

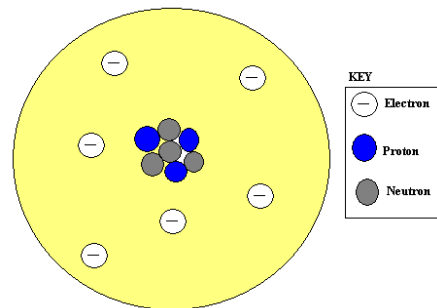
Radioactivity

Radioactivity happens due to the unstable nuclei going to a process of decaying to form more stable nuclei. The decaying process happens with emissions of certain radiation **Radioaktiviti berlaku kerana nukleus mengalami proses pereputan untuk membentuk nukleus yang lebih stabil.**

Atom

Atom is the smallest unit of element that retains chemical properties of that element. An atom has 3 constituents namely protons, electrons and neutrons. Look at the figure below

Atom adalah unit unsur yang terkecil. Satu atom mempunyai 3 konstituent iaitu proton, elektron dan neutron. Lihat gambar di bawah



Model of an Atom

Describe the Event and the Discovery of Radioactive

| Year | Discovery |
|------|--|
| 1985 | Wilhelm Conrad Roentgen Accidental discovered X-Ray when he took X-ray photograph of his his wife's hand Secara tidak sengaja menemui X-Ray ketika dia mengambil gambar sinar-X dari tangan isterinya |
| 1896 | Antoine Henri Becquerel Menjumpai radioaktif menggunakan Uranium |
| 1897 | Marie and Pierre Curie Discovered radioactive Polonium and Radium Menemui polonium dan Radium radioaktif |

Question 1

What is the use of Uranium? **Apakah kegunaan Uranium?**



Radioactive Decay

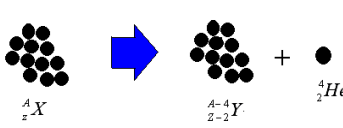
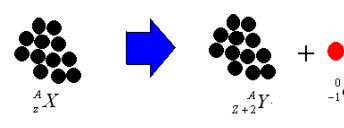
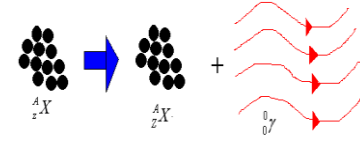
Radioactivity is a random and spontaneous decay process of an unstable nucleus by emitting radioactive radiation. **Radioaktiviti adalah proses pereputan secara rawak dan spontan dimana nukleus yang tidak stabil memancarkan bahan/sinaran radioaktif.**



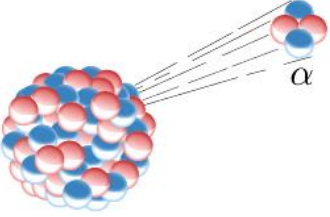
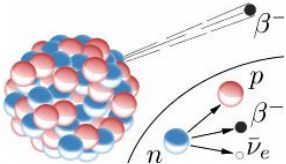
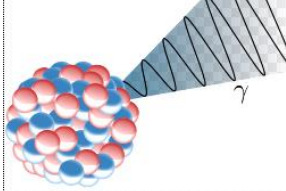
Radiation symbol / signboard

The most common are the 3 below which will be covered in

- a) alpha particles (α)
- b) beta particles (β)
- c) gamma rays (γ)

| alpha particles (α) | beta particles (β) | gamma rays (γ) |
|---|---|--|
| ${}^A_ZX \rightarrow {}^{A-4}_{Z-2}Y + {}^4_2He$ <p>Parent nucleus undergo alpha decay to form daughter nucleus</p>  <p>Charge: +2e Speed <i>kealjuaan</i>: $3 \times 10^7 \text{ ms}^{-1}$</p> <p>Same Kinetic Energy</p> <p>Ionizing Power: Strongest (Due to the slow speed, it is easier to ionize neighboring molecules) (Kerana <i>kealjuaan</i> perlahan, lebih mudah mengionkan molekul)</p> | ${}^A_ZX \rightarrow {}^A_{Z+1}Y + {}^0_{-1}e$ <p>Parent nucleus undergo beta decay to form daughter nucleus</p>  <p>During this process a neutron breaks up to form proton and a electron. There is no change in the mass. Proton stays in the nucleus and the electron is emitted as beta particle</p> <p>Charge: -1e Speed <i>kealjuaan</i>: $2.7 \times 10^8 \text{ ms}^{-1}$</p> <p>Different Kinetic Energy</p> <p>Ionizing Power: Weaker (Due to the fast speed, it is harder to ionize neighboring molecules) (Kerana <i>kealjuaan</i> sederhana perlahan, lebih sukar mengionkan molekul)</p> | ${}^A_ZX \rightarrow {}^A_ZX + {}^0_0\gamma$  <p>During the process the gamma energy is released as a form of electromagnetic waves</p> <p>Charge: NIL Speed <i>kealjuaan</i>: $3 \times 10^8 \text{ ms}^{-1}$</p> <p>Different Kinetic Energy</p> <p>Ionizing Power: Weakest (No Charge and travels speed of light. Very hard to ionized neighboring molecules) (Sukar mengion disebabkan <i>kealjuaan</i> yang cepat)</p> |



