Exploring STEM with Spheros!

Civil Air Patrol Sphero SPRK+ STEM Kit

Science - Forces in Microgravity Engineering Design Challenge	
Contributing AEM	Alexandra Hill
Materials	For this activity, you will need: • One SPRK+ Sphero • Personal device with the Sphero Edu app installed • One copy of the Forces in Microgravity Engineering Design Challenge • Engineering design challenges supplies (see below)
Learning Outcomes	• I can design and build a mechanism to move the Sphero toward an object in microgravity • I can displace an object in space the farthest distance • I can compare the forces at work in microgravity and on Earth

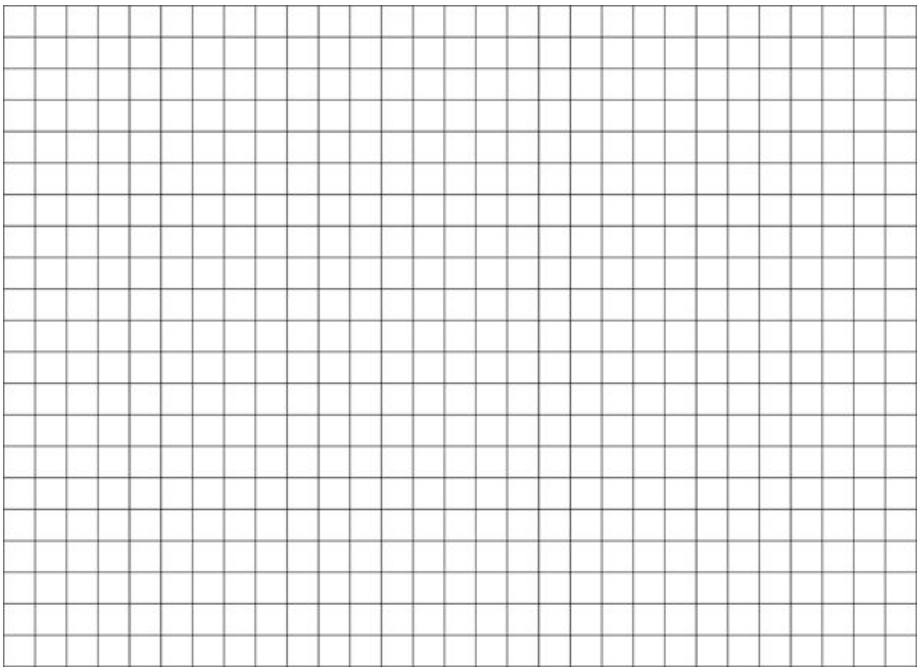
Engage - How does microgravity effect moving objects?	
Check?	**Activity Procedure**
	Watch the music video "Upside Down Inside Out" by *OK Go*. The link for the video: https://goo.gl/JEl3vy
	With a partner or independently, answer these questions: 1. What is microgravity? 2. What caused the microgravity in this video? 3. What was the effect of microgravity on the people in the plane? 4. In your own words, describe gravity (think about the opposite of what you saw in the music video). 5. Predict what type of motion the plane would have to be making in the video in order to simulate microgravity.
	Compare your answers with other students in the class in a group discussion.

	Explore - Design a mechanism to work in microgravity
Check?	**Activity Objective**

	Challenge: Design and build a mechanism to move the Sphero toward an object in simulated microgravity.
	
	Criteria (The product must adhere to the following elements):
	• Construct an attachment that adheres directly to the Sphero
	• Propel the Sphero with attachment toward an object 12 inches away from starting point in water
	• Program the Sphero to impact and displace the object with the Sphero (the object can be anything spherical in shape and that can float on top of the water). Adhere to the following programming constraints:
	  ○ Move without human contact after initial placement in the water
	  ○ Stop the movement of the Sphero once contact with the object is made
	
	Constraints (limits on your product design):
	• Time limit of one class period
	• Must use only provided materials
	• Program duration cannot exceed 10 seconds
	• Safety: Be sure to adhere to any necessary safety precautions when using any tools, including scissors, craft knives, etc.

	Brainstorm design ideas with your team. Describe or draw at least 3 of your team's ideas here: 1. 2. 3.

Sketch your individual designs here:



As a team, select one design that best meets the criteria and constraints for the challenge.

As a team, you have 100 credits to use to build your prototype. You must record the credits spent as you purchase supplies. Any credits not used can be added toward your final score.

Build a prototype of your design using the following materials:

Material:	Cost per item: (Credits)	Total amount purchased:	Total cost for item: (Credits)
1 rubber band	5		
1 plastic straw	5		
1 balloon	20		
1 in duct tape	5		
1 paper clip	5		
1 craft stick	5		
1 note card	10		
1 piece of aluminum foil (3 in x 3 in)	10		
		Total credits used:	

100 (credits available) - _____ (total credits used) = _____ (remaining credits)

Using the Sphero Edu app, design a program for your Sphero to complete the challenge. This program does not need to be complex. However, more points can be earned for incorporating sensors into your programming.

Test the prototype!

Analyze the data and redesign as needed.

	Describe two modifications you would make to improve your prototype: 1. 2.

Explain - What happens when two objects collide?

Check?	Activity Objective
	On Earth, all matter is affected by gravity. Gravity is the force that attracts an object toward the center of the Earth. Astronauts in space must adapt to live in a microgravity environment because they are not limited by the gravitational pull to Earth. Newton's Third Law states that for every action, there is an equal and opposite reaction. In this engineering design challenge, you explored what happens when objects collide in microgravity. • In the space provided, describe what would happen to two objects colliding on Earth. How is it different than the collision in microgravity?

Extend - How does microgravity affect astronauts living in space?

Watch this video about how astronauts are impacted by living in microgravity: "How to Wash Your Hair in Space"
Link to the video: https://youtu.be/kOIj7AgonHM

Either independently or with a partner, brainstorm 5 different applications of how astronauts are impacted by living in microgravity or how research completed in microgravity could benefit humans on Earth.

1.
2.
3.
4.
5.

Evaluate - How effective was your mechanism?

Point Value	Challenge Objective	Points Earned
+1 per remaining credit	All remaining credits from your design budget count toward your final score	
+2	Each team receives 2 points for every inch the object is displaced in the water	
+25	No human contact is made after initial placement and Sphero is programmed to stop after contact is made with the object	
+10	Bonus: Programming includes use of sensor blocks	

Contributing AEM	Alexandra Hill, Missouri Wing