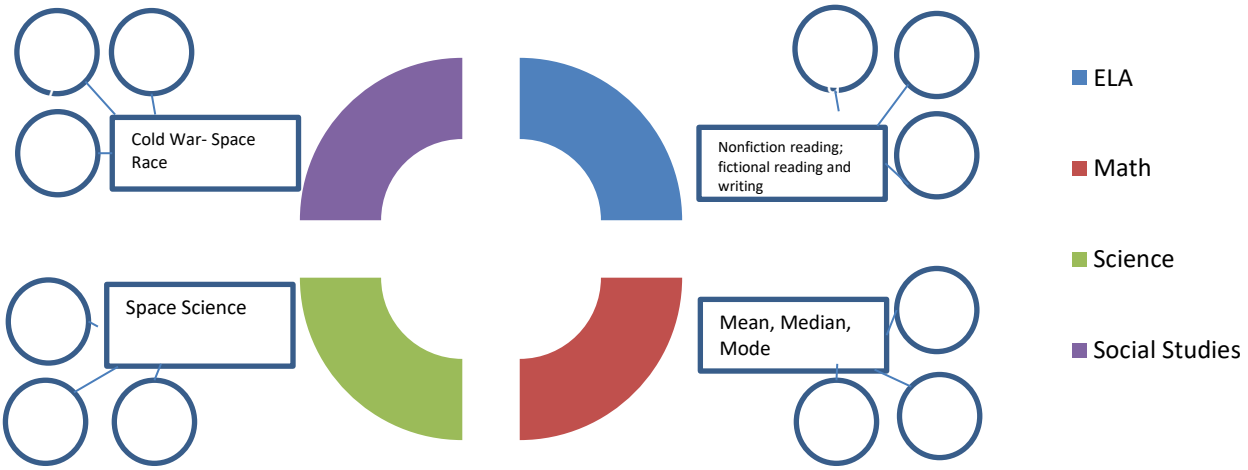
6th Grade STEM Unit #4:



Grade Level	6	Unit Length	9 weeks
Unit Overview	***Making a Difference- How the Past Changed the Present and the Future***		
Unit Essential Question(s)	How did innovations and inventions of the past make a difference in their world? How do innovations and inventions of the past make a difference in our world today? How can our inventions and innovations today make a difference in the future?		
Culminating Events	Paper Airplane Challenge "Hang Time", Rocket Building Day, & movie "The Rocketeer"		

Common Assessment

	STEM Project Rubric		**Project Title:** **Student Name:** **Date:**
	Advanced	**Proficient**	**Needs Improvement**
Math Components Mean, Median, Mode	Student will correctly calculate measures of central tendency 100% of the time.	Student will correctly calculate measures of central tendency 80% of the time.	Student will correctly calculate measures of central tendency less than 80% of the time.
Data Displays	Student can correctly display statistical information using a variety of representations 100% of the time.	Student can correctly display statistical information using a variety of representations 80% of the time.	Student can correctly display statistical information using a variety of representations less than 80% of the time.
Science Components: Space Science	Student will create a straw rocket and launch it for at least 25 meters. They will also create a paper airplane prototype, troubleshoot, and rebuild it with	Student will create a straw rocket and launch it for at least 15 meters. They will also create a paper airplane prototype and discuss how it could be better.	Students will create a straw rocket. Students will create a paper airplane.

	improved results.		
Social Studies Component Cold War & Space Race	Students will participated in a Cold War/Space Race simulation about planets, lights, and projection using glass marbles and cell phone flashlights. This is an experiential activity with discussion, not graded.		
ELA Component Final Draft of Children's Book	Text has little to no errors, illustrations are complete and colorful, story is complete	Text has a few errors, but they do not detract from the story; illustrations are finished; story may have a few holes, but it works overall	Text has not been edited at all; illustrations are incomplete or missing; story is difficult to follow and does not follow any plot structure

Strands (main ideas taught in unit)	
ELA	Non-fiction reading, fiction reading, multimedia, fictional writing
Math	Mean, Median, Mode; Data Displays
Science	Moon Phases, Planets, Astronomy
Social Studies	History, Geography
Vocabulary	
ELA	**context**- the parts of something written or spoken that immediately precede and follow a word or passage and clarify the meaning **illustrate**- explain or make clear **central**- of the greatest importance **convey**- make known or understandable for someone **subjective**- personal feelings, thoughts, or opinions **elaborate**- develop in detail **perspective**- a point of view **purpose**- reason for doing something **connotation**- the feelings or emotions associated with a word **denotation**- the dictionary definition **figurative**- not meant to be taken literally **interpret**- understand as having a particular meaning or significance **credible**- trustworthy **consistent**- staying the same **transition**- changing from one to another
Math	**Variability**: the amount of spread in a data set **Distribution**: a description of the relative numbers of times each possible outcome will occur in a number of trials **Center**: is located at the median of the distribution. **Spread**: how similar or varied the set of observed values are for a particular variable (data item) **Line Plots**: a graph that shows frequency of data along a number line. **Histograms**: a graphical representation of the distribution of numerical data. **Box Plots:** a way of graphically depicting groups of numerical data through their quartiles **Mean**: the average of the numbers **Median**: the number that is halfway into the set **Range**: the difference between the largest and smallest values **Interquartile Range:** a measure of variability, based on dividing a data set into quartiles.

