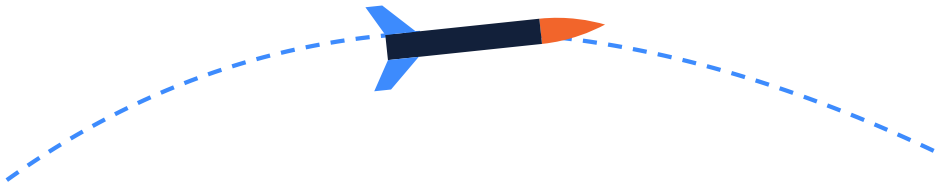
ELEMENTARY · GRADES 3–5 · 8 LESSONS

Rockets & Model Rocketry

Worksheets for paper rockets: balloon, straw and stomp rockets and parachutes. Goes with **Rocket Builder by Quiver Design Works** (rocket.quiverdesignworks.net), used on the class projector. Lesson plans: rocket.quiverdesignworks.net/learn/elementary.



	Page	Use in
M	My rocket journey (unit map)	Lesson 1
E1	Balloon rocket	Lesson 1
E2	Straw rocket forces	Lesson 2
E3	Launch angles	Lesson 3
E4	Swing test	Lesson 4
E5	Design plan	Lesson 5
E6	Test and improve	Lesson 6
E7	Parachute drop	Lesson 7
E8	Launch log	Lesson 8
P	Parts of a rocket	Any lesson
S	Safety pledge	Lesson 1
45	45° sighting cards	Lesson 8
★	Rocket Scientist certificate	Lesson 8
K	Answer key	Teachers

Printing: US Letter, portrait, 100%. One page per student per lesson. Print the answer key for the teacher only.

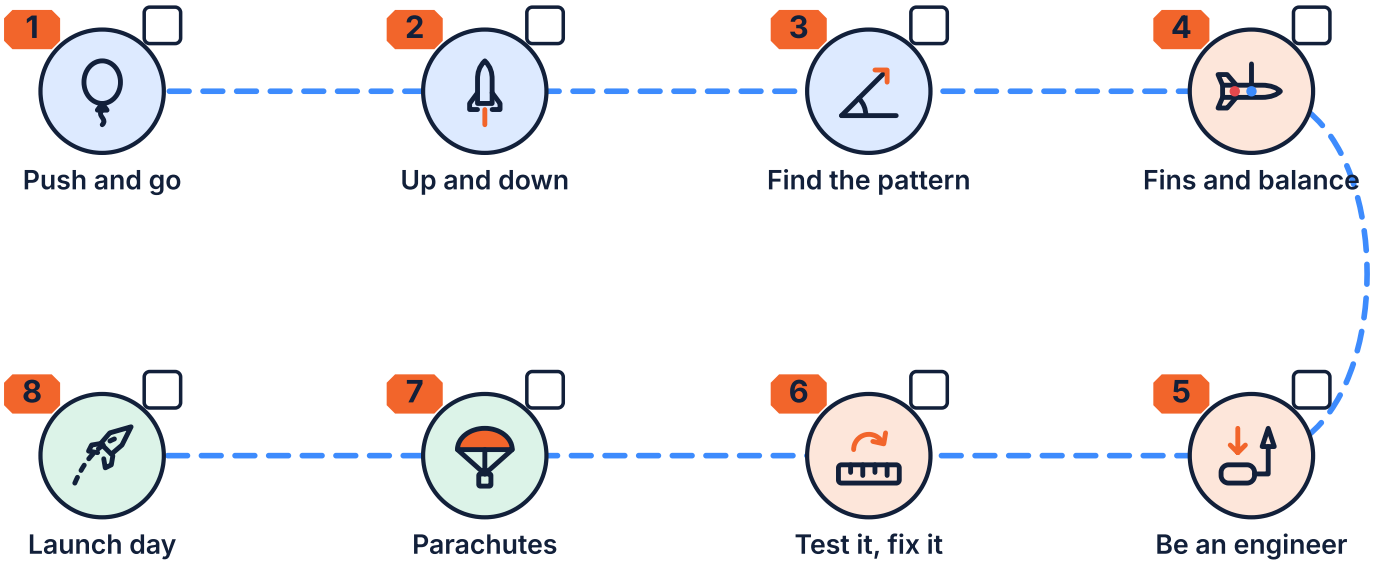
Standards: Washington State K–12 Science Learning Standards (NGSS): 3-PS2-1, 3-PS2-2, 4-PS3-1, 5-PS2-1, 3-5-ETS1-1 to 3. Each lesson plan lists its standards.

