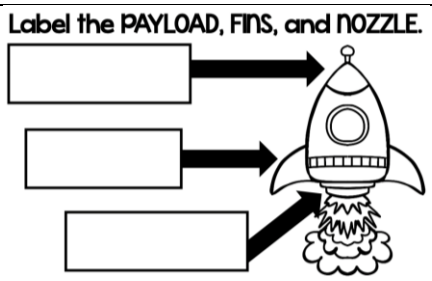
RAMP UP – LIFTOFF Lesson Plan

Title of Lesson:	Zooming Through the Skies: Exploring Forces of Flight with Straw Rockets
Grade Level:	3rd Grade (STEM)
AL COS Standard:	SC15.3.1 - Plan and carry out an experiment to determine the effects of balanced and unbalanced forces on the motion of an object using one variable at a time, including number, size, direction, speed, position, friction, or air resistance (e.g., balanced forces pushing from both sides on an object, such as a box, producing no motion; unbalanced force on one side of an object, such as a ball, producing motion), and communicate these findings graphically.
NGSS:	3-5-ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3 - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
Learning Targets/Objectives:	● Collaboratively plan an experiment to determine the effects of balanced and unbalanced forces on the motion of an object using one variable at a time. ● Carry out an experiment where each force acts on one particular object and has both strength and direction.
Materials Needed:	● **Video** ○ How Do Rockets Fly? | Let's Explore Mars! | SciShow Kids - https://www.youtube.com/watch?v=Lti6a_YYQl0 ● **Handouts** ○ Real Rockets! ○ Label the Rocket ○ Forces on a Rocket - Vocabulary ○ Zooming Through the Skies - Reflection Sheet ● **RAMP UP LIFTOFF Kit** ○ All materials needed for the LIFTOFF experiment are included in the kit. ● **Other Materials**

	○ paper (for recording experiments in Explore and Extend phases) ○ pencils (for recording experiments in Explore and Extend phases) ○ yard stick (for measuring distances in Explore and Extend phases) ○ tape (for Extend phase) ○ straw (for Extend phase) ○ scissors (for Extend phase) Links to the video and the handouts can be found on the LIFTOFF Kit Resources page https://uahrampup.org/liftoff/
Preparation:	● Order RAMP UP LIFTOFF kit online ● Gather all materials ● Print handouts ● Select an open space (e.g. hallway, gym, empty classroom) to conduct LIFTOFF experiment. ● Construct LIFTOFF rocket launchers (instructions in LIFTOFF guide)
Lesson Logistics:	● First, the students will meet as a whole group on the carpet for discussion, a video, and directions. ● Students will then need to be put in groups of 4 to complete the two challenges. ● The teacher will provide all the materials.
Vocabulary Words:	● thrust - the force of flight that pushes an object forward or upwards ● drag - force on an object in the air that reduces forward motion ● propel - to drive or push forward ● gravity - force of attraction of objects to the center of the Earth
Safety Considerations:	See LIFTOFF guide included in the kit.
Engage:	**Step 1**: Ask students what they know about rockets. Allow time for students to share their thoughts and then show the video, *How Do Rockets Fly? | Let's Explore Mars! | SciShow Kids*. **Step 2:** Introduce the Real Rockets! handout. Hold a class discussion on their thoughts and ideas. Record responses on a chart/board. **Step 3:** Introduce the Forces on a Rocket - Vocabulary handout and discuss the parts of a rocket. Have students complete the Label the Rocket handout.

	 **Label the Rocket**
Explore:	**Step 1:** Using the LIFTOFF guide, work with students to construct their straw rockets. **Step 2:** Take the students to the chosen area to conduct the experiments (teacher can determine how many times students are allowed to launch their rockets). They can try launching their rockets at different angles and by experimenting with the height of the plunger to see how far their rockets travel. Have students use paper and pencils to record the results of the different experiments.
Explain:	**Step 1:** Record the results from each group on the class chart. Discuss the forces of **push and pull**. **Step 2:** Let students elaborate on the **forces of flight** at work. **Step 3:** Openly discuss what each group would do differently if they were given this same challenge to do again.
Extend:	**Step 1:** Divide students into groups of 3. **Step 2:** Each group will design a rocket with the goal of having it travel the farthest. Each group must collaboratively **plan and draw** a design before creating the rocket. One idea is to draw a rocket on paper and cut it out to fit to a straw. They may use only the materials provided by the teacher. **Step 3**: They have 15 minutes to create and test 3 times.
Evaluation:	Students will independently complete the Zooming Through the Skies - Reflection Sheet