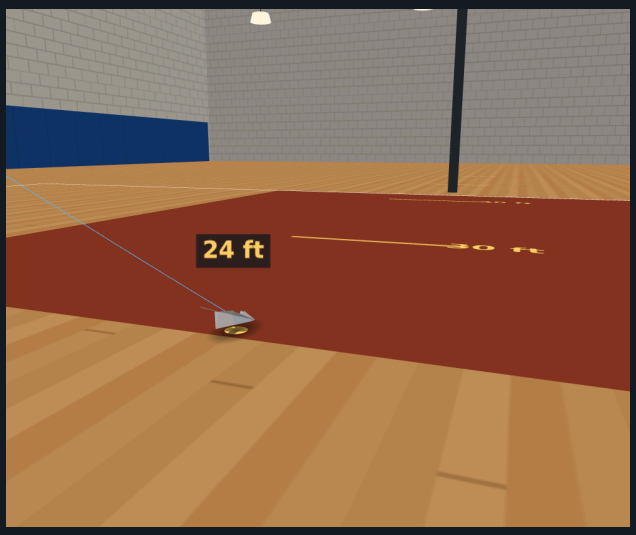
mytekDev

Flight Lab: How Hard Should You Throw It?

Grades 6-8 · 45 minutes

Physical science · Engineering



Slides, rubric and answer key **Print and go** **No student accounts**

Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a throw table
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grades 4 and 5 and in high school physics
- Standards: NGSS

Flight Lab: How Hard Should You Throw It?

Grades 6-8 · 45 minutes · Physical science, Engineering

Students throw the same paper dart at ten strengths and record what each throw did. Gentle throws dive or glide; harder ones climb, slow down and tip over into a dive; the hardest loop. Some hard throws land farther than the best glide, but where they land is hard to predict. Ten throws at one strength show that no hand throws the same way twice.

At a glance

ESSENTIAL QUESTION

Does throwing a paper plane harder always make it go farther?

OBJECTIVES

Students will be able to:

- change one thing, how hard the plane is thrown, and record what each throw does
- describe a glide, a dive, a climb then a dive, and a loop
- explain why a plane thrown too fast climbs, using lift and weight
- explain why one throw is not enough to judge a plane

VOCABULARY

Glide, Lift, Weight, Climb, Loop

STANDARDS

MS-PS2-2

TIME AND MATERIALS

45 minutes, grades 6-8.

- One computer or Chromebook per student, with a mouse or trackpad
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/flightlab?lesson=how-hard-should-you-throw-it&ref=tpt-flightlab-1 once on a student computer: it opens on the classic dart, and checks that your school's filter allows the app. Run it yourself, about ten minutes: press Fly and Throw it (a steady glide of 24 ft), then move How hard from 1 to 10, throwing each time, and finish with Throw it ten times at 3. The starter is set to feet and letter paper. The two buttons under Units on the Fly bench switch to meters (about a third as big).

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install and no sound. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up: should you throw it as hard as you can? Write every answer on the board.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app with the starter open. Press Fly and Throw it: a steady glide of 24 ft. Read the line under it aloud. Then set How hard to 5 and throw: it climbs, slows and dives. Show the climb slide and the stat slide. > **It's working when:** Point at the slider: 3 of 10 is 15 mph, 5 of 10 is 24 mph. The bench says the plane settles to about 11 mph in a glide. A plane thrown much faster than that has too much lift, so it climbs.	Watch, and fill in the vocabulary on the worksheet.
12 to 22	**Guided practice (We do)** The first throws together	Students open the link or scan the QR code. A short guide walks them through a throw at 3, at 1 and at 5. Ask what each one did, in the bench's words. > **Watch for:** Students who move the slider and read the old result. The numbers change only after Throw it is pressed again.	Fill in the first three rows of the throw table: How hard 1, 3 and 5.
22 to 38	**Independent practice (You do)** Every strength	Students throw at every How hard from 1 to 10 and fill in the table, then set How hard to 3 and press Throw it ten times. Walk the room with the What to look for questions. > **If they ask:** "Your farthest throw was a loop. If you threw it again, would it land in the same place? How do you know?" The farthest throw	Fill in the throw table and the ten throws line, then answer the questions.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students say which throw they would trust and why, then go back to the warm-up answers. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/flightlab?lesson=how-hard-should-you-throw-it&ref=tpt-flightlab-1. A short guide opens over the app. The classic dart is picked on the Plane bench. The benches run along the top: Plane, Fold, Shape, Fly, Paint, Mark and Export. This lesson happens on Fly.