Safety: paper and air rockets only. Model rocket motors are rated 12+ and only adults handle them. Glasses on for straw and stomp rockets.

Name _____ Date _____

M My rocket journey

Colour in each box when you finish a lesson.



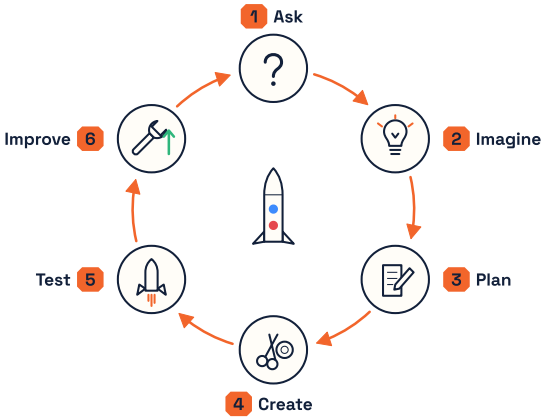
Pushes and pulls · Design like an engineer · Fly and land

The big parts

- **Pushes and pulls**: Lessons 1–3
- **Design like an engineer**: Lessons 4–6
- **Fly and land**: Lessons 7–8

Short on time?

Lessons 1, 2, 4, 7 and 8 make a 5-lesson unit.
Lessons 5 and 6 can be one longer block.



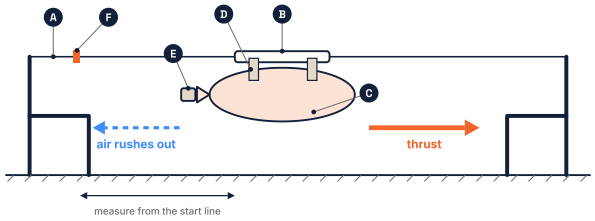
Engineers go round this loop again and again: you will too.

Name _____ Date _____

E1 Balloon rocket

Lesson 1 · Every push has a push back

force: a push or a pull · **thrust**: the push that moves a rocket



My guess: which balloon will go farther? **small balloon** **big balloon**

Balloon	Try 1	Try 2	Try 3	Farthest
Small				
Big				

Colour a bar for the **farthest** try.



The air pushes **forward** **backward**. The balloon goes **forward** **backward**.

Holding it still, the pushes are **balanced** **unbalanced**.

Name _____ Date _____

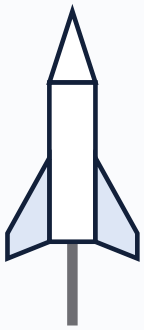
E2 Straw rocket forces

Lesson 2 · Up and down

gravity: Earth's pull, always down · **drag**: air pushing back · **apogee**: the highest point

Draw an arrow for each push or pull. **Orange** = thrust (push up). **Blue** = gravity (pull down).

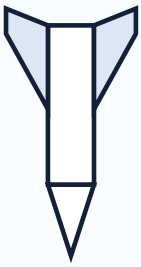
1. Launch



2. Going up



3. Coming down



Gravity pulls **up** / **down**.

My evidence: every time, my rocket **came back down** / **kept going up**.

The highest point is called the **apogee** / **launch**.

