EXTRA NAME

Class Work 4/29/14

10.2 Radioactive Decay

SPARK

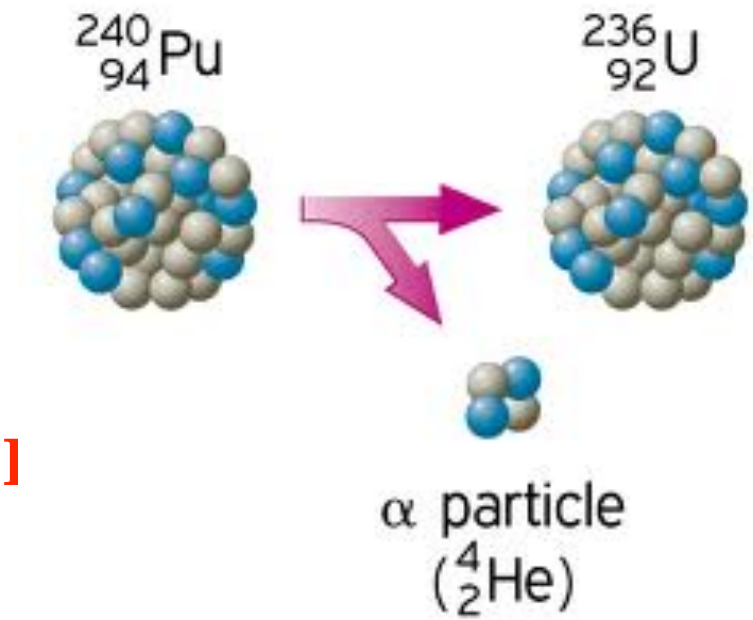
Read and complete the chart on your guided notes.

Objective

SWBAT compare and contrast the different types of radiation

Alpha -Decay

- Nucleus emits a helium nucleus = 2 protons and 2 neutrons
  - $^{4}_{2}\alpha$ or $^{4}_{2}\mathbf{He}$
  - Mass = 4
  - Charge = +2



Example:

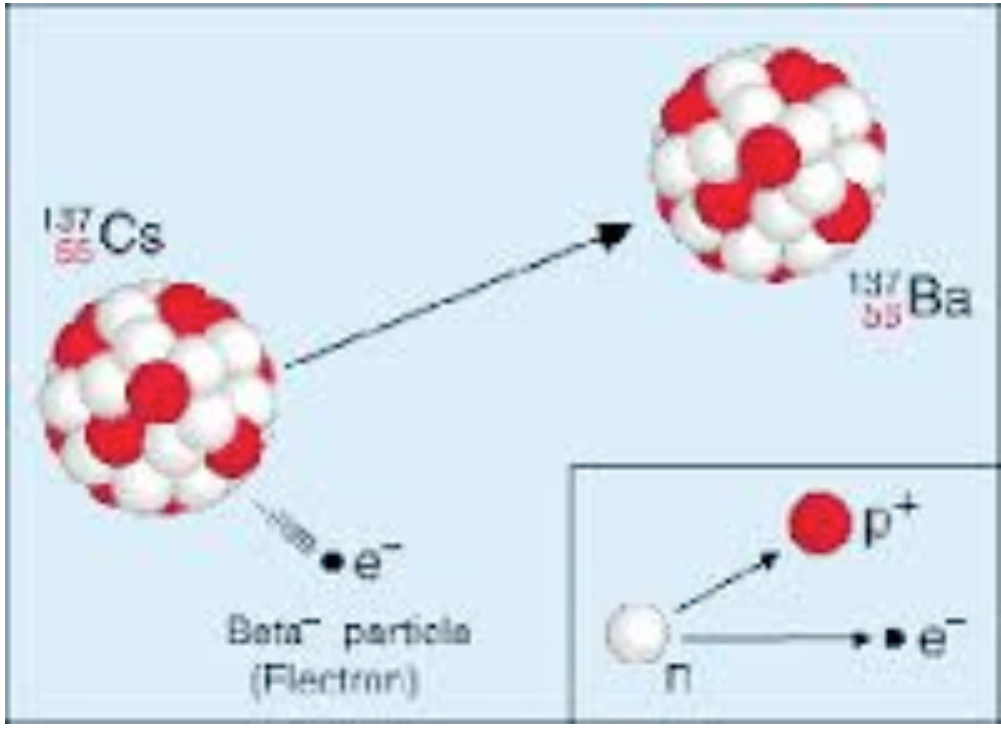
$^{238}_{92}\mathrm{U} \rightarrow \quad ^{234}_{90}\mathrm{Th} + ^{4}_{2}]$

