

# Quantum Tunneling Simulator

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/quantum-tunneling/>

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Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Learning objectives

- Describe quantum tunneling through a barrier.
- Relate tunneling probability to barrier height and width.
- Contrast quantum and classical behavior.

## Variables to change

- Barrier height
- Barrier width
- Particle energy

## Procedure

1. Send a particle at a barrier taller than its energy and watch part of the wavefunction pass through.
2. Increase the barrier width and observe the transmitted probability.
3. Increase the barrier height and observe again.

## Observations

Record how the transmission probability changes with barrier width and height.

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## Questions

1. What is quantum tunneling?
2. How does barrier width affect tunneling?

3. How does barrier height affect tunneling?
4. Why can this happen at all?
5. Give a real application of tunneling.

### Answer key (instructors)

- **1.** A particle passing through a barrier it classically lacks the energy to cross.
- **2.** Wider barriers sharply reduce the tunneling probability (it falls exponentially with width).
- **3.** Higher barriers reduce the tunneling probability.
- **4.** The particle is described by a wavefunction that extends into and beyond the barrier, giving a nonzero probability of being found on the far side.
- **5.** Scanning tunneling microscopes, alpha decay, and tunnel diodes all rely on it.

*Quantum particles are waves, so their wavefunction leaks into a barrier and can emerge on the far side even without enough energy to go over it. This tunneling probability drops exponentially with barrier width and height, and underlies alpha decay and the scanning tunneling microscope.*