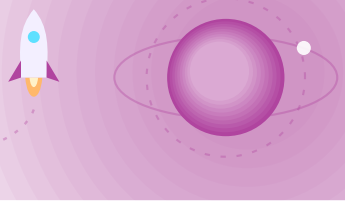
LESSON T3-02 · TIER 3 · ATMOSPHERE & ASCENT

Max Q Conductor

HIGH SCHOOL (9–12)



Name _____ Date _____ Class / Period _____

Conduct the squeeze of the air

Near the ground the air is thick, and the faster a rocket goes the harder the air squeezes it. Higher up the air is thin. In between there is a moment when the squeeze is greatest: Max Q. A rocket that is going too fast in thick air can be torn apart.

Mission goal: climb through Max Q without passing the limit, then use full power in the thin air above.

1 LOOK

OBSERVE BEFORE YOU TOUCH A CONTROL

Step 1 · Climb through the thickest air

- Our rocket's joints can take an air push (q) of up to _____ kPa. The Air push number on the screen shows q right now.
- q = ½ × air density × speed². Going faster raises it; climbing into thinner air lowers it.

Step 2 · When was Max Q?

- Your air push peaked at _____ kPa. The flight clock read _____ seconds at that moment, _____ km up.
- Max Q comes when the rocket is still speeding up but the air is already getting thinner.

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. Two climbs: one holds half power while the rocket is in thick air, the other uses full power from the start. Which one has the lower peak air push (q)?

Hint: q is how hard the air squeezes the rocket: ½ × air density × speed². It is measured in pascals (Pa) or kilopascals (kPa), where 1 kPa is 1,000 Pa.

□ The full-power climb

□ The gentle climb (half power at first)

□ Both the same

Because...

Prediction 2. When did the air push peak (Max Q)? Mark that moment on the flight clock.

Hint: The flight clock counts the seconds since the flight began. Aim for a band about 4 seconds wide, centred on the moment you read from your flight.

My prediction (circle or fill in): _____ to _____

Because...

3 EXPERIMENT

CHANGE ONE VARIABLE AT A TIME

Step 1. Press **[Space]** to light the engine and **[C]** for exactly half power. Climb and watch the Air push number rise, peak and fall. When it has fallen well below its peak and the Height is above _____ kilometres, press **[Z]** for full power.

Step 2. Keep going at full power and climb past _____ kilometres. Watch the Air push number stay under _____ kPa. Then press **[X]** to cut the engine.

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*