Announcements – Lecture XXII – Tuesday, Nov 26th

1. Exam III – Tuesday, December 3rd – In Class – 12:45-2:15 pm
   3 or 4 questions will be taken from Lab Owls 3, 4 and 5.
   Sunday, December 1st – Review , 3:00-5:00pm – ISB 135

2. Final Exam – Tuesday, December 10th – Marcus 131 – 8:00-10:00 am
   Sunday, December 8th – Review , 3:00-5:00pm – ISB 135

3. 

   iClicker:
   Choose any letter: A-E

9.3 What Happens When a Nucleus Emits Radioactivity

C – Alpha Emission (^4_2He)

Because of the short range of absorption, alphas are not, in general, dangerous to life. Large enough doses can cause any or all of the symptoms of radiation poisoning. It is estimated that chromosome damage from alpha particles is anywhere from 10 to 1000 times greater than that caused by an equivalent amount of gamma or beta radiation.

From Wikipedia

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

Why is this so dangerous?

9.3 What Happens When a Nucleus Emits Radioactivity

C – Alpha Emission (^4_2He)

BBC NEWS

Watch One-Minute World News

News Front Page

Africa
Americas
Asia-Pacific
Europe
Middle East
South Asia
UK
England
Northern Ireland
Scotland
Wales
UK Politics
Education
Magazine
Business
Health
Science & Environment
Technology
Entertainment
Also in the news

Video and Audio

Programmes
Have Your Say

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

E-mail this to a friend Printable version

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.

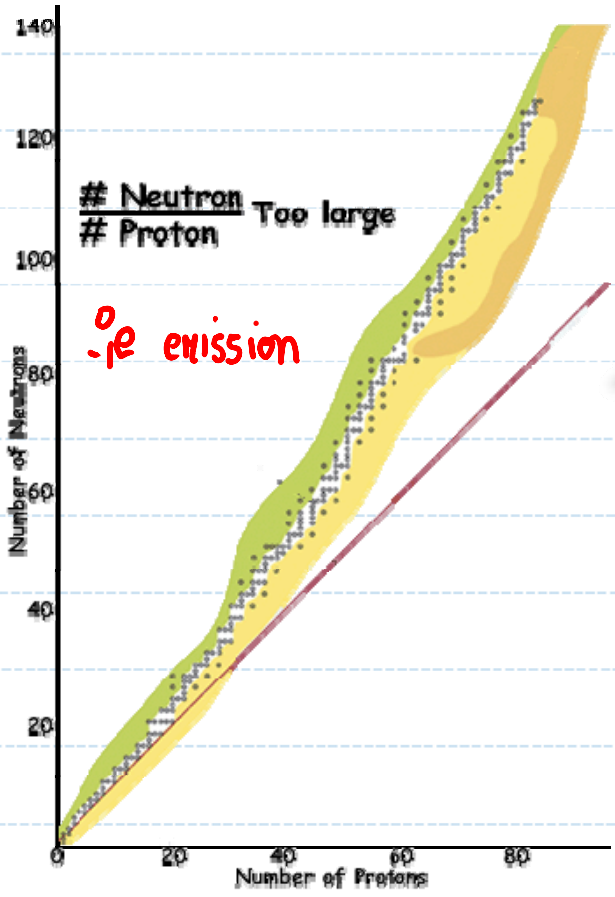
Traces of radioactive polonium-210 were discovered in his body, and more traces of the substance have been found at venues he visited in the capital on 1 November.

HAVE YOUR SAY

"I work in the one of the office buildings where polonium-210 has been detected, and we have had no assistance at all from the authorities..."

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

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 ✗

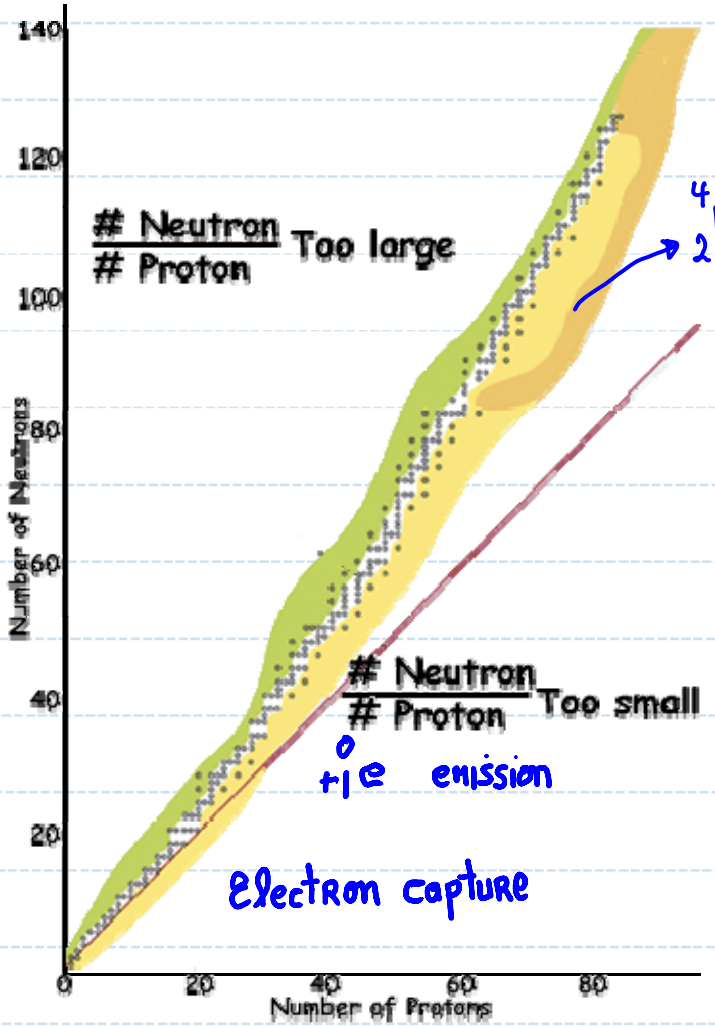
Electron capture : Proton converted to a Neutron ✗

