plan Solutions:
Make a Model:	**Test the Model:**
Reflect & Redesign	

My PowerPoint Notes

Define the Problem:	Plan Solutions:
Make a Model:	**Test the Model:**
Reflect & Redesign	

Define the Problem	Define the Problem
Plan Solutions	Plan Solution
Make a Model	Make a Model
Test the Model	Test the Model
Reflect & Redesign	Reflect & Redesign

Christian and Esprit attend class together; they have a lot of paperwork and supplies. Their paperwork and supplies are very unorganized. They decide to make a new binder that can keep their work more organized and keep all their supplies without it being too heavy.	Michael and Adrian feel like the sleds they use in the winter never go fast enough down the sledding hill. They don't have money to buy new sleds, so they begin to think of how they can sled faster.	Christian and Esprit attend class together; they have a lot of paperwork and supplies. Their paperwork and supplies are very unorganized. They decide to make a new binder that can keep their work more organized and keep all their supplies without it being too heavy.
After discussing as a team, Christian and Esprit have decided to make pockets in their binder to keep their supplies. They also decided to design pencil holders inside the pockets.	Michael and Adrian begin to make a list of liquids they can use to spray the bottom of their sled.	After discussing as a team, Christian and Esprit have decided to make pockets in their binder to keep their supplies. They also decided to design pencil holders inside the pockets.
Christian and Esprit take their solutions and make them real.	Michael and Adrian decide to spray the bottom of their sled with cooking oil.	Christian and Esprit take their solutions and make them real.
Christian and Esprit place their binder into their backpack and test it out for a week. They also weigh their binder.	Michael and Adrian test their sled to determine if cooking oil worked.	Christian and Esprit place their binder into their backpack and test it out for a week. They also weigh their binder.
After testing their binder, Christian and Esprit realize that the binder does not hold all of their supplies.	After testing their sled, Michael and Adrian determine that although cooking oil made their sled go faster, they have to use a lot of cooking oil. They begin to look for cheaper options.	After testing their binder, Christian and Esprit realize that the binder does not hold all of their supplies.

Lesson Plan

Name of Lesson: Tickets

Learning (TEKS) Objective:

- **Mathematics (7.9C)**

The student is expected to determine the area of composite figures containing combination of rectangles, squares, parallelograms, trapezoid, triangles, semicircles, and quarter circles

- **Mathematics (4.7C)**

The student is expected to determine the approximate measures of angles in degrees to the nearest whole number using a protractor

- **Art (Middle School 1, (c), 1(c))**

Understand and apply the principles of design, including emphasis, repetition/pattern, movement/rhythm, contrast/variety, balance, proportion, and unity, in personal artworks using art vocabulary appropriately

Student Outcome (*Students will be able to…)*

- **Students will be able to create a ticket while using a pop-up card template. They will determine the symmetry of the card.**

Day of the Week and Time:

- **Monday -11:30 am-12:45pm**

Total Length of Lesson:

- **1 hour and 15 minutes**

Materials *(per 1 class of 25 students):*

- **Ticket Design PP**
- **9 Area and Volume Worksheet**
- **25 Pop-Up Card Template 1**
- **25 Pop-Up Card Template 2**
- **25 construction paper (assorted colors)**
- **Markers**
- **25 scissors**
- **25 Rulers**

Advanced Preparation *(day before, morning of…)*

N/A

Instructional Delivery	**Notes to Teacher:**
Activity 1: Pop up card 1 example **Duration: 18 min**	
• **Introduce lesson by talking about amusement parks and how people get into the amusement parks. Once students mention ticket tell them that they are going to be decorating their own ticket but before they move on to the decoration, they must be able to build it. Then pass out *Pop-Up Card Template 1.* (3 min)** • **Tell students to calculate the area of each rectangle. (The area of the template is different from the area of each rectangle.) Students will determine the area of each of the 6 rectangles in centimeters. Make sure students write the dimensions of each rectangle. Pass**	**Teacher should wait until students say "Ticket"** **Quickly review the formula for area of a rectangle** **L x W= A**

out *Area & Volume Worksheet.* Have students write down their area in the box provided. (10 min) • **Move on to constructing the pop-up card. Talk about the symmetry of this card. Let students know that because of the symmetry it will be easier to cut. Students should cut on bold lines and fold on dotted lines.** • **Before students cut and fold, ask them to think about volume. Keeping in mind that this template is symmetrical tell them to predict the volume of the 3-d figure. Once students are done calculating the volume have students write down their predicated volume in the space provided in the worksheet. Students will then begin to cut and fold. (5 min)**	**Quickly review the formula for volume of a rectangular prism.** **L x W x H= V** **The instructions are on the template. Take the time to tell them where they must fold and where they have to cut.**
Activity 2: Pop Up Card 1 Template continue **Duration: 49 min**	
• **Now that students have a 3d model, have them calculate the volume of their figure and write down the volume in the space provided. Have students compare how accurate their estimate was. Talk about how the width and the height of the 3-d figure are the same. Why are they same? (they are the same because the template is symmetrical.) (12 min)** • **Have students calculate their Percent Error. (5 min)** $$\%error = \frac{|Predictaed - Exact|}{exact} * 100$$ • **Tell students that they are going to be working on a ticket for their amusement park. Student will have a template that they will use. The template is harder, and they will be able to decorate it. Tell them the requirements for their ticket. Have students write down the requirements on the back of their *Area and Volume Worksheet*. (2 min)** • **Have students design and decorate their ticket. Remind them of the requirements. (20 min)**	**Requirements for the ticket are found in PP** **Pass out *Pop-Up Card Template 2*** ***Not all students will be successful. Be prepared to help and/or give them a completed template.***
Activity 3: Gallery Walk & Clean Up **Duration: 8 min**	
• **Have students do a gallery walk – 5min** • **Clean up -3 min**	

Ticket Design

Calculate area & Predict Volume
(10 min)

https://www.online-stopwatch.com/countdown-timer/

Pop-up Card Template
(5 min)

https://www.online-stopwatch.com/countdown-timer/

Calculate Volume and Error Percent

$$\%error = \frac{|Predictaed - Exact|}{exact} * 100$$

(12 min)

https://www.online-stopwatch.com/countdown-timer/

Things you must include in your ticket
(1 min)

- Bar code
- Date
- Amusement park name
- Price
- A drawing on the 3-d part of their pop-up card

Design Ticket
(20 min)

https://www.online-stopwatch.com/countdown-timer/

Gallery Walk
(5 min)

https://www.online-stopwatch.com/countdown-timer/

3 min clean up

Area and Volume Worksheet

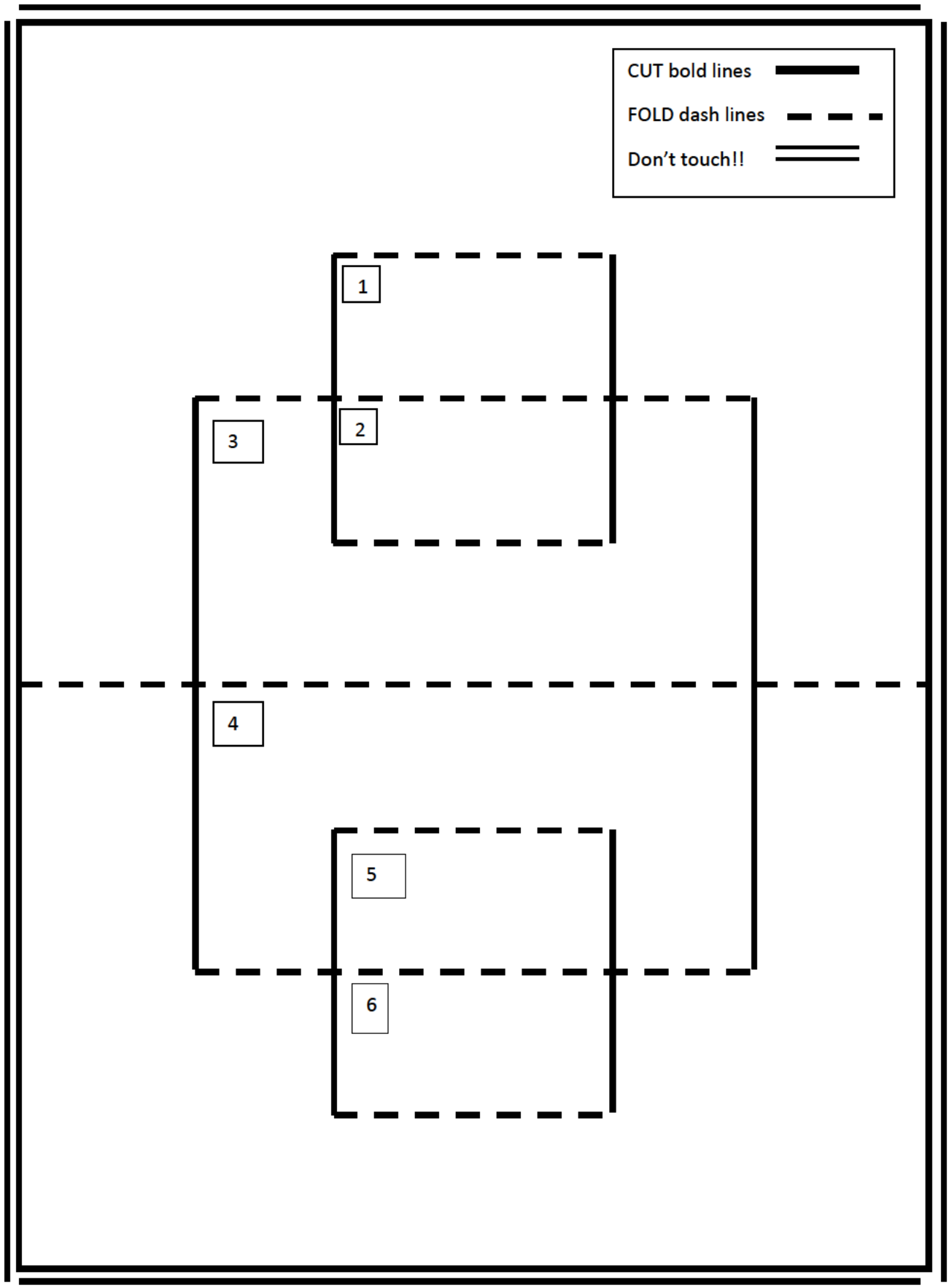
Total Area of all Rectangles	Predicted Volume of Figure	Volume of 3D figure	Percent Error

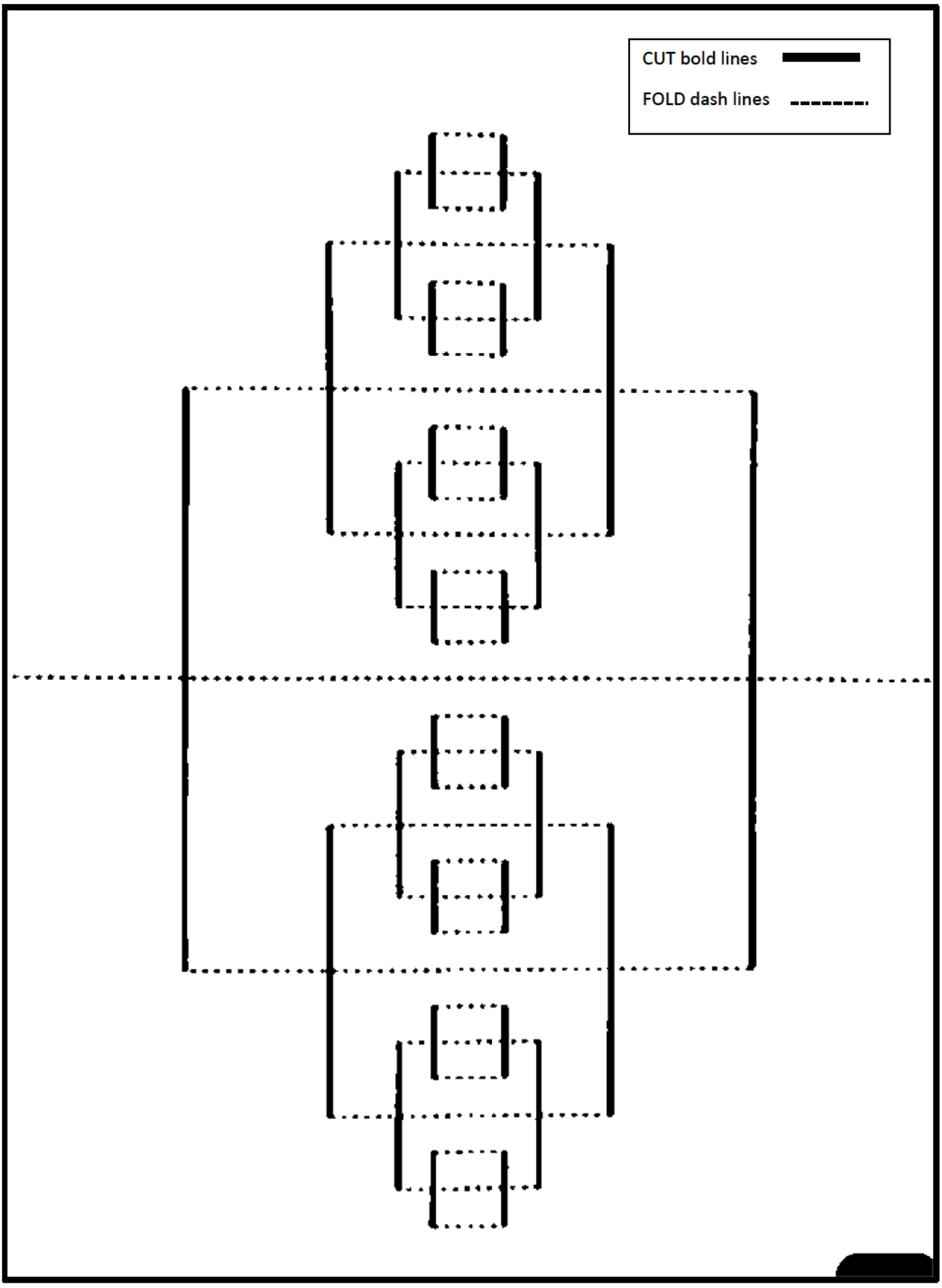
Area and Volume Worksheet

Total Area of all Rectangles	Predicted Volume of Figure	Volume of 3D figure	Percent Error

Area and Volume Worksheet

Total Area of all Rectangles	Predicted Volume of Figure	Volume of 3D figure	Percent Error


CUT bold lines
FOLD dash lines
Don't touch!!
1
2
3
4
5
6


CUT bold lines
FOLD dash lines

Lesson Plan	
Name of Lesson: Build a Park	
Learning (TEKS) Objective: **6th grade:** **(10) Expressions, equations, and relationships. The student applies mathematical process standards to use equations and inequalities to solve problems. The student is expected to:** **(A) model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts** **7th grade:** **(9) Expressions, equations, and relationships. The student applies mathematical process standards to solve geometric problems. The student is expected to:** **(C) determine the area of composite figures containing combinations of rectangles, squares, parallelograms** **(11) Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:** **(A) model and solve one-variable, two-step equations and inequalities;**	
Student Outcome (*Students will be able to…)* • **Students will be able to find the total area of shapes, and they will be able to find missing terms using algebra.**	
Day of the Week and Time: • **Monday: 12:45-1:45 p.m.**	
Total Length of Lesson: • **1 hour**	
Materials *(per 1 class of 25 students):*	
25 Area foldables **10 Cut out shape** **10 sheets of Grid paper** **10 Yardstick or rulers**	
Advanced Preparation *(day before, morning of…)*	
Group students in groups of 3 **Prepare Foldables**	
Instructional Delivery	**Notes to Teacher:**
Activity 1: Introduction of Project and Area Duration: 10 minutes	
• **Begin lesson by creating groups of 3 to 4 students. Then, you will welcome the engineers to their upcoming project by presenting the following scenario:** • **"Hello Engineers! You have been hired by a Developing firm (me the teacher) to plan and build an amusement park. You have been given a plot of land that is 24 units by 28 units and is fenced meaning it cannot be bigger. As engineers, you are now responsible for coming up with the blueprint of the parks set up to propose to the developers client (your classmates). Before presenting to the client, the firm must approve the blueprint of the set up. Once approved you will create a**	**Slide 1** **Slide 2**

presentation using a grid flip chart to present to your client along with official proposal documentation." (3 minutes) ● **First order of business, you will be working with area. We will begin by working in the foldable that is being handed out. On page 2 you will find 5 shapes. Let's refresh our knowledge of area of the following shapes:** ***On their own students will be asked to come up with the area formulas of*** ○ **Square** ○ **Trapezoid** ○ **Rectangle** ○ **Parallelogram** ○ **Circle** ● **You will work on your own for 2 minutes, then for 2 minutes you may collaborate with your group and help each others with any confusion. (4 minutes)** ● **Then for three minutes we will discuss as a class what we remember about the area formula of each shape and discuss any possible questions. (WE WILL BE USING BASE AND HEIGHT) (3 minutes)**	**Slide 3** **You will need to write down the formulas on the board, they are not provided in the powerpoint.**
Activity 2: Explanation of project and examples Duration: 10 minutes	
So now having area fresh in our minds, we will be using a lot of area to create our blueprints. **Before working with our project there are some things that we need to go over. For your projects there are some requirements that need to be met.** ● **In your amusement park, you are required to have certain facilities to meet code. – Welcome area, rest rooms (4 total), food plaza, eating pavilion, 8-10 roller coasters, and a petting zoo. YOU CAN ALSO ADD ADDITIONAL FACILITIES** ● **Use these requirements to map out your rough draft of your amusement park. Your park needs to fit into your plot of land; however, your park does not have to take up your whole plot of land.** ● **You will also be creating a legend for your map, so please keep in mind when drawing the map to place your vertices at efficient points on your map.** **You will also be working with the following materials:** ● **Foldable:** ○ **Facilities (name, shape, dimensions, area)** ○ **Checklist** ○ **Coordinate Points** ● **Graph paper:** ○ **You will be creating your draft on the paper using your dimensions from your foldable and the shapes that you can cut out.** ● **Cutout shapes:**	**Slide 4** **Slide 5**

○ **Label all shapes with the facility they are assigned** ○ **Write down their area** **On page 3-5, there are the names of our required facilities. Each facility has a shape assigned to it you will see dimensions and a Total Area of the shape. You are responsible for sketching your shapes and labeling its dimensions. You may notice that some of the shapes are missing dimensions or the total area. You are responsible for calculating the missing blank to be able to know how much space will be used per shape, and remember on page 1 we covered our area formulas, so you can use them to make your calculations. This will help you plan your park. (5 minutes)** **On page 2 at the very top, I will do 3 examples with you, and if you have any questions please feel free to ask. *on the whiteboard with expo markers you can perform the algebraic steps to complete the 3 examples* (answer key will be provided to you, the teacher) (5 minutes)**	**Slide 6** **Do the first example with students, but have the students do 2 and 3 up at the board** **remind them it's okay to look back at page 2 of the foldable** **eating pavilion is missing a 3 on the left hand side**
Activity 3: Making the Blueprint Duration: 34 minutes **Now you will begin filling out your foldable. Now, I will pass out the graph paper and a page with shapes on it to each group. On the graph paper is where you will be creating your map. You may divide the work between group members. Once you fill in your foldable and have the total area of the land along with the area and dimensions of the different shapes, you can begin planning your park on the graph paper I gave you. You can use the shapes from the paper that I gave you to help plan your map.** ● **Remember to fence** ● **your land by outlining the area, label your facilities, provide the area of your facilities, and then give the total area of the facilities. REMEMBER YOU CAN ADD ADDITIONAL THINGS TO YOUR MAP** ● **After you have made your plan using the cutouts, check the checklist on page 6 of your foldable to make sure all requirements are met and submit it to the firm (me) for approval. DO NOT GLUE DOWN YOUR SHAPES UNTIL YOU HAVE RECEIVED APPROVAL** **Students begin their rough draft with their groups using guidelines given and using strategies taught. The foldable will help guide the students, and I will be walking around the room to facilitate and help if there are any questions.**	**Slide 7** **Students can split up work and share their answers, but they must explain their work to their group** **In the case that students finish early send them back for revision of their map. Ask them how they can improve it and encourage them to optimize space.**

Activity 4: Submitting their blueprint Duration: 6 minutes **Students submit rough draft for approval before beginning map on Flip chart paper. If the total area of the facilities is less than the total area of the plot of land is met, then the map is approved. If the total area of the facilities is greater than the total area of the land, then the map is denied and sent back for review. 3 minutes** **Clean up: 3 minutes**	**When approved students can the glue down their shapes on to their map.** **Slide 8**

Build a Park

Day 1 (let's get in groups of 3)

Introduction

- You've been hired by a Developing Firm (the teacher) to build an **Amusement Park!**
- 24u x 28u (cannot be bigger)
- You are responsible for the blueprints of the parks setup
- You will be presenting to the class
  - Poster
  - Proposal Documentation
- I must approve your plans first

AREA

You will be working with area for the majority of the project.

