What Goes UP Must Come DOWN!

Topic: Rotorcraft and Lifting Off in Life

Objective:

- Students will use critical thinking skills to connect the aerodynamic aspects of the rotorcraft (helicopter) to the decision to lift off in life by working hard to achieve positive goals and being healthy and drug-free.

National Science Standards Alignment:

- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science
- Content Standard E: Science and Technology

National Character Education Partnership (CEP) Standard Alignment:

- Principles 1, 2, 3, 4, 6, 7, 9

Background Information:

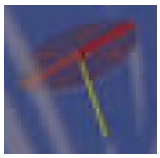
Newton's First Law of Motion states: "*An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force.*" This law is often called "The Law of Inertia." What does this mean?

This means that there is a natural tendency for objects to keep doing what they're doing unless something halts action. All objects resist change in their state of motion. In the absence of an unbalanced force, an object in motion will maintain its state of motion. This scientific law also connects to how we live life: We will not do anything unless prompted in some way to do so. Conversely, many times we continue doing what we are doing without changing toward a better direction unless acted on by another force, usually a negative action in life that tells us to "change directions" to do better!

Civil Air Patrol (CAP), the official Auxiliary of the United States Air Force, and a non-profit, humanitarian organization, uses aerospace/STEM education to inspire young people to make good life choices in moving *onward and upward* toward a fulfilling future. CAP also joins the rest of the nation in providing a strong "Drug Free, Way to Be!" message to young people. One of the ways CAP tries to accomplish this is by sharing flight adventure activities with young people to show them some ***alternatives*** to *doing nothing*, *doing drugs*, and/or *living an unhealthy and directionless life*.

This activity is about helicopters and how lift and flight is produced by the rotating blades. A helicopter is a "rotorcraft" that uses an engine to turn the rotor blades to allow the helicopter to take off and land vertically, hover in one spot, and fly forward, backward, and laterally. Wow! What a versatile air vehicle!

How does a helicopter fly? The rotating blades of the helicopter act as wings and produce lift. The angled shape of the blades form an ***airfoil*** which allows the air produced by the spinning blades to flow faster over the top surface than underneath. As the blades of a helicopter rotate and slice through the air, a strong wind is created. The faster the air flows, the lower the pressure. The air above the blades has lower pressure than below. This unequal air pressure creates lift, pushing the helicopter upward. The helicopter can continue going upward until the "lift" force is less than the force of gravity, which would make the helicopter go downward. *What goes up must come down!*



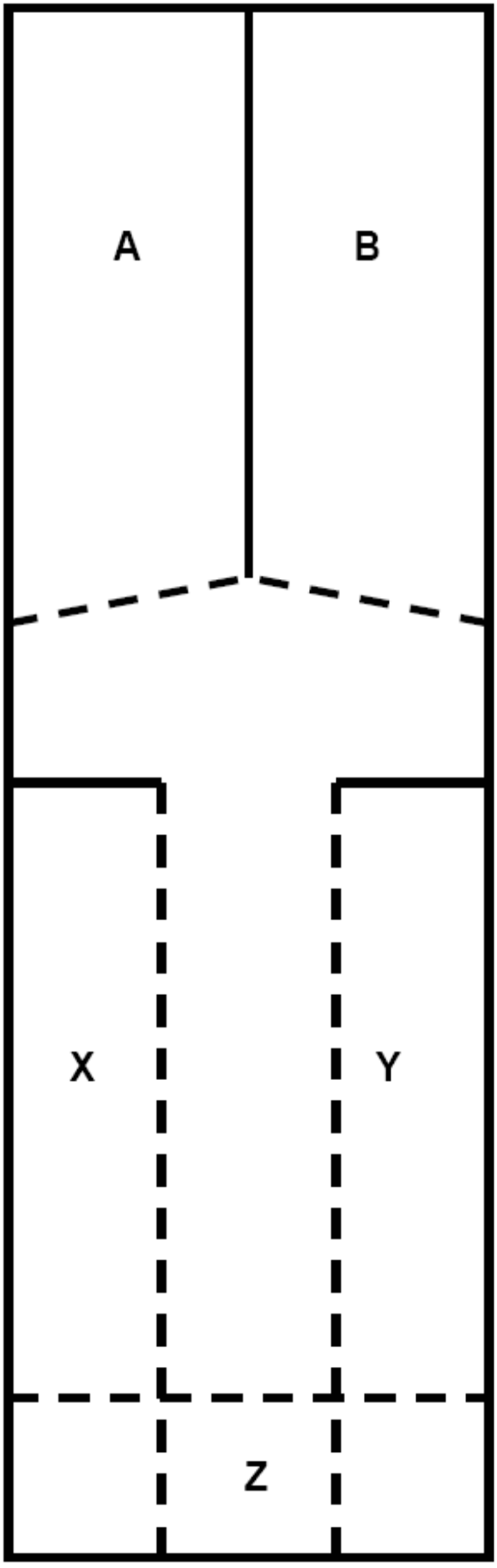
Lesson Exploration:

1- Fly the plastic Aero Prop to demonstrate how the rotor blades provide **lift (or ascent) for flight**. (www.aero-motion.com/)

2- To demonstrate the opposite **"autorotation" or the descending** maneuver of the helicopter to land, make & fly a paper helicopter, as shown on right. Using this paper copter, the effect of autorotation is created for a downward action. In autorotation, the airfoil is turned to push the air down, so that the air below the blades is moving faster creating less pressure under the blade, with the greater pressure above the blades. The unequal air pressure is now reversed, causing the helicopter to lose lift. When there is no lift, the helicopter descends with the force of gravity.

3- To make and fly the paper copter, cut along solid lines. Fold X & Y inward on dotted lines; then fold Z upward. Fold Wing A forward & Wing B backward. Thrust the paper copter upward & watch as it descends. Experiment rate of descent by adding gem clips for weight; folding the rotor blades up or down; and/or increasing or decreasing the Z section on the paper copter. The shape & the placement of weight can have a significant effect on the flight speed of the helicopter: adding more weight will make the helicopter drop more quickly. Altering the helicopter's shape has a direct relationship to the speed of descent. Longer blades than the body & upward curled blades slow the descent.

4- **Questions for inquiry:** What action makes the helicopter lift (ascend) into the air? (rotors produce downward push of air resulting in less air pressure at the top to produce lift) What actions can lift people onward & upward in life? (working hard; doing what is right; staying on the right path; changing paths if going down the wrong one) What forces act on the helicopter to make it go downward (descend)? (gravity; autorotation, which reverses greater air pressure to above the blades; extra weight; or altered blades) What actions push people downward in life? (making bad choices; hanging with wrong people; not setting future goals; using alcohol/drugs; etc.)



Summary: The helicopter's flight is a symbol of how to "lift-off" in life: take action & get up & get moving; head in the right direction by doing what is right; set goals for the future by studying & working hard; connect with positive people; & be physically fit while staying away from alcohol & drugs. Without lift, the helicopter stays on the ground. In life, doing nothing productive will also lead nowhere! Although the helicopter goes up when lift is created, it also goes down due to gravity or excess weight. In life, choosing the right actions propels one upward. Choosing wrong actions will lead to a downward spiral in life. Like the "Law of Inertia," the choices made today will determine if & where one will fly in life, so choose well!

AeroProp & lesson provided by Civil Air Patrol. Fantastic free aerospace/STEM resources for *K-12 formal and informal EDUCATORS* at www.GoCivilAirPatrol.com/ae. Exciting leadership, aerospace/STEM career exploration, and flights/flight scholarships for *STUDENTS*, ages 12 & above. Students can locate a CAP squadron to visit by entering ZIP code at www.GoCivilAirPatrol.com at "find your local unit."