| | | |
|---|--|--|
| <p>Distance traveled: 5cm Jarak yang dilalui: 5cm</p> <p>Penetrating Power: Weakest Kuasa Penembusan: Lemah</p> <p>Deflection to Electric Field and Magnetic Field: Small Pemesongan Medan Elektrik dan Medan Magnetic : Lemah</p> <p>Absorb: Paper Tidak boleh menembusi kertas</p>  <p>Artist Impression of Beta Decay wikipedia.com</p> | <p>Distance traveled: Couple of meters Jarak yang dilalui: beberapa meter</p> <p>Penetrating Power: Strong Kuasa Penembusan : Kuat</p> <p>Deflection to Electric Field and Magnetic: Large Pemesongan Medan Elektrik dan Medan Magnetic : Kuat</p> <p>Absorb: Aluminum Foil Tidak boleh menembusi kertas aluminium</p>  <p>Artist Impression of Beta Decay wikipedia.com</p> | <p>Distance traveled: Hundreds of meters Jarak yang dilalui: beberapa ratusan meter</p> <p>Penetrating Power: Strongest Kuasa Penembusan: Terkuat</p> <p>Deflection to Electric Field and Magnetic Field: NIL Pemesongan Medan Elektrik dan Medan Magnetic : Tiada</p> <p>(No Charge for gamma rays) Absorb: Lead or P_b Tidak boleh menembusi Plumbum</p>  <p>Artist Impression of Gamma Decay wikipedia.com</p> |
|---|--|--|

Question 2

What is the use of Uranium? **Apakah penggunaan Uranium?**

Question 3

Why X-Ray can penetrate skin but not the bones? **Mengapakah sinaran X-Ray boleh menembusi kulit tetapi bukan tulang?**

Question 4

Does human body consist of radioactive elements? **Adakah badan manusia terdiri daripada unsur radioaktif?**



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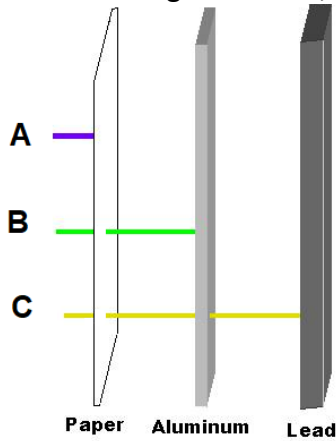
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Question 4

Given the diagram below,



Part 1

What are the radioactive particles? **Apakah zarah radioaktif itu?**

A:

B:

C:

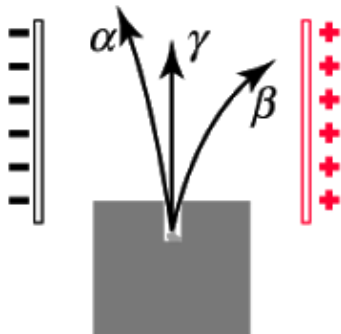
Part 2

Which particle is larger in size?

Zarah yang manakah lebih besar?

.....

Question 5



Part 1

What is the Charge for? **Berikan cas bagi?**

Alpha Particles:

Beta Particles:

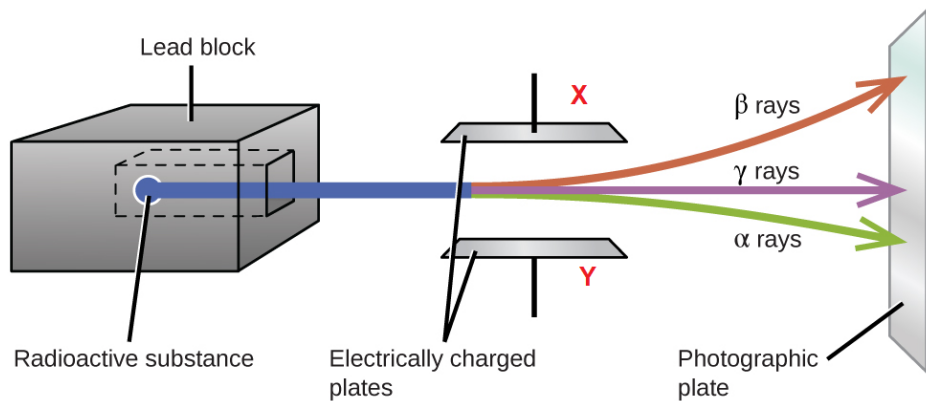
Gamma Rays:

Part 2

What is made of alpha particles? **Apa yang diperbuat daripada zarah alfa?**

.....