- On page 2 of the handout I just gave you, what are the area formulas of the following shapes:
  - Square
  - Trapezoid
  - Rectangle
  - Parallelogram
  - Circle
- Work on your own for 2 minutes.

Project Requirements

- In your amusement park, you are required to have certain facilities to meet code.
  - Welcome Area
  - Restrooms (4 total)
  - Food Plaza
  - Eating pavilion
  - 8-10 Roller Coasters
  - A Petting Zoo
  - Body of Water
- YOU CAN ALSO ADD ADDITIONAL FACILITIES IF I HAVEN'T PLACED LIMITATIONS (restrooms and roller coasters)
- Use the requirements to complete your draft.
- You must fit in your plot of land
- You will be writing down ordered pairs later in the project, so keep facility placement in mind.

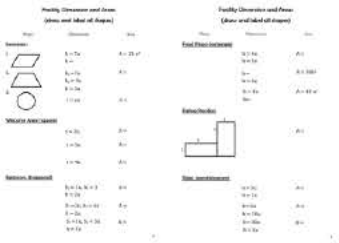
Materials

- Foldable:
  - Facilities (name, shape, dimensions, area) pg 3-5
  - Checklist pg 6
  - Coordinate Points pg 7
- Graph paper:
  - You will be creating your draft on the paper using your dimensions from your foldable and the shapes that you can cut out.
- Cutout shapes:
  - Label all shapes with the facility they are assigned
  - Write down their area

Foldable pg 3-5

- Name of Facilities
- Assigned shape
- Dimensions
- Area
- Some information is missing
- Examples

Note: The eating pavilion is missing a dimension of height 3 on the left hand side.



Making the Blueprint

Divide up your work :

- 1 person cut out the shapes and label each shape with the facility name and area of the shape
- 1 person begin outlining the park on the graph paper (24u x 28u)
- 1 person work on the foldable finding the areas, drawing, labeling

Once you have finished your part see if your groupmates need help, and help them

Begin planning your park:

- Use your cut outs to represent facilities
- Calculate the total area of the land and the total area of the facilities
- Check your checklist on page 6
- Fill out your bottom section of your check list:
  - Total area of land
  - Total area of facilities
  - Free space (area of land - area of facilities)
- Submit for review (raise hand and i will come to you)
- DO NOT GLUE until you have received approval.

Clean Up

Glue this side down into your notebook.

Thank you!

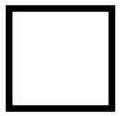
Checklist and Guide for:

Area, Facilities, and Legend

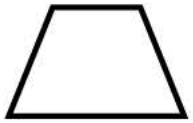
What is our area?

(What are the area formulas of the shapes?)

Square:



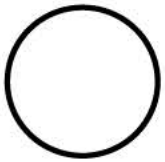
Trapezoid:



Rectangle:

Parallelogram:

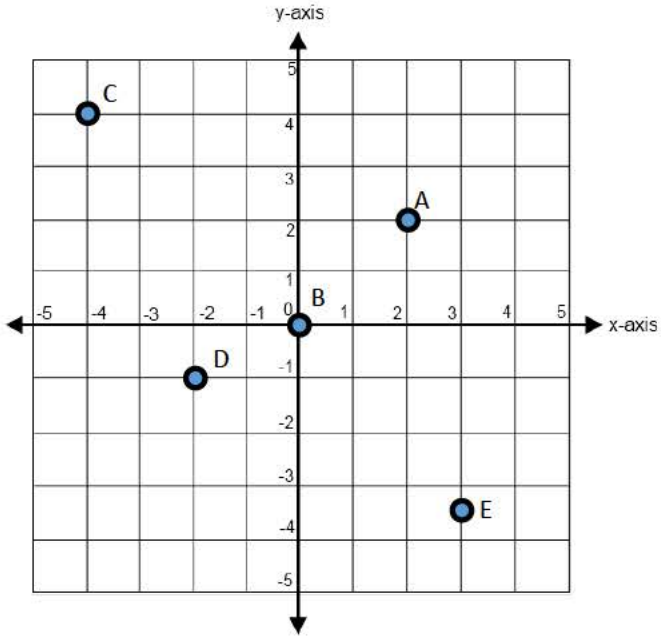
Circle:



Coordinate Points

Coordinate plane: A coordinate system formed by the intersection of a horizontal number line, called the x-axis, and a vertical number line, called the y-axis.

Ordered pair: A pair of numbers that can be used to locate a point on a coordinate plane. E.g. C(-4,-4) is point A located at "-4" on x-axis and at "4" on y-axis.



What are the coordinate points for each point?

A

B

C

D

E

Checklist

- ◊ 1 Welcome Area
- ◊ 4 Restrooms
- ◊ 1 Food Plaza
- ◊ 1 Eating Pavilion
- ◊ 8-10 Rides
- ◊ 1 Petting zoo
- ◊ 1 Body of Water
- ◊ Any thing you want to add?
- ◊ Is there still space for crowd movement?

Total area of the land:

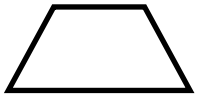
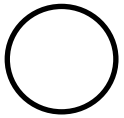
Total area of the facilities:

Free area:

Approved, Denied or Revision:

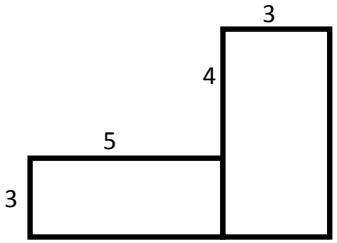
Facility Dimension and Areas

(draw and label all shapes)

Shape	Dimensions	Area
Examples:		
1. 	$b = 7u$ $h =$	$A = 28\ u^2$
2. 	$b_1 = 7u$ $b_2 = 9u$ $h = 3u$	$A =$
3. 	$r = 2u$	$A =$
Welcome Area (square)		
	$s = 2u$	$A =$
	$s = 3u$	$A =$
	$s = 4u$	$A =$
Restroom (trapezoid)		
	$b_1 = 1u, b_2 = 3$ $h = 2u$	$A =$
	$b_1 = 2u, b_2 = 6u$ $h = 2u$	$A =$
	$b_1 = 1u, b_2 = 5u$ $h = 3u$	$A =$

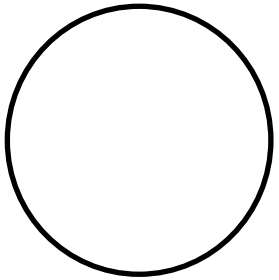
Facility Dimension and Areas

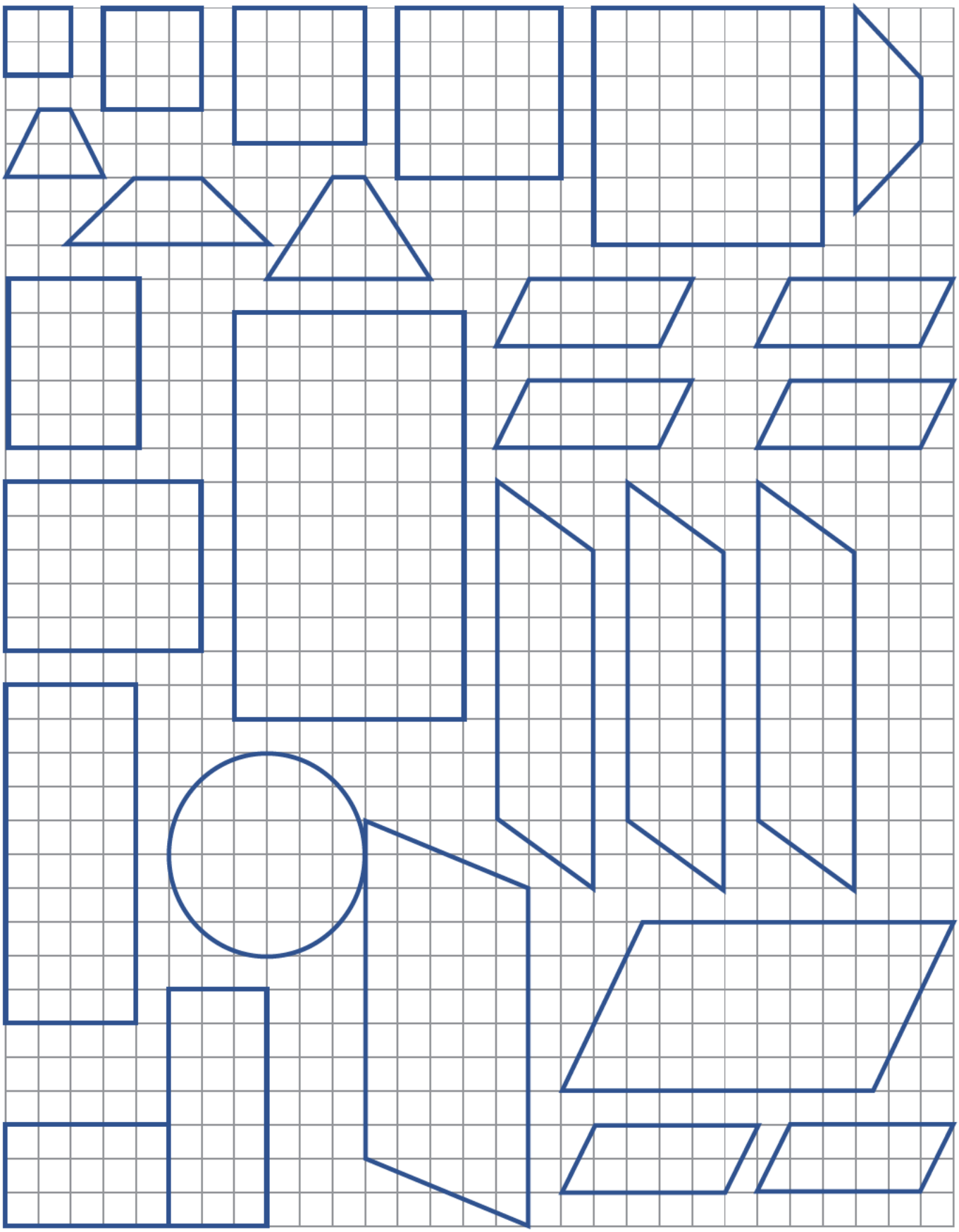
(draw and label all shapes)

Shape	Dimensions	Area
Food Plaza (rectangle)		
	$b = 4u$ $h = 5u$	$A =$
	$b =$ $h = 6u$	$A = 30u^2$
	$b = 4u$ $h =$	$A = 40\ u^2$
Eating Pavilion		
		$A =$
Rides (parallelogram)		
	$b = 5u$ $h = 2u$	$A =$
	$b = 3u$ $h = 10u$	$A =$
	$b = 10u$ $h = 5u$	$A =$

Facility Dimension and Areas

(draw and label all shapes)

Petting Zoo (square)		
	$b = 5u$	$A =$
	$b = 7u$	$A =$
Body of Water		
	$b = 7u$ $h =$	$A = 84u^2$
	$r = 6u$	$A =$



Lesson Plan

Name of Lesson: Build a Park (Day 2)

Learning (TEKS) Objective:
6th grade:
(10) Expressions, equations, and relationships. The student applies mathematical process standards to use equations and inequalities to solve problems. The student is expected to:
(A) model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts
(11) Measurement and data. The student applies mathematical process standards to use coordinate geometry to identify locations on a plane. The student is expected to graph points in all four quadrants using ordered pairs of rational numbers
7th grade:
(9) Expressions, equations, and relationships. The student applies mathematical process standards to solve geometric problems. The student is expected to:
(C) determine the area of composite figures containing combinations of rectangles, squares, parallelograms
(11) Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:
(A) model and solve one-variable, two-step equations and inequalities;

Student Outcome (*Students will be able to…)*
Students will be able to label points on a coordinate grid.

Day of the Week and Time:
Tuesday: 12:45- 1:15 p.m.

Total Length of Lesson:
45 Minutes

Materials *(per 1 class of 25 students):*

10 Proposal Pages
30 Area foldables (from yesterday)
10 sheets of Grid paper (from yesterday)
10 Yardstick or rulers
10 sheets of grid flip chart paper (25in x 30in)

Advanced Preparation *(day before, morning of…)*

Instructional Delivery	**Notes to Teacher:**
Activity 1: Proposal Documentation Duration: 7 minutes	
Good afternoon Engineers! So today we will begin working on our final presentation. Yesterday we submitted our drafts and so now we can move on to creating our proposal presentation.	**slide 2**
We will start today by me handing out the proposal documentation. The proposal documentation is asking for simple questions like: Engineers working on the project, the Park Name, the location of your park and the area of the plot of land and the area of the facilities as well as the "free space" available. As a group you will be given 7 minutes to complete your proposal cover sheet.	**slide 3** **this information is on page 6 of the foldable**

Activity 2: Coordinate Points Duration: 12 minutes	**slide 4**
We will be using the grid chart as a coordinate plane. The coordinate plane will help us create a legend of our map. For the Legend, on the back of your proposal sheet, you will see the name of the required facilities. Next to the facilities there will be blanks. Your job for the legend is to label the vertices of your facilities and write down their coordinate points next to the name. For the circle, you can use just the center point of the circle as your coordinate point. Please only work in Quadrant 1 of a coordinate plane, meaning, the graph paper should be labeled 0 to 24 on the x axis, and 0 to 28 on the y axis. **(5 minutes)**	**Slide 5**
On page 7 of yesterday's foldable, there is an example of coordinate points, we will work on it together. (there are definitions and practice points) 7 minutes	**Slide 6** **typo on foldable** **slide is right** **Draw the example for ordered pair**
Activity 3: Creating final Presentation Duration: 26 minutes	
Now that we have completed our proposal sheet and know how to fill in our legend, we will move on to drawing our blueprint onto the grid Flip chart I will be handing out. The grid is similar to what we used yesterday, but is in a bigger scale.	**slide 7**
Now, work on your presentation,you should transfer your draft on to the flip chart paper, name each attraction and facility. To help you, you can assign responsibilities to each member in your group, but you all should be working together.	**after they are done transferring, encourage students to help with the legend. Once finished, allow students to begin being creative in the roller coasters, and attractions.**
Students will create their final poster and map. Students should be creative and use color and label each shape with the name of the attraction. Using the map, students will also be asked to make a list of all the required attractions and include the four points of the shape. (23 minutes) **clean up (3 minutes)**	

Build a Park

Day 2

Good Afternoon Engineers!!

Today we will...

- Start working on our final presentation
  - Proposal Documentation
  - Move our draft on to a poster
  - Legend of our map
- Learn about the Coordinate Plane and Coordinate Points

Proposal Documentation

Fill in the blank lines:

- Engineer's Names
- Name of Park
- Total Area of Land
- Area of Facilities
- Free Space

} Hint: On page 6, you already have this information!

Coordinate Plane and Coordinate Points

Filling in the Legend

Our park is in Quadrant 1 (+,+)

- You will be writing down the ordered pair of the vertex (corner) of each shape for the assigned facility name (for the circle use the center point for the ordered pair)
- Ex.

  Welcome Area: (2,0), (2,2), (4,2), (4,0)

What are they? (pg 8 of foldable)

Coordinate Plane:

A coordinate system formed by the intersection of a horizontal number line, called the x-axis, and a vertical number line, called the y-axis.

Coordinate Points (ordered pair):

A pair of numbers that can be used to locate a point on a coordinate plane.

Ex. (-4, 4) is point A located at "-4" on x-axis and at "4" on y-axis.

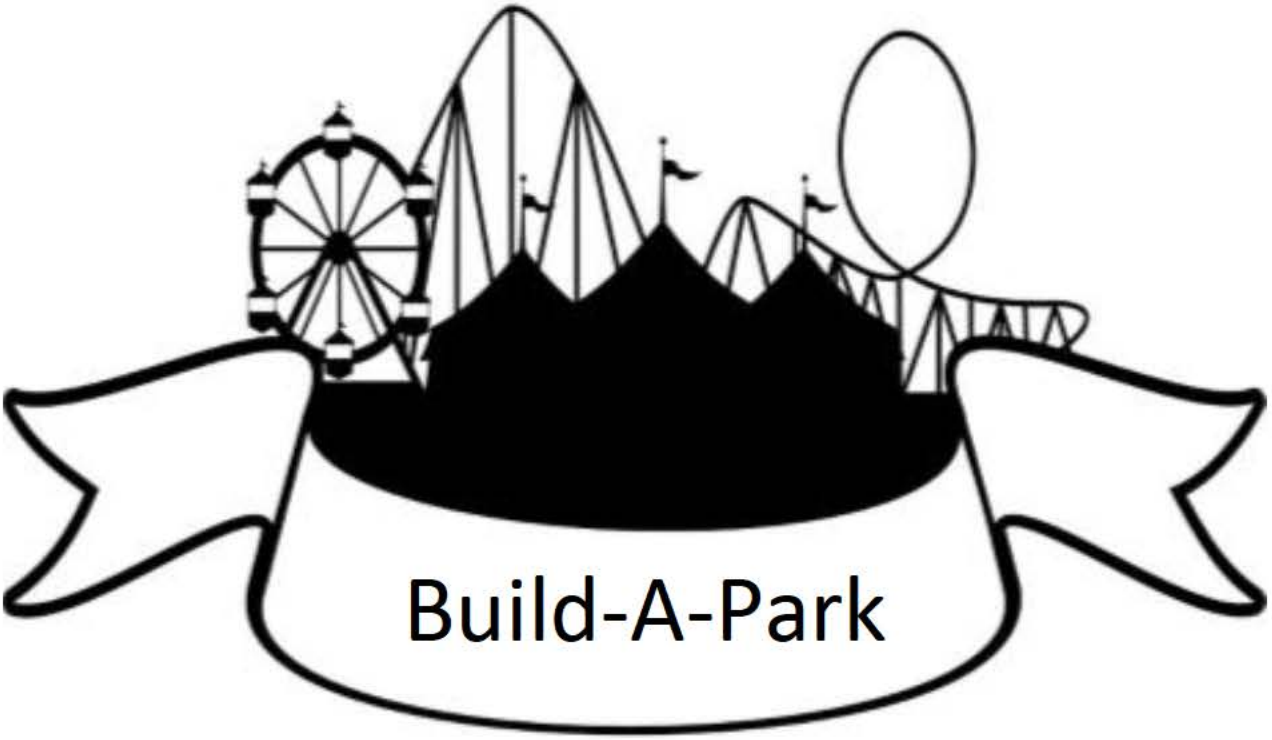
Final Presentation

What to expect, what we need to do & how to do this.