1. **The first throw.** Press `Fly`, check Gym is picked under Where, and press `Throw it`. The plane leaves a thrower's hand and glides: "A steady glide: 24 ft in 1.7 s."

2. **Every strength.** Drag How hard to 1 and throw: a dive, 8 ft. 2 and 3 glide, 16 and 24 ft. 4, 5 and 6 climb, then dive: 28, 29 and 25 ft. From 7 up it loops: 28 ft at 7, about 44 ft at 8 and 9, 40 ft at 10.
3. **Ten throws.** Set How hard to 3 and press `Throw it ten times`: "Ten throws: 22 ft to 25 ft." Half landed past 24 ft.

> The moment that lands is How hard 4. Students expect a harder throw to glide farther; instead it climbs and dives. On a slow computer, press Diagram under Watch: it shows the same flight from the side and from above.

Background for the teacher

The wings lift more the faster the air goes over them: twice as fast is four times the lift. A glide is the speed where lift and weight balance; the classic dart, with its back edges bent as it came, settles to about 11 mph. A paper plane is so light that the arm, not the plane, sets how fast it leaves the hand, and How hard 3 is 15 mph.

Thrown much faster, the plane has far more lift than weight, so it climbs. Climbing slows it down, its nose tips over, and it dives. Thrown harder still, it climbs right over the top: a loop. Those flights can land farther than the glide, but a small change in the throw moves where they land.

Students may have heard of a stall: the wings meet the air too steeply, the air stops flowing smoothly over them, and they lose lift. A short, pointed paper wing can meet the air very steeply before that happens, so in Flight Lab these throws tip over first. Common mistakes: harder is always farther; one throw tells you what a plane does. Flight Lab works out each flight from the folded shape and the throw. A few of its numbers are our own, set where no published measurement exists, so a real paper dart lands near the distances on screen, not exactly at them. Real throws also vary more than the app's, real paper softens with use, and the app never shows a stall: its short paper wings tip over before they would stall.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- What did your plane do at How hard 1, and why do you think it dove?
- Why did a harder throw make it climb?
- What happened to its speed as it climbed?
- Which throw would you trust to land where you wanted?
- Your ten throws did not all land in one place. Why not?

> The second question is the real test: a student who says the faster air gave the wings more lift than the plane's weight has the idea.

Cross-curricular extensions

- Math: make a bar graph of distance against How hard. Where is the top, and is the graph a smooth curve?

- Math: ten throws landed between 22 and 25 ft. Find the range, and explain what it says about one throw.
- Building: fold a real dart and throw it gently, then hard, five times each. Measure with a tape measure. Which throws scatter more?
- English: write a short guide for a younger student on how to throw a paper plane well, and why.

Vocabulary

Glide	A steady flight, slowly coming down, not climbing and not diving.
Lift	The push up from the air on the wings. The faster the air goes over them, the more lift.
Weight	How hard gravity pulls the plane down.
Climb	Going up. A plane climbs when its lift is more than its weight.
Loop	A climb that goes right over the top, upside down, and round.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the screen as you say each word: the flight line, the plane and the slider numbers carry the meaning.
- Pair each learner with a partner; the flight line is a picture and the distance is a number.
- Accept the throw table as numbers and the flight names copied from the screen.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students for the independent part, one at the app and one filling in the table.
- Zoom the browser to 125%; the bench and the slider stay readable.
- Allow How hard 1 to 6 instead of 1 to 10, where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "When I threw it harder, the plane ___ because ___."
- A check-in after the guide: every student has a glide, a dive and a climb then a dive before anyone moves on.
- Give only four strengths to try: 1, 3, 5 and 8.

