# Announcements – Lecture XXII – Thursday, Dec 3rd

1. **Final Lab – Saturday, December 5th … 1-4pm … ISB 155/160 (A-E)**

   a) *Print lab prior to coming to lab -- use the 'Print Friendly Version' located on the top left hand side of the page – this is the version that contains the 'Data Sheet' that you will hand in upon completing the lab.*

   b) *The pre-lab quiz associated with this lab is the 'TA Evaluation' that that can be found in your Class Owls. Completing this by Friday, December 11th is equivalent to a perfect quiz score.*

2. **Third Exam – Tuesday December 8th – 1:00-2:15pm – In Class**
   **3 or 4 questions will be taken from Lab Owls 3, 4 and 5.**

3. 

**iClicker:**
*Choose any letter: A-E*

## 9.3 What Happens When a Nucleus Emits Radioactivity

### C – Alpha Emission ($^4_2He$)

$^{234}_{92}U$ undergoes radioactive decay by emitting an alpha particle. As a result of this emission the #Neutron/#Proton ratio –

a) Increases ✓ b) Decreases c) Remains the same

$$^{234}_{92}U \rightarrow {}^{4}_{2}He + {}^{230}_{90}Th + \gamma \text{ RAYS}$$

$$^{234}_{92}U : \frac{142}{92} = 1.543$$

$$^{230}_{90}Th : \frac{140}{90} = 1.556$$

# 9.3 What Happens When a Nucleus Emits Radioactivity

## C – Alpha Emission ($^4_2He$)


PROBLEM:

$$^{222}_{86}Rn \rightarrow {}^{218}_{84}Po + {}^{4}_{2}He + \gamma$$

↳ adheres to lung tissue.

$$^{218}_{84}Po \rightarrow {}^{214}_{82}Pb + {}^{4}_{2}He + \gamma$$

Solution:

a) Seal all cracks.

b) Ventilation.

# 9.3 What Happens When a Nucleus Emits Radioactivity

## C – Alpha Emission ($^4_2He$)

BBC NEWS

Last Updated: Thursday, 30 November 2006, 21:26 GMT

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### Radiation found at 12 locations

**Experts probing the death of former Russian spy Alexander Litvinenko have found traces of radioactivity at 12 locations, the home secretary has said.**

Mr Litvinenko died last week in a London hospital

Among them are two British Airways (BA) planes. A third one is awaiting checks.

Home Secretary John Reid told Parliament that two Russian aircraft, one of which is currently at Heathrow airport, were also of interest.

The Health Protection Agency said 24 people had been referred to a specialist clinic for tests.

BA is contacting 33,000 passengers from 221 flights. But Mr Reid stressed the public health risk was low.

Mr Litvinenko, an ex-KGB officer and a fierce critic of Russian President Vladimir Putin, died last week of radiation poisoning.

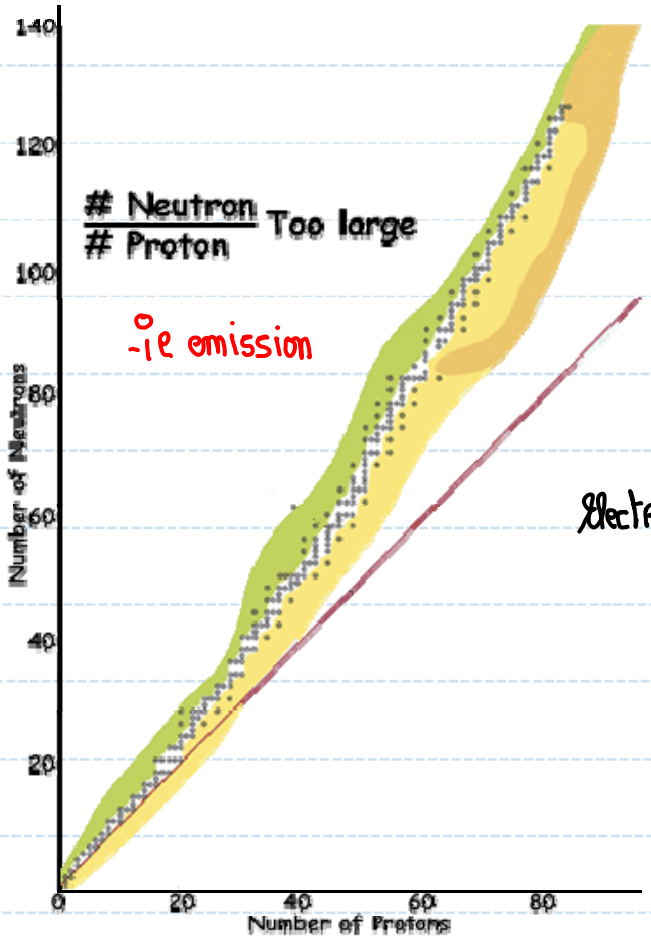
Traces of radioactive polonium-210 were discovered in his body, and more traces of the substance have been found at venues he visited in the capital on 1 November.

Earlier, an inquest into the death of Mr Litvinenko was

$^{210}_{84}Po \rightarrow {}^{4}_{2}He + {}^{206}_{82}Pb$

See class web site for some 2015 articles.