Beta -Decay

- Neutron turns into a proton and emits an electron
  - $^{0}_{-1}\mathbf{e}$ or $^{0}_{-1}\beta$
  - Mass = 0
  - Charge = -1

Example:

$$^{87}_{37}Rb \rightarrow {}^{87}_{38}Sr + {}^{0}_{-1}\beta$$

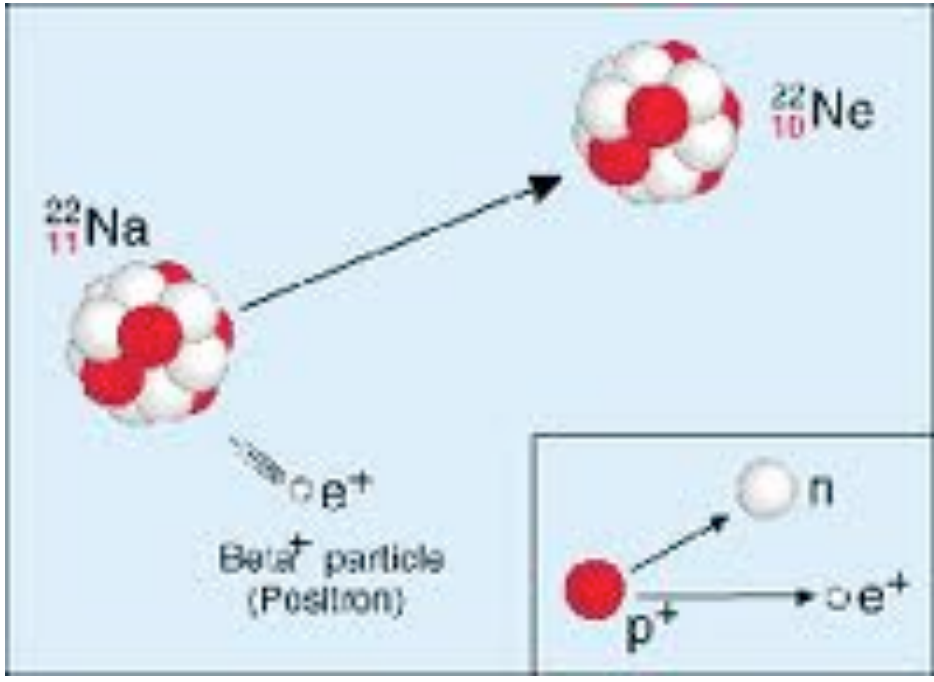


Positron Emission

- Proton turns into a neutron and emits an positron
  - ${}^{0}_{+1}\mathbf{e}$ or ${}^{0}_{+1}\beta$
  - Mass = 0
  - Charge = +1

Example:

$$ {}^{15}_{8}\mathrm{O} \longrightarrow {}^{15}_{7}\mathrm{N} + {}^{0}_{+1}\beta $$



Gamma Radiation

- Electromagnetic radiation given off during radioactive decay
  - $^{0}_{0}\gamma$
  - Mass = 0
  - Charge = 0

Examples:

$$^{226}_{88}Ra \longrightarrow ^{222}_{86}Rn + ^{4}_{2}He + ^{0}_{0}\gamma$$

$$^{234}_{91}Pa \rightarrow ^{234}_{92}U + ^{0}_{-1}\beta + ^{0}_{0}\gamma$$

Table O
Symbols Used in Nuclear Chemistry

Name	Notation	Symbol
alpha particle	${}^{4}_{2}He$ or ${}^{4}_{2}\alpha$	α
beta particle	${}^{0}_{-1}e$ or ${}^{0}_{-1}\beta$	β^{-}
gamma radiation	${}^{0}_{0}\gamma$	γ
neutron	${}^{1}_{0}n$	n
proton	${}^{1}_{1}H$ or ${}^{1}_{1}p$	p
positron	${}^{0}_{+1}e$ or ${}^{0}_{+1}\beta$	β^{+}

Check For Understanding

- Which of the particles released during radioactive decay have no mass?

