Flying Machines

Rubber band-powered flyers that zoom high and far.

GRADES 1 THROUGH 8 | AGES 6 TO 14 | ABOUT 45 MIN

These are the standards listed in the Flying Machines educator guide. Under each one is where you will see it in the activity.

Next Generation Science Standards (NGSS)

CODE	WHAT IT COVERS
K-PS3-1	Energy and Motion
WHERE YOU'LL SEE IT (GRADES K-2): Learners explore how **winding the rubber band clockwise stores elastic potential energy** that converts to kinetic energy when the propeller is released, observing how more twists produce faster spinning and longer flights.	
K-2-ETS1-2	Engineering Design
WHERE YOU'LL SEE IT (GRADES K-2): Learners **follow the design process by building, testing, and improving their Flying Machine**, starting with a bare fuselage flight, then adding a test wing, and finally designing a custom wing shape to improve performance.	
3-PS2-1	Forces and Interactions
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **investigate how wing shape and size affect the forces acting on their Flying Machine**, testing whether bending wing tips changes the flight path from straight to curved, and observing how symmetry affects stability.	
3-5-ETS1-3	Planning and Carrying Out Investigations
WHERE YOU'LL SEE IT (GRADES 3-5): Learners systematically **test different wing designs using the wing evolution worksheet**, changing one variable at a time - shape, size, or symmetry - documenting flight results across four iterations to identify the most effective design.	
MS-PS3-5	Conservation of Energy and Energy Transfer
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **analyze the complete energy transfer chain in their Flying Machine** - from mechanical work winding the rubber band, to elastic potential energy stored in the twisted band, to kinetic energy released through the spinning propeller - and explain why energy is conserved but changes form at each stage.	
MS-ETS1-2	Developing Possible Solutions
WHERE YOU'LL SEE IT (GRADES 6-8): Learners apply an iterative design process to **optimize flight by systematically varying wing geometry, rubber band tension, and launch technique**, evaluating each solution against criteria of distance, height, and stability before selecting their best design.	

Common Core State Standards (Math and ELA)

CODE	WHAT IT COVERS
RI.K-2.7	Use illustrations and words in a text to describe key ideas
WHERE YOU'LL SEE IT (GRADES K-2): Learners review the instructional diagrams on their cardstock sheet and **identify how each labeled part - propeller, fuselage stick, rubber band - contributes to flight**, describing the function of each component in their own words.	
SL.K-2.1	Participate in collaborative conversations
WHERE YOU'LL SEE IT (GRADES K-2): Learners discuss their wing design choices with peers after each test flight, **describing what happened when they changed wing shape or size** and listening to classmates' observations about their own Flying Machines.	
RI.3-5.7	Interpret information from diagrams and text
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **analyze the energy transfer diagram** showing elastic potential energy converting to kinetic energy, then explain in their own words why winding the rubber band clockwise stores energy that the propeller releases as motion.	
W.3-5.2	Write informative/explanatory texts
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **document their wing evolution process** on the worksheet, explaining why each successive wing design performed differently and how changes in symmetry, shape, or size affected flight distance.	
RST.6-8.7	Analyze diagrams and scientific texts
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **create annotated diagrams of the energy transfer process** in their Flying Machine, labeling where elastic potential energy is stored in the wound rubber band and where kinetic energy is released through the spinning propeller.	
W.6-8.1	Write arguments to support claims with evidence
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **write a brief analysis arguing which wing design achieved optimal flight**, citing measured distances, number of rubber band twists, and wing dimensions from their wing evolution worksheet as evidence.	

CODE	WHAT IT COVERS
2.MD.A.1	Measure the length of an object using appropriate tools
WHERE YOU'LL SEE IT (GRADES K-2): Learners **measure the length and width of their cardstock wings** with a ruler, comparing dimensions across iterations to see how larger or smaller wings affect flight distance and stability.	
2.G.A.1	Identify shapes by their attributes
WHERE YOU'LL SEE IT (GRADES K-2): Learners **identify the triangles and quadrilaterals in their wing and fuselage designs**, naming each shape as they cut and assemble the cardstock wing before attaching it to the plane.	
4.MD.A.2	Solve problems involving measurement of distances and intervals of time
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **measure both how far and how long each flight goes** across four wing-evolution iterations - using subtraction to find how many inches farther each new wing flew, and how many seconds longer it stayed up when they wound the propeller more times.	
4.G.A.3	Recognize a line of symmetry for a two-dimensional figure
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **cut symmetrical wings from cardstock and fold them to check the line of symmetry**, reasoning about why a mismatched, asymmetrical wing tends to pull the plane off a straight flight path.	
7.RP.A.2	Recognize and represent proportional relationships between quantities
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **time how long each flight lasts at 25, 50, 75 and 100 winds** and record the pairs in a table, then test whether the ratios stay equivalent - does doubling the winds double the flight time? They decide from their own data whether winds and flight duration are truly proportional, and describe where the relationship starts to break down.	
6.G.A.1	Find the area of triangles and other shapes by composing and decomposing
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **decompose their wing shape into triangles and rectangles to calculate its total area**, comparing symmetrical versus asymmetrical wing designs and reasoning about how greater wing area affects lift.	

LEARNERS EXPLORE

elastic potential energy and flight; aerodynamics and symmetry; the engineering design process; iterative wing design; energy transfer (elastic to kinetic)