Park Hill School District

Building Successful Futures • Each Student • Every Day

Summer School 7-8: Rocketry Curriculum

Scope and Sequence:

Timeframe	Unit	Instructional Topics
24 Days	Rocketry	Topic 1: Basics of Force and Motion Topic 2: Comparison of Forces Topic 3: Soda Bottle Rockets Topic 4: Rocket Design Topic 5: Flying Machine

Summer School Unit: Rocketry

Subject: Rockets
Grade: 7-8
Name of Unit: Rocketry
Length of Unit: 25 Days
Overview of Unit: This unit will allow the students the opportunity to experience how rockets work. The students will learn how Force, Motion, Friction, and a myriad of other factors affect the flight pattern of a rocket. The students will use different types of projectiles that will allow them many different hands on experiences culminating in the building and launching of an estes rocket.

Priority Standards for unit:

- Identify and describe the types of forces acting on an object in motion, at rest, floating/sinking (i.e., type of force, direction, amount of force in Newton's)
- Explain that a change in motion is the result of an unbalanced force acting upon an object

Supporting Standards for unit:

- Classify different types of motion (e.g., straight line, projectile, circular, vibrational)
- Given an object in motion, calculate its speed (distance/time)
- Recognize an object's weight is a measure of the gravitational force of a planet/moon acting on that object
- Compare the forces acting on an object by using a spring scale to measure them to the nearest Newton
- Compare the effects of balanced and unbalanced forces (including magnetic, gravity, friction, push or pull) on an object's motion
- Explain that when forces (including magnetic, gravity, friction, push or pull) are balanced, objects are at rest or their motion remains constant
- Explain how the acceleration of a moving object is affected by the amount of net force applied and the mass of the object
- Recognize examples of work being done on an object (force applied and distance moved in the direction of the applied force) with and without the use of simple machines
- Calculate the amount of work done when a force is applied to an object over a distance ($W = F \times d$)
- Recognize the amount of work output is never greater than the amount of work input, with or without the use of a simple machine

Unwrapped Concepts (Students need to know)	Unwrapped Skills (Students need to be able to do)	Bloom's Taxonomy Levels	Webb's DOK
types of forces acting on an object in motion, at rest, floating/sinking	Identify	Remember	1
types of forces acting on an object in motion, at rest, floating/sinking	Describe	Evaluate	3
a change in motion is the result of an unbalanced force acting upon an object	Explain	Understand	3

Essential Questions:

1. How does a rocket work?
2. How does friction impact the motion of an object?
3. How does the design affect accuracy?

Enduring Understanding/Big Ideas:

1. The output forces of the rocket propel it a specific direction.
    a. A change in motion ("liftoff") happens due to an unbalanced force acting on an object.
    b. The object's weight is relational to the distance/height traveled.
    c. The net force applied is greater than the mass of the object.
2. The friction of the air slows down the rocket.
    a. The type of material of the component parts impact flight.
    b. When friction is greater than the pushing force the object stops.
3. The design affects speed, aerodynamics, distance, the role of friction, etc.

Unit Vocabulary:

Academic Cross-Curricular Words	Content/Domain Specific
	Speed Force Motion Friction Work Acceleration Projectile

Resources for Vocabulary Development: Quality Tools

Topic 1: Basics of Force and Motion

Engaging Experience 1

Title: Balloon rocket

Suggested Length of Time: 5 days

Standards Addressed

Priority:

- Identify and describe the types of forces acting on an object in motion, at rest, floating/sinking (i.e., type of force, direction, amount of force in Newton's)

Supporting:

- Classify different types of motion (e.g., straight line, projectile, circular, vibrational)
- Compare the forces acting on an object by using a spring scale to measure them to the nearest Newton
- Compare the effects of balanced and unbalanced forces (including magnetic, gravity, friction, push or pull) on an object's motion
- Explain that when forces (including magnetic, gravity, friction, push or pull) are balanced, objects are at rest or their motion remains constant
- Explain how the acceleration of a moving object is affected by the amount of net force applied and the mass of the object
- Students demonstrate a sound understanding of technology concepts, systems, and operations (ISTE 6 - Technology Operations and Concepts).
    - Understand and use technology systems.
    - Transfer current knowledge to learning of new technologies.

Detailed Description/Instructions:

- (Day one) Students will be instructed in the basics of force and motion in regards to rocketry.
- (Day two) Students will use a balloon to propel a straw along a length of string. They will calculate speed (S=d/t).
- (Day three) Students will learn about the effects of friction by changing the material of string. They will measure speed.
- (Day four) Students will learn about the effects of gravity as they try to keep a balloon in the air. Students will measure time.
- (Day five) Students will modify their balloons by adding fins and wings to try to determine if there is an impact on the speed, distance, and height of the balloon.