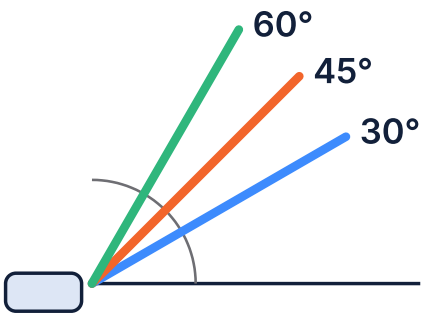
Rocket Builder: number the parts in order as you watch: ___ coast ___ liftoff ___ parachute ___ top

Name _____ Date _____

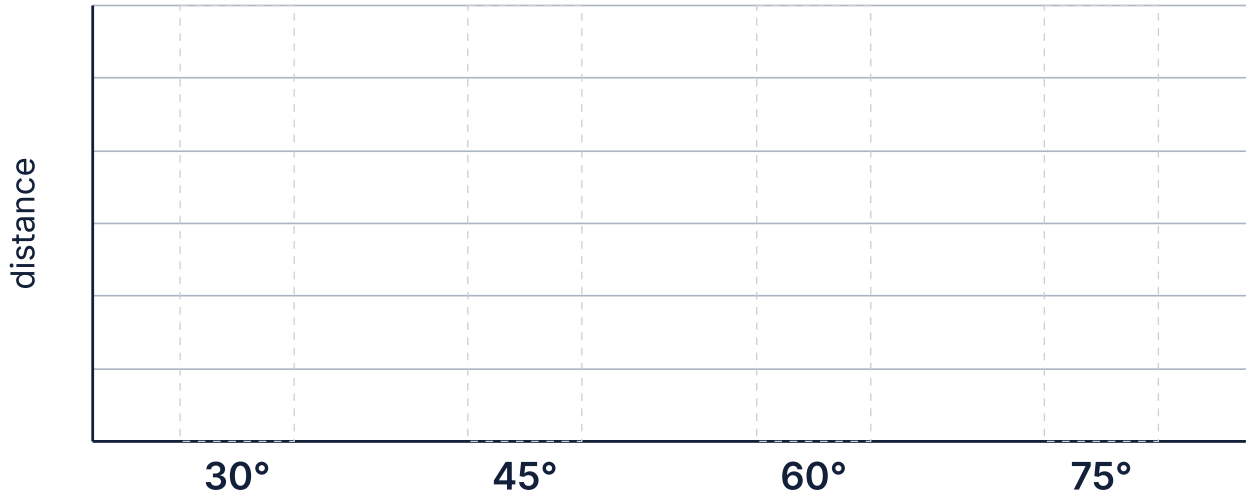
E3 Launch angles

Lesson 3 · Find the pattern

angle: how much it tilts, in degrees (°) · **pattern**: something that happens the same way again and again



Angle	Try 1	Try 2
30°		
45°		
60°		
75°		



Predict before you test 75°: it will go

farther than 60° | shorter than 60°

Was I right? yes | no

The pattern:

steeper is always farther | the best angle is in the middle

Name _____ Date _____

E4 Swing test

Lesson 4 · Fins and balance

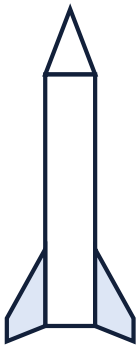
fins: the rocket's feathers · **balance point**: where it balances (blue dot) · **push point**: where the air pushes (red dot)

Swing each rocket. Tick what it did.



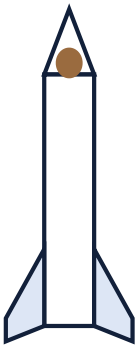
A no fins

- ☐ straight
- ☐ wobbly
- ☐ tumbles



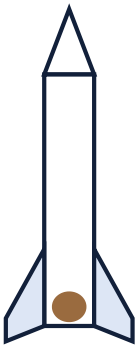
B fins

- ☐ straight
- ☐ wobbly
- ☐ tumbles



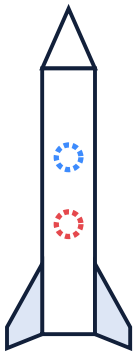
C fins + clay in nose

- ☐ straight
- ☐ wobbly
- ☐ tumbles



D fins + clay in tail

- ☐ straight
- ☐ wobbly
- ☐ tumbles



Colour the dots. The balance point is **blue**. The push point is **red**.