- Tomorrow you will be presenting your map to the committee (class) for approval: you will present your proposal documentation and your map.
- So we need to:
  - Transfer our drafts on to our flipchart paper
  - Fill in your legend using ordered pairs
- Assign roles:
  - 2 transfer the map on to the bigger scale
  - 1 fill in the legend

Clean Up

f you aren't finished, you will have some time tomorrow.



Engineer's Names:_____

Name of Park: _____

Total Area of Land: _____

Area of Facilities: _____

Free space: _____

Park Map Legend

Facilities	Coordinate Points
Welcome Area	
Restroom 1	
Restroom 2	
Restroom 3	
Restroom 4	
Food Plaza	
Ride 1	
Ride 2	
Ride 3	
Ride 4	
Ride 5	
Ride 6	
Ride 7	
Ride 8	
Ride 9	
Ride 10	
Petting Zoo	
Body of Water	

Lesson Plan

Name of Lesson: Build a Park day 3

Learning (TEKS) Objective:
6th grade:
(10) Expressions, equations, and relationships. The student applies mathematical process standards to use equations and inequalities to solve problems. The student is expected to:
(A) model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts
(11) Measurement and data. The student applies mathematical process standards to use coordinate geometry to identify locations on a plane. The student is expected to graph points in all four quadrants using ordered pairs of rational numbers
7th grade:
(9) Expressions, equations, and relationships. The student applies mathematical process standards to solve geometric problems. The student is expected to:
(C) determine the area of composite figures containing combinations of rectangles, squares, parallelograms
(11) Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:
(A) model and solve one-variable, two-step equations and inequalities;

Student Outcome (*Students will be able to…)*
Students will be able to present in front of a class their design process and mathematical elements.

Day of the Week and Time:
wednesday: 12:45-1:45

Total Length of Lesson:
60 minutes

Materials *(per 1 class of 25 students):*

10 Proposal Pages (yesterday)
30 Area foldables (yesterday)
10 sheets of Grid paper (yesterday)
10 Yardstick or rulers (yesterday)
10 sheets of grid flip chart paper (25in x 30in) (yesterday)
Spinner (link)

Advanced Preparation *(day before, morning of…)*

Instructional Delivery	**Notes to Teacher:**
Activity 1: Introduction and breakdown of expectations Duration: 10 minutes	
Today is our presentation day, you will have 20 minutes to finish anything you may need done, remember to complete proposal documentation, the presentation, and the legend. **Explain the expectations of each presentation:** ○ **Each group has 3 minutes to present their poster** ○ **Each group should walk us through their map** ○ **Present their Proposal sheet** ■ **Provide the free space**	**slide 2**

■ Provide area of the attractions ○ Tell us about the park and where it's built ○ Why the client should approve the construction of their attraction ● The order of presentation will be at random. Assign numbers to group and use spinner to choose. ● https://wheeldecide.com/index.php?c1=1&c2=2&c3=3&c4=4&c5=5&c6=6&c7=7&c8=8&c9=9&c10=10&t=Presenting+will+be+Group...&time=5	Slide 3
Activity 2: Finishing Touches Duration: 20 Have the students finish up any changes they may want to do to the project and clean up. Their project should meet all requirements, and be creative with the drawing of the park at the 2-D level. Have the students draw walkways, name their rides, draw benches, and trees.	slide 4
Activity 3: Presentation of final Product Duration: 30 Presentations to the whole class. ○ Each group has 3 minutes to present their poster ○ Each group should walk us through their map ○ Present their Proposal sheet ■ Provide the total area that is available ■ Provide area of the attractions ○ Tell us about the park and where it's built ○ Why the client should approve the construction of their attraction use spinner Clean up if time permits	slide 5

Build a Park

Day 3

Presentation Day!

Today s agenda:

- You will have 20 minu es o make your projec as crea ive as possible, add rees, benches, color any hing you'd like o see a your dream park This is also your ime o inish any hing up.
- You will hen have presen a ions

Expectations of Presentations

- Each group has 3 minutes to present their poster
- Each group should walk us through their map
- Present their Proposal sheet
  - Provide the free space
  - Provide area of the attractions
- Tell us about the park and where it's bui t
- Why the c ient should approve the construction of their attraction
- The order of presentation will be at random

Finishing touches

- Finish up any thing you have left
- Your project should meet all requirements, and be creative with the drawing of the park at the 2-D level.
- Draw walkways, name your rides, draw benches, and trees.

20 minutes
http://www.on ine-timers.com/timer-20-minutes? ime=20793066_695

Order of Presentations

Number off 1-10

This spinner will determine your order...

https://wheeldecide.com/index.php c1=18c2=28c3=34c = 8c5=58c6=63c7=73c8=88c9=93c10=103&=Presenting wil l be Group &time=3

Lesson Plan

Name of Lesson: Step Right Up

Learning (TEKS) Objective:
TEKS:

1. **7th grade: (6) Proportionality. The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:**
   (D) make predictions and determine solutions using theoretical probability for simple and compound events;

Student Outcome (*Students will be able to…)*
students will be able to make predictions based or probability.

Day of the Week and Time:
Tuesday: 8:15-9:00

Total Length of Lesson:
45 minutes

Materials *(per 1 class of 25 students):*

2 deck of cards
Handout
Candies (~75 candies)

Advanced Preparation *(day before, morning of…)*

Day before: divide card decks into groups of 10

Instructional Delivery	**Notes to Teacher:**
Activity 1: Modeling Duration: 10 Use Powerpoint Introduce the game as something fun to get the day started. Explain that you'll be using a regular deck of cards to help students understand some challenging probability problems. While you're modeling how to play and use the organizer, that's the best opportunity to review the structure of a regular deck of cards, as that's essential knowledge they'll need to play. PPT provided Show them the graphic organizer and how to fill it in by "playing" a few sample rounds.	**Play a few rounds where students guess if your next card is going to be higher or lower. offer an incentive if students are right.** **explain to students that there denominator decreases each time, and tell then to account for previously drawn cards**
Activity 2: Playing Duration: 25 Split your class into small groups, giving each one no more than 10 regular playing cards. Each group would have a different set of cards and probabilities to figure out, which eliminates the problem of students copying answers. That element plus the "game" itself should keep most students focused and invested in the activity. They'll be filling out the organizer and then considering the reflection questions as well.	**have PPT up for students to self regulate them selves**

Activity 3: Discussion Duration: 10	
At the end of the game there's a few reflection questions you might talk about together. Students will probably think this game is pretty easy at the beginning—how hard can it be to guess correctly high or low? I think their results will probably skew towards an even number of correct and incorrect guesses.	

STEP RIGHT UP

Take a chance higher or lower? Maybe even equal?

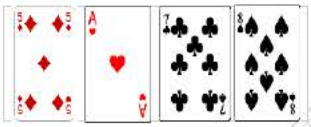
If you're right, you get a prize!!

Game of Chance

- Probability
- Event: A set of possible outcomes resulting from a particular experiment.

Anatomy of a Deck of Cards

- 52 cards in a deck
- 4 faces (Hearts, Spades, Club, Diamond)
- 13 cards per faces
- Value increases from A, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K



How to Play!

- Draw the card on top of your deck
- Write down the number (and face) on your paper
- Calculate the chances of each prediction: Higher, Lower or Equal
- Make Prediction!
- Draw next card
- Write down if you were right or wrong
- Repeat!!

Probability: "High or Low?"

Card	Probability HIGH?	Probability LOW?	Probability EQUAL?	Your Guess?	Was your guess correct?
Number Face	#/51	#/51	#/51	High, Low or Equal	Yes or No
	#/50	#/50	#/50		
	#/49				

Filling Out Game

All numerators when added up should equal denominator, and denominator always decreases by 1


Questions to think about while playing!
Do all of my fractions add up?
Did I take into account cards I have already drawn?
Have I been subtracting from the denominator every time?

NAME: **CLASS:** **DATE:**

Probability: “High or Low?”

Card	Probability HIGH?	Probability LOW?	Probability EQUAL?	Your Guess?	Was your guess correct?

Reflection Questions:

1. How many of your groups' guesses were right? How do you think your group did overall?

2. Was this game easier or harder than you thought before you started? Explain.

3. How would the game change if you put each card back into the deck and shuffled every time before dealing a new card?

Lesson Plan

Name of Lesson: Budgeting

Learning (TEKS) Objective:

- Career Development

5.A,D,E

(5) The student uses mathematical processes with graphical and numerical techniques to study patterns and analyze data related to finance. The student is expected to:

(A) use rates and linear functions to solve problems involving finance and budgeting, including compensations and deductions;

(D) use mathematical processes with algebraic formulas, numerical techniques, and graphs to solve problems related to job cost analysis;

(E) identify what parameters to change such as cost of materials, cost of labor, and work time required to improve the overall cost of a project

Student Outcome (*Students will be able to…)*

- Students will have the opportunity to create their own budget on Excel about an amusement park. Students will work in pairs to create a budget while receiving a predesigned Excel form where the students are able to manipulate the sheet as well as to see how the form contains the formulas. Information needed will be given so that the students know how to create an amusement park budget keeping in mind a scenario that will have specific information that students have to keep in mind while doing their budgeting.

Day of the Week and Time:

- Day 2 from 9:00 AM to 11:00 AM

Total Length of Lesson:

- 2 hours

Materials *(per 1 class of 25 students):*

- Computers with Excel (one per pair of students)
- Handout with essential information and activity information (one per pair)
- Budgeting PowerPoint
- Scenarios (1 per pair)
- Students budgeting handout (one per student)

Advanced Preparation *(day before, morning of…)*

N/A

Instructional Delivery	**Notes to Teacher:**
Activity 1: Budgeting Activity **Duration:** 45 minutes • Before doing a class discussion about the warm-up have the students copy the warm-up into their notebook (give them 3 minutes to do that) • After doing that have let the students talk among each other to see what the come up with and the conclusions that they can draw for 5 minutes	Everything needed for the lesson plan is on the powerpoint provided The warm-up overall has to take 15 minutes but if you

• Once the students have had the chance to discuss among each other have a class discussion and make sure to bring this topics up when discussing:
  ○ What is your plan?
  ○ How did you determine this?
  ○ How long will it take you to buy the bike?
  ○ Were you able to buy the bike within the two months?
• After the warm-up there is a slide that has a definition about budgeting and an example
• The students will have a budgeting activity in which the students will be given a scenario so that no one feels discriminated
  ○ For this activity each student will receive a budgeting plan so that they all have an opportunity to show how they manage money
  ○ Each student may have different ways of spending money, but make sure that each student spends at least 5 dollars from what the scenario says
  ○ When discussing make sure that everyone has an opportunity to sure what they think
	think think you need more time for discussion its fine but no longer then 20 minutes for the warm-up
	
	The slide is not something that has to be too much time spent on
	The budgeting activity should take around 15 minutes
	○ 2 minutes for instruction
	○ 7 minutes for students to work
	○ 7 minutes to share

Activity 2: Team Builder **Duration:** 15 minutes	

• The whole topic can be very overwhelming for the students so this is a perfect time for a break
• On the PowerPoint you will find all the instructions on how the activity is played, but for further explanation I will leave a video to you to watch or for the class to watch
  ○ https://www.youtube.com/watch?v=DWnZhxhqUbA
• Activity:
  ○ Per Pair:
  ▪ One plastic ball
  ▪ 2 pieces of twine (3 yards)
  ○ Per Classroom:
  ▪ 2 bowls
  ○ Goal:
  ▪ Get the ball into the bowl
  ○ Challenge:
  ▪ Ball has to travel twice before being put into bowl
  ○ Introduction:
  ▪ Get your piece of twine and your ball and line up face to face with your partner
  ▪ Ball starts on partner one side and has to travel to partner 2 side and back
  ▪ Once you are successful and comfortable with your partner switch with someone and try it again
• However your new partner has to be taller or shorter than you NOT
	It is up to you if you want to choose your pairs or you let them choose
	
	Just keep in mind that the team builder relates to budgeting because it is all about knowing how to balance
	
	It is a great way to introduce budgeting to a higher scale

your same size o Instructions (Extra Challenge): ▪ The pair has to be face each other holding the twine over the bowl ▪ Ball starts on partner one side and has to travel to partner 2 side and back ▪ Once that is accomplished now you can attempt to drop the ball into the ball ▪ If the ball falls at any time you have to start all over again ▪ First pair to drop the ball successfully into the bowl wins ● Optional Choices (Other Challenges): o Activity can be played inside or outside depending on classroom set up and timing o If you decide to play more rounds switch students into new pairs and have them try it without talking	If you decide to take the students outside for the activity make sure that all the students are respectful, quiet, stay all together
Activity 3: Amusement Park Budgeting **Duration:** 1 hour	Try to put students into pairs before continuing the lesson so that it does not take time from the learning later
● As you start to talk about budgeting at a higher scale there is slide about it ● There is an example that is related to the previous activity that the students did about the budgeting plan ● It is important to go over this example because it is using the Excel sheet so that students have an idea of what we are talking about ● After the example the slide that continuous introduces how we will be using Excel to formulate a budgeting sheet ● At this point the students should be in pairs already and before the activity instructions have the students download their document so they are able to edit it ● Also have the students pick out their scenario and give them their instructions ● The slide of instructions has all the information that students need in order to complete the assignment ● Give students 45 minutes to do the assignment and if you need more time the time is available, but if students finish with enough time have them present their Excel sheet and have them explain with detail what they decided. ● If you have the students finish to early have them present their budgeting by having all the students gather around the computers o Students have to say ▪ how many rides they have ▪ what type of land they received	If you are taking the students to the computer lab make that they already know who their partners are, have them choose their scenario, and take the instructions to the lab Make sure you go over the rules again about being quiet in the hall, take all there instructions with them, and DO NOT allow any drink or food to the lab Once the students have downloaded the Excel file have the students o go to the second sheet of the Excel form o from there have them click on formulas tab o Then click on show formulas so that students see the math behind it

▪ the number of restrooms and what type of restrooms ▪ the parking lot o Make sure they have a name for the amusement park	As you go over this have another tab open with the budgeting plan of Excel so that you can show how the formulas work on a program like that and the math behind every calculation

WARM UP

- You want to buy a bike within two months which cost $150.00, so you decide to work for your neighbor by walking his dog every afternoon. Your neighbor has told you that he will pay you $10.00 a day for walking the dog for an hour. However you owe your older brother $30.00 and you have to return the money before you buy the bike. What is your plan?

THIS IS BUDGETING

- Budgeting is a form of managing money
- People use budgeting when having to pay bills and other house expenses
- Examples:
  - When parents get paid they divided the full amount of their check into how much is going to be used to pay bills and what is left for spending or saving

BUDGETING ACTIVITY

- You will all receive a handout where you are going to determine how you manage the money that your parents provide you every week
- You will determine the type of expenses you experience in school or the expenses you think you can have in school
- From there you will be writing down how much you spend and what you spend it on
- At the end you will put the total amount that you spend and if you have any money left over you will record that as savings
- Must spend at least $5.00 of the money you recieve

SCENARIO

- Your parents give you $20.00 every week for the your school expenses. You only have $20.00 flat there is no credit cards or borrowing which means that you need to be wise on how you spend your money. Must spend at least $5.00

TIMER

https://www.google.com/search?q=timer&rlz=1C1JZAP_enUS811US811&oq=timer&aqs=chrome..69i57j0l5.817j0j7&sourceid=chrome&ie=UTF-8

PRESENTATION

- Let's have a couple of students present your saving plan
- At least two students

PLASTIC BALL COASTER

- Per Pair:
  - One plastic ball
  - 2 pieces of twine (3 yards)
- Per Classroom:
  - 1 bowls
- Goal:
  - Be able to make the ball travel from one side of the twine to the other
- Challenge:
  - Ball has to travel twice before being put into bowl

PLASTIC BALL COASTER

- Introduction:
  - Get your piece of twine and your ball and line up face to face with your partner
  - Ball starts on partner one side and has to travel to partner 2 side and back
  - Once you are successful and comfortable with your partner switch with someone and try it again
    - However your new partner has to be taller or shorter than you NOT your same size

PLASTIC BALL COASTER NEW CHALLENGE

- Instructions:
  - The pair has to be face each other holding the twine over the bowl
  - Everyone has to form a circle around the bowl
  - Ball starts on partner one side and has to travel to partner 2 side and back
  - Once that is accomplished now you can attempt to drop the ball into the ball
  - If the ball falls at any time you have to start all over again
  - First pair to drop the ball successfully into the bowl wins

BUDGETING AT A HIGHER SCALE

- When budgeting at a higher level it is hard to do it in paper because it is too many calculation
- Now we have programs that do the calculations to ensure that there is no errors
- Excel is one of the programs that computes this calculations to ensure a good managing and we will be using this program for this activity

BUDGETING EXAMPLE

Net Income:		$20.00
	Cost:	
Daily Expenses:		
Junk Food	$	10.00
Friday Games	$	2.00
Total Amount:	$	12.00
Savings:	$	8.00

BUDGETING

- However now we will be talk about budgeting for a bigger project, AMUSEMENT PARKS
- When building an amusement park, budgeting plays a great role
- To be able to build something this big one has to know how much you are spending for parking lot, for ride space, for restrooms, for the entrance, etc.
- However we are only going to be focusing on some components like the rides, restrooms, parking lot, and land

ACTIVITY INSTRUCTIONS

- You have all been hired to come up with a budget for building an amusement park
- You will be working in pair for this activity
- You will all receive a scenario where you will be told the total amount you are receiving for the project in hand and the amount of money that is already being used for certain constructions
- Keep in mind what you learned previously and that amusement parks have between 8 to 10 rides (HOWEVER the amusement park that you are constructing is a lot bigger and needs to have more of everything)
- Your job is to use the money wisely to come up with a full amusement park including rides, restroom, etc. You will have 45 minutes to work on your budgeting
- When you finish you will be turning it in and we will present after everyone is done

TIMER

https://www.google.com/search?q=timer&rlz=1C1JZAP_enUS811US811&oq=timer&aqs=chrome..69i57j0l5.817j0j7&sourceid=chrome&ie=UTF-8

PRESENTATIONS

- Show budgets on the computers and explain every detail

Name: _____ Date: _____

Net Income: _____ /week

	Cost
Daily Expenses:	
	$
	$
	$
	$
	$
	$
	$
Total Expenses:	$
Saving (if any):	$

Name: _____ Date: _____

Net Income: _____ /week

	Cost
Daily Expenses:	
	$
	$
	$
	$
	$
	$
Total Expenses:	$
Saving (if any):	$

Name: _____ Date: _____

Net Income: _____ /week

	Cost
Daily Expenses:	
	$
	$
	$
	$
	$
	$
	$
Total Expenses:	$
Saving (if any):	$

Activity Instructions

Today you will be building a budget and determining how expensive it is to build an amusement park. Each pair will pick out a little paper from the container which will contain your scenario that will change your budgeting. You will create your budgeting on Excel and the document you will open it and download. Once you have downloaded the document you can start editing it. However if you do not download the document all the work you do on it will not save because the person after will change everything. On your budgeting you have to include

- the cost of the land and its services
- the number of rides and how much it cost for each ride
- the cost of restroom and the amount of restrooms you will have
- the parking lot and the size of it

When you open the document it already has the formulas included for you so you do not have to go online and search for anything. Once you have finished with the document you will either print it out or turn it in online to present it to the class.

