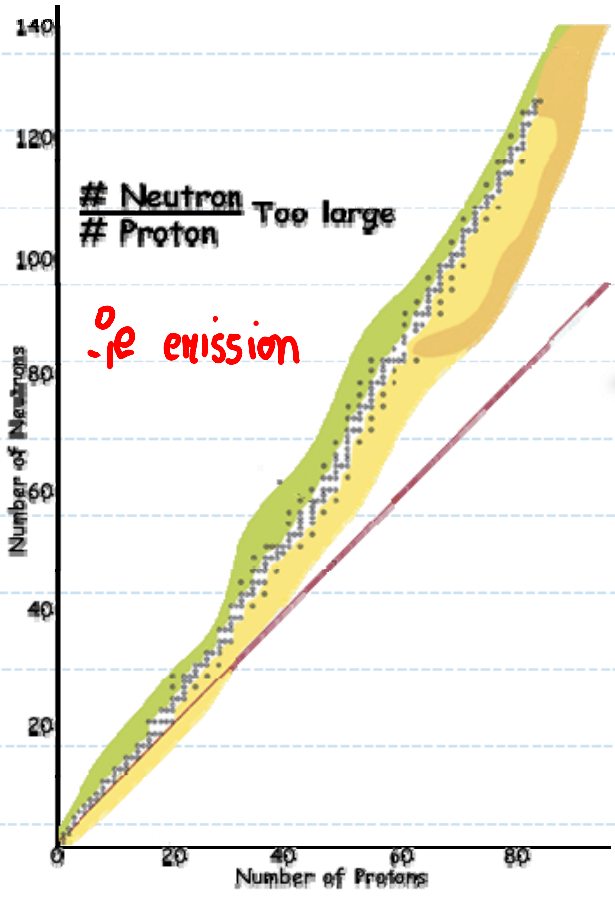
Announcements – Lecture XXI – Tuesday, Dec 4th

1. Exam III … Thursday, December 6th, ISB 135, 12:45-2:15pm
   3 or 4 questions will be taken from Lab Owls 3, 4 and 5.

2. Final Exam … Wednesday, December 12th, ISB 135, 8:00-10:00am
   Final Review … Sunday, December 9th, ISB 135, 1:00-3:00pm

9.3 What Happens When a Nucleus Emits Radioactivity



$^{60}_{27}Co$ is one of many radioactive isotopes whose #Neutron/#Proton ratio is too large. Radioactive isotopes on this side of the stability have only one form of radioactive decay available to them –

a) Alpha emission
b) Positron emission
c) Electron capture
d) Beta emission.

$^{4}_{2}He$: causes $\frac{\#\text{NEUTRON}}{\#\text{PROTON}}$ to ↑ ✗

$^{0}_{+1}e$: Proton converted to a Neutron ✗

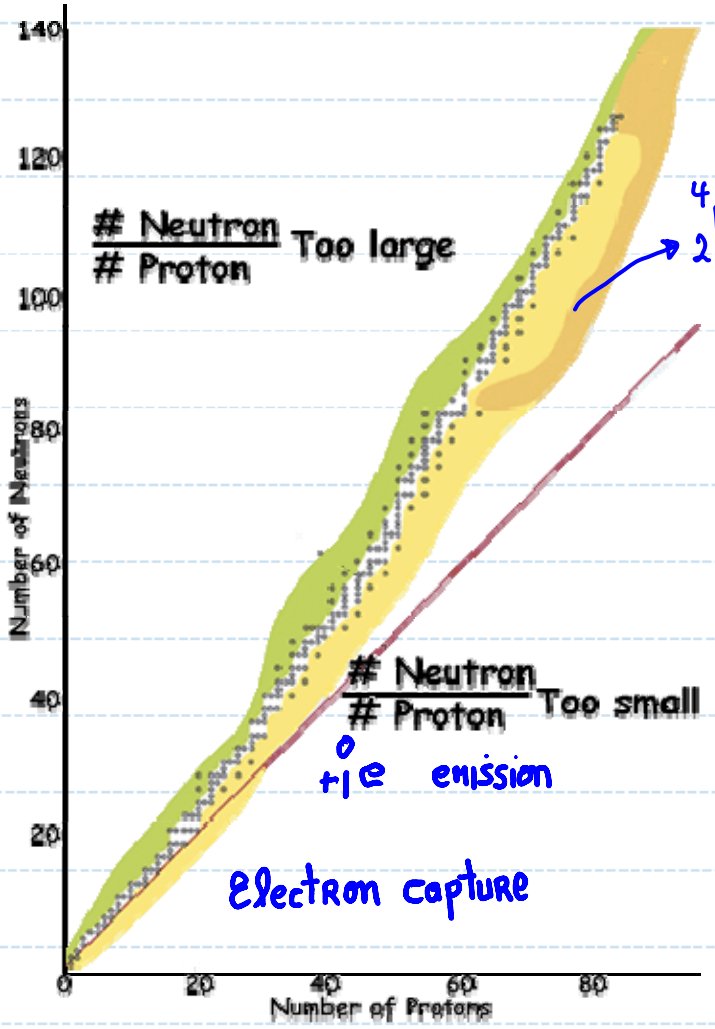
Electron capture : Proton converted to a Neutron ✗

