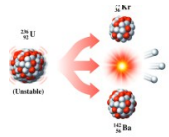
Nuclear Chemistry

Nuclear Fission and Fusion



Nuclear Fission

In **nuclear fission**,

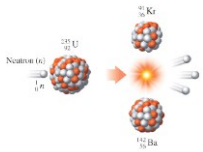
- a large nucleus is bombarded with a small particle
- the nucleus splits into smaller nuclei and several neutrons
- large amounts of energy are released

Nuclear Fission

When a neutron bombards U-235,

- an unstable nucleus of U-236 forms and undergoes fission (splits)
- smaller nuclei are produced such as Kr-91 and Ba-142
- neutrons are released to bombard more ^{235}U

Nuclear Fission Diagram and Equation



$$^{1}_{0}n + {}^{235}_{92}\mathrm{U} \rightarrow {}^{236}_{92}\mathrm{U} \rightarrow {}^{91}_{36}\mathrm{Kr} + {}^{142}_{56}\mathrm{Ba} + 3{}^{1}_{0}n + \text{energy}$$

Learning Check

Supply the missing atomic symbol to complete the equation for the following nuclear fission reaction.

$$^{1}_{0}n + {}^{235}_{92}\mathrm{U} \rightarrow {}^{137}_{52}\mathrm{Te} + ? + 2{}^{1}_{0}n + \text{energy}$$

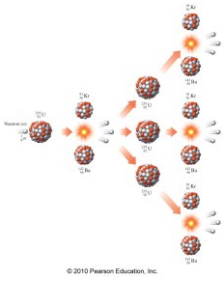
Solution

$$^{1}_{0}n + {}^{235}_{92}\mathrm{U} \rightarrow {}^{137}_{52}\mathrm{Te} + {}^{97}_{40}\mathrm{Zr} + 2{}^{1}_{0}n + \text{energy}$$

Chain Reaction

A chain reaction occurs

- when a critical mass of uranium undergoes fission
- releasing a large amount of heat and energy that produces an atomic explosion

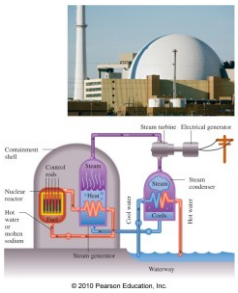


Nuclear Power Plants

In **nuclear power plants**,

- fission is used to produce energy
- control rods in the reactor absorb neutrons to slow and control the chain reactions of fission

Nuclear Power Plants (continued)



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Nuclear Fusion

Nuclear fusion

- occurs at extremely high temperatures (100 000 000 °C)
- combines small nuclei into larger nuclei
- releases large amounts of energy
- occurs continuously in the sun and stars

Learning Check

Indicate if each of the following describes 1) nuclear fission or 2) nuclear fusion.

___ A. a nucleus splits
___ B. large amounts of energy are released
___ C. small nuclei form larger nuclei
___ D. hydrogen nuclei react
___ E. several neutrons are released

Solution

Indicate if each of the following describes 1) nuclear fission or 2) nuclear fusion.

1 A. a nucleus splits
1, 2 B. large amounts of energy are released
2 C. small nuclei form larger nuclei
2 D. hydrogen nuclei react
1 E. several neutrons are released