Essential Information for Creating Profit and Loss Budget of an Amusement Park

- Total amount given for creating the amusement park
    - Total amount given is $109,610,000
- Cost of land
    - developed or undeveloped land
- Cost of building
    - Rides
        - 8 to 10 rides
        - cost for each ride
    - Restrooms
        - amount of restroom

Scenario 1:

A company has hired you to build an amusement park, but before being able to do that you have to come up with a plan of what your amusement park will have. The company is giving you $109,610,00 to be able to construct the amusement park. You will have to come up with a budget that you will be showing the company so that they can give you green light to be able to start on the project. You have bought a developed land which means that it is in good conditions to build and you are in luck because it comes with water, light, and gas service. This means that you are all set to just start building. The cost for the land is $10,600,000. Whatever you have left is now being used for rides, restrooms, and other. Keep in mind that you need to save money for managing the amusement park for any corrections that have to be made. You need to save at least $10,000,000.00.

Scenario 2:

A company has hired you to build an amusement park, but before being able to do that you have to come up with a plan of what your amusement park will have. The company is giving you $109,610,00 to be able to construct the amusement park. You will have to come up with a budget that you will be showing the company so that they can give you green light to be able to start on the project. You have bought a developed land which means that it is in good conditions to build however the land has no services. The land itself cost $9,500,000, but you will have to pay $5,000 more for your services to be added. Now that all of that is settle you can now use the money that is still available to start thinking about rides, restroom, and other thing that your amusement park is going to have. Keep in mind that you need to save money for managing the amusement park for any corrections that have to be made. You need to save at least $10,000,000.00.

Scenario 3:

A company has hired you to build an amusement park, but before being able to do that you have to come up with a plan of what your amusement park will have. The company is giving you $109,610,00 to be able to construct the amusement park. You will have to come up with a budget that you will be showing the company so that they can give you green light to be able to start on the project. You have bought an underdeveloped land which means that it has to be cleaned and water, light, and gas services have to be done. The land itself cost $8,450,000 however for the services to be added that will be $5,000 more and with the cleaning of the land that will be another $5,000. Now that all of that is settle you can now use the money that is still available to start thinking about rides, restroom, and other thing that your amusement park is going to have. Keep in mind that you need to save money for managing the amusement park for any corrections that have to be made. You need to save at least $10,000,000.00.

Budgeting Plan

	Cost	Quantity	Total Cost	Total Amount Left
Inital Amount	$109,610,000.00	1	$109,610,000.00	$109,610,000.00
Land	$0.00	1	$0.00	$109,610,000.00
Rides	$10,650,000.00	1	$10,650,000.00	$98,960,000.00
Restrooms	$0.00	1	$0.00	$98,960,000.00
Parking Lot	$0.00	1	$0.00	$98,960,000.00
			Total Left Over	$98,960,000.00

Rides	Ride Type	Cost	Quantity	total
	Roller Coaster	$5,000,000.00	2	$10,000,000.00
	Drop Zone	$900,000.00		$0.00
	Ferris Wheel	$800,000.00		$0.00
	Water Ride	$10,000,000.00		$0.00
	Flying Swings	$900,000.00		$0.00
	Kids Ride	$90,000.00		$0.00
	Bumper Cars	$100,000.00		$0.00
	Shuttle	$3,000,000.00		$0.00
	Air Seats around Park	$4,000,000.00		$0.00
	Haunted House	$8,000,000.00		$0.00
	Tea Cup Ride	$95,000.00		$0.00
	Himalayas	$700,000.00		$0.00
	Lazer Tag	$1,000,000.00		$0.00
	Go Karts	$2,000,000.00		$0.00
	Souvenoir Shop	$4,000,000.00		$0.00
	4D Movie Experience	$4,000,000.00		$0.00
	Petting Zoo	$5,000,000.00		$0.00
	Lazy River	$650,000.00	1	$650,000.00
	Food Place	$35,000,000.00		$0.00
			Total Amount	$10,650,000.00

Land	Land Type	Cost	Services	Total
				$0.00
			Total Amount	$0.00

Restrooms	Restroom Type	Cost	Quantity	Total
	Single	$10,000.00		$0.00
	Commercial	$30,000.00		$0.00
			Total Amount	$0.00

Parking Lot	Parking Space	Cost	Quantity	Total
	300 people	$200,000.00		$0.00
	500 people	$650,000.00		$0.00
	1,000 people	$900,000.00		$0.00
			Total Amount	$0.00

Lesson Plan

Name of Lesson: Volume

Learning (TEKS) Objective:

(9) Expressions, equations, and relationships. The student applies mathematical process standards to solve geometric problems. The student is expected to:

(A) solve problems involving the volume of rectangular prisms, triangular prisms, rectangular pyramids, and triangular pyramids;

(D) solve problems involving the lateral and total surface area of a rectangular prism, rectangular pyramid, triangular prism, and triangular pyramid by determining the area of the shape's net.

Student Outcome (*Students will be able to…)*

- **Students will be able to determine which cylindrical container can hold more popcorn. To do this, students will have to find a pattern for the dimensions for containers.**

Day of the Week and Time:

- **Tuesday 11:30-1**

Total Length of Lesson:

- **1 hour 30 minutes**

Materials *(per 1 class of 25 students):*

- **25 foldables**
- **-8.5x11 inches (30) demo**
  Cardstock
  -9x12 inches (8)
  12x18 in. colored paper (8)
- **Popcorn**
- **Plate**
- **Cup**
- **Ruler**
- **25 shark tank judge sheets**
- **Paper money $1,000 per group (8 groups)**
- **Construction paper**
- **Markers**
- **Tape**

Advanced Preparation *(day before, morning of…)*

- **Have students cut the flaps of the foldable so that they can open one section at a time, this will allow them to concentrate on one section at a time.**

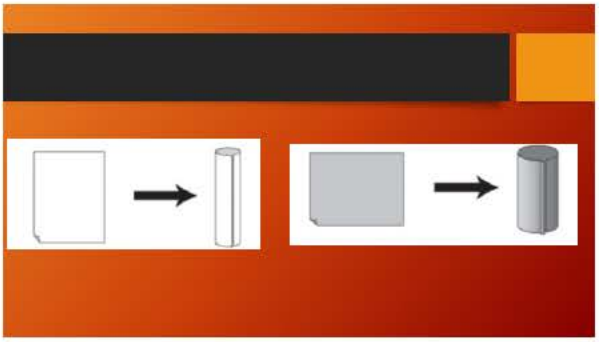
Instructional Delivery	**Notes to Teacher:**
Activity 1: Volume with cylinders **Duration: 20 minutes** • **Ask students what kinds of treats they like to eat when they go to an amusement park.**	-You can walk in the classroom saying, "popcorn get your popcorn here!" with the popcorn bags in your hand. It will set the mood of the lesson.

• **Begin with a small demo to get students thinking about volume** -Take the colored paper (8.5x11 inches) and roll it up along the longest side to form a baseless cylinder that is tall and narrow. Do not overlap the sides. Tape along the edges. - Take the other colored paper (8.5x11 inches) and roll it up along the shorter side to form a baseless cylinder that is short and stout. Do not overlap the sides. Tape along the edge.	-Have students in pairs following what you're doing with their own materials. -Display slide 2 of the power point so that students have a visual of how you want their cylinders to look
• **Now that you have both cylinders ask students to predict which cylinder they think it will hold more popcorn.** -Do you think the two cylinders will hold the same amount? Do you think one will hold more than the other? Which one? Why?	-Slide 3 -Let them discuss their ideas with their group and write their predictions in their foldables.
• **Place Cylinder B (short and stout) on the paper plate with Cylinder A (tall and narrow) inside it. Use the cup to pour popcorn into your Cylinder A as well as in student's Cylinder A until it is full. Carefully, lift Cylinder A so that the popcorn falls into Cylinder B. Have a count down with students so everyone lifts cylinder A at the same time.**	-Display slide 4 so students can see which cylinder is A and which cylinder is B -Student pairs will be following the same exact steps with their own materials and popcorn.
• **Describe what happened. Is Cylinder B full, not full, or overflowing?** -Was your prediction correct? How do you know? If your prediction was incorrect, describe what actually happened. -Students will answer these questions on their foldables independently.	-Slide 5
• **Now have students share what they think happened. If they are the same size paper why did one cylinder hold different amounts of popcorn than the other one?**	-Do not mention any terminology. Let the students mention things like same area different volume before you begin explaining. -you can discuss this as a class.
• **Measure the dimensions in inches with a ruler and record your measurements on the board. Label the tall and narrow Cylinder as Cylinder A.**	-do this while you're looking at slide 6.
• **Measure the de dimensions in inches with a ruler and record your measurements on the board. Label the short and stout Cylinder as Cylinder B.**	-have students label cylinder A (tall) and cylinder B (short) In their tables for both area and volume.
• **Once students have mentioned area and volume you can now move on to explain area. Make sure you explain what area is and how you calculate area for the rectangles used to create the cylinders.** • **Students will calculate area first so that they see that the area is the same for both cylinders.**	-Area slide 7 on Power Point. -Students will be filling in the Area table on their foldables and calculating area.

o **Make sure you explain that the area is the space inside the rectangle not the cylinder** o *Make sure to explain to students that their answer for area needs to be squared. • **Once students realize that the area is the same you can move on to explain that volume is the measure of the amount of space inside of a solid figure, like a cube, ball, cylinder or pyramid. Make sure you explain what volume is and how you calculate volume of a cylinder** • **Students will calculate volume and based on their numbers they'll understand that although the cylinders have the same area when they're flat rectangles, they have different volumes when they are rolled into different cylinders.** o **Make sure you explain that the volume is the space inside the cylinder that's why one cylinder holds more popcorn than the other one** o *Make sure to explain students that their answer for area needs to be cubed.	-calculate the area of cylinder A (rectangle A) together and have them calculate cylinder B (Rectangle B) on their own in their foldables. -Volume slide 8 on Power point. -Students will be filling in the Volume table in their foldables and calculating volume. -calculate the volume of cylinder A together and have them calculate cylinder B on their own -Make sure to explain diameter and radius on the board while doing the examples with the students. -Measure diameter with the ruler.
Activity 2: Popcorn container design Duration: 30 • **Students will be designing their own popcorn containers as pairs.** **The objective will be for students to design a good quality container that will meet the following requirements. They will need to convince their peers that their design is the best design to be sold at an amusement park.** • **Students will pick a construction paper size 8.5x11 inches or 12x18 inches and tape it either long ways or side ways** **Requirements:** **-Cost effective (include price)** -Not too expensive because customers won't buy it, and not too cheap because you won't make profit out of it. **-Can hold a reasonable amount of popcorn** -They'll also need to calculate area and volume of their container and mention those calculations when they're presenting. **-Has an attractive design** **-And they can include other features like reusable, biodegradable, environmentally friendly, or something like promotions (when you buy a popcorn container you get a free soda or free tickets to a ride)** -things that will catch the attention of customers**.**	**-**remind students to consider volume when building their container. **-** it can be either short and stout or tall and narrow, it is up to the students how they want to design it, but they'll have to explain why they chose that size. -Slide 9 -Students should do their area and volume calculations on the same section where they draw their container design, or on the outside of that section/flap.

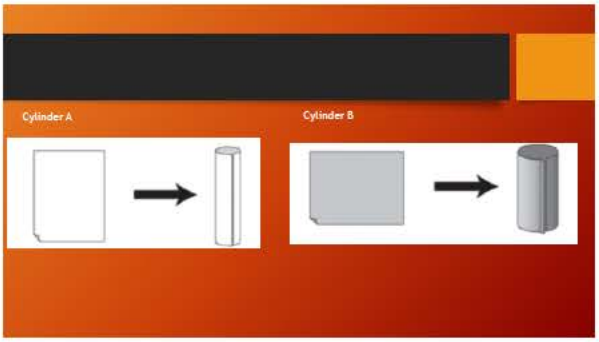
• **Students will need to sketch their design first before they begin to build their popcorn container**	
Activity 3: Duration: 40 minutes • **Students will be presenting to their classmates their popcorn design with the objective of their classmates to invest in their product.** • **Ask them if they have seen the tv show shark tank and show them a short clip that demonstrates a person showing their product with the purpose of convincing the Sharks (judges) to invest in their product.** • **Once students have finished with their container and you have shown the students the shark tank video, let them practice what they will say before they present to the class.** • **During presentations students should mention** o **price of container** o **area and volume** o **why they designed it the way they did** o **key features of their container** o **why sharks should invest in your product** • **While the groups present, the other students will be writing important things that the presenters mention as well as comments they might like to share after in the SHARK TANK JUDGE SHEET.** **(20 minutes presenting)** • **After every group has presented, each group will vote for a group or groups whose product they liked.** -They cannot pick themselves. • **Once they have picked a group/groups, they will award their $1,000 to the group whose design they liked the best. They can also distribute the money to various groups whose design they liked the best.** **(10 minutes deciding what group they like, giving the money, and explaining why they liked it)** **(5 minutes journaling and 5 cleaning)**	-The shark tank video clip is on slide 10 on the Power Point. Play it from the start and stop it at minute 1:45 -Slide 11

Popcorn get your popcorn here!!!



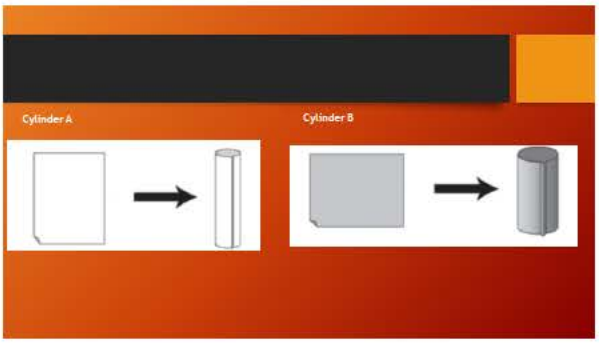
Quick write: Predictions

- Do you think the two cylinders will hold the same amount?
- Do you think one will hold more than the other? Which one? Why?



Quick write: After Demo

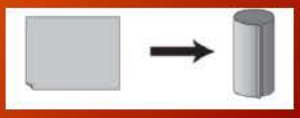
- Describe what happened. Is Cylinder B full, not full, or overflowing?
- Was your prediction correct? How do you know?
- If your prediction was incorrect, describe what actually happened.



Area $A=L \times W$

The area of a flat, or plane figure is the number of unit squares that can be contained within it.

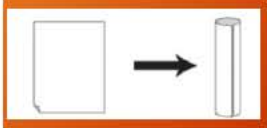
- L
- W



- L
- W

Volume $V=\pi r^2 h$

Volume is the measure of the amount of space inside of a solid figure, like a cube, ball, cylinder or pyramid.



- $\pi=3.14$
- $r^2 = r \times r$
- h

- $\pi=3.14$
- $r^2 = r \times r$
- h

Popcorn Container Project

- Cost effective
  - Not too expensive because customers won't buy it, and not too cheap because you won't make profit out of it
- Can hold a reasonable amount of popcorn
- Has an attractive design
- And you can include other features like reusable, biodegradable, environmentally friendly, or something like promotions (when you buy a popcorn container you get a free soda or free tickets to a ride) etc.
  - things that will catch the attention of customers
- Calculate area and vo ume of their container and mention the calcu ations during presentations.

Presenting to the Sharks

- https://www.youtube.com/watch?v=k3PY_p_M-8w
  - Start from the beginning and stop at minute 1 45
- Each group presents their product to the sharks
- Sharks will be writing their comments on the SHARK TANK JUDGE SHEET
- At the end of presentations each group will pick the product they like the most and will award that group $1,000 to invest on their product. Groups can also distribute the money to various groups

Presentations

- During your presentation you should mention
  - price of your container
  - area and volume
  - why you designed it the way you did
  - key features of your container
  - why sharks should invest in your product

Reflection

- Why is it important for product designers to plan their products before they put it for sale on the market?

1 Predictions

3 Area

Dimensions	CYLINDER A	CYLINDER B
Length (in.)		
Width (in.)		
Area A= *L x W*		

5 List of container characteristics

2 Quick write after Demo

4 Volume

Dimension	CYLINDER A	CYLINDER B
Height (in.)		
Diameter (in.)		
Radius (in.)		
Volume V=$\pi r^2 h$		

6 Popcorn container sketch

$ $

$100

COASTING into SPACE

Summer 2019

MaST Insights YISD GEAR UP

$100

$ $

$ $

$100

COASTING into SPACE

Summer 2019

MaST Insights YISD GEAR UP

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SHARK TANK JUDGE SHEET

GROUP 1_____	**GROUP 2**_____
GROUP 3_____	**GROUP 4**_____
GROUP 5_____	**GROUP 6**_____
GROUP 7_____	**GROUP 8**_____
GROUP 9_____	**GROUP 10**_____
GROUP 11_____	**GROUP 12**_____

Who has your team decided to give the $1,000 to begin the production of their popcorn containers? Why did your team pick them? What did you like about their product?

Lesson Plan

Name of Lesson: G forces

Learning (TEKS) Objective:

(5) Science concepts. The student knows the nature of forces in the physical world. The student is expected to:

(B) describe and calculate how the magnitude of the gravitational force between two objects depends on their masses and the distance between their centers;

Student Outcome (*Students will be able to…)*

- Students will be able to identify the 4 different G forces present in a roller coaster and where and why we feel each force at a particular point throughout a roller coaster ride.

Day of the Week and Time:

- **Wednesday 8:15-9:45**

Total Length of Lesson:

- **1 hour and 30 minutes**

Materials *(per 1 class of 25 students):*

- **25 foldables**
- **8 pictures**
  - **-2 Positive G pictures (same)**
  - **-2 Negative G pictures (same)**
  - **-2 Lateral G pictures (same)**
  - **-2 Linear G pictures (same)**
- **8 gallery walk questions**
- **12 Pipe insulators 2 meter (6 foot)**
- **8 small Glass marbles**
- **8 Paper cups (pixie cup)**
- **8 Roll of masking tape**
- **Construction paper**
- **Scissors**

Advanced Preparation *(day before, morning of…)*

Before this lesson is presented to students, the pipe insulators should be glued.