Check For Understanding

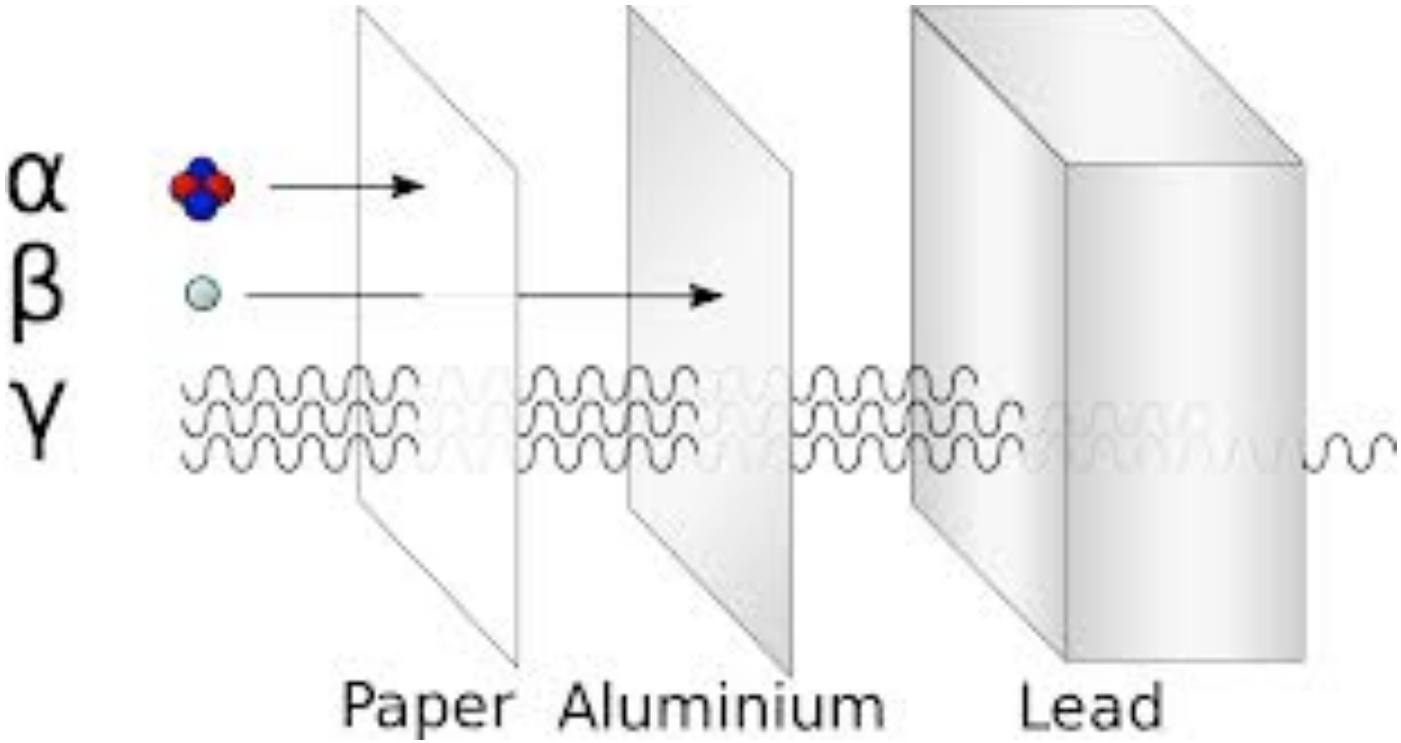
- Which particle has *no* mass and *no* charge?