Question 6



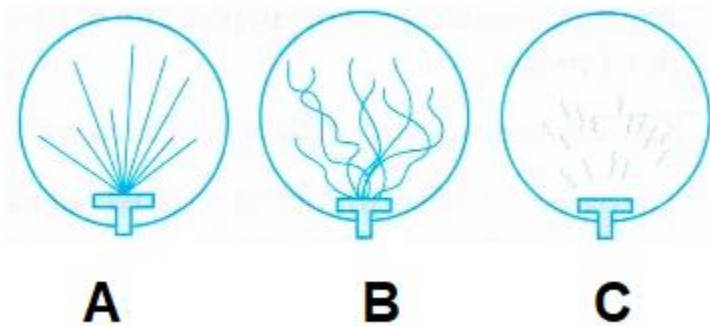
What is the Charge for the plate X and Y? Apakah caj bagi plat X dan Y?

.....

Which particles (alpha, Beta and Gamma) travels the fastest? Zarah yang mana (alpha, Beta dan Gamma) bergerak paling pantas?

.....

Question 6



The diagram above shows the Cloud Chamber. Determine the type of type of radioactive particles/energy. Rajah di atas menunjukkan pemerhatian dalam kebul asap. Tentukan jenis jenis zarah radioaktif

| TYPE | RADIOACTIVE |
|------|-------------|
| A | |
| B | |
| C | |

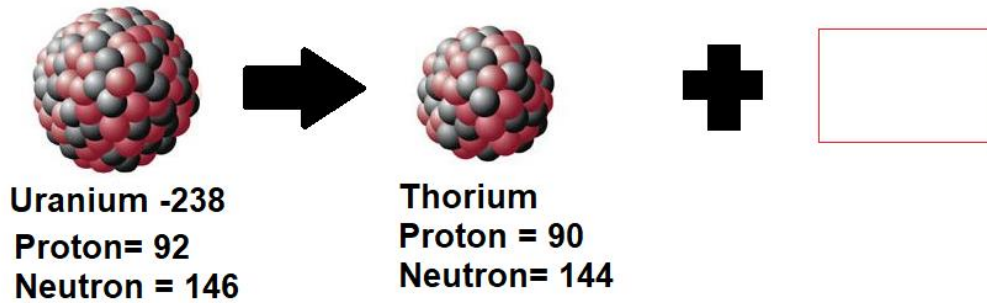
Part 2

Why does the Type C radioactive particles/energy shows very blurry lines in the cloud chamber? Mengapakah zarah / tenaga radioaktif Jenis C menunjukkan garis yang sangat kabur di ruang awan?

.....

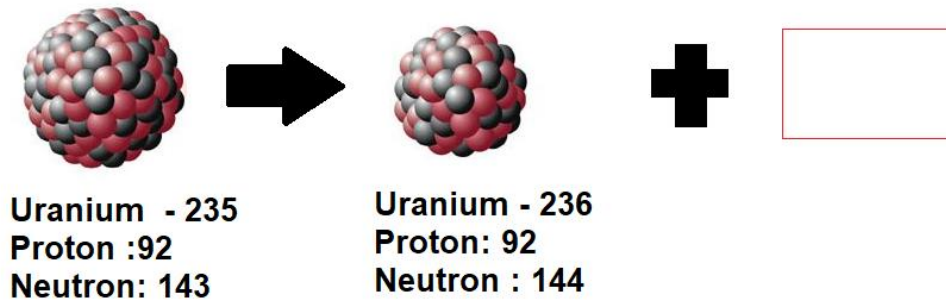
Question 7

Complete the diagram after Uranium 238 decayed. **Lengkapkan rajah setelah Uranium 238 reput.**



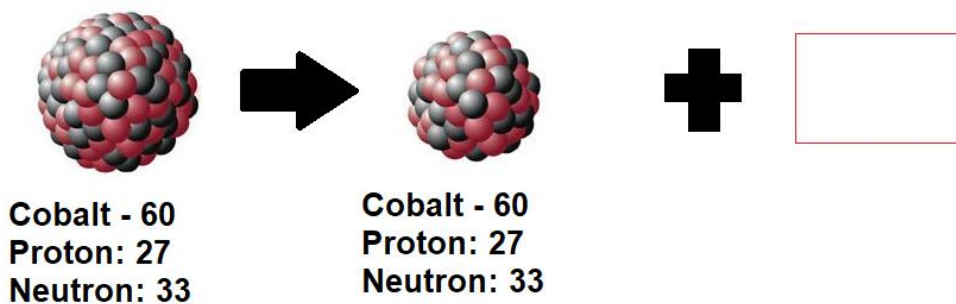
Question 8

Complete the diagram after Uranium 235 decayed. **Lengkapkan rajah setelah Uranium 235 reput.**