- **Each group should have 1 pipe insulator (6 ft.) and a half (3 ft.).**
- **You will cut 1 whole pipe insulator (6 ft.) in half and glue it together, making it (12 ft.) in length.**
- **You will then take the other half of the insulator (3 ft.) and glue it to the (12 ft.) pipe insulator making it 15 ft. in length**

- **For the foldable have students trace the middle vertical line and the middle horizontal line with a marker to make four squares. This is to make the foldable look less overwhelming.**
- **Also have students cut the flaps of the foldable so that they can open one section at a time, this will allow them to concentrate on one section at a time.**

Instructional Delivery	Notes to Teacher:
Activity 1: Introduction to coasters and forces **Duration: 12 minutes**	-Begin the YouTube video on minute 2:00 and stop the video on minute 3:50 -After the video make a comment like, "that's a scary roller coaster, would any of you consider riding a roller coaster like the one in the video?" This will help set the mood for the lesson
• **Begin the lesson by showing the students the video on YouTube "Jimmy and Kevin Hart ride a Roller Coaster".** https://www.youtube.com/watch?v=OPdbdjctx2I **(2 minutes)**	
• **After the video discuss with students what constraints are (bullet 1 and 2 on slide 3) and why engineers have to take them into consideration. Ask why do you think engineers have to take these requirements and limitations into consideration? Hint: they need to take them into consideration in order to come up with a successful solution.**	-After bullet 2 on slide 3, and after talking about consideration of constraints begin with the following sentence. "in order…"
• **"In order for a roller coaster like the one we saw on the video to work and be safe, engineers have to take many constraints into consideration both for the roller coaster as well as for the person riding it."**	-Before the students do their quick write on their foldables lead the discussion so they begin to think about constraints while building a roller coaster.
• **Then ask the following question "In the case of designing a roller coaster, what might be some constraints that engineers would have to consider?"** **(3 minutes on this whole discussion)**	-Have students use the T chart on their foldables to organize their thoughts.
• **The teacher should draw a T chart on the board and do one example for each side before they get to come up with their own examples within their group.** **(2minutes)** --students might think of practical limitations such as building materials, budget, safety measures for users, maintenance requirements and/or anticipated weather conditions. They might also think about client requirements such as type of movements they like in roller coasters, for instance, up-side-down loops, degree turns (which goes on the left side of the T chart). --Other students might consider the natural physical laws that exist in our world, such as gravity and effects of slope, speed, and friction. (which goes in the right side of the T chart). **(3 minutes for students to fill chart)**	-On the left side of the T chart students should list constraints on building a roller coaster and the Right-side students should list constraints on the human body.
* **After students have had a chance to discuss with their groups, redirect the class to a discussion and fill the T chart on the board with the ideas that the students had.** **(2 minutes to fill the T chart on the board together)**	

Activity 2: Gallery walk and PPP **Duration: 20 minutes**	
• **Students will now look at pictures through a gallery walk.** • **There will be a total of 8 pictures** **-2 Positive G pictures (same)** **-2 Negative G pictures (same)** **-2 Lateral G pictures (same)** **-2 Linear G pictures (same)** **(5 minutes)**	
• **4 of the pictures will be taped on one side of the room spaced out and labeled 1-4. The other 4 pictures which are the exact same as the other 4 will also be numbered 1-4 and will be placed on the other side of the room. This will help with time management.** **-Positive G will be #1** **-Negative G will be #2** **-Lateral G will be #3** **-Linear G will be #4**	-The numbering of the pictures is for organization purposes on the foldable and for the numbered pictures to coincide with the pictures on the power point. -Correctly number the pictures with a marker.
• **There will be 7 groups of 3 students and 1 group with 4 students. 4 of the groups will be on one side of the room and the other 4 groups will be on the other side of the room. Students will be working on the same thing but just in different sides of the room so that the activity doesn't take too long.**	
• **Each group will be looking at a picture and will be writing on their foldable what they have felt, how their body feels, or how their body moves at the position shown in the picture while riding a roller coaster. If they haven't been on a roller coaster, they can write what they think they might feel at that position.** -Tape a set of these questions next to each picture included in the gallery walk.	-Students should write their thoughts on the appropriate box. When they are looking at picture 1, they should write in their foldables on the box labeled picture 1, and so on. -students will have a minute per picture and will rotate after a minute has passed.
• **Once students have had the time to explore through the gallery walk, you will move on to explain G force and the different types of G forces experienced on a roller coaster.** **(15 minutes)**	-Do not read off the power point, use the power point as your guide only. -Make emphasize on the effects of these forces on the body.
• **Students will include information on their foldables regarding the information presented to them via Power Point.**	-For the purpose of not having students write a lot, they will only include the red text in their foldables
• **Make sure to assess the students before moving on to the roller coaster activity.**	-You can simply assess them by randomly calling on students to answer a couple questions on

	information presented to them during the PPP. -You will assess all students at the end of the roller coaster activity with a kahoot game.
Activity 3: Designing a roller coaster **Duration: 58 minutes**	
• **Now that students understand the forces experienced during a roller coaster ride, they will be building a roller coaster. Students should keep in mind the constraints on the human body while building a roller coaster.** -Students should include the following requirements on their roller coaster project: -They need to begin with a hill in order for the marble to successfully make it through their roller coaster. -They should include sections on the rollercoaster where all 4 G forces are correctly represented and label them. -They should include a loop and a turn. -Students should be creative with their design and decorate it as they wish. -They will use a wall as their support. -Each team will use 1 pipe insulator and ½	<u>Student roles</u> -Recorder: takes notes summarizing team discussions and decisions. -Timekeeper: keeps group aware of time constraints and deadlines. -Runner: Gets needed materials and is the liaison between the group and the instructor. -Harmonizer: Strives to create a harmonious and positive team atmosphere and reach consensus. **(every student should be a reporter!)**
• **Before students begin their designs, they need to sketch their design and have the forces labeled within their roller coaster design.** **(7 minutes)** -Students will sketch their roller coaster design on the back of their foldable, above the line. -They can number the back side with a 4 and label it Sketch.	-Ask students if engineers go straight to building when they have an idea. -Then you can mention that the purpose of them sketching their design first is to know exactly what they're doing, also to not waste materials, and for the design to be safe.
• **The teacher should check their design to make sure they have included everything that is required in the design before they move on to building.**	-Mention that engineer's blue prints (sketches) should always be evaluated and approved by their supervisor before they give the order to begin building. (this is what the teacher represents when they check the students sketches before they move on).
• **The students can now begin to build their roller coasters with their group members.** **(35 minutes)**	-If their marble falls out of their roller coaster, students will have to redesign.

• **The teacher will walk around assisting students through the construction process as well as assessing the groups individually once they feel their design is ready.** • **Kahoot to assess the information they have just learned (6 minutes)** • **Reflective writing in their foldables** **What G forces in your opinion is the most fun to experience in a roller coaster and why?** **(5 minutes)** • **Clean materials, put everything away.** **(5 minutes)**	-They should explain to the teacher why they chose that design, if they had to redesign at any point during their construction process and why, and explain where in their roller coaster each G force is represented. -Kahoot link on slide 11 in the power point -reflective question on slide 12. Students will write on the reflection portion of the foldable. -They do not have to destroy their roller coaster project if they do not want to. -Students will use this design for the final construction on day 4. -Students will remain in these same groups for the building on day 4.

G Force

Video

- https://www.youtube.com/watch?v=OPdbdjctx2I
- Start at minute 2 00
- Stop at minute 3 50

Quick Write: Think as an Engineer

- When engineers design objects and structures in your homes and other products you use or in this case a roller coaster they work with what they call constraints.
  - Constraints are project requirements and/or limitations and engineers have to take into consideration these constraints in order to come up with successful solutions.
  - In the case of designing a roller coaster what might be some constraints that engineers would have to consider? List as many as you can.

Gallery walk

- You will be conducting a gallery walk and for each picture you will write down
  - what you have felt
  - how your body feels
  - or how your body moves at the position shown in the picture while riding a roller coaster.
- If you haven't been on a roller coaster write what you think you might feel at that position.

What is G force?

- G-Force is short for **gravitational force**, which is the force that pulls or attracts all physical objects towards the center of our planet.
  - Several forces are felt when riding a roller coaster and keeping these within safe values is a vital skill for roller coaster designers.
  - These forces are known as G's . G stands for Gravity and the number in front of it represents how many times the force of gravity is felt at a particular point.
  - Everybody experiences 1G in everyday life the regular force of gravity when still.

Positive G

- on a roller coaster positive G can occur after the car reaches the bottom of a hill and starts going up another. This makes you feel heavier than you really are.
- For example if you normally weigh 100 lbs. and are experiencing 3 g's you would weigh 300 lbs. at that point of the ride!
- At 5gz humans are at risk of loss of consciousness

Negative G

- These occur when cresting a hill on a roller coaster.
- This occurs because on the uphill you are still going up while the train is trying to go down. This creates the common butt out of seat thing.
- **At -4gz, mental confusion and unconsciousness**

Lateral G

- Lateral G Forces occur when a train goes around an un-banked corner or a corner not banked far enough. This is commonly experienced when riders are abruptly forced sideways.
- **Humans can tolerate high levels of lateral G's if properly restrained;** otherwise injury to the body can occur.

Linear G

- Linear G's occur when a coaster launches very quickly in a straight line. The human body can tolerate high levels of Linear G forces. Linear G forces push against riders during high-speed launches.
- **Humans can tolerate up to 17 Linear G's Front to Back and -7 Linear G's Back to Front**

Roller coaster Project

- sketch your design with your group
- include the following requirements
  - Begin with a drop in order for the marble to successfully make it through their roller coaster.
  - Include sections on the rollercoaster where all 4 G forces are correctly represented and label them.
  - Include a loop and a turn.
  - Students should be creative with their design and decorate it as they wish.
- Have a teacher check your design
- Begin building!

Kahoot

LINK: HTTPS://CREATE.KAHOOT.IT/SHARE/G-FORCE/30D0DB66-8C3F-43BE-A098-9B9BE06B8A9E

Journal question

WHAT G FORCES IN YOUR OPINION IS THE MOST FUN TO EXPERIENCE IN A ROLLER COASTER AND WHY?

References

- https://www.teachengineering.org/activities/view/duk_rollercoaster_music_act
- https://coasterforce.com/physics/

1

Constraints on Building a Roller coaster

Constraints on the human body

2 Picture 1

Picture 2

Picture 3

Picture 4

3 Positive G

Negative G

Lateral G

Linear G

5 Reflection

- What have you felt at this position during a roller coaster ride?

- How does your body feel at this position during a roller coaster ride, or how does your body move at this position in the roller coaster ride?

    - If you haven't been on a roller coaster write what you think you might feel at that position.

Lesson Plan

Name of Lesson: Centripetal Force

Learning (TEKS) Objective: (6)Force, motion, and energy. The student knows that there is a relationship between force, motion, and energy. The students is expected to (B) differentiate between speed, velocity, and acceleration

Student Outcome (*Students will be able to…)*
Students will be able to describe centripetal force and understand the concepts of acceleration, velocity, and speed and how they are related.

Day of the Week and Time:
Wednesday 9:45-10:30

Total Length of Lesson: 45 minutes

Materials *(per 1 class of 25 students):*

- 8 plastic cups
- 8 small bouncy balls
- 25 balloons
- 25 pennies
- 25 printed copies foldable templates
- 25 brads (paper fasteners)

Advanced Preparation *(day before, morning of…)*

Sort materials. (balloons, pennies, and handouts will be given one per student)
one plastic cup and one small ball per group of 3 students

Instructional Delivery	**Notes to Teacher:**
Activity 1: Ball in a cup **Duration: 5 minutes**	

- ➢ Help students construct graphic foldable with the powerpoint presentation.
  - ❖ Tell the students they will not cut the larger circle at all. Have students cut their paper in half and then cut out the smaller circle and individual sections (they cut along the dotted lines on this circle only. Then, please have them put the scissors away. They will NOT cut the other circle!)
  - ❖ Have the student write one topic on each section: Speed, Velocity, Acceleration, Direction, Force as they come up in the presentation
  - ❖ Have them outline each section a different color
  - ❖ On the large circle have them color the section IN THE SAME ORDER as the small circle (this is important!)
  - ❖ DO NOT Let them cut this circle!
  - ❖ Use the questions and answers from powerpoint to fill foldable. EXAMPLE BELOW
    - ➢ On the section for acceleration with the title, have students draw an arrow pointed towards the center of the circle to show the direction of acceleration.

➢ on the section for direction, have students cut an arrow out of a piece of scrap paper and tape it tangential to the circle to show the instantaneous direction of the object. (Always travel in straight path, they could choose either direction as long as it is perpendicular to the point they tape it to) ➢ Along the outside of the large circle have the student draw arrows to show circular motion, these arrow should coincide with the directional arrow. ➢ In the section of force also have the students draw an arrow pointed towards the center of the circle. This is the direction of force because it is dependent on acceleration. ❖ Once they have completed notes, students will take a brad and poke a hole through the center of the small circle first. ❖ Then have them poke the brad through the center of the larger circle and fasten by separating the little prongs. ❖ Have the students glue this in their notebooks. It is important that they only put glue along the perimeter of the paper to allow the small circle to move even after being glued.	
Activity 2: Penny in a balloon Duration: 20 minutes ➢ Have students place a penny into their balloons (make sure the penny is completely inside the balloon) ➢ Have them inflate the balloon but have them keep it small enough to fit comfortably in their hand (for better control and reduced risk of popping) ➢ Then, discuss with them what is happening. Discussion questions, answers, and guiding notes are in the folder.	
Activity 3: Ball in Cup Challenge Duration: 5 minutes ➢ IF TIME ALLOWS ➢ Challenge students in groups of three to attempt to get their ball in the cup without using their hands to lift it. ➢ Tell them to be creative in trying to do so. ➢ Have them place ALL items on the ground during this time. ➢ They are not allowed to use any materials that are not on their tables.Help students construct graphic foldable based on the notes you have created. ➢ ➢ IF you have extra time, have students draw the example of the ride in their notebooks and label the circular motion components.	At the end of this activity show students that you can can the ball in the cup by spinning it. If students were able to figure that out ask them if it still works if they spin the marble faster, slower.

Have any of you ever been on this ride?

What do you notice about it? Specifically, what do you notice about the shape of this ride?

Right now, we are going to explore circular motion.

On your handout, write circular motion in the title space. Your foldable should read, "All About Circular Motion."

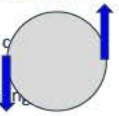
Each tab you have will have a component of circular motion.

If something is traveling in circles, in what direction does the object move?

The direction of the object is constantly changing!

That means, that the direction depends on the position of the object at any given time. **Direction is a straight path tangent to the circle.**

Can anyone tell me in what direction the



be rota

How fast does this ride go?
Is it pretty slow?
Is it really fast?
Does it change like a roller coaster tends to do?

When we want to describe how fast something moves we use the word speed.

Speed is how fast an object is moving. With this ride we know that it has to speed up for a while, but after that it can keep its speed constant. In circular motion an object CAN have a constant speed.

Let's stop saying "speeds up" or "slows down". Can anyone tell me a more scientific way to say it?

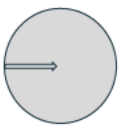
Acceleration, but did you know that it doesn't only refer to speed?

Acceleration is a change in speed OR direction.

What did we say about the direction of the object? Does it stay the same?

Acceleration

If direction constantly changes, that would me that the object always experiences acceleration.



Acceleration always points to the center of the circle.

We already said that speed can be constant. Does that mean the velocity is constant too?
Are these words synonyms?

Velocity is actually a little bit different

Speed is actually just one part of velocity.

Velocity is BOTH speed and direction.

So, can velocity be unchanging in circular motion?

We said direction is constantly changing.

Velocity depends on direction which can only mean that velocity is **always changing in circular motion.**

How is it possible to travel in circular motion though?

On this ride, you aren t strapped in like you typically are on other rides.

How is it possible to stay on the ride safely?

Centripetal Force

The direction of your body is always a straight path, like we discussed.

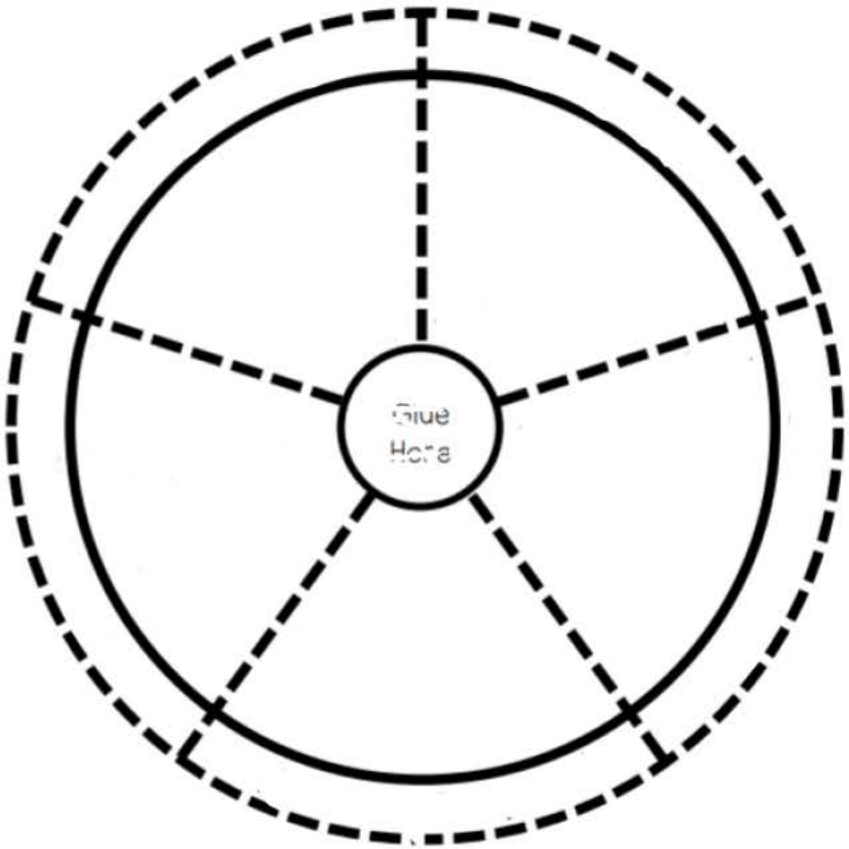
You don t fly off because the ride itself pushes you forcing you to change direction.

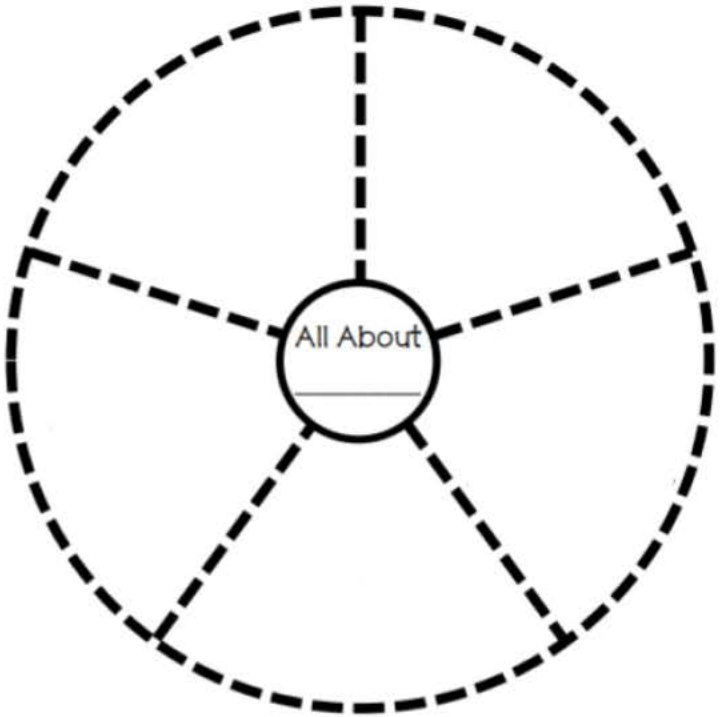
The force that allows circular motion to occur is centripetal force.