The **blue** dot must be **in front (nearer the nose)** **behind**.

Rocket Builder: our score was _____. Green? **yes** **no**

Fins work like the **feathers on an arrow** **wheels on a car** .

Name _____ Date _____

E5 Design plan

Lesson 5 · Be an engineer

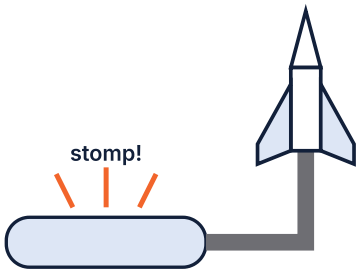
Problem: design a paper rocket that flies straight off the stomp launcher and lands in the target zone.

Criteria (it must...)

- ☐ fly nose-first
- ☐ land in the zone
- ☐ still work after 3 launches

Constraints (my limits)

- ☐ 1 sheet of paper
- ☐ 1 index card
- ☐ 50 cm of tape
- ☐ 15 minutes



Idea 1: draw it

Idea 2: draw it

	Flies straight?	Lands in the zone?	Strong?
Idea 1			
Idea 2			

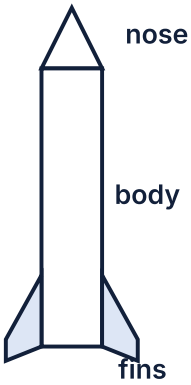
I picked idea (1) (2) because _____

Name _____ Date _____

E6 Test and improve

Lesson 6 · Fair tests and failure points

Launch	Straight or wobbly?	In the zone?	Still works?
1	☐ straight ☐ wobbly	☐ yes ☐ no	☐ yes ☐ no
2	☐ straight ☐ wobbly	☐ yes ☐ no	☐ yes ☐ no



Circle the failure point on the rocket: the part that didn't work.

I changed **one** thing: ☐ nose ☐ fins ☐ length ☐ weight

After my fix:

Launch	Straight or wobbly?	In the zone?	Still works?
3	☐ straight ☐ wobbly	☐ yes ☐ no	☐ yes ☐ no
4	☐ straight ☐ wobbly	☐ yes ☐ no	☐ yes ☐ no

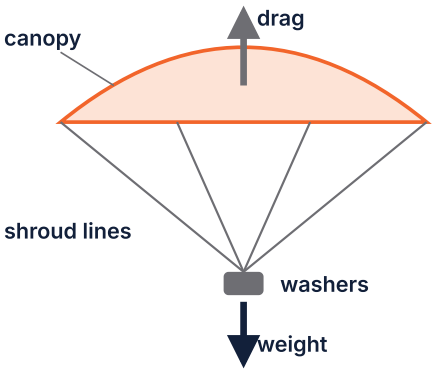
Did my change help? **yes** **no** **a little**

Name _____ Date _____

E7 Parachute drop

Lesson 7 · Coming down gently

parachute: catches air to slow a fall · **drag**: air pushing back · **gravity**: pulls down



	Drop 1 (seconds)	Drop 2 (seconds)
No parachute		
Small (20 cm)		
Big (40 cm)		
Streamer		

Circle the **slowest** one in the table.

A bigger parachute falls **faster** **slower**.

Gravity pulls **up** **down**. Drag from the air pushes **up** **down**.

Every parachute had the same washers, so the test was **fair** **not fair**.

Rocket Builder: the parachute for a real rocket is _____ inches.

