

Jet Engine Simulator

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/jet/>

Name: _____ Date: _____

Learning objectives

- Explain how a jet engine produces thrust.
- Name the stages of the Brayton cycle.
- Relate thrust to airflow and exhaust speed.

Variables to change

- Airflow rate
- Compression ratio
- Fuel flow

Procedure

1. Run the engine and follow air through intake, compressor, combustor, turbine, and nozzle.
2. Increase fuel flow and observe thrust and exhaust speed.
3. Change the airflow and observe the effect on thrust.

Observations

Record thrust versus fuel and airflow, and note where air is compressed, heated, and expanded.

Questions

1. How does a jet engine create thrust?
2. Name the Brayton-cycle stages.

3. Write thrust in terms of airflow and speed.
4. What does the turbine do?
5. Why do high-bypass turbofans improve efficiency?

Answer key (instructors)

- **1.** By accelerating a mass of air rearward; the reaction force pushes the engine forward (Newton's third law).
- **2.** Intake, compression, combustion (heat addition), expansion through the turbine, and exhaust.
- **3.** Thrust $\approx \dot{m} \cdot (v_{\text{exhaust}} - v_{\text{inlet}})$ — mass flow times the increase in speed.
- **4.** Extracts energy from the hot gas to drive the compressor.
- **5.** They move more air at lower speed, which is more efficient for subsonic flight.

A jet engine follows the Brayton cycle: it compresses incoming air, burns fuel to heat it, and expands it through a turbine and nozzle. Thrust $\approx \dot{m} \cdot (v_{\text{exhaust}} - v_{\text{inlet}})$ — accelerating air backward pushes the engine forward.