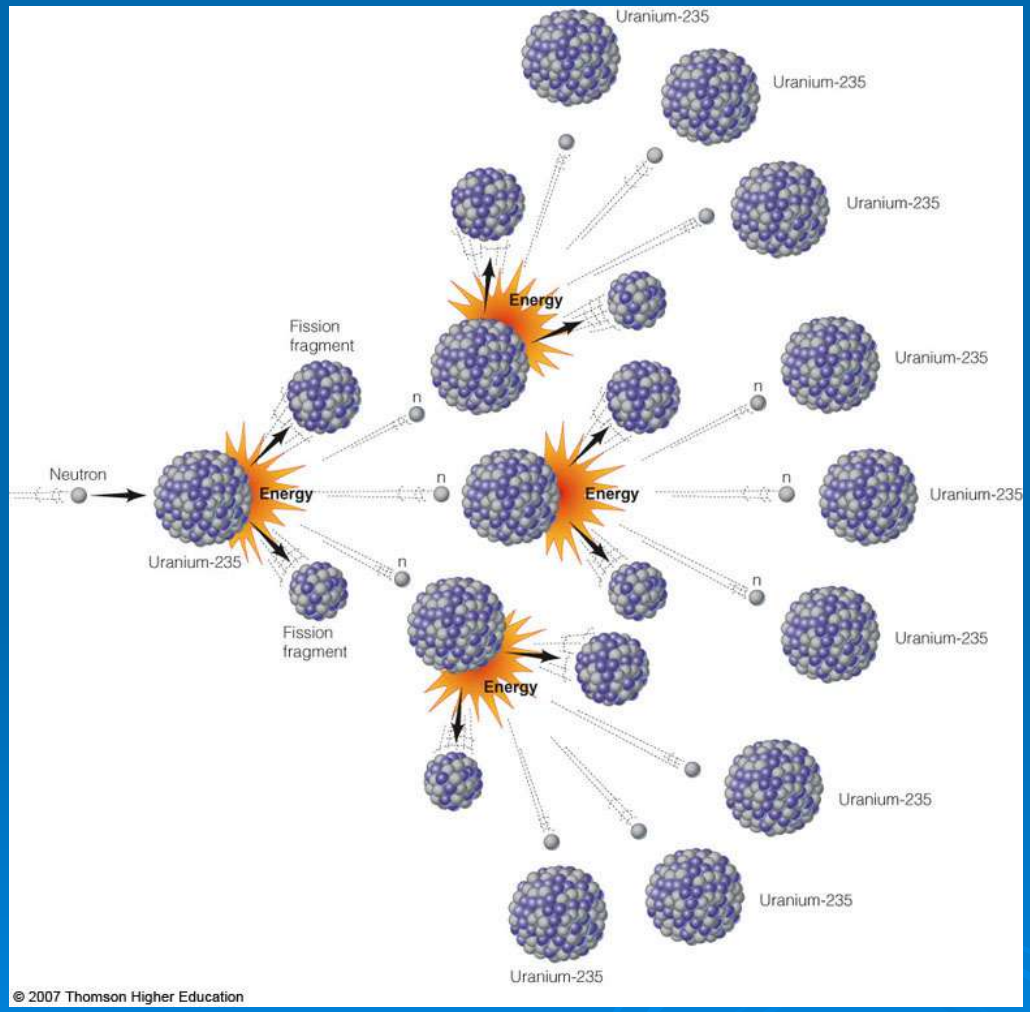
# Three Types of Atomic Nuclear Changes

- Radioactive decay- atoms “break down” by emitting ionizing radiation
- Fission- splitting large atoms (like uranium)
  - First atomic bombs
  - All nuclear power plants
- Fusion- fusing atoms together (like hydrogen)
  - “H-Bomb”
  - Sun and all other stars
  - 100 million degrees Celsius to begin reaction