$^{0}_{-1}e$: 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

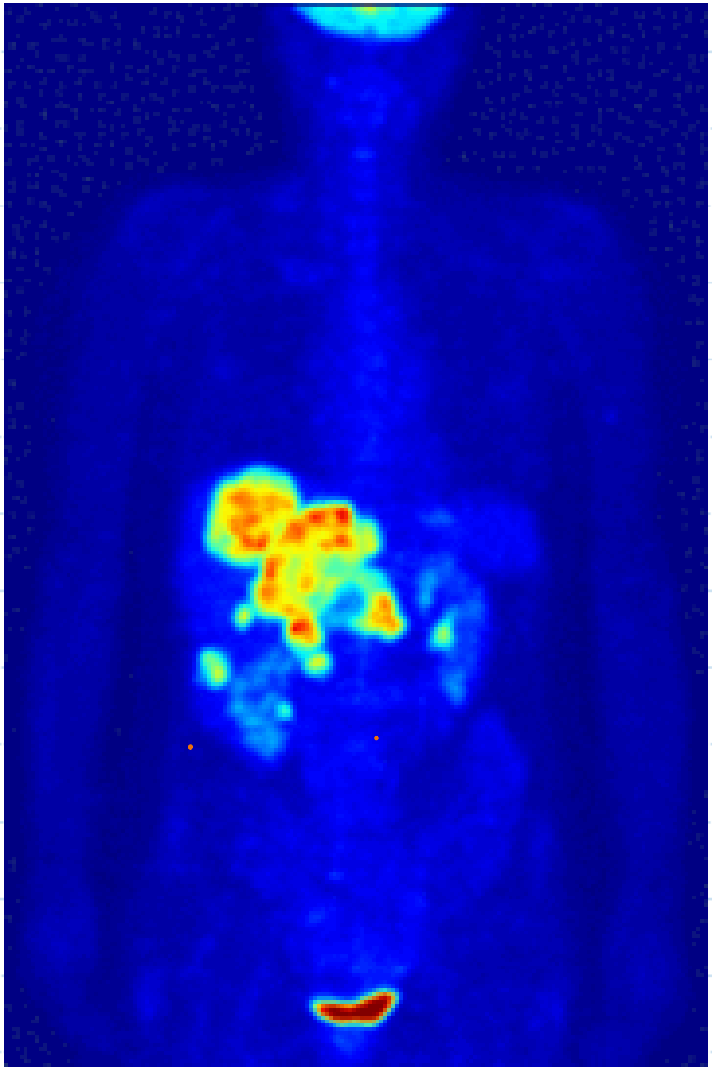
$$^{18}_{9}F \rightarrow ^{0}_{+1}e + ^{18}_{8}O + \gamma \text{ Rays}$$

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

What volume of a 0.286 M solution of K_2CO_3 contains the same number of moles of K_2CO_3 as there are in 36.9 mL of a 0.155 M solution of K_2CO_3?

0.02 V(L)

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

$$\#\,mol\ K_2CO_3 = 0.155 \times 0.0369 = 5.72 \times 10^{-3}\ mol\ K_2CO_3$$

$$\#\,mol\ K_2CO_3 = M \times V(L)$$

$$5.72 \times 10^{-3} = 0.286 \times V(L)$$

$$V(L) = \frac{5.72 \times 10^{-3}}{0.286} = 0.02$$

In the laboratory you **dilute** 4.00 mL *of a concentrated* 3.00 M **hydriodic acid** *solution to a total volume of* 150 mL. *What is the* **concentration** *of the* **dilute solution** ?

0.08 M

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

$$\#\,mol\ HI = 3.00 \times 0.004 = 1.20 \times 10^{-2}\ mol\ HI$$

$$M = \frac{\#\,mol\ HI}{V(L)} = \frac{1.20 \times 10^{-2}}{0.150} = 0.08M$$

$BaBr_2$

How many **milliliters** of an aqueous solution of **0.134 M** barium bromide is needed to obtain **4.00 grams** of the salt ?

Ba : 137.33 Br : 79.90

100

?00 mL

$$M = \frac{\#\,mol}{V(L)} \qquad \#\,mol = \frac{\#g}{MM}$$

$BaBr_2$: $137.33 + 2(79.90) = 297.13\ g.mol^{-1}$ ... $\frac{297.13\ g}{1\ mol}$

$$\#\,mol\ BaBr_2 = \frac{4.00g \mid 1\ mol}{297.13g} = 1.35 \times 10^{-2}\ mol\ BaBr_2$$

$$\#\,mol = M \times V(L)$$

$$1.35 \times 10^{-2} = 0.134 \times V(L)$$

$$V(L) = \frac{1.35 \times 10^{-2}}{0.134} = \frac{0.100\ L \mid 1000\ mL}{1\ L} = 100\ mL$$