

تم تحميل هذا الملف من موقع المناهج الإماراتية



almanahj.com

موقع  
المناهج الإماراتية

\*للحصول على أوراق عمل لجميع الصفوف وجميع المواد اضغط هنا

<https://almanahj.com/ae>

\* للحصول على أوراق عمل لجميع مواد الصف الثاني عشر العام اضغط هنا [12/ae/com.almanahj//:https](https://almanahj.com/ae/12)

\* للحصول على جميع أوراق الصف الثاني عشر العام في مادة كيمياء ولجميع الفصول, اضغط هنا

<https://almanahj.com/ae/12chemistry>

\* للحصول على أوراق عمل لجميع مواد الصف الثاني عشر العام في مادة كيمياء الخاصة بـ الفصل الأول اضغط هنا

<https://almanahj.com/ae/12chemistry1>

\* لتحميل كتب جميع المواد في جميع الفصول للـ الصف الثاني عشر العام اضغط هنا [grade12/ae/com.almanahj//:https](https://almanahj.com/ae/grade12)

للتحدث إلى بوت المناهج على تلغرام: اضغط هنا [bot\\_almanahj/me.t//:https](https://t.me/bot_almanahj)

# \*Types of radioactive Decay

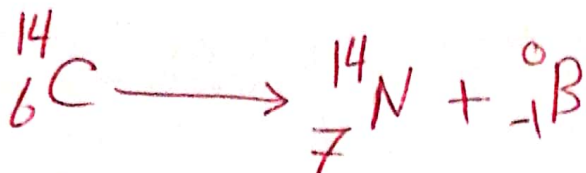
## Notes

- 1] Atoms lying above the band of stability generally have too many neutrons to be stable.
- 2] atoms lying below the band of stability tend to have too many protons to be stable.
- 3] The goal of radioactive decay is to convert unstable nuclei into stable nuclei.

## ♥ Beta decay

- \* A radioisotope that lies above the band of stability is unstable?
- ↳ Because it has too many neutrons relative to its number of protons.
- Beta decay increases the number of protons in the nucleus.
- Beta decay increases the stability of a neutron-rich atom by lowering the ratio of  $n/p$
- The resulting atom is near the stability range.

## Example



n : p

8 : 6

1.33 : 1

unstable

n : p

7 : 7

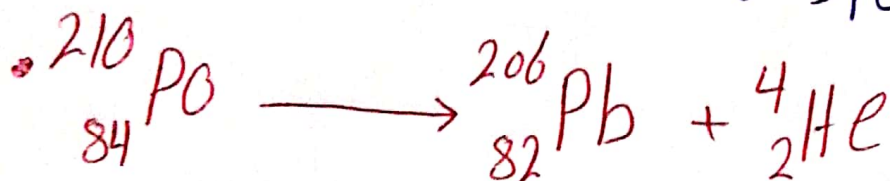
1 : 1

stable

- When beta decay occurs the atomic number increases by (1) and the mass does not change.
- Be the ratio 1:1 to become stable.

## ALPHA decay

- All nuclei with more than 82 protons are radioactive and decay spontaneously.



Polonium-210

Lead-206

ALPHA Particle

- Calculate how the neutron-to-Proton ratio changes when Polonium-210 decays into Lead-206.



## \* Positron emission \*

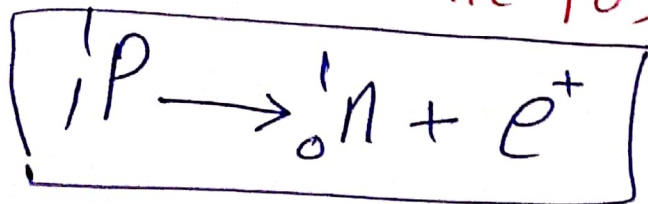
\* is a radioactive decay process that involves the emission of a positron from a nucleus.