STUDENTS READY FOR MORE

- At How hard 3, change Standing to Kneeling, then to On a step. Does a higher hand go farther? By how much?
- Look at Things to try at the bottom of the Fly bench. Which throw ticks Three seconds in the air?
- Press From the side and Slow motion under Watch and throw at 5. Point at the moment the plane was slowest: what was its nose doing just after?

Adapting for other grades

Younger students: In grades 4 and 5, do the guide together on the projector, then let pairs share a computer with one student on the mouse and one recording. Give them the numbers to try instead of asking them to choose. Skip the third rubric row; total 8, and 6 meets the objectives. Compare only the flight names and the distances, without lift.

Older students: In high school physics, lift grows with the square of the speed: twice as fast is four times the lift. Students use the slider's mph and the glide's 11 mph to work out how many times its weight the dart's lift is at How hard 3 and at 5, and connect the extra lift to the climb.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/flightlab?lesson=how-hard-should-you-throw-it

Essential question: Does throwing a paper plane harder always make it go farther?

Warm-up: Should you throw a paper plane as hard as you can to make it go farthest? Why?

_____

1. **Vocabulary.** Glide, lift, weight, climb, loop: write each in your own words.

2. **The throw table.** For How hard 1 to 10: what it did (glide, dive, climb then dive, loop) _____; how far _____ ft. One throw on each line. Then ten throws at 3: from _____ ft to _____ ft.

1. Which throw went farthest? Which throw would you trust to land where you wanted? Why?

2. Why does a plane thrown too hard climb?

Exit ticket

Name: _____

1. A plane thrown much faster than it likes to fly will first (A) dive (B) climb (C) fly level

2. Why does a climbing plane slow down? (A) Gravity pulls back on it as it goes up (B) The wings get heavier (C) The air gets thinner

3. Your farthest throw was a loop. Explain why it might not be the best throw for a contest.

Flight Lab: How Hard Should You Throw It?

Exit ticket

Name: _____

1. A plane thrown much faster than it likes to fly will first (A) dive (B) climb (C) fly level

2. Why does a climbing plane slow down? (A) Gravity pulls back on it as it goes up (B) The wings get heavier (C) The air gets thinner

3. Your farthest throw was a loop. Explain why it might not be the best throw for a contest.

Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	Faster air gives the wings more lift than the plane's weight, so it climbs.
2	A	Going up, part of the pull of gravity acts against its motion, so it loses speed until its nose tips over.
3	It is hard to predict where it lands	A small change in a hard throw moves where a loop or a climb then a dive lands. The glide lands close to the same place every time, as the ten throws showed. "It is not the farthest" alone is half.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The throw table	Every strength from 1 to 10, each with what it did and how far, and the ten throws line.	At least six strengths, each with what it did and how far.	Some strengths recorded.	No throws recorded.
Explaining the climb	Says a fast throw gives more lift than weight, so it climbs, then slows until its nose tips over.	Says a fast throw makes it climb, then dive.	Says harder throws do something different, with no reason.	No answer.
Judging a throw	Uses the ten throws to say why one throw is not enough, and names the throw to trust and why.	Names the throw to trust, with a reason.	Names the farthest throw as the best, with no reason.	No answer.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is built for MS-PS2-2: students change one thing, the throw's speed, and see the plane's motion change with the balance of lift and weight.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
NGSS	**MS-PS2-2**	6-8	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.	Students throw the same plane at ten speeds, record how its motion changes, and explain the climb with lift greater than weight.

Checked November 2026 against: NGSS MS-PS2-2, Motion and Stability.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/flight-lab/lessons/how-hard-should-you-throw-it/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

Terms of use

Thank you for downloading this lesson. The plan, the handouts and the art were made by mytekDev.

You may:

- print and copy it for your students
- change it for your own classes
- post it on your class website or learning management system
- share this file with other teachers, whole and unchanged, with this page included

You may not:

- sell it, or put it in a product you sell
- share a changed copy
- claim it as your own

The app this lesson uses is free and runs in the browser. Students need no account. It is at mytekdev.com.

Questions, or found a mistake? Ask on the Teachers Pay Teachers Q&A for this resource, or write to us at mytekdev.com/contact.

© 2026 mytekDev. All rights reserved.