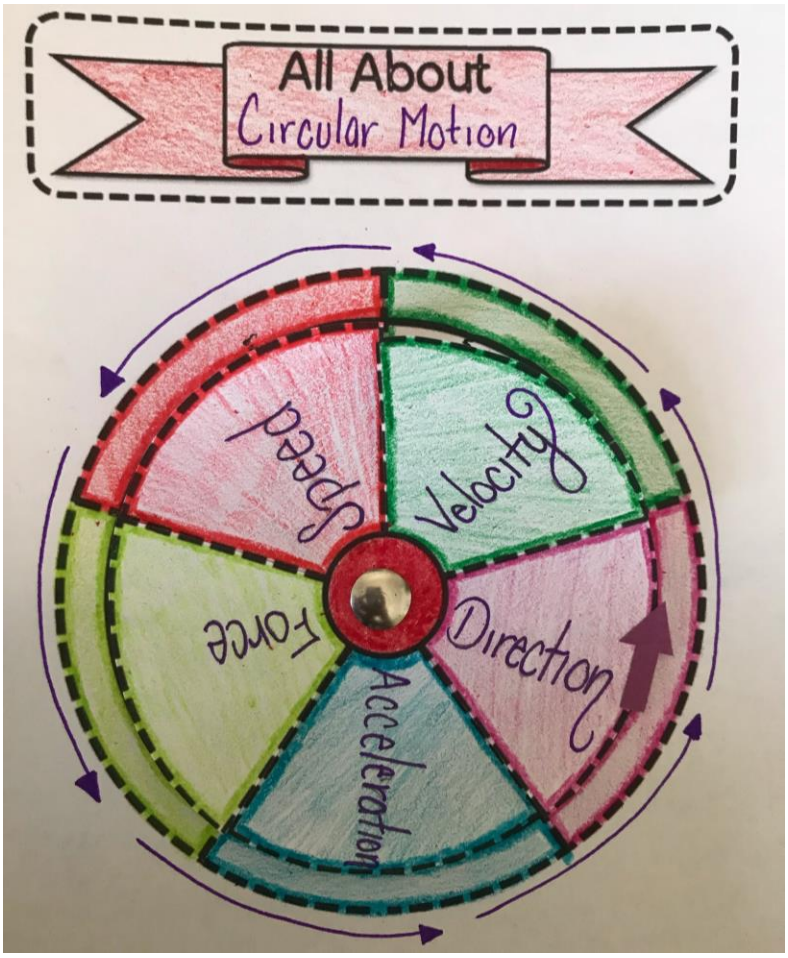
All forces act in the same direction as the acceleration.

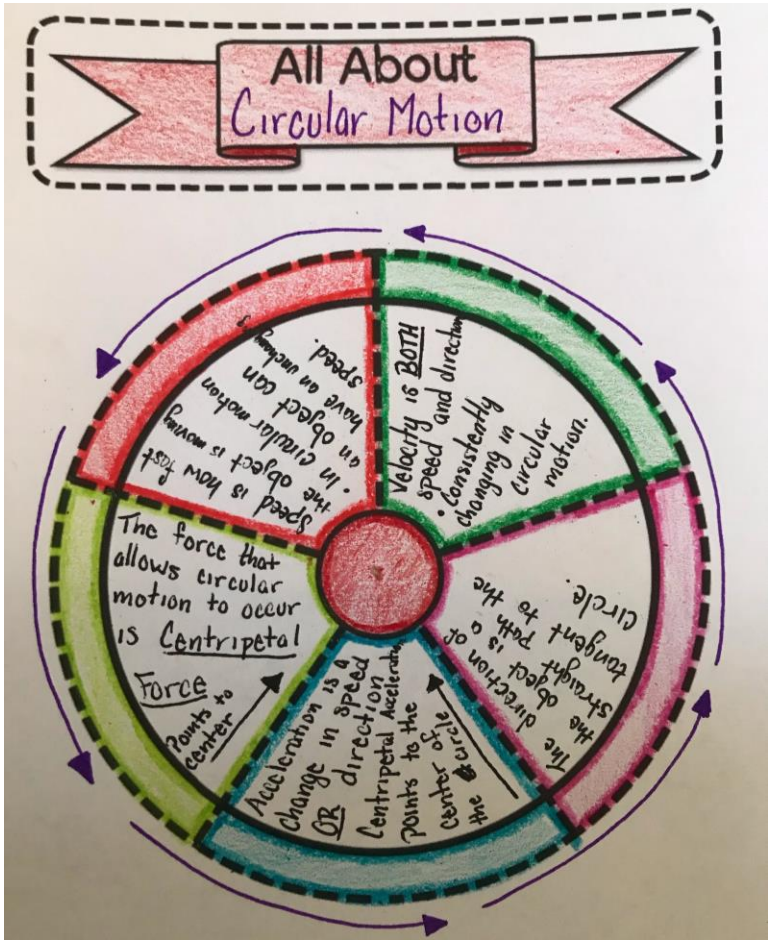
Draw an arrow on the tab to represent the direction of force.

All About






All About
Circular Motion
Speed
Velocity
Force
Direction
Acceleration


All About
Circular Motion
Speed is how fast the object is moving. In circular motion an object can have an unchanging speed.
Velocity is BOTH speed and direction. Consistently changing in circular motion.
The direction of the object is a straight path tangent to the circle.
The force that allows circular motion to occur is Centripetal Force
Points to center
Acceleration is a change in speed OR direction. Centripetal Acceleration points to the center of the circle.

Centripetal Force Questions

1. I have a question, why is it that if you get on a ride they sometimes tell the smaller person to be on one side? *So that the bigger person gets squished*
2. Can anyone gives me an example of this? *The himalayas at western playland, the little dragon ride at Oasis lanes (if that still exists)*
3. Where is the penny? *At the bottom of the balloon*
4. Why doesn't it fall to the ground? *Because the balloon holds it up*

********** Introduce Newton's 1st law **********

An object at rest stays at rest unless acted on by an unbalanced force.

Define unbalanced force (example tug of war)

****

5. Is it possible to get the penny to be at another position in the balloon? How? *Spinning it like we did with the ball in the first activity*
6. Is doing this similar to what we did with the marble and they cup? *Yes, because we rotate it the same way.*
7. Is the penny changing speed as we rotate the balloon (if we spin it with a constant speed)? *No*
8. Is the penny changing velocity though? *Yes (They probably won't get this one)*
9. Well, what is the difference between speed and velocity? *(Have them make notes of this)*

********** Stop Here and discuss the difference between speed and velocity**********

Speed is how fast the penny is moving

Velocity is how fast the penny moves but includes the direction in which it is moving

Draw a circle on the board and show the change in direction.

****

10. So, can we say that there is a change is velocity? *Yes, because there is a change in direction*
11. Is the penny accelerating? *Yes (some students may say now because it isn't changing its speed)*
12. What is acceleration? *A change in velocity (speed OR direction)*
13. What causes the penny to change direction? *The balloon*
14. In what direction is the acceleration going (Rephrase, in what direction does the balloon push?)
15. Can we say that the balloon exerts a force on the penny? *Yes, because it pushes the penny*
16. What do we call this force? *Centripetal force.*

****

Centripetal force is the force that causes objects traveling in circular motion to stay in circular motion.

In this example, we see the balloon causing that force, but what about in our first activity? *(the cup caused the centripetal force)*

Can you think of another time you experience circular motion? *Playgrounds, amusement park rides, in the car when you take a turn.*

Motion does not have to be completely circular, any partial circle will undergo the same forces (i.e. turning in a car)

How does the speed of the object affect force though? *The faster the object moves the more force it has.*

Would you be able to pick up the marble from the table or made the penny rotate if you spun the objects slower? *No, because it required more force.*

What would happen if we spun the balloon too fast? (***if one of your students popped their balloon ask instead,*** We noticed that _____'s balloon popped when they spun it too quickly, why did that happen?) *There was too much force on the balloon.*

****

Now, let's take what we know and make a visual representation.

(Go to circle handouts)

Lesson Plan

Name of Lesson: 2D to 3D Roller Coaster Lesson Plan

Learning (TEKS) Objective: Math (7.5) Proportionality.
The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to:
(A) represent linear proportional situations with tables, graphs, and equations in the form of $y = kx$

Student Outcome (*Students will be able to…)*
Today we will learn how to bring a ride to a 3 Dimensional scale. This will be accomplished when one can use proportions and structure.

Day of the Week and Time:
Thursday @ 9:45 AM - 11:30 AM & 12:00 PM - 1:45 PM

Total Length of Lesson:
3 Hours and 30 Minutes

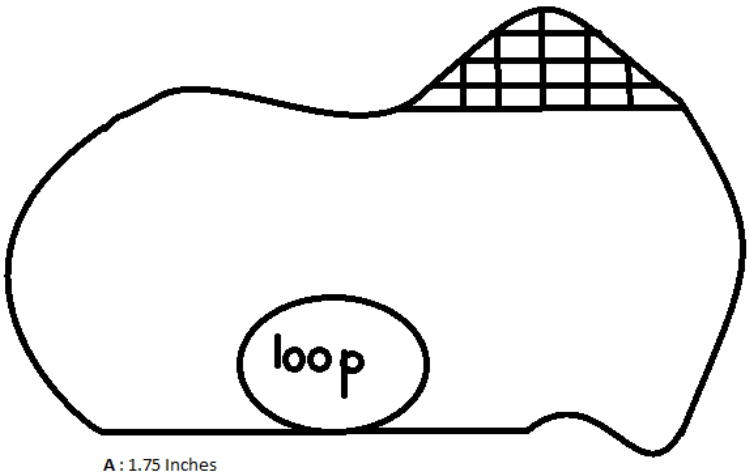
Materials *(per 1 class of 25 students):*

- Pencils
- Paper
- Build a Park Day 3: "Blueprint"
- G Force: "Foldable Design of Roller Coaster"
- Timelapse questions
- 100 Construction Paper (10 per group of 3)
- 10 Popsicle Sticks bundles (1 bundle = 50 Popsicles Per Group of 3)
- Tape (Roll Per Group)
- Sticky Notes (Stack Per Group)

Advanced Preparation *(day before, morning of…)*

a) Tape Blueprints (Build a park day 3) on different sections of the classroom
b) Write title & link on board/project video of timelapse roller coaster
c) Place "Foldable Design of Roller Coaster" to respective group tables
d) Have bundled Roller coaster materials for each group set on table
e) Have students names printed on slips and cut.
f) Groups of 3

Instructional Delivery	**Notes to Teacher:**
Activity 1: Gallery Walk **Duration: 25 - 30 minutes**	*Reference to Georginas lesson plan: Build a park Day 3. *Point of emphasis: Explain that each park is in two dimensions. *Nothing is presented in reality (3D)
1. Given their previous blueprint (Build a Park; Day 3) Ask students to walk around in groups with a paper/pencil and write observations of the rides for each park they observe. **Say:** "The Blueprints on the wall were made by you guys yesterday. Today we are going to see what stands out in each one of them. I would like for each group to stand up and use the sheet of paper to write down everything they see in each park. For example (*Refer below*). 3 minutes will be given for each park you visit. Get ready, Set, Go." Examples to look for: - Rectangle - Ferris Wheel - Circle - Roller Coaster **2.** Ask one student from each group to explain one observation they made for the group next to them.	

3. Point out that every single blueprint is 2 dimensional and is just a starting point for engineers!	
Activity 2: Timelapse Video **Duration: 10 minutes** **1.** Students will watch a video of an actual roller coaster being built. **Say:** "Engineers use more than one blueprint to make stuff. This is true even for roller coasters. To give you an idea of this. we are going to watch a video of an actual roller coaster being built. During the video you will write answers to these questions [Hand out questions]." *Questions*: 1. Why would a blueprint be useful for the start of the building process? How many blueprints were used? 2. How much concrete, steel, and paint were used for the roller coaster? 3. How much time do you think this roller coaster took to complete? **2.** Review the questions with the students. **3.** Have groups pull out their "Foldable Design Roller Coaster" A. Reference back to engineers and how they are consistently working in 3 dimensions	If projector is available, have video set up to play for entire room. If there is not a projector, ask students to use laptop or device. https://www.youtube.com/watch?v=o5rM7s2PuEc Answer to questions: 1. 250 blueprints 2. Concrete: 2,500 Yards Steel: 1.5 million tons Paint: 1,500 Gallons 3. 1993-1994 = 1 year(Their own guess is okay)
Activity 3: Proportions **Duration: 15 minutes** **1.** Use whiteboard or chalkboard to explain scales. **2.** Draw the outline below on the whiteboard or project on Powerpoint  A : 1.75 Inches **3.** **Say:** "The length of section A is 1.75 inches. So we would plug this into the x because it is the length from our blueprint. Our scale factor will always be 4 in the equation. This just means the our blueprint will be 4 times large in reality. When we multiply them against each other, we get the length of our 3D model." **4.** Reference to the "Foldable Design Roller Coaster" and ask to pull it out. **Say: "**The blueprints you created for G-force are going to be used to practice with scaling. Please pull out the orange foldable"	*y=kx x: Initial length on blueprint k: Scale Factor y: 3D length

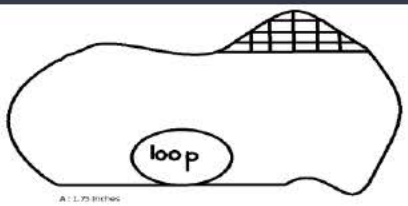
5. Then have them scale sections of their blueprint using a standard Inch/Centimeter ruler for sections such as the straight part of a track. The String from the bundle is used for the loops and curves. Use the string to lay against the ruler to figure out the length of the loop. **6.** The students should write down the measurements on the same foldable from the blueprint.	
Activity 4: 3D Model Duration: 60 - 90 minutes	The students are able to create the base of their structures by using popsicle sticks, tape, construction paper, sticky notes, and the string from the previous activity.
1. Explain: **Say:** The objective of today's project is a bit of a challenge. Each group is given popsicle sticks, Sticky Notes, Construction Paper, String, and a roll of tape. It is up to you to build this section of a roller coaster. Show images on powerpoint However, before you start picking up your materials and building. There will be 10 minutes of planning. This means that each group has to come up with a blueprint. If a good blueprint isn't created, your group won't start until a plan is made. KEEP in mind that there is ONLY 50 popsicle sticks. Planning starts NOW!" **2.** Teachers and Tutors can approve groups that they think are ready to start building. Hand them the materials and tell them that they have an hour to build. They also need a sign for the ride they are constructing. This is just a drawing on a piece of paper that goes on the model. **3.** Have groups construct their 3D model on a flat surface. **4.** Once the hour mark has finished, give students who are done with the roller coaster a small hand full of popsicle sticks from the sandwich bag and ask them to extend. **5.** Give them 10 minutes more to finish up their models and last touches.	
Activity 5: Presentations Duration: 20 minutes	
1. Explain: **Say:** "Now that you have a roller coaster in 3 demensions, you and your group have to make it sound fun. Prepare a small presentation that tells us the - Name - Location - Speed - Cool facts You'll be give 5 minutes to prepare and we'll start. **2.** Give groups 5 minutes to prepare presentation of project **3.** Each group will Present, and to be kind. Everyone gets their roller coaster built.	
Activity Final: Luck of the Draw Duration: 10 minutes	
1. Place Container filled with students names in center of the classroom. **2.** Call a random student up to the container and **Say:** "Pull one slip of paper from the container." **3.** Whichever name is pulled out of the container, have that student explain his/her favorite part of the camp. **Say:** "What was your favorite part of the amusement park camp?"	

3D Park

It's Time To Get Creative

Blueprints! (with Questions)

How Do I Scale?



How Do I Scale?

$$y = kx$$

X is the measurement on the blueprint

K is the scale factor

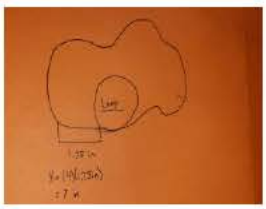
Y is the 3D length

It's your Turn!

Scale your blueprint and put your answers on the foldable.

—> Example

Use String From bundle for loop and curves.



Objective

Rules!

1. Plan and layout a blueprint for 10 minutes
2. See Tutor or Teacher for approval of Blueprint. Then full materials will be given
3. 60 minutes will be given for building.

Presentation

Now that you have a roller coaster in 3 demensions, you and your group have to make it sound fun. Prepare a small presentation that tells us the

- Name
- Location
- Speed
- Cool facts

Clean Up

Collect leftover sticks and return to tutors.

Throw away trash and clean area!

Lesson Plan

Name of Lesson: Circuits

Learning (TEKS) Objective: 2A Scientific investigation and reasoning.
(A) plan and implement comparative and descriptive investigations by making observations, asking well defined questions, and using appropriate equipment and technology

Student Outcome (*Students will be able to…)*
Students will be able to distinguish and become familiar with the different types of circuits.

Day of the Week and Time:
Wednesday 11:00-11:30 & 12:00-1:15

Total Length of Lesson:
1 hour 15 minutes

Materials *(per 1 class of 25 students):*

- **40** Christmas lights (5 per group of 3 students)
- **40** Strips of aluminum foil (5 per group)
- 2 - 9 Volt Batteries
- 4 Poster boards (Cut in half)
- Markers colored pencils
- 13 printed copies of venn diagram handout (because there are two venn diagrams per page)
- laptops with internet access

Advanced Preparation *(day before, morning of…)*

Strip Christmas lights and separate them (5 per group)

Instructional Delivery	**Notes to Teacher:**
Activity 1: Introducing circuits Duration: 30 minutes -Show students images of signs on the google slides document. have students decide which signs are they most attractive (attention getting) and why? -When students see lit sign introduce them to vocabulary [Series and parallel] -Third slide in google slides show pictures of two circuits, students will begin filling out the venn diagram. They will then go to simulator on their computer to see how they work. https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html	**Intro before lunch 11:00-11:30** **Complete circuit simulator guide in script.**
Activity 2: Making signs Duration: 30 minutes Students will create lit signs for their amusement park - Each group will design a sign and circuit to light it up - They will decide which circuit type to use on their sign (they should use parallel circuits, but we won't tell them)	
Activity 3: Gallery Walk/presentations Duration: 15 minutes -Have students visit other groups tables and have each group present their sign. what kind of attraction was the sign for? ask what type of circuit they used and why.	

What do circuits look like though?
Is anyone familiar with circuits already?

Have you ever seen a light that stays on all the time?
How do we control whether a light is on or off?

With this entire circuit we are building we will use symbols that electrical engineers use in their plans.
A switch looks like this

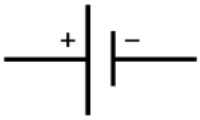
Electricity doesn't magically reach the light bulb though. How, or through what, does electrical energy move.