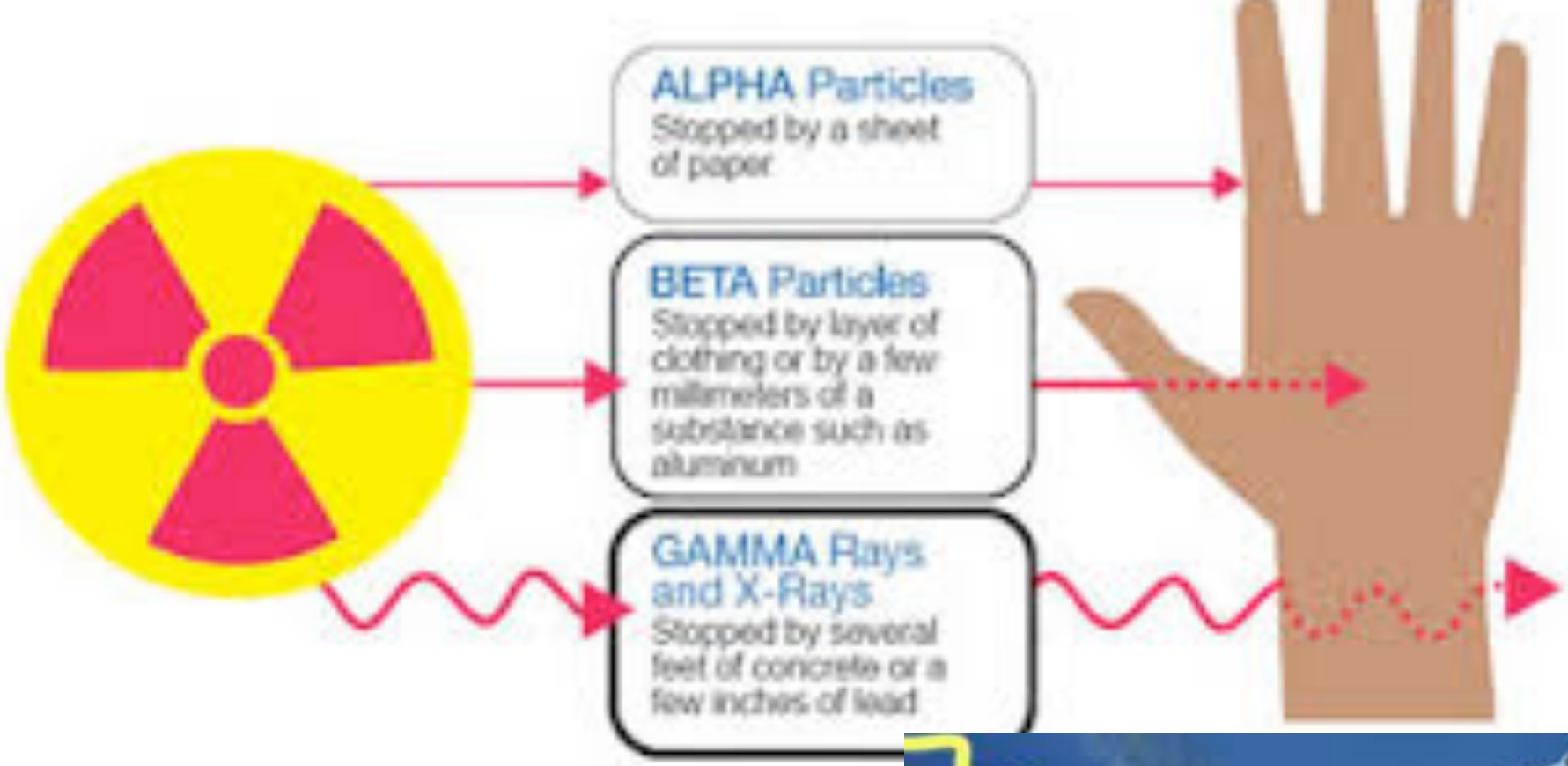
1. alpha
2. beta
3. gamma
4. neutron

Reading – Penetrating and Ionizing Power

- When you finish, place the particles in order of their penetrating power.

Penetrating Power




ALPHA Particles
Stopped by a sheet of paper
BETA Particles
Stopped by layer of clothing or by a few millimeters of a substance such as aluminum
GAMMA Rays and X-Rays
Stopped by several feet of concrete or a few inches of lead