Name _____ Date _____

E8 Launch log

Lesson 8 · Launch day

I stood _____ m from the launcher. My job: ☐ countdown ☐ stomper ☐ tracker ☐ recorder ☐ recovery

#	Stomp	My guess: above or below 45°?	What happened?
1	☐ soft ☐ medium ☐ hard	☐ above ☐ below	☐ above ☐ below
2	☐ soft ☐ medium ☐ hard	☐ above ☐ below	☐ above ☐ below
3	☐ soft ☐ medium ☐ hard	☐ above ☐ below	☐ above ☐ below
4	☐ soft ☐ medium ☐ hard	☐ above ☐ below	☐ above ☐ below
5	☐ soft ☐ medium ☐ hard	☐ above ☐ below	☐ above ☐ below

A harder stomp made the rocket go **faster and higher** / **slower and lower**. It had **more** / **less** energy.

The parachute rocket's parachute opened: **yes** / **no**

Rocket Builder predicted _____ m for a real rocket with a motor.

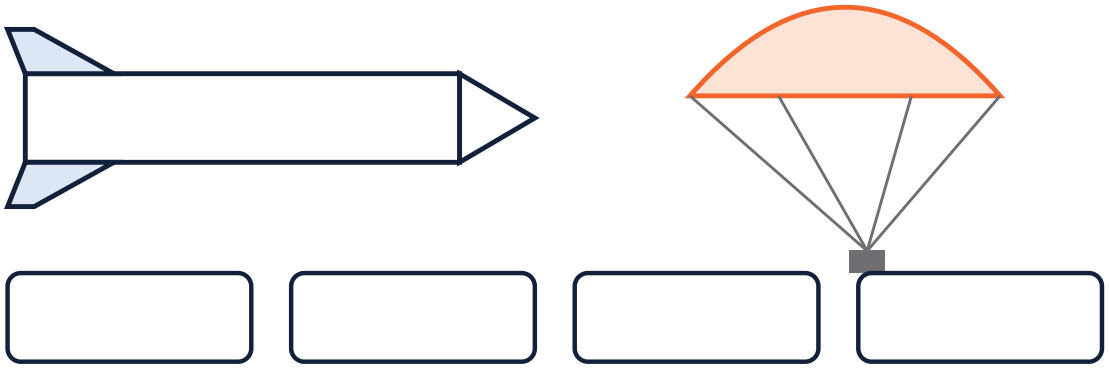
My best flight (first, next, last): _____

Name _____ Date _____

P Parts of a rocket

Any lesson

Write the name of each part in a box. **Word bank:** nose cone · body tube · fins · parachute



The **fins** keep the rocket **flying straight** / **going fast**.

The **parachute** helps it **go higher** / **land gently**.

The **nose cone** is pointed so the air flows **smoothly around it** / **into it**.

Name _____ Date _____

S Safety pledge

Lesson 1 · Read it together, then sign

I will keep everyone safe. I promise to:

- ☐ wear safety glasses for straw and stomp rockets
- ☐ never aim a rocket at a person, an animal or a window
- ☐ wait for the countdown: 3, 2, 1, launch!
- ☐ stand behind the line until the adult says “clear”
- ☐ never chase a rocket into a road, a tree or a power line
- ☐ never look at the sun
- ☐ leave real rocket motors to adults (they are for ages 12+)

Signed _____

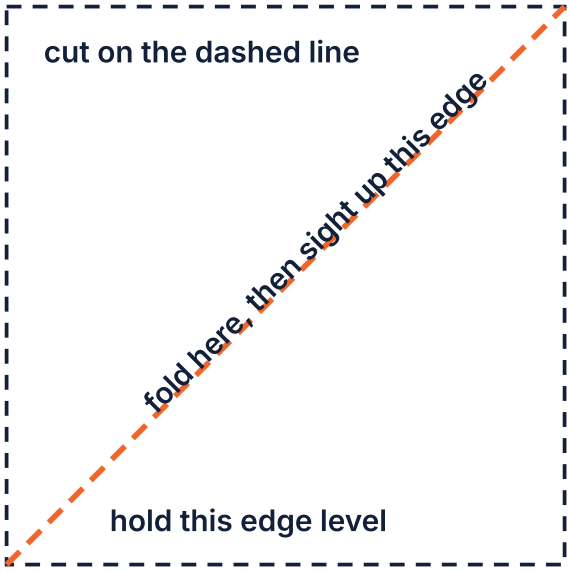
Model rocket motors and kits are rated 12+. In our class we fly paper and air rockets.