$^{0}_{-1}e$: Neutron converted to a proton ✓

$$^{60}_{27}Co \rightarrow {}^{0}_{-1}e + {}^{60}_{28}Ni + \gamma \text{ Rays}$$

9.3 What Happens When a Nucleus Emits Radioactivity

Positron Emission – Electron Capture – Alpha Emission



$^{4}_{2}He$ emission

$^{0}_{+1}e$ emission

Electron capture

Electron Capture

$$^{41}_{20}Ca + ^{0}_{-1}e \rightarrow ^{41}_{19}K + \gamma \text{ Rays}$$

Reactant

Positron Emission

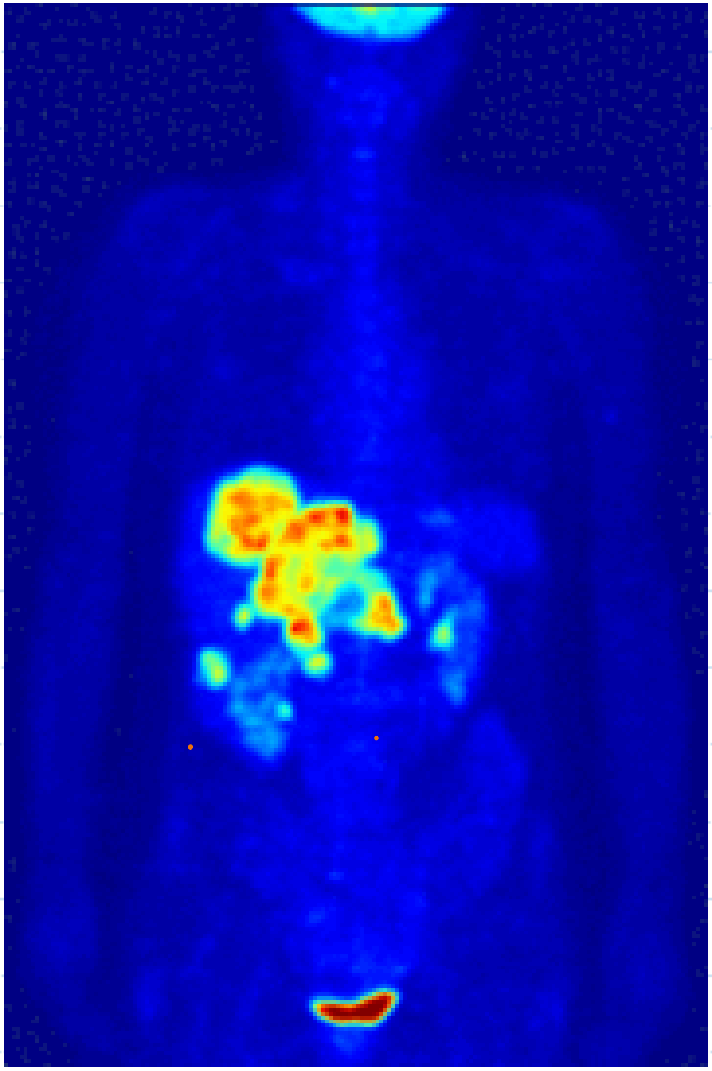
$$^{18}_{9}F \rightarrow ^{0}_{+1}e + ^{18}_{8}O + \gamma \text{ Rays}$$

Used in PET

↳ Positron emission tomography

9.3 What Happens When a Nucleus Emits Radioactivity

D – Positron Emission ($^{0}_{+1}e$) – Positron emission tomography



Short lived

$^{11}_{6}C$: ~ 20 minutes

$^{13}_{7}N$: ~ 10 minutes

$^{15}_{8}O$: ~ 2 minutes

$^{18}_{9}F$: ~ 110 minutes


MAVIC
880
Discovery

Calcium hydroxide is standardized by titration with 0.320 M solution of nitric acid. If 38.5 mL of base are required to neutralize 23.4 mL of acid, what is the molarity of the calcium hydroxide solution?

$$Ca(OH)_2(aq) + 2\,HNO_3(aq) = Ca(NO_3)_2 + 2\,H_2O(l)$$

$Ca(OH)_2$: 38.5 mL, M = ?

HNO_3: 0.320 M, 23.4 mL

$$M = \frac{\#\,mol}{V(L)} \quad ; \quad \#mol = M \times V(L)$$

$$\#mol\ HNO_3 = 0.320 \times 0.0234 = 7.49 \times 10^{-3}\ mol$$

$$7.49 \times 10^{-3}\ mol\ HNO_3 \left| \frac{1\ Ca(OH)_2}{2\ HNO_3} \right. = 3.74 \times 10^{-3}\ mol\ Ca(OH)_2$$

$Ca(OH)_2$:

$$M = \frac{\#\,mol\ Ca(OH)_2}{V(L)}$$

$$M = \frac{3.74 \times 10^{-3}}{0.0385}$$

$$= 0.0972$$

How many grams of solid barium hydroxide are needed to exactly neutralize 12.7 mL of a 1.49 M hydrochloric acid solution?
Assume that the volume remains constant.

$$\underset{?,\ g}{Ba(OH)_2\,(aq)} + \underset{\substack{12.7\ ml \\ 1.49\ M}}{2\,HCl\,(aq)} = BaCl_2 + 2\,H_2O\,(l)$$

$\#\ mol\ HCl = 1.49 \times 0.0127 = 1.89 \times 10^{-2}\ mol$

$1.89 \times 10^{-2}\ mol\ HCl \left| \frac{1\ Ba(OH)_2}{2\ HCl} \right. = 9.46 \times 10^{-3}\ mol\ Ba(OH)_2$

$Ba(OH)_2$: $137.33 + 2(16.00 + 1.01)$

$171.35\ g.mol^{-1}$ ..... $\frac{171.35\ g}{1\ mol}$

$9.46 \times 10^{-3}\ mol\ Ba(OH)_2 \left| \frac{171.35\ g}{1\ mol} \right. = 1.62\ g\ Ba(OH)_2$