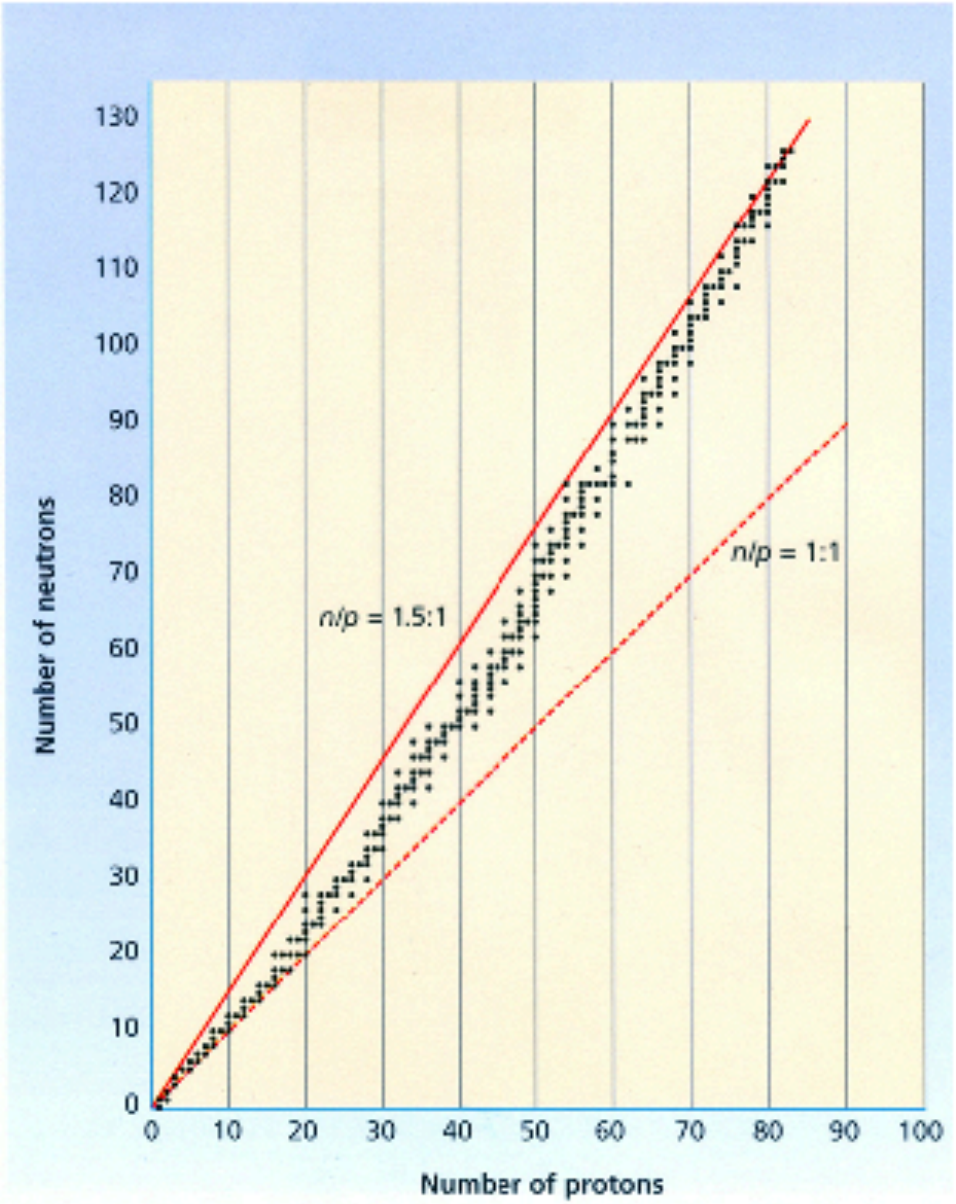
What Makes a Nucleus Unstable?

