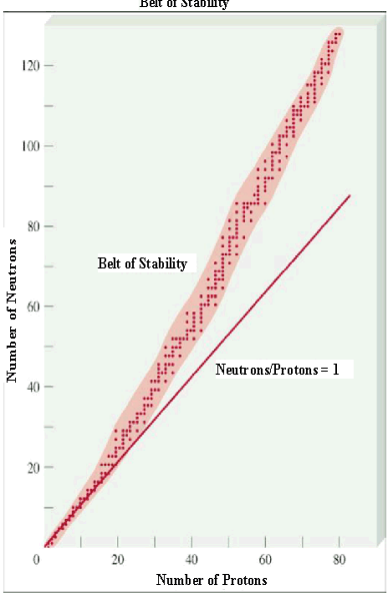
DUKE NUKE'M: Nuclear Chemistry



I. More About the Nucleus

A. How is the nucleus held together?

1. The nucleus is made up of
2. Protons
3. This repulsion is overcome by the
4. If the nucleus has

a. This stability is predicted by the

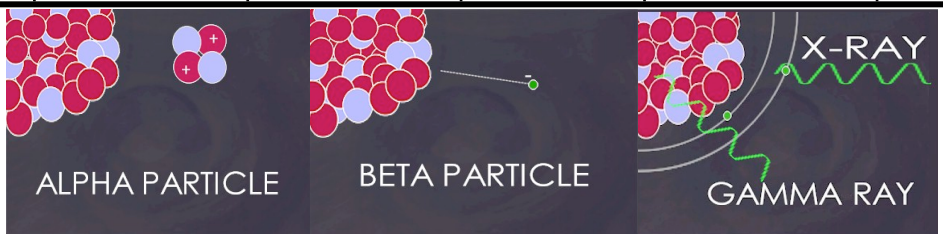
b. This band is based on the

c. These nuclei will undergo in order to become stable.

d. Lighter nuclei whereas heavier nuclei

B. – the spontaneous emission of radiation from the nucleus. There are

Particle Type	Size	Penetration	Symbol(s)	Stopped by	Speed

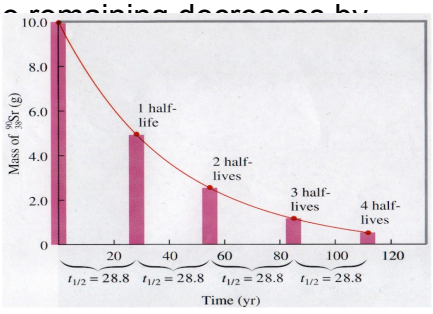


C.

1.

a. Ranges from fractions of seconds to thousands of years.

b. As each half life passes, the amount of radioactive nuclide remaining decreases by



c. Ex: The half life for carbon-14 is 5730 years.

2. To solve half life problems, use the following equations:

a.

b.

c. Another way:

i. Use the first equation to

ii.

d. Ex.: Fluorine-21 has a half life of approximately 15.0 seconds. How much of an original sample of 20.0g would remain after 45.0 seconds?

e. Ex.: The half-life of ^{90}Sr is 29 years. After 116 years, how much of a 64g sample will remain? How much has decayed?

f. Ex: After 133.5 days, there is 0.2500g of iron-59 (half-life of 44.5 days). How much was originally present?

II. Nuclear Reactions

A. The nucleus undergoes various reactions that involve A LOT of

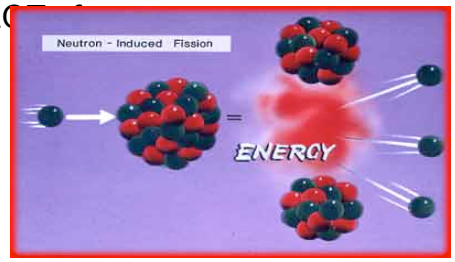
B. There are three types of nuclear reactions.

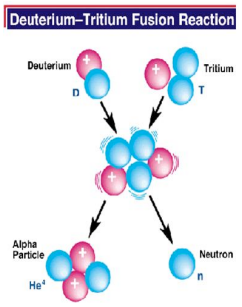
1.

a.

b. This is common in

c. Usually





2.

a. Example:

b. This happens

c. In a fusion bomb, you need a lot of energy to get a fusion reaction started.

d.

3.

a. Involves

(Usually 1-->1)

b. Element (in an equation, the particle is a).

c. This can be accomplished by bombarding an atom with a nuclear particle or with another atom (<u>induced transmutation</u>).

d. This is an option for dealing with nuclear waste.

4. Quick Quiz!

a. $^{241}_{95}U + {}^{4}_{2}He \rightarrow 2\ {}^{1}_{0}n + {}^{243}_{97}Bk$

b. $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{142}_{56}Ba + {}^{91}_{36}Kr + 3\ {}^{1}_{0}n$

c. $^{235}_{92}U \rightarrow {}^{4}_{2}He + {}^{231}_{90}Th$

d. $^{99}_{43}Tc \rightarrow {}^{99}_{44}Ru + {}^{0}_{-1}e$

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III. Balancing Nuclear Equations

A. Nuclear equations describe nuclear reactions.

1. Example: $^{131}_{53}\text{I} \rightarrow {}^{0}_{-1}\beta + \_\_\_\_\_$

2. To balance nuclear reactions:

a. Assume the arrow is an

b. Insert a number so that the

c. Determine

3. Example: $^{288}_{88}\text{Ra} \rightarrow \_\_\_\_\_ + {}^{284}_{86}\text{Rn}$

IV. Where does all the energy come from?

A. During nuclear reactions,

B. This energy (a.k.a.) is described by

1. E=

2. m=

3. c=