Inside the Reactor

Trace nuclear reactions from fuel to usable energy.

PS.4.g "Use models to explain how nuclear fission and fusion reactions can be used as energy sources."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline sentences that describe a change in a nucleus, then number the steps from fission to electricity at a home in order.

Two Paths to Nuclear Energy

1. At a nuclear power plant, a neutron strikes a uranium-235 nucleus. The nucleus splits into smaller nuclei and releases energy and more neutrons. Some released neutrons strike other uranium-235 nuclei, creating a chain reaction. Control rods absorb some neutrons, keeping the reaction at a manageable rate. The released energy heats water, producing steam that spins a turbine connected to a generator. The generator changes the turbine's motion into electricity sent to homes through power lines.

2. Fusion starts with small nuclei rather than splitting a large one. For example, a deuterium nucleus and a tritium nucleus, both forms of hydrogen, can combine to form a helium nucleus and a neutron. A tiny amount of mass becomes released energy in both fusion and fission. To make fusion happen on Earth, researchers heat fuel into a hot gas called plasma and confine it. A proposed fusion plant would use released energy to heat a fluid and ultimately turn a generator.

3. Imagine tracing energy with arrows: nuclear change, released energy, moving turbine, electrical energy. Both kinds of reactions could feed this path, but their starting conditions differ. A fission plant needs fuel and a controlled chain reaction. A fusion plant would need conditions that let small nuclei combine while supplying more usable energy than the plant consumes. Fission reactors generate electricity today. Researchers have produced fusion reactions, but no fusion plant currently supplies commercial electricity to the grid.

2 ANSWER WITH EVIDENCE

Use the passage

1. In a fission model, what should arrows from one split uranium-235 nucleus show to explain how the reaction continues?

2. Trace the energy from a fission reaction to a home. What steps belong between the reaction and the electricity reaching the home?

3. In a fusion model, what nuclei enter the reaction, what leaves it, and what must happen to the fuel first?

4. A model shows fusion fuel connected directly to a working wall outlet. What energy-transfer steps and real-world limit are missing?

3 YOUR TURN

Your own words

A coastal town wants a nuclear plant that makes electricity and uses some reactor heat to warm a greenhouse. Draw an energy-flow model using a power source available today. Show the nuclear event, how it is controlled, and the paths to both the power lines and the greenhouse.

ANSWER KEY

Inside the Reactor

PART 1 · READ AND MARK

Underline sentences that describe a change in a nucleus, then number the steps from fission to electricity at a home in order. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In a fission model, what should arrows from one split uranium-235 nucleus show to explain how the reaction continues?	**Released neutrons strike more uranium-235 nuclei, causing more splits that release energy and neutrons.**
2	Trace the energy from a fission reaction to a home. What steps belong between the reaction and the electricity reaching the home?	**Released energy heats water into steam. The steam spins a turbine, which turns a generator. Electricity travels through power lines to the home.**
3	In a fusion model, what nuclei enter the reaction, what leaves it, and what must happen to the fuel first?	**Deuterium and tritium nuclei combine, releasing a helium nucleus, a neutron, and energy. The fuel must be heated into plasma and confined.**
4	A model shows fusion fuel connected directly to a working wall outlet. What energy-transfer steps and real-world limit are missing?	**Released energy would heat a fluid and ultimately turn a generator to make electricity. No fusion plant currently supplies commercial electricity to the grid.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Neutron + uranium-235 nucleus → split nuclei + neutrons + released energy. Control rods absorb some neutrons. Released energy → heated water → steam → turbine → generator → electricity → power lines. A branch from the reactor's heat → heat exchanger → separate greenhouse heating loop.

Accept other clear arrow models that identify controlled fission, trace heat through a turbine and generator to electricity, and show a separate path carrying heat to the greenhouse.