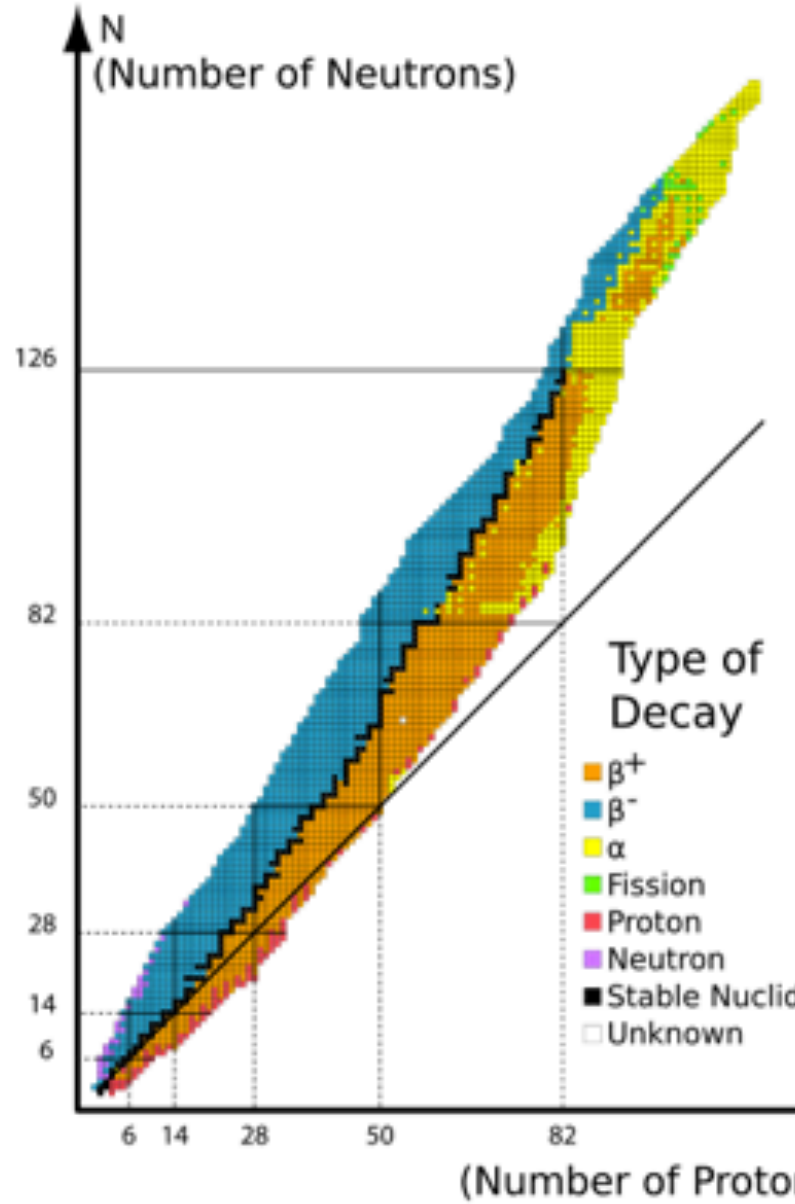
The table below indicates the stability of six nuclides.