# Nuclear Changes: Radioactive Decay

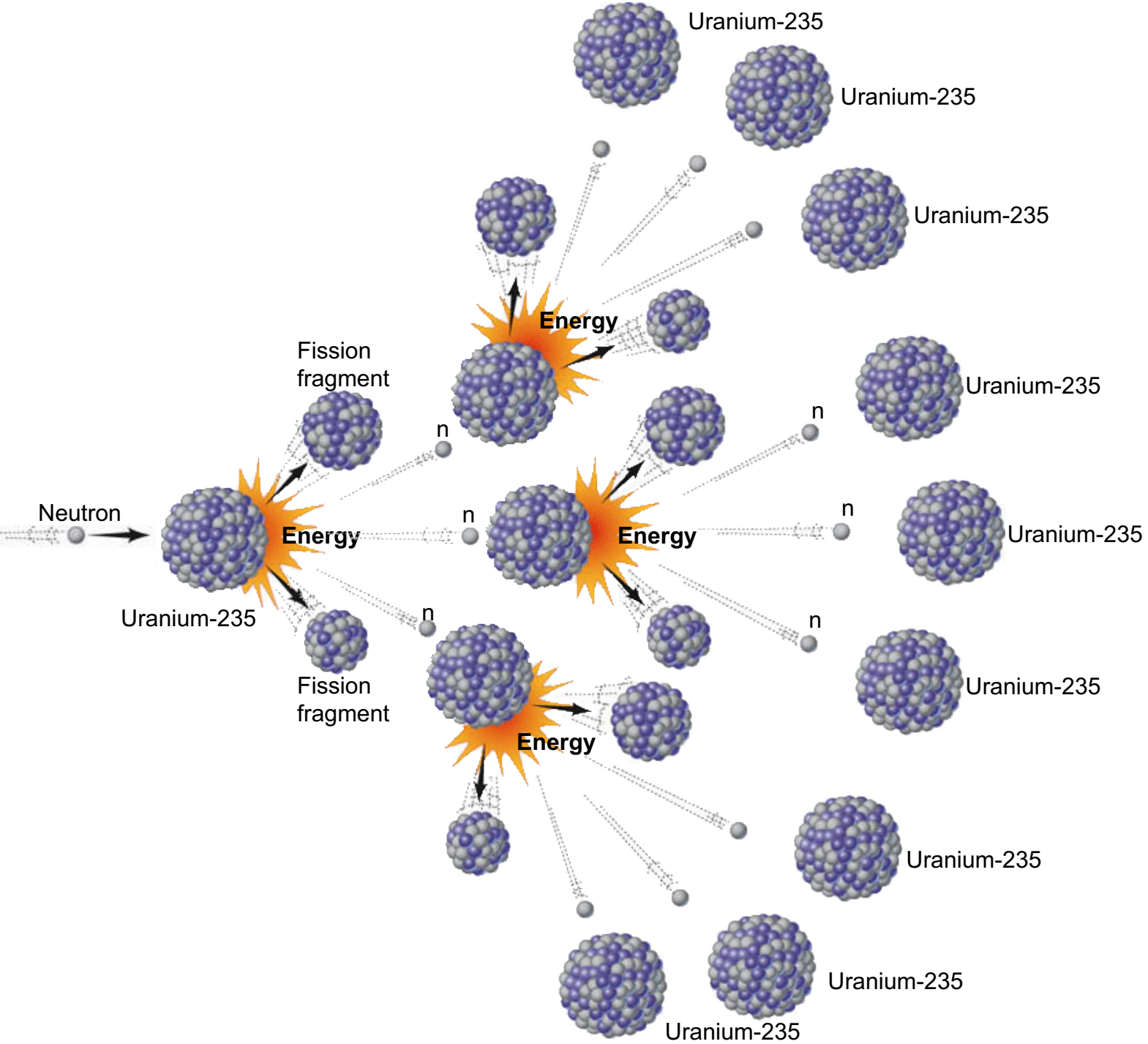
- Natural radioactive decay: unstable isotopes spontaneously emit fast moving chunks of matter (***alpha*** or ***beta particles***), high-energy radiation (***gamma rays***), or both at a fixed rate.
  - Radiation is commonly used in energy production and medical applications.
  - The rate of decay is expressed as a ***half-life*** (the time needed for one-half of the nuclei to decay to form a different isotope).