\* **Positron** → Is a particle with the same mass as an electron but opposite charge

Symbol  $\beta^+$  or  $e^+$

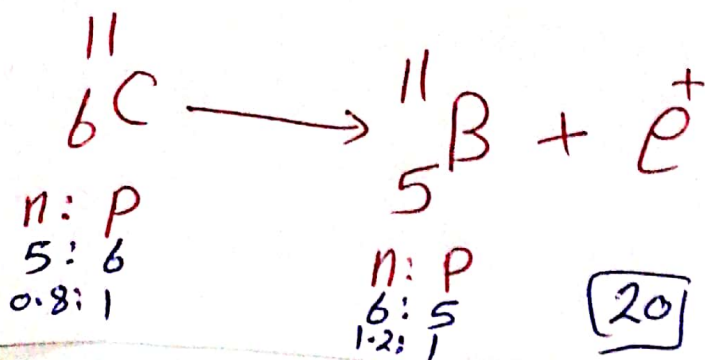
\* *يحدث في النوى ذات النسبة المنخفضة* Occurs in the nuclei of (n:p) Low

\* During positron emission, a proton in the nucleus is converted into a neutron and positron, and then the positron is emitted



\* At the emission of the positron the atomic number decreases by (1) and the mass is unchanged

Because: the proton has turned into a neutron and positron

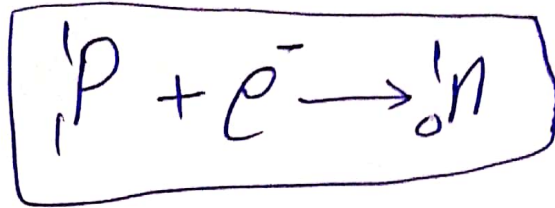


20

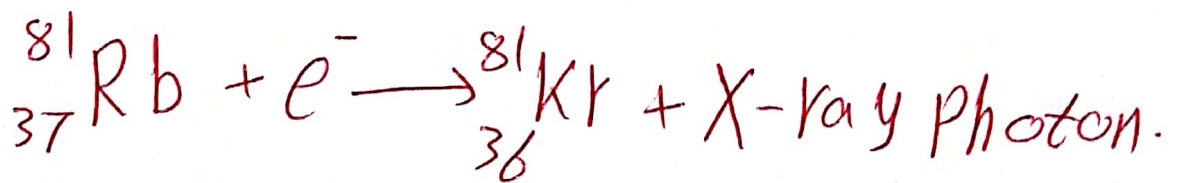
working to increase the ratio n:p

## \* Electron capture:

- It occurs when the nucleus of an atom attracts one of its surrounding electrons.
- The captured electron combines with the Proton form a neutron



- \* The atomic number of the nucleus decreases by (1) as a result of electron capture. and emits an X-ray photon.
- \* Capturing the electron occurs unstable nuclei located below the stability range.





Type of Radioactive Decay	Particle Emitted	Change in Mass Number	Change in Atomic Number
Alpha decay	${}^4_2\text{He}$	decreases by 4	decreases by 2
Beta decay	$\beta^-$ or $e^-$	no change	increases by 1
Positron emission	$\beta^+$ or $e^+$	no change	decreases by 1
Electron capture	X-ray photon	no change	decreases by 1
Gamma emission	$\gamma$	no change	no change

\* NASA uses the alpha decay of plutonium-238 ( ${}^{238}_{94}\text{Pu}$ ) as a heat source of a spacecraft

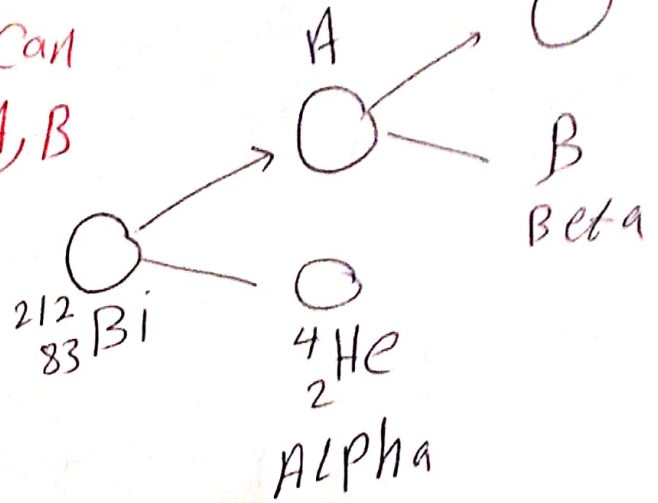
Write a balanced equation for this decay

\* Write a balanced nuclear equation for the reaction in which oxygen-15 undergoes positron emission.