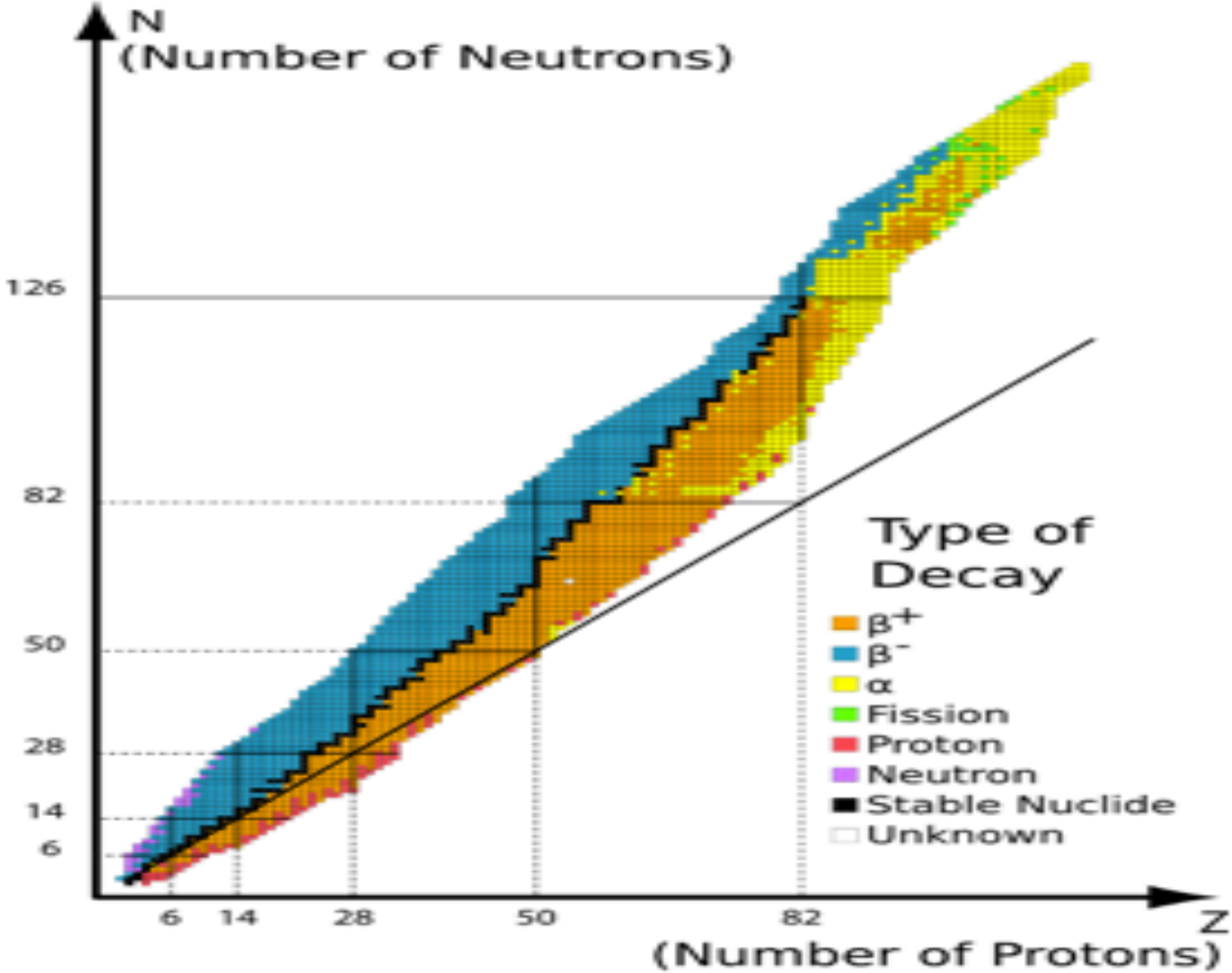
Stability of Six Nuclides

Nuclide	Stability
C-12	stable
C-14	unstable
N-14	stable
N-16	unstable
O-16	stable
O-19	unstable

BAND OF STABILITY






N
(Number of Neutrons)
126
82
50
28
14
6
6
14
28
50
82
Z
(Number of Protons)
Type of Decay
β+
β−
α
Fission
Proton
Neutron
Stable Nuclide
Unknown

Stability of Nuclei

- Generally:
  - If neutrons >> protons, typically unstable
  - If protons >> neutrons, typically unstable
  - If protons > 83, typically unstable

Table N
Selected Radioisotopes

Nuclide	Half-Life	Decay Mode	Nuclide Name
^{198}Au	2.695 d	β^-	gold-198
^{14}C	5715 y	β^-	carbon-14
^{37}Ca	182 ms	β^+	calcium-37
^{60}Co	5.271 y	β^-	cobalt-60
^{137}Cs	30.2 y	β^-	cesium-137
^{53}Fe	8.51 min	β^+	iron-53
^{220}Fr	27.4 s	α	francium-220
^{3}H	12.31 y	β^-	hydrogen-3
^{131}I	8.021 d	β^-	iodine-131
^{37}K	1.23 s	β^+	potassium-37
^{42}K	12.36 h	β^-	potassium-42
^{85}Kr	10.73 y	β^-	krypton-85
^{16}N	7.13 s	β^-	nitrogen-16
^{19}Ne	17.22 s	β^+	neon-19
^{32}P	14.28 d	β^-	phosphorus-32
^{239}Pu	2.410×10^4 y	α	plutonium-239
^{226}Ra	1599 y	α	radium-226
^{222}Rn	3.823 d	α	radon-222
^{90}Sr	29.1 y	β^-	strontium-90
^{99}Tc	2.13×10^5 y	β^-	technetium-99
^{232}Th	1.40×10^{10} y	α	thorium-232
^{233}U	1.592×10^5 y	α	uranium-233
^{235}U	7.04×10^8 y	α	uranium-235
^{238}U	4.47×10^9 y	α	uranium-238

Check For Understanding

- What is the decay mode of ^{235}U?

1. β^-
2. β^+
3. γ
4. α

Check For Understanding

- What is the decay mode of ^{60}Co?

1. β^-
2. β^+
3. γ
4. α

HOMEWORK

Complete 10.2 HW

Objective: SWBAT edit their drafts for Paper #5