Nuclear Reactions

Chapter 24.2: Radioactive Decay
Radioactive Decay & Nuclear Stability

- **Main Idea:** _______ nuclei can _______ apart spontaneously, changing the ___________ of their atoms.

- Radioactive decay involves the ______________ of one element into another.

- Most important factor determining the _____________ of an atom is its ______ of ____________ to ____________.
  - Too many or too few __________ results in:
    - __________
    - _______ of ____________ through radioactive decay.

- Eventually, radioactive ______________ undergo enough radioactive decay to form ______, ________________ atoms.
Radioactive Decay Rates

✧ Radioactive elements decompose ______________ over time.

✧ Radioactive decay _____ are measured in ___________.
  ✧ Half-life is the _______ required for ______________ of a radioisotope to ______________ into another, more ____________ element.
  ✧ Each ______________ has its own ____________ half-life.
  ✧ Can range from ______________ of a second to ______________ of years.
Radioactive elements decompose gradually over time. An element’s half life is the amount of time it takes for one half of the isotopes to decompose into another more stable element.

If we start with **100.0 g** of strontium-90, which has a **half life of 29 years**, how much will we have left...?

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<th>amount</th>
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</table>
Half-Life

Chemistry Half-life problems(use a table for all problems)

1. An isotope of cesium (cesium-137) has a half-life of 30 years. If 1.0 mg of cesium-137 disintegrates over a period of 90 years, how many mg of cesium-137 would remain?

2. A 2.5 gram sample of an isotope of strontium-90 was formed in a 1960 explosion of an atomic bomb at Johnson Island in the Pacific Test Site. The half-life of strontium-90 is 28 years. In what year will only 0.625 grams of this strontium-90 remain?

3. Actinium-226 has a half-life of 29 hours. If 100 mg of actinium-226 disintegrates over a period of 58 hours, how many mg of actinium-226 will remain?
Half-Life

4. Thallium-201 has a half-life of 73 hours. If 4.0 mg of thallium-201 disintegrates over a period of 6.0 days and 2 hours, how many mg of thallium-201 will remain?

5. Sodium-25 was to be used in an experiment, but it took 3.0 minutes to get the sodium from the reactor to the laboratory. If 5.0 mg of sodium-25 was removed from the reactor, how many mg of sodium-25 were placed in the reaction vessel 3.0 minutes later if the half-life of sodium-25 is 60 seconds?

6. The half-life of isotope X is 2.0 years. How many years would it take for a 4.0 mg sample of X to decay and have only 0.50 mg of it remain?
Nuclear Chemistry

Chapter 24.3: Nuclear Reactions
Induced Nuclear Reactions

✦ **Main Idea:** ____________, the __________ of __________, and __________, the __________ of __________, __________ tremendous amounts of _______.

✦ **Review:** All nuclear reactions described are examples of __________ ______________.

✦ One __________ is __________ into __________.

✦ Nuclear reactions can be __________ by _______________ a stable nucleus with a __________ or high-energy ______, _____, __________ radiation.

✦ Produced ______________.
Induced Nuclear Reactions

- __________ nuclear reactions involve ________ nuclei with high-velocity ______________.

- Scientists developed __________ ____________ that accelerate ____________ particles to extreme __________ by using very strong ___________ and ____________ fields.

- Technique has been used to ______________ hundreds of new ___________ and ______________.

- Elements with atomic numbers _______ and above have been produced in ____________________ and are ________________.
Nuclear Fission

- Nuclear __________ is the ______________ of a nucleus into ______________.
  - Accompanied by a very large _______ of ____________.
  - Process is used by nuclear __________ __________ to generate ____________.
Nuclear Fission

✦ First nuclear fission discovered involved ______________.
✦ When bombarded with a ____________________, uranium-______ forms unstable uranium-_________.
✦ U-236 splits into two ___________ nuclei and additional ______________.
Nuclear Fission

_____ ____________
drive nuclear fission and
_________ _________.

_____ ___________
process in which one
reaction ____________
the next.
Nuclear Reactors

- Nuclear reactors produce _______ that drives the formation of _________.

  - Energy from steam spins a ___________; produces ___________________.
  - Steam is ___________ and ______________.
  - Water used to cool the steam enters __________ _______; _____ is released into the atmosphere.
Nuclear Fusion

- Nuclear _________ is the ______________ of atomic ______________.

- Capable of releasing very large amounts of __________.
  - Can you name an example of a fusion reaction?

- Reactions ______ generally ________________.

- Produce ________ energy than ______________ reactions.
Nuclear Fission

- Why don’t we use fusion to fill the need for electricity?
Mass Defect

- ______ of the ______________ is always _____ than the ____ of the individual _________ and __________.
- ______ in _____ between a _____________and its component ________ is called the _____ ________.
- When particles _________ together to form an _____, the ______________ corresponding to the ______ ____________ is ____________.