# **Core Skills Analysis**

### Physics

- Learned how potential energy stored in a twisted rubber band converts to kinetic energy to make the helicopter blades spin.
- Understood basic aerodynamics concepts such as lift and thrust, as spinning blades generate upward force.
- Explored rotational motion and torque principles by observing how the rotor blades rotate to lift the helicopter.
- Recognized how different variables like rubber band tension or blade size may affect flight duration and stability.

#### Engineering

- Practiced designing and constructing a simple mechanical device with moving parts, building fine motor skills.
- Experienced problem-solving by adjusting parts to improve flight performance, such as rotor blade angle or rubber band winding.
- Gained insight into the iterative design process through trial, error, and modification to optimize helicopter flight.

### Tips

To deepen understanding, encourage the student to experiment systematically by changing specific variables—like the length or thickness of blades, or number of rubber band twists—and recording how these affect flight distance and hover time. You can extend the project by researching real helicopter designs and comparing their physics principles. A fun challenge is to create helicopters that can carry small loads or travel specific targets, integrating math skills related to measurements and angles. Make observations outdoors to see environmental effects like wind and discuss real-world applications of aerodynamics, fostering curiosity and scientific thinking.

#### **Book Recommendations**

- <u>How Things Work: The Physics of Everyday Life</u> by Louis A. Bloomfield: An engaging introduction to physics concepts explaining how simple machines and everyday objects function.
- <u>The Kid's Guide to Simple Machines</u> by Deborah Hodge: A hands-on exploration of basic machines including levers, pulleys, and rotors, perfect for young inventors.
- <u>Awesome Engineering Activities for Kids</u> by Christina Schul: Step-by-step projects that encourage engineering curiosity and problem-solving using basic materials.

## **Learning Standards**

- CCSS.ELA-LITERACY.RI.5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a text (applied by encouraging explanation of energy conversion and flight principles).
- NGSS 4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- NGSS 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.

#### **Try This Next**

• Create a worksheet where the student records variables tested (blade length, rubber band twists) and results to analyze patterns.

- Design a drawing task to plan helicopter modifications before building to visualize engineering improvements.
- Prepare quiz questions on energy transformations, forces in flight, and mechanical advantage related to the helicopter.