LESSON T1-05 · TIER 1 · ANATOMY, FORCE & STABILITY

The Hanging Rocket Myth

GRADES 6–12

Name _____ Date _____ Class / Period _____

Does a rocket hang from its engine?

Many people picture a rocket hanging from its flame like a pendulum, which stays steady by itself. But a rocket is one solid thing, and its engine is just another part of it. What really matters is where the line of the push goes.

Mission goal: find out what a push can and cannot do to a rocket's spin.

1 LOOK

OBSERVE BEFORE YOU TOUCH A CONTROL

Step 1 · A push through the balance point

- Our rocket's engine pushes with _____ N along the rocket's axis, straight through its balance point.
- The engine is below the balance point on this rocket, but a rocket works the same with the engine above it.

Step 2 · Moving the engine

- Picture the same push, but with the engine moved to the other side of the balance point.
- The line of the push still goes through the balance point.

Step 3 · What can pull it straight?

- A hanging weight, like a lamp on a string, is pulled straight by the string, a force from outside the weight.
- A parachute lifts a falling capsule in the same way: its pull comes from the air, outside the capsule.

Step 4 · A push that misses

- Now move the engine's push _____ centimetres to the right of the balance point.
- The push still points up the rocket, with a force of _____ N. A push that misses the balance point acts like pushing the edge of a door.

Write the numbers shown in the sim in the blanks above, then record what you notice:

2 PREDICT

COMMIT TO A HYPOTHESIS FIRST

Prediction 1. The engine sits above the balance point, and its push goes straight through that point. A kick makes the rocket start to spin. What does the engine's push do to the spin?

Hint: A push only makes a rocket turn if its line misses the balance point. Think about a door: pushing on the hinge does not open it.

□ It makes the spin faster

□ It pulls the rocket straight again

□ Nothing: the push goes through the balance point

Because...

Prediction 2. Now the engine sits below the balance point, and its push still goes straight through that point. What does the engine's push do to a spin?

Hint: The position of the engine along the rocket does not matter. The line of the push does.

□ Nothing: the push goes through the balance point

□ It makes the spin faster

□ It pulls the rocket straight again

Because...

Prediction 3. Which of these can pull a spinning rocket back to straight?

Hint: A hanging weight, like a pendulum, is steady because of a force that comes from outside the weight itself.

□ A push that goes straight through the balance point

□ A parachute pulling from above, outside the rocket

Because...

Prediction 4. The engine's push now misses the balance point, off to the right when you look at the rocket from the side with its nose pointing up. Which way does the push turn the rocket?

Hint: Clockwise is the way a clock's hands move. Counter-clockwise is the other way.

□ Clockwise

□ Counter-clockwise

Because...

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3 EXPERIMENT

CHANGE ONE VARIABLE AT A TIME

Step 1. Press **[Space]** to light the engine and **[Z]** for full throttle. Press **[T]** for the steering assist. Fly straight up for 10 seconds and watch the Nose off course number. Press **[X]** when you are done.

Step 2. Read the numbers, then press Got it. If the engine is still on, press **[X]** to cut it.

Step 3. Read the numbers, then press Got it.

Step 4. Read the numbers, then press Got it.

Trial	What I changed	What I measured / saw	Matched my prediction?
1			Yes · No · Partly
2			Yes · No · Partly

3			Yes · No · Partly

4 EXPLAIN

CLAIM · EVIDENCE · REASONING

Claim — What did you find out? (answer the mission goal in one sentence)

Evidence — Which numbers or observations from the sim support your claim?

Reasoning — Which science idea connects your evidence to your claim?

Self-check: □ I made a prediction before experimenting □ I used numbers from the sim □ I explained *why*, not just *what*