\* Thorium-229 is used to increase the lifetime of fluorescent bulbs. What type of decay occurs when thorium-229 decays to form radium-225??

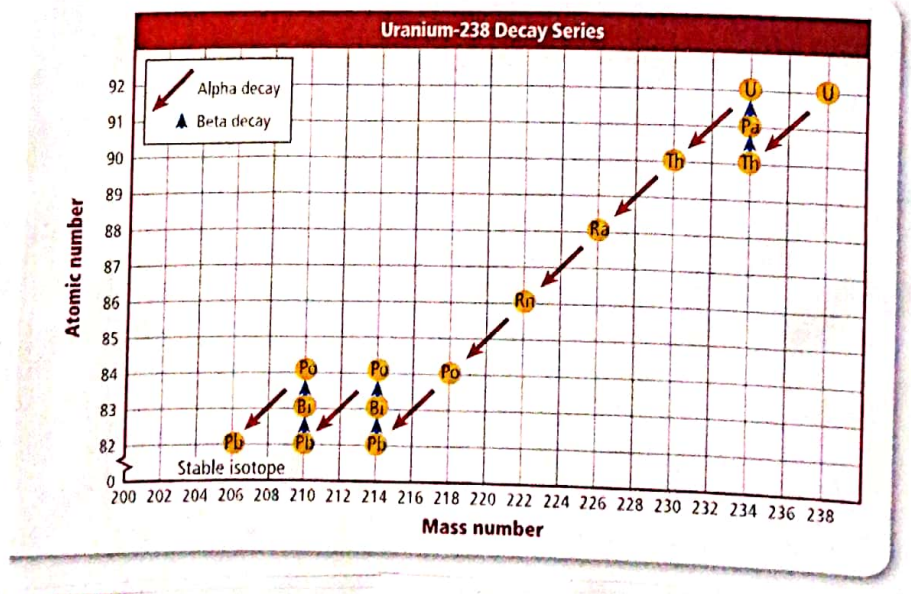
\* The figure at right shows one way that bismuth-212 can decay producing isotopes A, B

a) Write a balanced nuclear equation for this decay.



\* radio active decay series: سلسلة الانحلال الإشعاعي

- is a series of nuclear reactions that begins with an unstable nucleus and results in the formation of a stable nucleus.
- List each step in the decay of uranium-238 include the type of decay and the resulting product.





## \* half-life عمر النصف

• is the time required for one-half of radioisotope's nuclei to decay into its products

\* Use the graph to answer the following questions:

① What is the half-life period of strontium-90

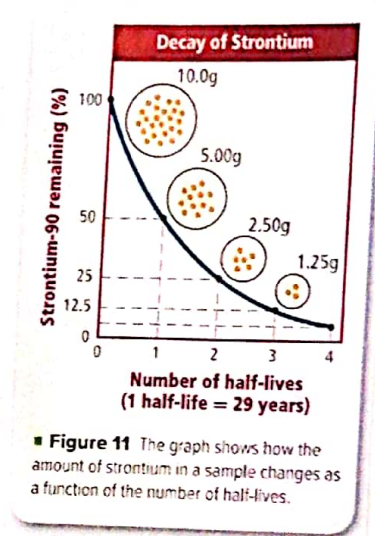
-----

② What is the mass of strontium-90 after 38 years?

-----

③ How many years need for strontium-90 to be 1.25 g?

-----



Number of Half-Lives	Elapsed Time	Amount of Strontium-90 Present
0	0 y	10.0 g
1	29 y	$10.0 \text{ g} \times \left(\frac{1}{2}\right) = 5.00 \text{ g}$
2	58 y	$10.0 \text{ g} \times \left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = 2.50 \text{ g}$
3	87 y	$10.0 \text{ g} \times \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = 1.25 \text{ g}$
4	116 y	$10.0 \text{ g} \times \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = 0.625 \text{ g}$



\* The remaining amount of radioactive element  
حساب الكمية المتبقية من العنصر اذاعي

$$N = N_0 \left(\frac{1}{2}\right)^n$$

(N) is the remaining amount  
الكمية المتبقية

(N<sub>0</sub>) is the initial amount  
الكمية الاولية  
{الابتدائية}

(n) is the number of half-lives that have passed.

$$n = \frac{t}{T}$$

(t) is the elapsed time  
الزمن المنقضي (الكلي)

(T) is the duration of the half-life  
عمر النصف

**CALCULATING THE AMOUNT OF REMAINING ISOTOPE** Krypton-85 is used in indicator lights of appliances. The half-life of krypton-85 is 11 y. How much of a 2,000-mg sample remains after 33 y?