Let's add a wire to out circuit. This symbol is the easiest because it is a straight line.

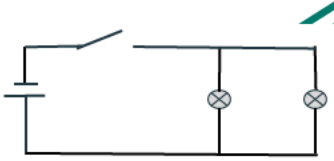
Now, we finally get to our goal of lighting the bulb. When we draw schematics a light bulb can have various symbols. Today we'll use this one.

Now, we have almost completed the circuit but what is missing? How are we going to power or light bulbs?

A power source. Any place the circuit gets energy from. In this case we'll draw a battery which looks like this



Have we made a complete circuit?
Does anyone know what this type of circuit is called?



What can we say about this circuit?
Is it the same?
What do we call this type of circuit?
Write down any similarities and differences you can see from this circuit.

Schematics are a really good way of seeing what the circuits look like but I think we should also see how they are different.

Go to the webpage coastingintospace.weebly.com
From there find the simulator button under student links.

We will be using the same workspace to build both circuits you have drawn so start by placing a battery on the upper left side of the blue workspace.

Next we can click and drag a wire to connect it to the battery. Remember! Schematics are always drawn with straight lines so keep the wire horizontal.

Our little circuit seems a little pointless without a lightbulb so let's add a couple.

Be VERY careful with this part. Notice that the light bulb has two terminals (red circles) if you don't connect a piece of circuit in each it will not light up.

Add a piece of wire to the second terminal of the light bulb and then add a second light bulb.

Then, we have to get closer to the battery again so let's use wires to start moving back that way.

Of course, we do want to be able to control whether or not the light is on so we would like to add a switch.

Close the switch and what do you notice?
Do you think their will be any difference when we build a circuit in parallel?

Go ahead a start building a circuit in parallel.

Questions:

- What do you notice about the lightbulbs in each circuit?
- What would happen if we add another light bulb in each?
- What would happen if a one lightbulb burns out? (You can demonstrate this by removing one light bulb because a burned light bulb breaks the circuit)
- What type of circuits are used in your home? How do you know?

A lot of thought goes into to planning how an amusement park would be lit up!
Today, you get to wear the hat of an electrical engineer and design signs for your amusement park.

Signs should:

- Clearly represent the ride, attraction, game, food type, they are for
- Use the 5 light bulbs strategically to call attention.
- Have organized circuits on the back side to light up the sign.

Circuit: Series and Parallel (A Script)

Beginning the lesson:

Say something along the lines of, “You all have seen signs before. Whether it was on street signs, fast food restaurants, or the signs you typically see at amusement parks, right?”

Show them different unlit signs and ask, “Which of these signs would catch your attention more? Why?”

(students might mention color, size, shape, familiarity, etc. Make note of any answers on the board)

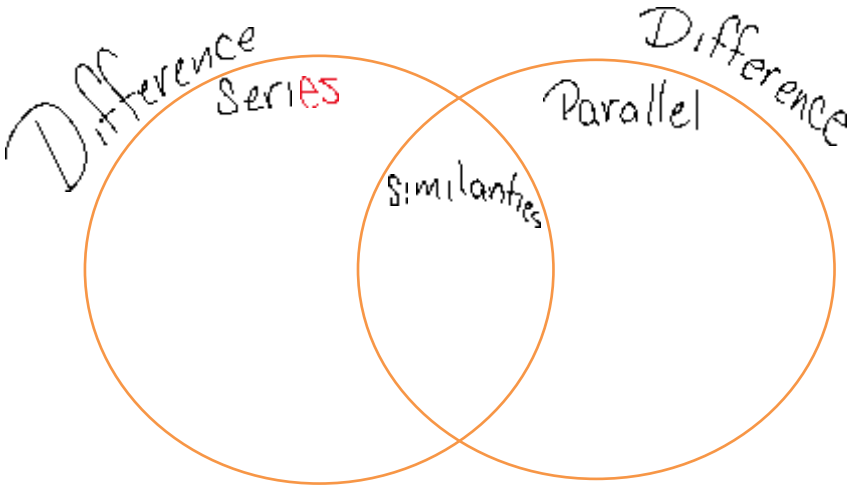
Then, show them different lit signs ask them, “Which of these is the most attention-grabbing? Why did you choose the one you did?”

(Again make note of all answers on the board)

“A lot of thought has to go into the lighting of signs though. Let’s see how lights in different signs are wired. But there are two types of circuits we use, does anyone know what these circuits are?” (*students may or not be familiar with circuit types*)

If not introduce the words to them: [Series and parallel]

“How are these circuits are related. To do this, we’ll be using a venn diagram.” Start Venn Diagram to compare and contrast the circuit types. Draw Venn Diagram and have students draw them too, ask them if they are familiar with the diagram and explain how to use it)



“What do these circuits look like though? Let’s construct a circuit together. I’ll draw it on the board and you can draw it in your notebook.” (There is a labeled schematic of the circuits below.)

“But first how do we turn the lights on? If you are at your house, do you leave the lights off all the time? -- No, right? So how do you turn the lights on?” (*They would flip a switch)*

“Switches are important parts of a circuit so let’s draw one. Now, it would take too long to draw a switch in detail so when drawing circuits we’ll use symbols instead.” *(draw a switch on the board and have them draw it in their notebooks)*

“When we use symbols to draw these circuits we call them schematics.”

"Then what happens? Does the electricity magically reach the lightbulb? How does that electricity travel?" *(Through wires)* "Wires in circuits are easy to draw though, they are just straight lines. Let's add some wire to our circuit."

"What do you think will be next? Well, if we are talking about lighting up signs we would eventually need lightbulbs right? The symbol for light bulbs is a little weird though. There are different symbols for it but for today we'll use this symbol." *(Draw a light bulb on your circuit)* "Typically though, you won't see a sign that only has one light bulb so lets add some extra wire (draw this wires vertically so that we get to close the circuit.) and another light bulb. (Have this light bulb under the first light bulb)

"We're almost done with this circuit, but what is missing?" (a power source, outlet, battery, wherever the circuit will be getting its energy from.) "Let's draw a battery for the circuit here. and from there we can close the circuit."

"But if I draw a circuit like this instead (draw a parallel circuit beside the series one and have students copy it into their notebooks too) what is different?"

Students will start naming differences in the circuits, as they do start filling in the venn diagram on the board. A completed Venn Diagram can be found below.

Phet Circuit Simulator

Tell students that they are only allowed to use the first set of options on the left side of the workspace.

You should say:

"From the schematics we can only really see difference in how they look, though. I want to see how they work differently." (Have students access the link below to build circuits.)

"The first part of this circuit will be our battery, on the left side of your screen you will see a battery. Click and drag it onto your workspace."

- Let's keep this closer to the top left side of the screen so that we have enough room for both circuits.

"But the energy needs to flow through something, so now we have to connect a wire to it. Click and drag a wire to connect to the battery."

"Remember! We want this diagram to look as similar to the schematics in your notebook as possible so keep the wire horizontal!"

"Now, we have to connect the light bulb because, well, that is the point of this circuit after all. Notice though we you look at the lightbulb it has two terminals. (the little circles where things can be connected) connect one of the terminals to the wire."

"Take another wire and connect it to the other terminal. Everyone should make sure that the wires are connected to different terminals or else your circuit won't work!"

"We'll be using a lot of wires on this, so take another one and connect to the wire after the lightbulb. To complete the circuit, we have to start getting closer to the battery again so click and hold the end of the wire that isn't connected to the circuit and drag it down to turn it to make the vertical line like in your schematic."

“Go ahead and add another wire and light bulb to the circuit the same way we had the first one. Again, make sure each wire is connected to a different circle on the light bulb!”

“Of course, We don’t want the lights to be on ALL the time. We have to be able to control whether they are on or off. So, let’s add a switch into our circuit.”

“Lastly, let’s use one last wire to connect the switch and the battery and click the switch to close the circuit.”

- ➢ What kind of circuit did we make? (Series)
- ➢ Do you think there will be any difference with the parallel circuit? (They might say different things, don’t give them any answers they’ll see it when they build it)

“Now, let’s build a parallel circuit. Again, let’s start with a battery.”

“Remember that a parallel circuit has 2 paths. We have to make sure with leave connection for each path so let’s place two wires.”

“At each of these connection points connect a wire and rotate it down by clicking and dragging.”

“Next, we can go ahead and connect a lightbulb to each path. You can rotate the lights the same way you do for the wires.” (This might take them some time to adjust for them.)

“Take another wire and connect it to the remaining terminals of the light bulb. After you connect them, make sure none of the circles are red. If there is a red circle, you’ll have to disconnect the wires and reconnect them making sure that both terminals of the lightbulbs are used.”

“Lastly, let’s add that switch and connect it back to the battery to complete the circuit.”

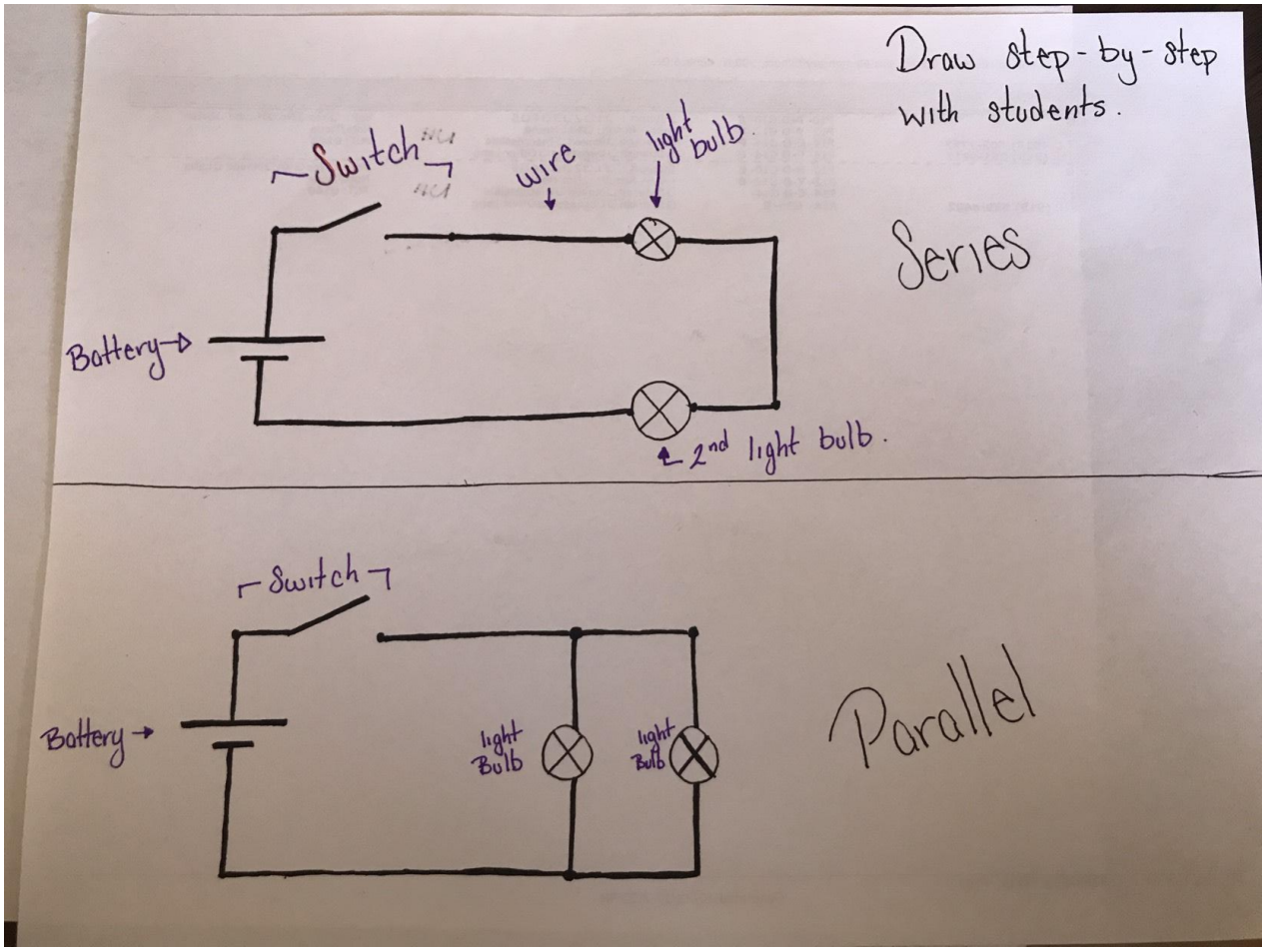
https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html

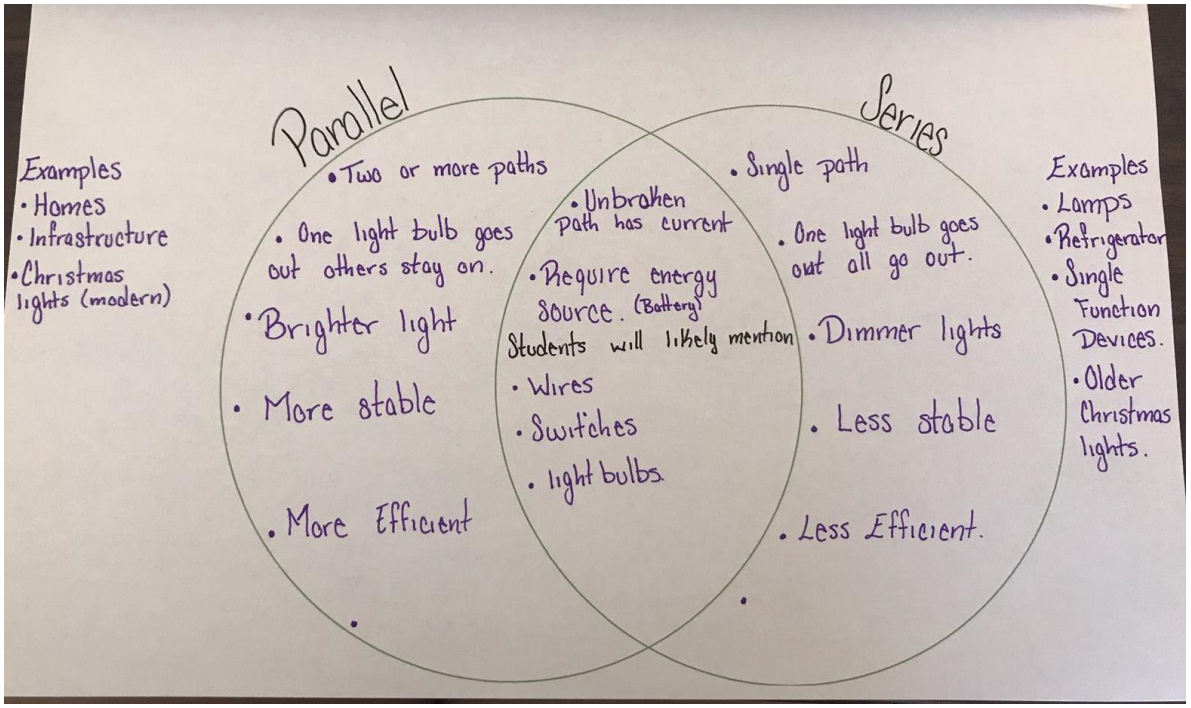
Questions:

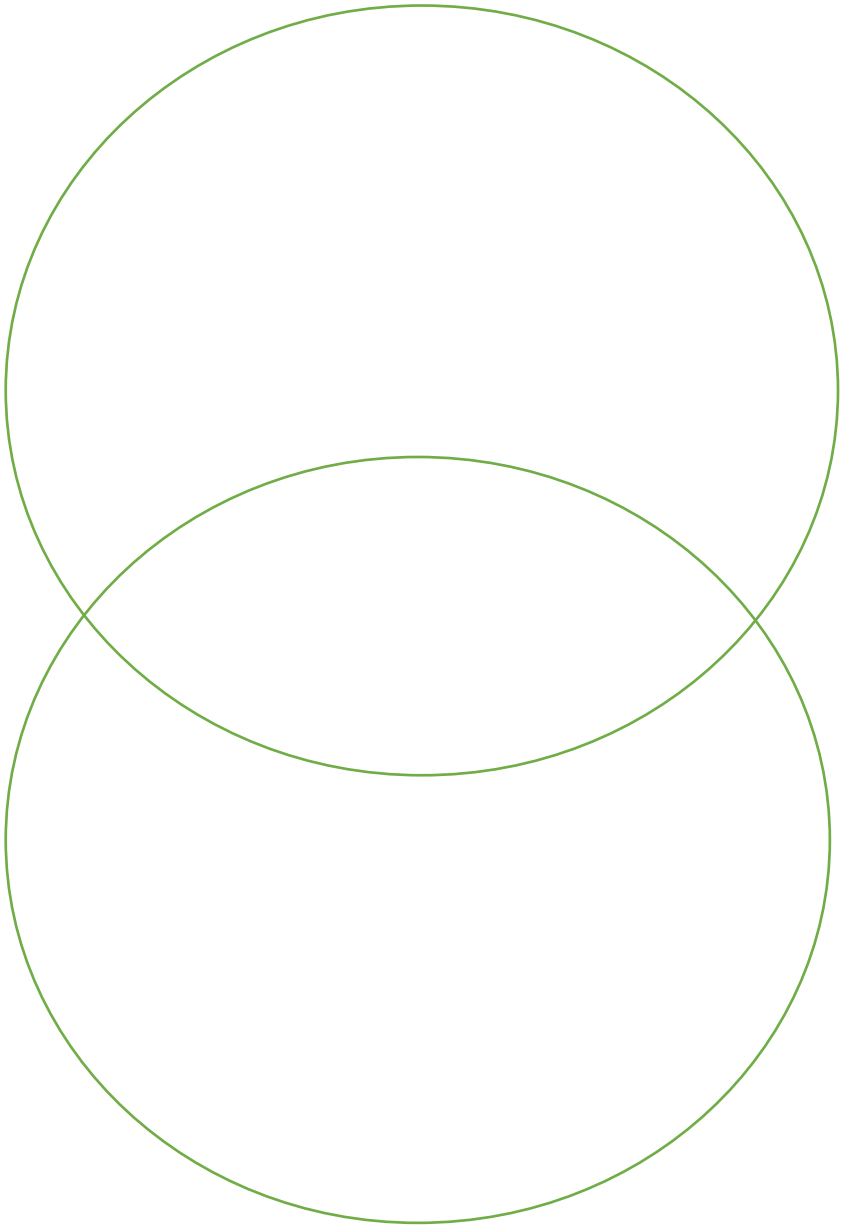
- ❖ What do you notice about the lightbulbs in each circuit?
  - o In series, the light bulbs are dimmer.
- ❖ What would happen if we add another light bulb in each? (Students might assume the light bulbs would dim in both circuits, they don’t)
  - o In series the light bulbs dim more, in parallel they do not.
- ❖ What would happen if a one lightbulb burns out? (You can demonstrate this by removing one light bulb because a burned light bulb breaks the circuit)
  - o In series the other bulbs turn off too, in parallel other lights stay on.
- ❖ What type of circuits are used in your home? How do you know?
  - o Parallel because if one light goes out the others stay on.