Science	**Waxing: When the lighted part of the moon is growing larger.** **Waning**: When the lighted part of the moon is growing smaller. **Asteroid**: a large, irregularly shaped object in space that orbits our Sun. **Astronomy**: The study of the moon, stars and other objects in space. **Axis**: The imaginary line that passes through Earth's center and the North and South poles, about which the Earth rotates. **Orbit**: The path of an object as it revolves around another object. **Rotation**: The spinning motion of a planet on an axis. **Solstice**: Two days of the year on which the sun reaches its greatest distance north or south of the equator. **Equinox**: The two days of the year on which neither hemisphere is tilted toward or away from the sun. **Force**: A push or pull exerted on an object. **Gravity**: The attractive force between objects, its strength depends on their masses and the distance between them. **Inertia**: The tendency of an object to resist a change in motion. **Eclipse**: The partial or total blocking of one object in space by another. **Umbra**: The darkest part of the shadow. **Penumbra**: The part of the shadow surrounding the darkest part. **Solar eclipse**: The blocking of sunlight to Earth that occurs when the moon is directly between the sun and Earth. **Tide**: The periodic rise and fall of the level of water in the ocean.
Social Studies	**communism-** a political and economic system in which factors of production are collectively owned and directed by the state **democracy**- a system of government in which political authority is held by the people **Cold War-** a state of political hostility that existed from 1945-1990 between countries led by the Soviet Union and countries led by the United State

Key Questions				
	ELA	Math	Science	Social Studies
	How do you determine a theme in a work of literature? *How do you cite textual evidence to support analysis of what a text says and draw inferences?* *How are main ideas introduced, illustrated, and elaborated on in a text?* *How do sentences, paragraphs, or chapters fit into the overall structure of a text and contribute to the development of ideas?* *How do you use context to determine or clarify the meaning of words and phrases?* *How do you plan, develop, edit and revise to create clear and coherent writing?*	*How do the paper airplane designs affect measures of central tendency?*	*How does the moon affect the tides?* *What causes the seasons on earth?* *What are the phases of the moon?*	*How did the Space Race reflect the ongoing Cold War between the Soviet Union (communism) and the United States (democracy)?*

Hook for Unit	**Paper Airplane Activity, Rocket Building Day**
Literature Component	*Wrinkle in Time* and *The Giver*
Writing Closure	Finishing the children's book
Materials Needed for Culminating Event	Materials to make rockets- balloons, straws, scotch/masking tape, fishline, paper, pencils (see attached lesson plans) & paper airplanes (paper).

Standards: Indiana State Standards	
ELA Indiana State Standards.	**LA.6.RL.2.2** Determine how a theme or central idea of a work of literature is conveyed through particular details; provide a detailed, objective summary of the text. **LA.6.RN.2.1** Cite textual evidence to support analysis of what a text says explicitly as well as inferences drawn from the text. **LA.6.RN.2.3** Analyze in detail how a key individual, event, or idea is introduced, illustrated, and elaborated in a text (e.g., through examples or anecdotes). **LA.6.RN.3.2** Analyze how a particular sentence, paragraph, chapter, or section fits into the overall structure of a text and contributes to the development of the ideas. **LA.6.RV.2.1** Use context to determine or clarify the meaning of words and phrases. **LA.6.W.4** Apply the writing process to - Plan and develop; draft; revise using appropriate reference materials; rewrite; try a new approach; and edit to produce and strengthen writing that is clear and coherent, with some guidance and support from peers and adults. Use technology to interact and collaborate with others to generate, produce, and publish writing. **LA.6.W.1** Write routinely over a variety of time frames for a range of tasks, purposes, and audiences; apply reading standards to support analysis, reflection, and research by drawing evidence from literature and nonfiction texts. **LA.6.W.2** Students are expected to build upon and continue applying concepts learned previously.
Math Indiana State Standards.	**MA.6.DS.4:** Summarize numerical data sets in relation to their context in multiple ways, such as: report the number of observations; describe the nature of the attribute under investigation, including how it was measured and its units of measurement; determine quantitative measures of center (mean and/or median) and spread (range and interquartile range), as well as describe any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered; and relate the choice of measures of center and spread to the shape of the data distribution and the context in which the data were gathered. **MA.6.DS.3:** Formulate statistical questions; collect and organize the data (e.g., using technology); display and interpret the data with graphical representations (e.g., using technology). **MA.6.DS.2**: Select, create, and interpret graphical representations of numerical data, including line plots, histograms, and box plots. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for the variability in the answers. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
Science Indiana State Standards. *Earth and Space Science*	**SCI.6.2 2010** Understand the relationships between celestial bodies and the force that keeps them in regular and predictable motion. **SCI.6.2.1 2010** Describe and model how the position, size and relative motions of the earth, moon and sun cause day and night, solar and lunar eclipses, and phases of the moon. **SCI.6.2.2 2010** Recognize that gravity is a force that keeps celestial bodies in regular and predictable motion, holds objects to earth's surface and is responsible for tides. **SCI.6.2.3 2010** Understand that the sun, an average star where nuclear reactions occur, is the central and largest body in the solar system. **SCI.6.2.4 2010** With regard to their size, composition, distance from sun, surface features and ability to support life, compare and contrast the planets of the solar system with one another and with asteroids and comets. **SCI.6.2.5 2010** Demonstrate that the seasons in both hemispheres are the result of the inclination of the earth on its axis, which causes changes in sunlight intensity and length of day. Student will correctly calculate measures of central tendency 100% of the time.
Social Studies Indiana State Standards.	**6.1.15** Describe the impact of industrialization and urbanization on the lives of individuals and on trade and cultural exchange between Europe and the Americas and the rest of the world. **6.1.16** Identify individuals, beliefs and events that represent various political ideologies during the nineteenth and twentieth century's and explain their significance. Examples: Liberalism, conservatism, nationalism, socialism, communism, fascism and popular sovereignty **6.1.17** Discuss the benefits and challenges related to the development of a highly technological society. Examples: Atomic energy, computers and environmental change