Bloom's Levels: Apply

Webb's DOK: 3

Topic 2: Comparison of Forces

Engaging Experience 1

Title: Paper Airplanes

Suggested Length of Time: 5 days

Standards Addressed

Priority:

- Identify and describe the types of forces acting on an object in motion, at rest, floating/sinking (i.e., type of force, direction, amount of force in Newton's)
- Explain that a change in motion is the result of an unbalanced force acting upon an object

Supporting:

- Recognize an object's weight is a measure of the gravitational force of a planet/moon acting on that object
- Compare the forces acting on an object by using a spring scale to measure them to the nearest Newton
- Compare the effects of balanced and unbalanced forces (including magnetic, gravity, friction, push or pull) on an object's motion
- Explain that when forces (including magnetic, gravity, friction, push or pull) are balanced, objects are at rest or their motion remains constant.
- Explain how the acceleration of a moving object is affected by the amount of net force applied and the mass of the object

Detailed Description/Instructions:

- (Day one) Students will design and create paper airplanes that are designed for the greatest distance
- (Day two) Students will create paper airplanes that are designed for the greatest flight time
- (Day three) Students will design and create paper airplanes that are designed for the greatest accuracy
- (Day four) Students will design and create paper airplanes that are designed for the greatest speed.
- (Day five) Students will use what they learned this week to design an airplane that will will compete in 4 different airplane competitions (Distance, flight time, accuracy, and speed)

Bloom's Levels: Apply

Webb's DOK: 3

Topic 3: Soda Bottle Rockets

Engaging Experience 1

Title: Soda Bottle Rockets

Suggested Length of Time: 5 days

Standards Addressed

Priority:

- Identify and describe the types of forces acting on an object in motion, at rest, floating/sinking (i.e., type of force, direction, amount of force in Newton's)

Supporting:

- Classify different types of motion (e.g., straight line, projectile, circular, vibrational)
- Compare the forces acting on an object by using a spring scale to measure them to the nearest Newton
- Compare the effects of balanced and unbalanced forces (including magnetic, gravity, friction, push or pull) on an object's motion
- Explain that when forces (including magnetic, gravity, friction, push or pull) are balanced, objects are at rest or their motion remains constant
- Explain how the acceleration of a moving object is affected by the amount of net force applied and the mass of the object
- Students demonstrate a sound understanding of technology concepts, systems, and operations (ISTE 6 - Technology Operations and Concepts).
    - Understand and use technology systems.
    - Transfer current knowledge to learning of new technologies.

Detailed Description/Instructions:

- (Day one) Students will learn of the materials and directions of a soda bottle rocket
- (Day two) Students will learn of the materials and directions of a soda bottle rocket. *work day*
- (Day three) Students will learn of the materials and directions of a soda bottle rocket. *work day*
- (Day four) Students will launch their rockets and evaluate
- (Day five) Students will modify their rockets for the second launch. Second launch

Bloom's Levels: Evaluate

Webb's DOK: 4

Topic 4: Rocket Design

Engaging Experience 1

Title: Rocket design

Suggested Length of Time: 5 Days

Standards Addressed

Priority:

- Identify and describe the types of forces acting on an object in motion, at rest, floating/sinking (i.e., type of force, direction, amount of force in Newton's)
- Explain that a change in motion is the result of an unbalanced force acting upon an object

Supporting:

- Recognize an object's weight is a measure of the gravitational force of a planet/moon acting on that object
- Recognize examples of work being done on an object (force applied and distance moved in the direction of the applied force) with and without the use of simple machines
- Calculate the amount of work done when a force is applied to an object over a distance (W = F x d)
- Recognize the amount of work output is never greater than the amount of work input, with or without the use of a simple machine

Detailed Description/Instructions:

- (Day one) Students will receive material and information on model rockets.
- (Day two and three) Students will build their model rocket.
- (Day four) Students will perform a test model rocket launch
- (Day five) Students will modify rockets based off what they learned from test launch and then perform second launch

Bloom's Levels: Evaluate

Webb's DOK: 4

Topic 4: Flying Machine

Engaging Experience 1

Title: Flying Machine

Suggested Length of Time: 1 week

Standards Addressed

Priority:

- Explain that a change in motion is the result of an unbalanced force acting upon an object

Supporting:

- Compare the effects of balanced and unbalanced forces (including magnetic, gravity, friction, push or pull) on an object's motion
- Explain that when forces (including magnetic, gravity, friction, push or pull) are balanced, objects are at rest or their motion remains constant
- Explain how the acceleration of a moving object is affected by the amount of net force applied and the mass of the object
- Recognize examples of work being done on an object (force applied and distance moved in the direction of the applied force) with and without the use of simple machines

Detailed Description/Instructions:

- (Day one) Students will use what they have learned in this unit to develop a flying machine that will compete in multiple competitions. (Speed, Distance, Accuracy, Time of Flight)
- (Day two) Students will use what they have learned in this unit to develop a flying machine that will compete in multiple competitions. (Speed, Distance, Accuracy, Time of Flight)
- (Day three) Students will use what they have learned in this unit to develop a flying machine that will compete in multiple competitions. (Speed, Distance, Accuracy, Time of Flight)
- (Day four and five) Students will compete in multiple competitions. (Speed, Distance, Accuracy, Time of Flight)

Bloom's Levels: Evaluate

Webb's DOK: 4

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Students will build and launch rockets over the course of the entire class. See each topic and its experiences for the scaffolding aligned with meeting the overall expectation of this scenario.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Basics of Force and Motion	Balloon rocket	• (Day one) Students will be instructed in the basics of force and motion in regards to rocketry. • (Day two) Students will use a balloon to propel a straw along a length of string. They will calculate speed (S=d/t). • (Day three) Students will learn about the effects of friction by changing the material of string. They will measure speed. • (Day four) Students will learn about the effects of gravity as they try design a balloon that stays in the air the longest. Students will measure time in air. • (Day five) Students will modify their balloons by adding fins and wings to try to determine if there is an impact on the speed, distance, and accuracy of the balloon.	1 Week
Comparison of Forces	Paper airplanes	• (Day one) Students will design and create paper airplanes that are designed for the greatest distance • (Day two) Students will create paper airplanes that are designed for the greatest flight time • (Day three) Students will design and create paper airplanes that are designed for the greatest accuracy • (Day four) Students will design and create paper airplanes that are designed for the greatest speed.	1 Week

		• (Day five) Students will use what they learned this week to design an airplane that will compete in 4 different airplane competitions (Distance, flight time, accuracy, and speed)	
Rocket Design	Soda Bottle Rockets	• (Day one) Students will learn of the materials and directions of a soda bottle rocket • (Day two) Students will learn of the materials and directions of a soda bottle rocket. *work day* • (Day three) Students will learn of the materials and directions of a soda bottle rocket. *work day* • (Day four) Students will launch their rockets and evaluate • (Day five) Students will modify their rockets for the second launch. Second launch	1 week
Rocket Design	Model Rocket Build	• (Day one) Students will receive material and information on model rockets. • (Day two and three) Students will build their model rocket. • (Day four) Students will perform a test model rocket launch • (Day five) Students will modify rockets based off what they learned from test launch and then perform second launch	1 week
Flying Machine	Flying Machine	• (Day one) Students will use what they have learned in this unit to develop a flying machine that will compete in multiple competitions. (Speed, Distance, Accuracy, Time of Flight) • (Day two) Students will use what they have learned in this unit to develop a flying machine that will compete in	1 week

		multiple competitions. (Speed, Distance, Accuracy, Time of Flight) ● (Day three) Students will use what they have learned in this unit to develop a flying machine that will compete in multiple competitions. (Speed, Distance, Accuracy, Time of Flight) ● (Day four and five) Students will compete in multiple competitions. (Speed, Distance, Accuracy, Time of Flight)	

Unit of Study Terminology

Appendices: All Appendices and supporting material can be found in this course's shell course in the District's Learning Management System.

Assessment Leveling Guide: A tool to use when writing assessments in order to maintain the appropriate level of rigor that matches the standard.

Big Ideas/Enduring Understandings: Foundational understandings teachers want students to be able to discover and state in their own words by the end of the unit of study. These are answers to the essential questions.

Engaging Experience: Each topic is broken into a list of engaging experiences for students. These experiences are aligned to priority and supporting standards, thus stating what students should be able to do. An example of an engaging experience is provided in the description, but a teacher has the autonomy to substitute one of their own that aligns to the level of rigor stated in the standards.

Engaging Scenario: This is a culminating activity in which students are given a role, situation, challenge, audience, and a product or performance is specified. Each unit contains an example of an engaging scenario, but a teacher has the ability to substitute with the same intent in mind.

Essential Questions: Engaging, open-ended questions that teachers can use to engage students in the learning.

Priority Standards: What every student should know and be able to do. These were chosen because of their necessity for success in the next course, the state assessment, and life.

Supporting Standards: Additional standards that support the learning within the unit.

Topic: These are the main teaching points for the unit. Units can have anywhere from one topic to many, depending on the depth of the unit.

Unit of Study: Series of learning experiences/related assessments based on designated priority standards and related supporting standards.

Unit Vocabulary: Words students will encounter within the unit that are essential to understanding. Academic Cross-Curricular words (also called Tier 2 words) are those that can be found in multiple content areas, not just this one. Content/Domain Specific vocabulary words are those found specifically within the content.

Symbols:


This symbol depicts an experience that can be used to assess a student's 21st Century Skills using the rubric provided by the district.


This symbol depicts an experience that integrates professional skills, the development of professional communication, and/or the use of professional mentorships in authentic classroom learning activities.