Lesson 3: Roto-Copter Lab

Grade: 3rd-8th

Duration: 30- 45 minutes

Standards:

- *NGSS Nature of Science* – Planning and carrying out an investigation in which variables are controlled and data is analyzed to identify design aspects for improvement.

Objective:

- Students will practice using a scientific procedure to determine how variables affect the fall speed of a paper helicopter.

Key Vocabulary:

- helicopter, experiment, variable, constant

Materials:

- print-out of the attached Roto-Copter pattern (enough for three or more copters per student), pencil, scissors, paper clips, stopwatch, paper for recording results

Additional Resources:

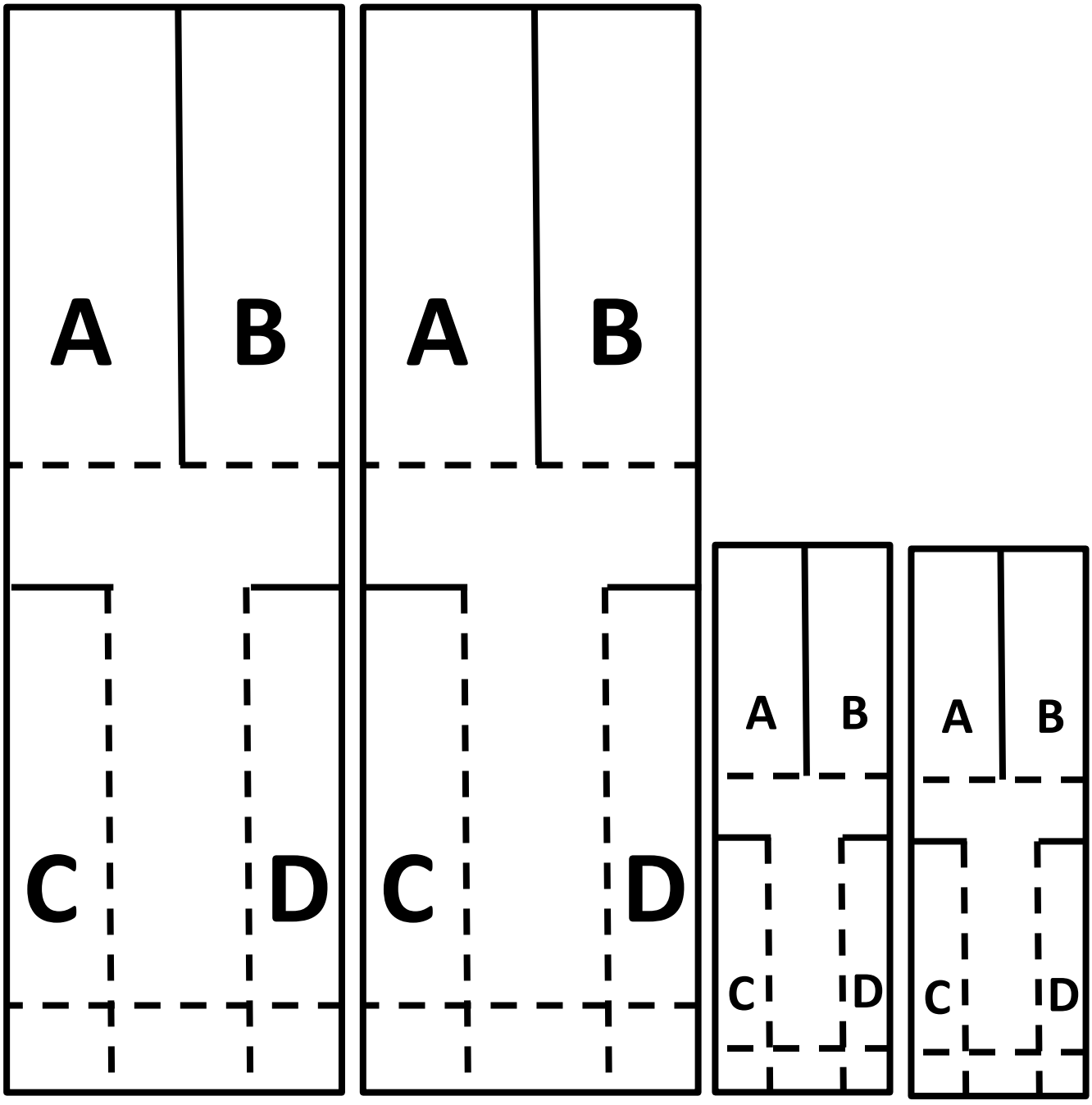
- Exploratorium Roto-Copter activity

Procedure:

1. Introduce the activity by engaging what students already know about helicopters. This activity will explore helicopter flight from the point of view of a helicopter engineer whose goal is to increase the amount of time a helicopter stays in the air. If a helicopter malfunctions and is going to crash, more time spent in the air means a less forceful and potentially dangerous crash. We will use roto-copters to simulate helicopters and experiment to find out how to make them stay in the air longer as they fall.
2. Using a pre-built roto-copter, demonstrate how to launch the copter by holding it overhead and dropping it. Ask students to make observations about its motion as it falls.
3. Discuss why the roto-copter spins. When the roto-copter falls, air pushes up against the blades, bending them up just a little. When air pushes upward on the slanted blade, some of that thrust becomes a sideways, or horizontal, push. Because there are two blades getting the same push in opposite directions, the two opposing thrusts work together to cause it to spin. If you bend the blades in the opposite directions, the roto-copter will spin in the opposite direction as it falls.
4. Explain that in this experiment, we are going to make roto-copters out of paper to simulate helicopters and alter one variable of the copter to change how long it takes to reach the ground.

5. If ability allows, discuss experimental design with the students, including how to identify variables, set up a control, and make three additional treatment roto-copters with variations. Example: After conducting research you decide that longer wings will make the rotocopter fall slower. Plan and conduct an experiment with roto-copters that have wings of different lengths. Remember: Do not change anything except the wing length in each design. All other factors remain constant.
6. Students can work individually or with partners to observe and record the time it takes for each roto-copter to fall to the ground from a fixed distance.
7. Depending on age and ability, calculate the speed of each trial using a stopwatch and record the data for 3-5 trials of each copter. With older students, use this as an opportunity to discuss the importance of multiple trials.
8. Following experimentation, discuss results with students to determine which designs were most effective at slowing down the fall of the roto-copter.
9. Optional: At the end of the lab, have students create a poster or give a brief presentation to share their findings. The presentation should include the elements of the experiment: problem, hypothesis, procedure, data, analysis, conclusion, and the winning design.

Roto-Copter Pattern



Roto-Copter patterns can be found in the Exploratorium Roto-Copter activity guide
https://www.exploratorium.edu/science_explorer/roto_patterns.html

Created by:

minotaur mazes