# Nuclear Changes: Fission




- Nuclear fission: nuclei of certain isotopes with large mass numbers are split apart into lighter nuclei when struck by neutrons.

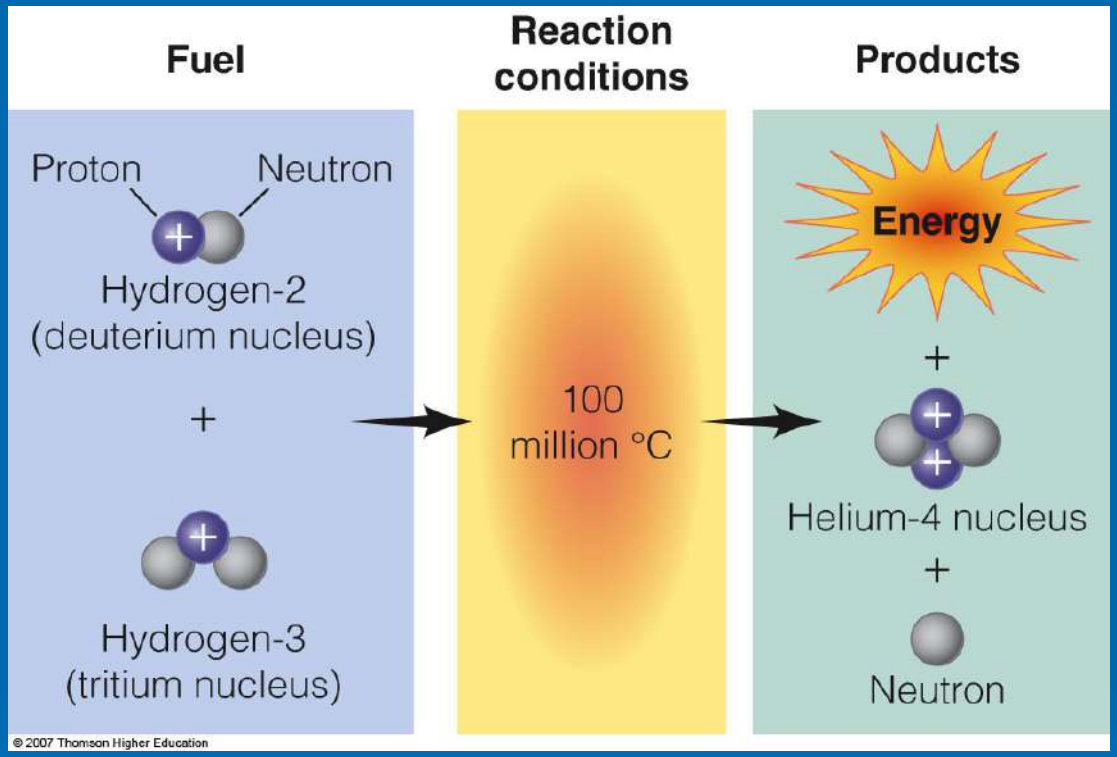
Figure 2-9




**Stepped Art**

**Fig. 2-6, p. 28**

# Nuclear Changes: Fusion




- Nuclear fusion: two isotopes of light elements are forced together at extremely high temperatures until they fuse to form a heavier nucleus.