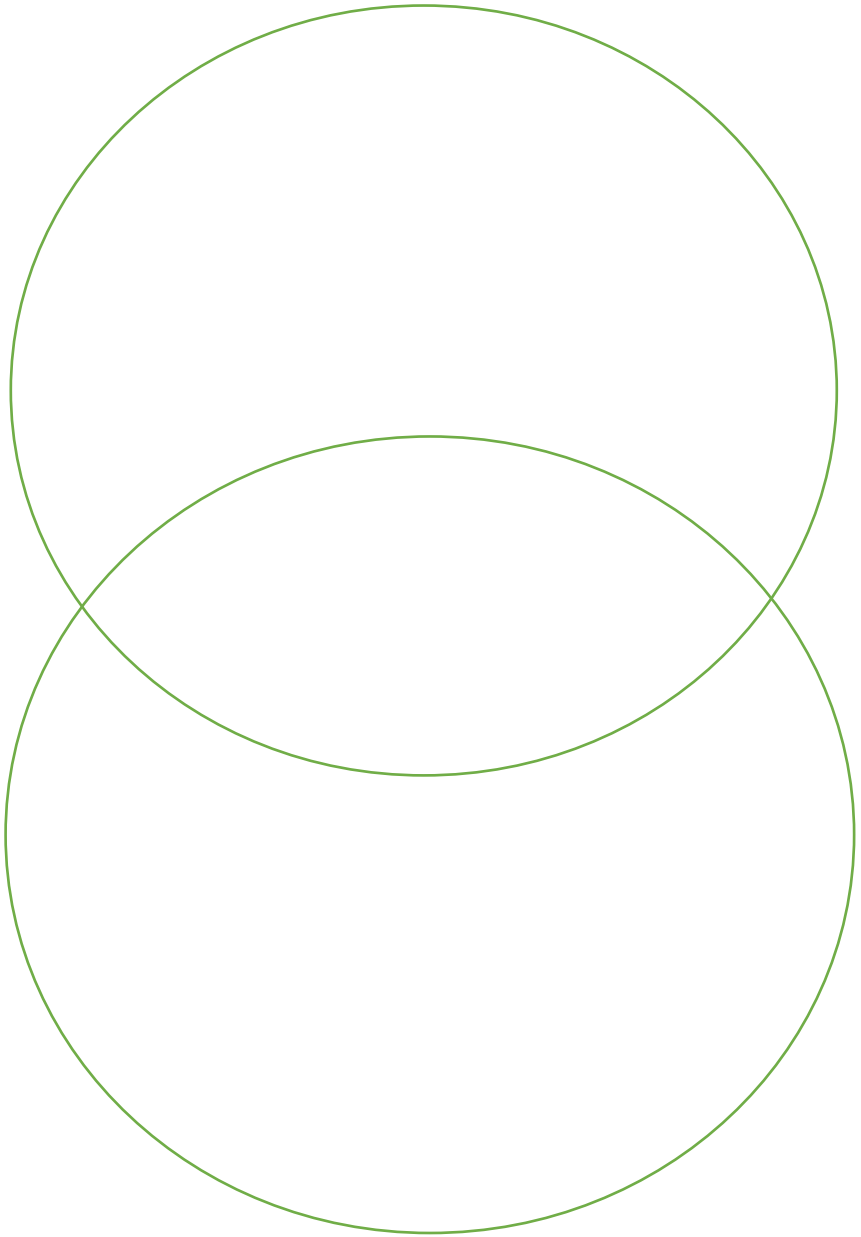
Once completing the Venn Diagram have students begin designing their own amusement park signs. (In groups of 4)

You may start the activity by saying something to the effect of, “Now that we have highlighted the components of these simple circuits, we can use that, along with everything else we said creates attractive signs, to design signs for your amusement park. With your group I want you to discuss how you are going to make your sign. Draft it on a sheet of paper making sure to include where you will be placing your lights and how you are going to wire them.”


Draw step-by-step with students.
Switch
wire
light bulb
Series
Battery
2nd light bulb.
Switch
Battery
light Bulb
light Bulb
Parallel


Parallel
Series
Examples
• Homes
• Infrastructure
• Christmas lights (modern)
• Two or more paths
• One light bulb goes out others stay on.
• Brighter light
• More stable
• More Efficient
• Unbroken path has current
• Require energy source. (Battery)
Students will likely mention
• Wires
• Switches
• light bulbs
• Single path
• One light bulb goes out all go out.
• Dimmer lights
• Less stable
• Less Efficient.
Examples
• Lamps
• Refrigerator
• Single Function Devices.
• Older Christmas lights.





Lesson Plan

Name of Lesson: Energy

Learning (TEKS) Objective: 8(6)Force, motion, and energy. The student knows that there is a relationship between force, motion, and energy. The students is expected to (A) demonstrate and calculate how unbalanced forces change the speed or direction of an object's motion.

Student Outcome (*Students will be able to…)*
Students will be able to differentiate between different types of potential energies. They will be able to relate elastic potential energy to distance and speed.

Day of the Week and Time: Thursday 8:15-9:15

Total Length of Lesson: 1 hour

Materials *(per 1 class of 25 students):*

- 10 pieces of foam board (5x6 in) (one 20x30in foam board will produce 20 pieces)
- 60 hollow noodles
- 10 balloons
- 20 wooden dowels
- 40 Buttons (Reusable)
- 10 (2'x2') *(giant sticky notes)*
- 30 copies of energy graphic organizer

Advanced Preparation *(day before, morning of…)*

Cut the foam boards in 5x6in pieces
Sort materials for carts per group (1 piece of foam board, 4 buttons, 6 pasta noodles, 1 balloon, 2 dowels)

Instructional Delivery	**Notes to Teacher:**
Activity 1: Discussing energy forms **Duration: 15 minutes** ➢ Ask, "Why do we eat?" (let students say answers until someone mentions energy, you can mention that it is chemical energy) then, "Why do plants need sunlight?" ➢ Once they mention that they use sunlight to make food ask, "So does the sun provide energy?" ➢ Students should already be thinking of energy by now ask them to come up with other forms of energy. (wind, solar, hydro, electric) If they don't mention electric energy you can ask, "What about when you made the signs? What energy did we use there?" They likely will not come up with elastic, gravitational, kinetic. ➢ Once they run out of ideas you can introduce the idea of the other forms. ➢ As students discuss forms of energy they will be filling in energy graphic organizer. (You should draw graphic organizer on the board and be writing forms of energy with definitions as you go along) ➢ After finishing up the graphic organizer you can say, "So let's see if we can use energy to power go-karts."	Highlight: chemical energy (food), radiant energy (photosynthesis) Introduce: gravitational potential, elastic potential, and kinetic energy. (Energy cheat sheet can be found in the folder)

Activity 2: Building and testing carts Duration: 20 minutes ➢ Students will be in groups of three. (Inflater/Releaser, Measurer/timer, and recorder) If by chance you have a group of four separate measurer and recorder. ➢ Have students build their carts as shown. (If a group finishes early, they can decorate their cart with markers while they wait for the rest of the students to finish)	Building- 13 minutes Testing/ recording- 7 minutes
Activity 3: Analyzing data Duration: 25 minutes ➢ Students will refer to handout to create tables, make graphs, and answer questions on the sticky note given to them. Let them know these posters will be hung on the walls. ➢ As a closing question, "Most amusement parks today offer go-karts as an attraction. Discuss with your group what energy source you would want to use in the go-karts in your amusement park." (write answer in journals)	Making posters- 20 minutes Closing question- 5 minutes

Why do we Eat?

I know it seems like a silly question, but really what is the purpose of eating?

How do you feel if you have gone all day without eating?

Besides hungry.

Food provides us with energy that we need!

What about plants though? They don't eat in the same way we do but we know that they produce their own food. Where do they receive their energy?

Your turn!

Name as many forms of energy as you can and we'll write them down on the board.

Types of Energy Sources

- Chemical
- Wind
- Elastic
- Radiant
- Hydroelectric
- Gravitational
- Electric
- Thermal
- Nuclear

There are actually many energy sources! For our handout let's discuss some of them!

Kinetic Vs. Potential

These are two different types of energies

Kinetic Energy is the energy objects have when they are in motion

Potential energy is energy that is stored Objects that have potential energy can the ability to release energy or eventually begin motion

Let's think about food again!

If I throw a banana at you, do you automatically have energy?

Nope, although that would be cool You would have to eat the now bruised banana and wait until you start digesting it

The process changes the banana chemically and so food is said to contain chemical energy that is released when you eat it

Would we consider this a kinetic or potential energy then?

Wind

How do we collect energy from the wind?

Have you ever driven outside of the city and seen these things?

Or these on I-10 on Airway?

What do they do?

Would this be kinetics or potential engery?

Radiant (or Solar)

Here is a tough one is radiant energy kinetic or

Potential?

Discuss this with your group for a minute before we answer

Elastic

Have you ever stretched a rubber band and let it go?

What happened? It quickly snaps back into place, right?

As long as you hold it though, nothing happens

What kind of energy would this be?

Hint Nothing happens unt l you let go or release the rubberband!

Hydroelectric

What is this?

It uses the movement of water to generate energy similar to the wind turbines we saw earlier

If it uses motion what energy would it be?

Electric

We all became a little more familiar with electricity when we learned about circuits yesterday!

Is electric energy considered a kinetic or potential energy?

Hint There is a reason we need wires!

Gravitational

If I took one of your notebooks and held it up, does it have energy?

Is there a possibility that the notebook can start moving?

If it can eventually move, what kind of energy does it have?

Energy Cheat sheet!

Kinetic: Energy of objects in motion. Faster moving objects have more kinetic energy.

Potential: Can become energy

Radiant Energy: travels in waves. Most common form of radiant energy is from the sun. (photosynthesis)

Chemical Energy: Energy released in chemical reaction. (digestion)

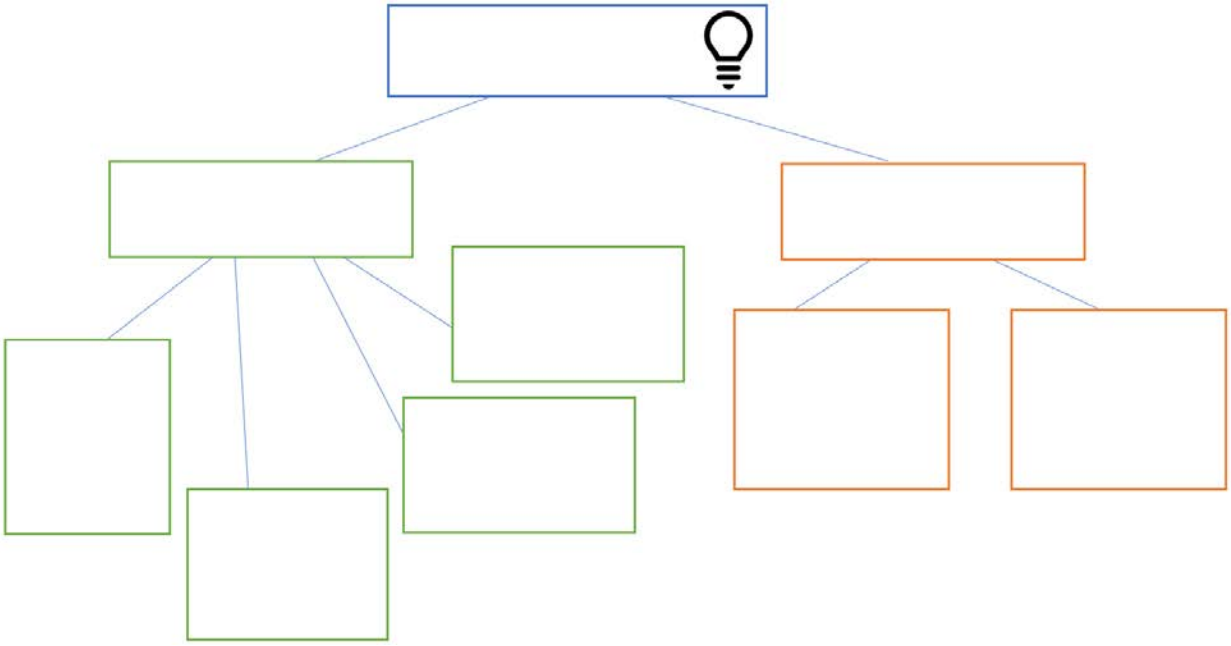
Hydroelectric energy: Harnessed kinetic energy specifically from moving water (water mill)

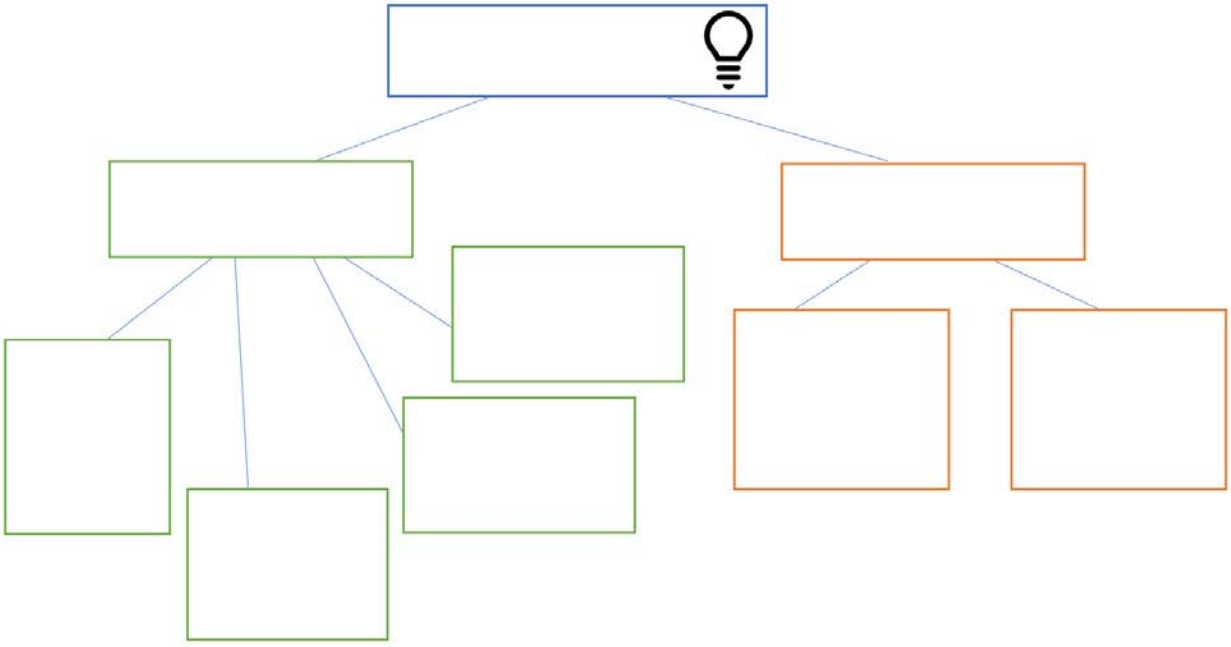
Elastic potential: Energy stored from deformation of elastic objects (stretched rubber band, compressed spring)

Gravitational potential: energy an object stores because of its position. (Monica's roller coaster, the marble fell because of gravity)

Wind: Used to generate electricity by harnessing kinetic energy from the wind. (Wind mills, the ones by airway on I-10 are a good example of this)

Energy is always conserved until affected by friction! (Friction causes the carts to stop)

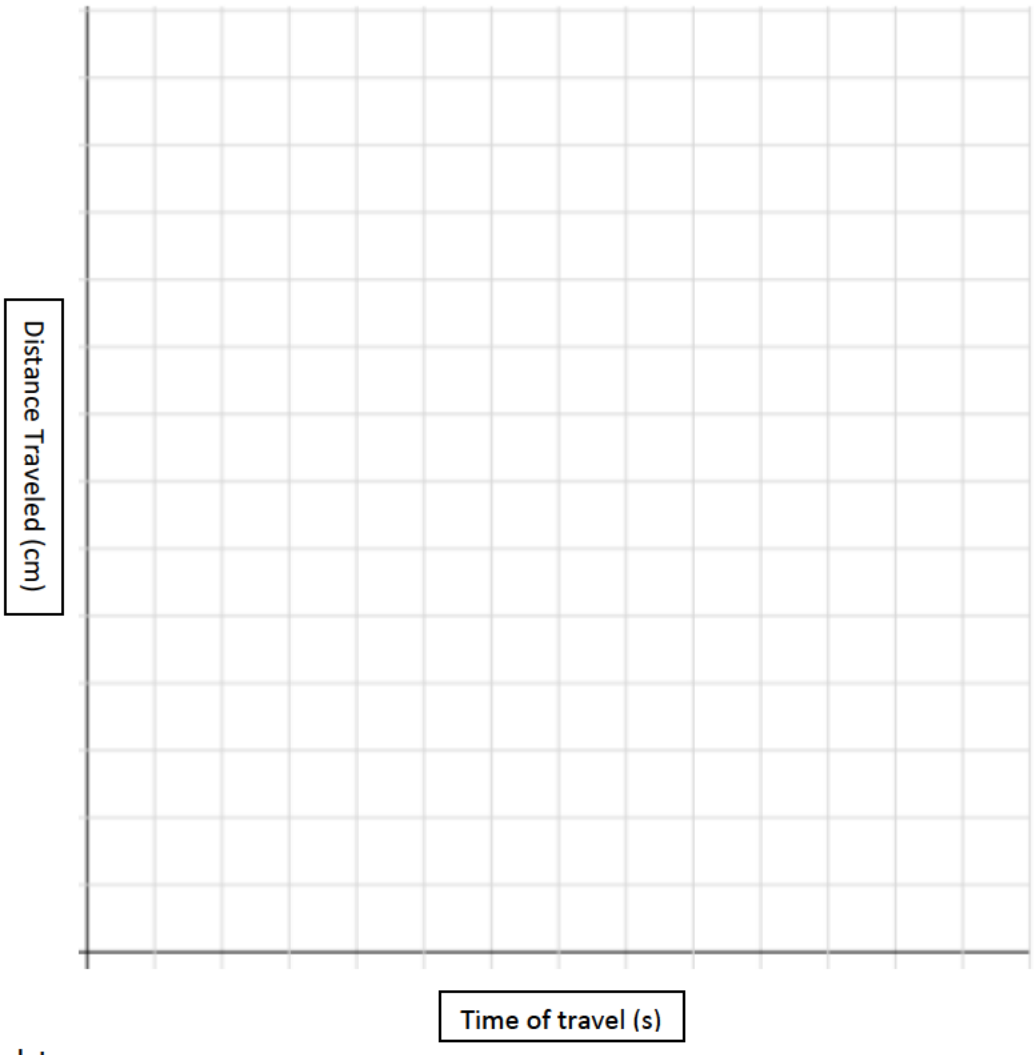




Now that you have completed constructing your go-karts, it's time to rev them up and let them go!

Recording data:

	Trial 1	Trial 2	Trial 3	Trial 4
Distance traveled				
Travel time				
Speed of Cart $S = \frac{D}{t}$				



Analyzing data:

1. During which trial did your cart have the most potential energy at the beginning? How do we know this?
2. Take a look at your graphs. What do you notice about the relationship between the distance traveled and the time the car was in motion?
3. Can we determine in which trial your cart had the most kinetic energy? Which was it?
4. What happened to the total energy of the cart when you released the balloon?
5. Talk to your group and come up with ideas on how to best increase the speed of the carts.

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