

Nuclear Reactor Simulator

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

Name: _____ Date: _____

Learning objectives

- Explain nuclear fission and chain reactions.
- Describe how control rods regulate a reactor.
- Define criticality.

Variables to change

- Control rod position
- Neutron population
- Fuel enrichment

Procedure

1. Start the reactor and watch the neutron population and power.
2. Withdraw the control rods and observe the reaction rate rise.
3. Insert the control rods and observe it fall.

Observations

Record how neutron population/power responds to control rod position.

Questions

1. What is nuclear fission?
2. What is a chain reaction?
3. What does "critical" mean ($k = 1$)?

4. How do control rods work?

5. What happens if $k > 1$?

Answer key (instructors)

- **1.** A heavy nucleus splitting into lighter nuclei, releasing energy and neutrons.
- **2.** Neutrons from one fission trigger further fissions, sustaining the process.
- **3.** Each fission causes exactly one further fission on average, so the reaction is steady.
- **4.** They absorb neutrons; inserting them slows the reaction, withdrawing them speeds it up.
- **5.** The reaction rate grows (supercritical); reactors are kept at $k \approx 1$ for steady output.

Fission splits heavy nuclei, releasing energy and neutrons that can trigger more fissions — a chain reaction. A reactor is held critical ($k = 1$) for steady power; neutron-absorbing control rods raise or lower the reaction rate.