# 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 #N/#P to ↑ ✗

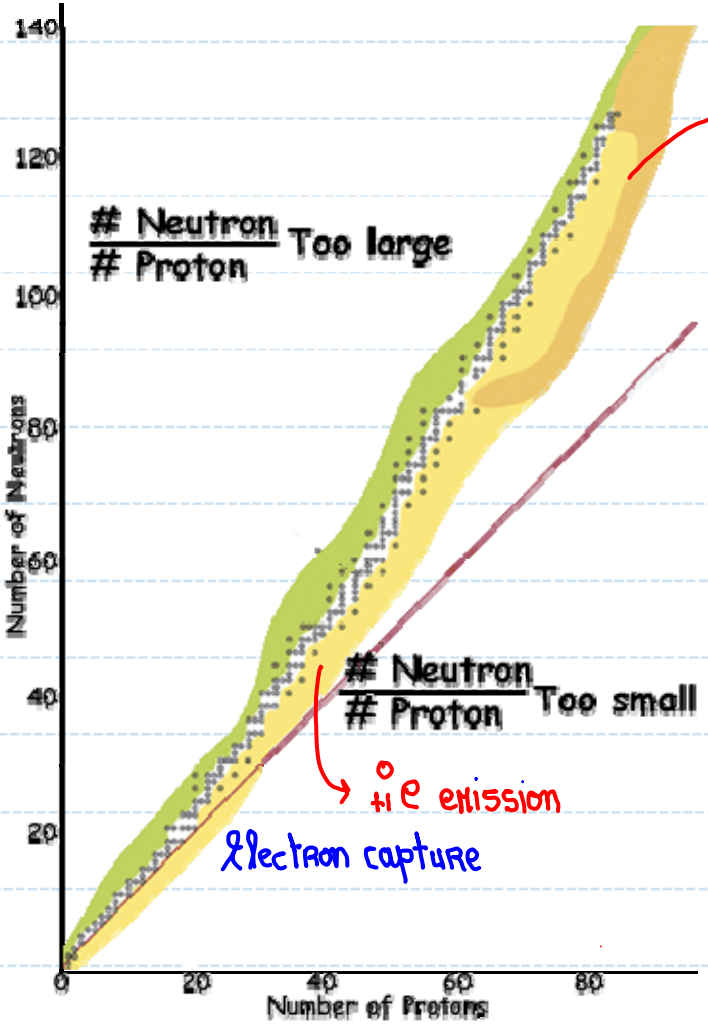
$^{0}_{+1}e$ : Proton converted to a Neutron. ✗

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




**Electron Capture:**

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

↳ Reactant.

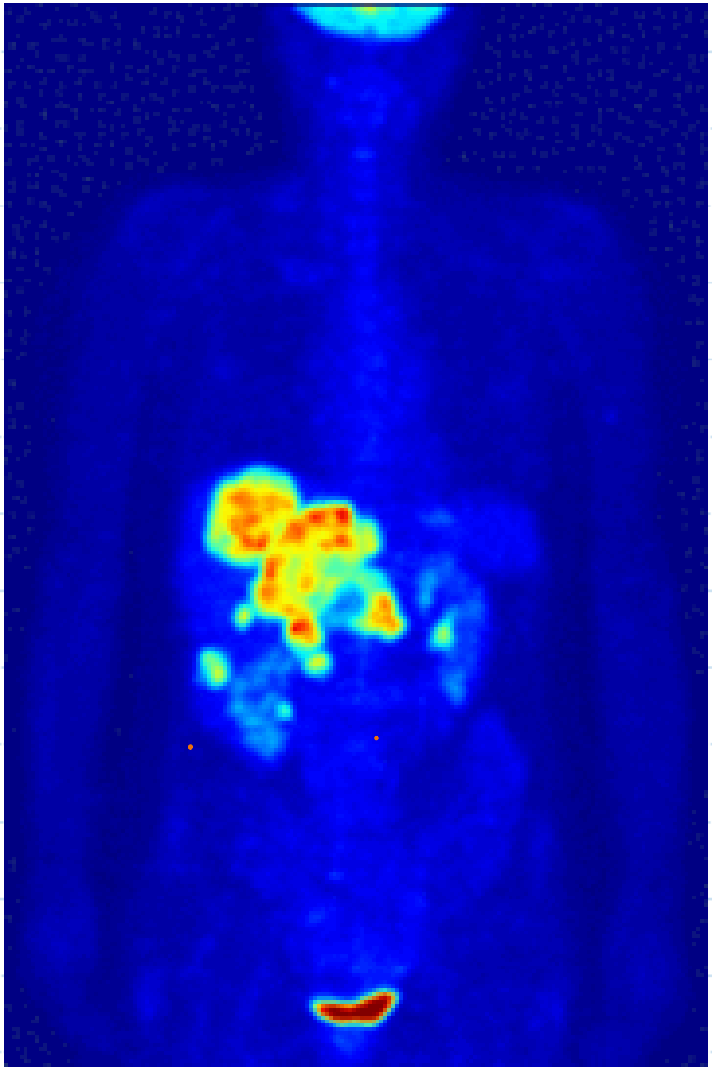
**Positron Emission:**

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

↳ 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 isotopes:

$^{11}_{6}C$ : ~ 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?**

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

38.5 mL — 0.320 M

M = ? — 23.4 mL

$$\#\text{ mol } HNO_3 = 0.320 \times 0.234 = 7.49 \times 10^{-3}\text{ mol}$$

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

$$M = \frac{3.74 \times 10^{-3}}{0.0385} = 0.0972$$