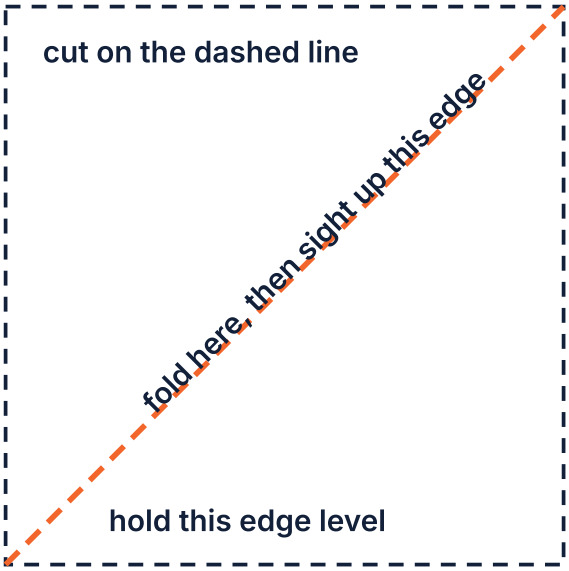
Name _____ Date _____

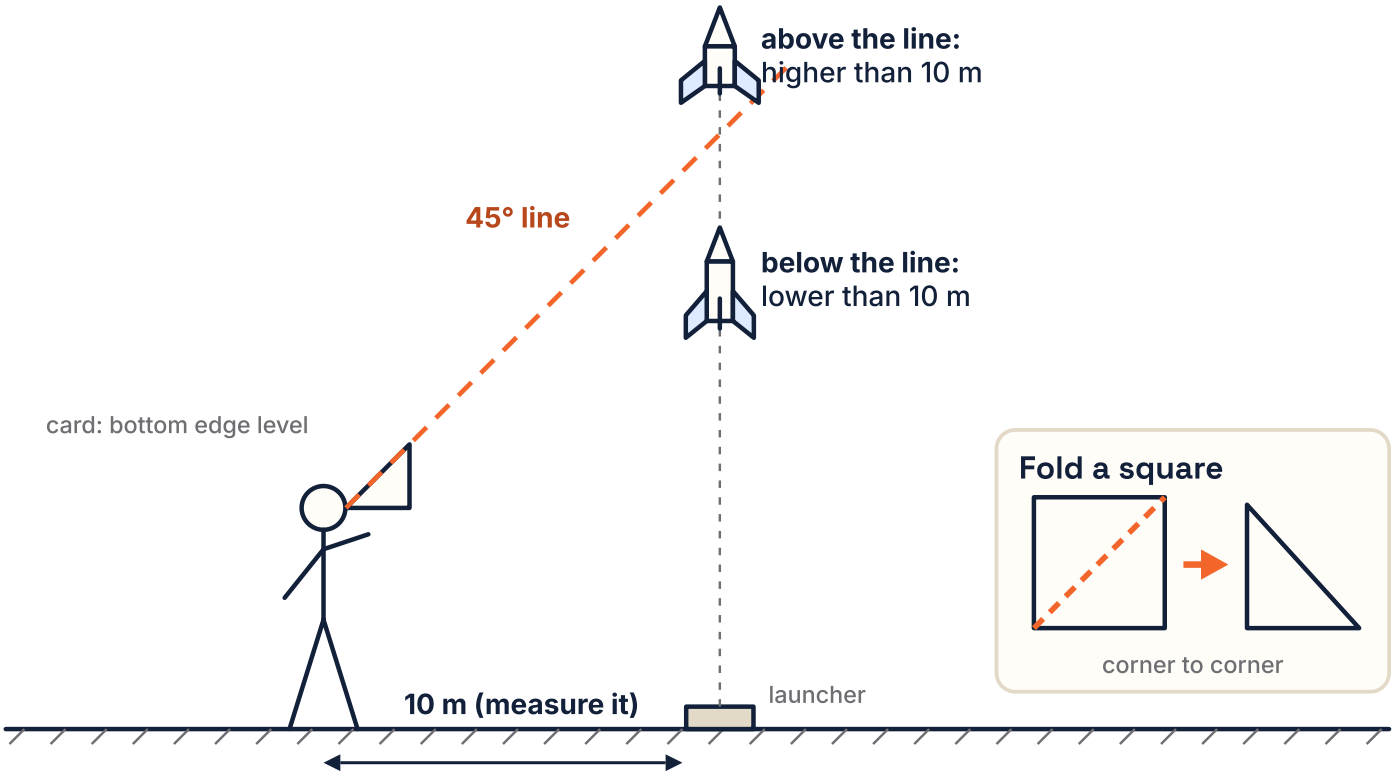
45 45° sighting cards

Lesson 8 · Cut out, fold, track

Cut out a square and fold it corner to corner. Hold the bottom edge **level** and look up the folded edge: that line goes up at **45°**.







If you stand **10 m** from the launcher and the rocket goes **above** your 45° line, it went higher than 10 m.

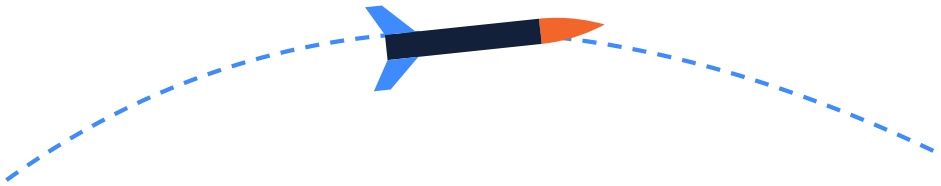
ROCKET BUILDER · ROCKETS & MODEL ROCKETRY

Rocket Scientist

This certifies that

_____

designed, built, tested and launched rockets like a real engineer, and knows that every push has a push back, gravity pulls down, and fins keep a rocket flying straight.



Date _____ Teacher _____

K Answer key

Teachers

For teachers

E1 Balloon rocket

- Data varies; the big balloon usually goes farther (a longer push).
- The air pushes backward; the balloon goes forward. Held still: balanced.

E2 Straw rocket forces

- Launch and going up: orange thrust arrow up, blue gravity arrow down (thrust longer while pushing). Coming down: blue gravity arrow down.
- Gravity pulls down; it always came back down; apogee. Order: liftoff 1, coast 2, top 3, parachute 4.

E3 Launch angles

- Data varies; about 45° (often a bit less) usually goes farthest; 75° goes shorter than 60°.
- Pattern: the best angle is in the middle.

E4 Swing test

- Usually A tumbles, B may wobble, C flies straight, D wobbles or tumbles.
- The blue (balance point) dot is in front, nearer the nose. Fins work like the feathers on an arrow.

E5 Design plan

- Any two different ideas; a reason that uses the criteria.

E6 Test and improve

- Common failure points: a leaky nose, crooked or loose fins, fins too far forward. One change at a time.

E7 Parachute drop

- Slowest: the big parachute. No parachute is fastest; the streamer is in between.
- Bigger falls slower. Gravity pulls down; drag pushes up. Same washers: fair. Rocket Builder: often 12–18 inches.

E8 Launch log

- Harder stomp: faster and higher, more energy. Above the 45° line from 10 m means higher than 10 m.

Parts of a rocket

- Boxes left to right: nose cone, body tube, fins, parachute. Fins keep it flying straight; the parachute helps it land gently; the nose lets air flow smoothly around it.