How Rockets Fly – Stability

Name _____ Block _____ Date _____

Scenario:

You are from a planet near Omicron Theta IV. Your society is in the early Industrial Revolution stage. Rockets are a concept, but your people have never had a successful launch. It seems the rockets take off and turn and head straight for the ground. Being the resourceful engineer of your society, the people look to you for salvation. It seems that your planet, Alpha Beta II, is in distress. All the industry on this very small planet has caused CO2 levels to rise in your atmosphere. The planet is heating up and the Polar Ice Caps are melting. The scientists of your planet estimate you have 20 years before total flood. Now, your planet is only twenty miles around and the estimated flood will cause the water levels to rise 8 inches. Although not life threatening, who wants to walk around with soggy shoes all the time?

The people of Alpha Beta II have decided they want off this soggy rock. You are in charge of developing a rocket that will fly straight. Use the following rocket model to test 3 different wing configurations.

Materials:

- Paper
- Tape
- Scissors
- Sharpened pencil
- Straw

Procedure:

1. Cut a narrow rectangle strip of paper about 5 inches by 5 inches.
2. Roll it tightly around the pencil. Tape it and remove it from the pencil.
3. Cut Crown points onto one end of the cylinder and slip it back onto the pencil.
4. Slide the crown points to the pencil tip and squeeze the points together. Tape them to seal them shut. This should form your nose cone.
5. Remove the cylinder and check for leaks.
6. Cut out 2 sets of fins using the pattern provided.
7. Make two more rockets and fins.
8. Experiment with fin placement. 1 towards the back, one towards the middle and one towards the front.
9. Slip the straw into the rocket's opening. Point the rocket up at a slight angle from 90 degrees and blow.
10. Record your observations. Do this 3 times with each rocket.
11. Take the best rocket and do three speed calculations.
12. Dispose of trash…including the straw.

MISSION: Hang Ten!

BRIEF:

You and your team have been selected to make a paper device that can stay in the air for the longest time possible.

RULES:

1. You will design a paper device.
2. Your finished device must be no longer in any dimension than 24 inches.
3. You will work alone or with a single partner. Teams may be of no more than 2 people.
4. You may use any thickness, color, or size paper you want, so long as the finished product is less than 24 inches in all dimensions. Additional tape, paperclips, or other approved materials may be added to your design.
5. Hang time will be measured with a stopwatch after the device is thrown. The longest time wins. Three attempts will be given.

STEM CHALLENGE ACTIVITY:

Balloon Rocket Races - Student Instructions

Student Name(s):_____

Challenge: Can you create a balloon rocket that will be fast? Is it fast enough to win in a race against other groups? Your challenge is to create a balloon that will travel from one end of a fishing line to the other as fast as possible!

Make predictions: Some things that you can experiment with are the shape of the balloon and the length of the straw attached to the string.

1. What shape do you think will be the best? Why?

2. What length of straw do you think will be best? Why?

Experiment: (Remember, only change one variable at a time. Experiment with different shaped balloons to determine the best one. Then experiment with different lengths of straws to determine the best one.)

1. Based on your practice time (experiment) what is your group's plan?

Let the races begin!

2. How did your rocket do? If you could change anything about your balloon or straws, what would you change and why?

3. Newton's 3rd Law states that "For every action there is an equal and opposite reaction." What was the action and reaction in this project?

Further research:

Rockets that launch into space apply Newton's Third Law of motion. However, they don't use balloons as Thrust. What do they use as their fuel? Be prepared to share what you learned in class tomorrow.