Figure 2-10

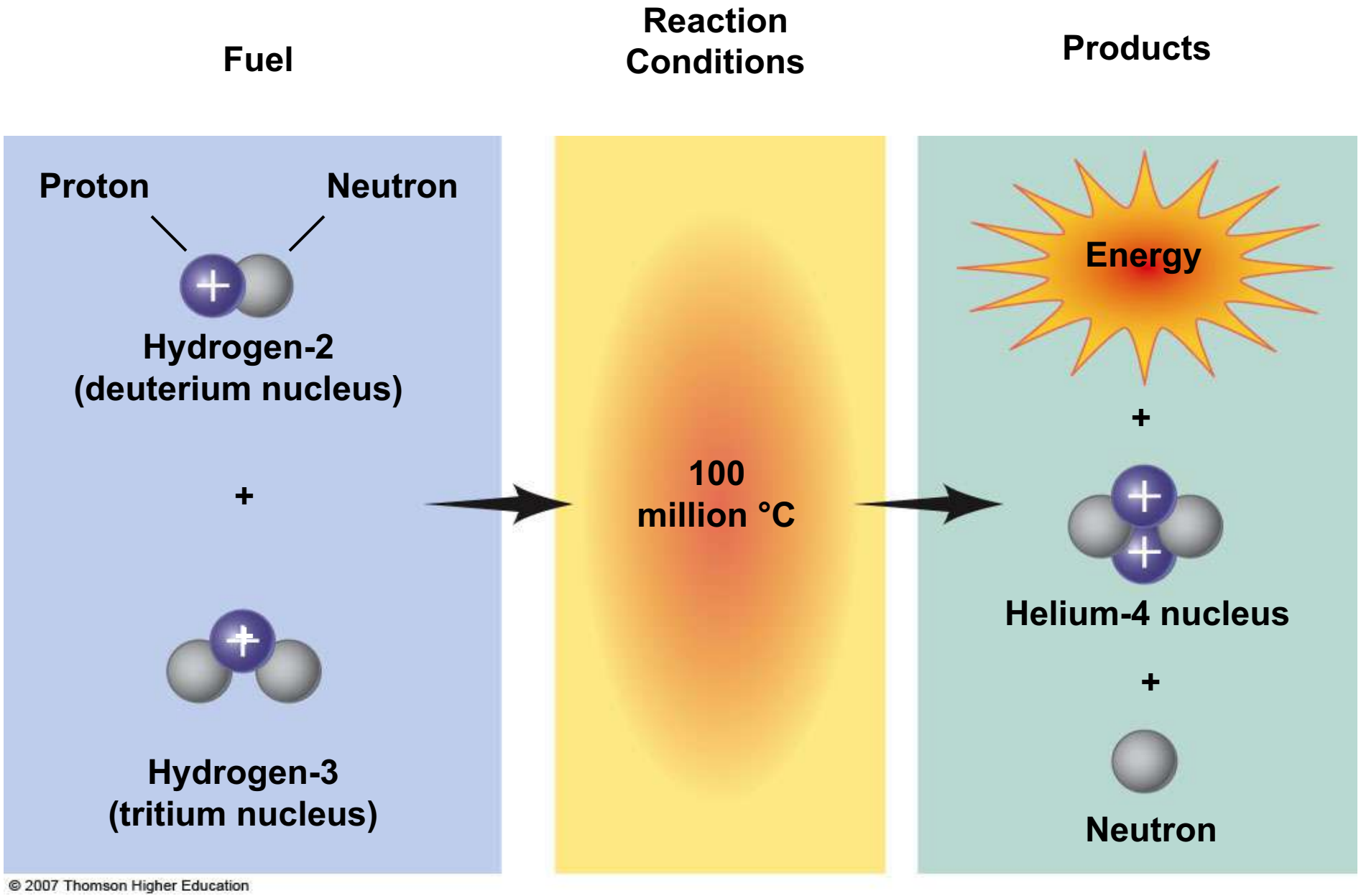

Fuel
Reaction Conditions
Products
Proton
Neutron
Hydrogen-2 (deuterium nucleus)
+
Hydrogen-3 (tritium nucleus)
100 million °C
Energy
+
Helium-4 nucleus
+
Neutron
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Fig. 2-10, p. 42

# ENERGY

- Energy is the ability to do work and transfer heat.
  - Kinetic energy –
    - energy in motion
      - heat, electromagnetic radiation
  - Potential energy –
    - stored for possible use
      - batteries, glucose molecules