\* يستخدم  
الكريبتون في

أضواء مؤشرات الأجهزة

$$n = \frac{t}{T} = \frac{33 \text{ y}}{11 \text{ y}} = 3$$

known

$$T = 11 \text{ y}$$

$$N = ?$$

$$N_0 = 2 \text{ mg}$$

$$t = 33 \text{ y}$$

$$N = N_0 \left(\frac{1}{2}\right)^n$$

$$N = 2 \left(\frac{1}{2}\right)^3 = 0.25 \text{ mg}$$

24

## \* Applications:

① Bandages can be sterilized by exposure to gamma radiation from Cobalt-60. which has a half-life of 5.27y. How much of a 10mg sample of Cobalt-60 is left after one half-life. Two half-life? Three half-life.

• [2] If the passing of five half-lives leaves 25mg of a strontium-90 sample. how much was present in the beginning??



# Nuclear Chemistry



وزارة التربية والتعليم  
MINISTRY OF EDUCATION

## Worksheet ( 9 )

### Half-life Period فترة عمر النصف

\* Define half-life.

\* عرف فترة عمر النصف.

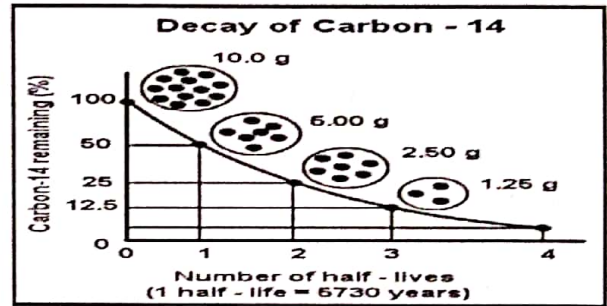
\* Use the graph to answer the following questions:

\* استخدم الرسم البياني في الإجابة عن الأسئلة:

1- What is the half-life period of carbon-14?

2- What is the mass of carbon-14 after 11460 years?

3- How many years need for carbon-14 to be 1.25 g?



\* **Solve the problem:**

A rock contains 16 kg of uranium-238, its half-life is 4.5 billion years, how many years need for the uranium mass to become 2 kg?

\* **حل المسألة:**

تحتوي صخرة على 16 جرام من اليورانيوم-238، فترة عمر النصف له 4.5 بليون سنة، كم سنة يحتاجها اليورانيوم لتصبح كتلته 2 كجم؟

\* **The remaining amount of radioactive element:**

\* **حساب الكمية المتبقية من العنصر المشع:**

$$N = N_0 \left( \frac{1}{2} \right)^n$$

N is the remaining amount

$N_0$  is the initial amount

n is the number of half-lives that have passed

\* **example:** Krypton-85 is used in indicator lights of appliance. The half-life of krypton-85 is 11 years. How much of 2.0 mg sample remains after 33 years?

\* **مثال:** يستخدم الكريبتون-85 في المؤشر الضوئي لأحد الأجهزة. فترة عمر النصف للكريبتون-85 هي 11 عام. ما الكمية المتبقية من العينة بعد مرور 33 عام

\* **Radiochemical dating:** The process of determining the age of an object by measuring the amount of a certain radioisotope remaining in that object

**التأريخ بالنشاط الإشعاعي الكيميائي،**  
\* **التأريخ بالنظائر المشعة:** عملية يتم من خلالها تعيين عمر جسم عن طريق قياس كمية النظير المشع المتبقي في الجسم

\* What is the isotope used in measuring the age of living organism remains in rocks?

\* ما هو النظير المستخدم في تعيين عمر بقايا الكائن الحي في الصخور؟

\* Calculate the neutron-to-proton ratio for each atom.

Ⓐ tin-134 القصدير

Ⓑ silver-107 (Ag) الفضة

Ⓒ carbon-12 كربون

Ⓓ carbon-14 كربون

\* Complete the following equations