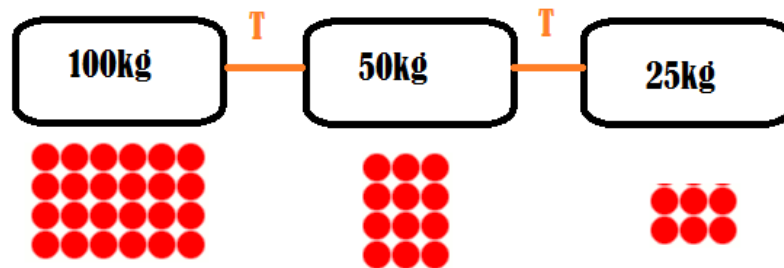
Question 8

Complete the diagram after Cobalt-60 decayed. **Lengkapkan rajah setelah Cobalt-60 reput**

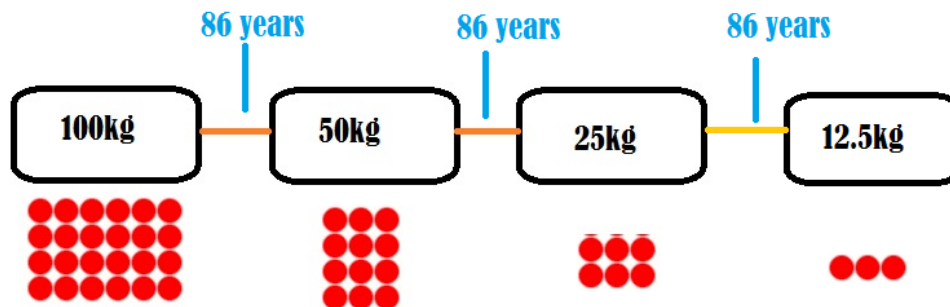


Half-life Decayed

Half Life process is a process where nucleus reduces its quantity by half for every half life. Lets take an example. **Proses Separuh Hayat ialah satu proses di mana nukleus mengurangkan kuantitinya dengan separuh bagi setiap separuh hayat.**



For every half life, the number of atoms will reduce by half. Plutonium - 238 has a half life of 86 years. If given that we have 100kg of plutonium and it undergoes decay. So after 258 years (86y + 86y + 86y) the balance of Plutonium 238 is only 12.5kg. **Untuk setiap separuh hayat, bilangan atom akan berkurang dengan separuh. Plutonium - 238 mempunyai separuh hayat 86 tahun. Sekiranya jisim plutonium ialah 100kg. Jadi selepas 258 tahun (86y + 86y + 86y) baki Plutonium 238 hanyalah 12.5kg**



Units of Radioactivity

One curie is 3.7×10^{10} decays per second, that is: $1 \text{ Ci} = 3.7 \times 10^{10} \text{ decays/s}$

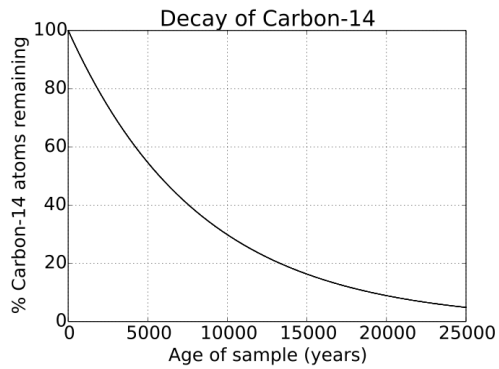
The S.I. unit of radioactivity is **becquerel (Bq)**.

1 becquerel (Bq) is 1 decay per second, that is: $1 \text{ Bq} = 1 \text{ decay/s}$



Question 9

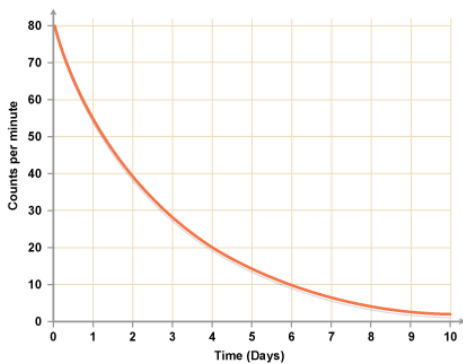
The diagram below shows the decay of Carbon 14 over the number of years. **Rajah di bawah menunjukkan pereputan Karbon 14 dalam tempoh masa tertentu.**



Estimate the half life of the Carbon- 14. **Anggarkan jangka separuh hayat bagi Karbon 14**

Question 10

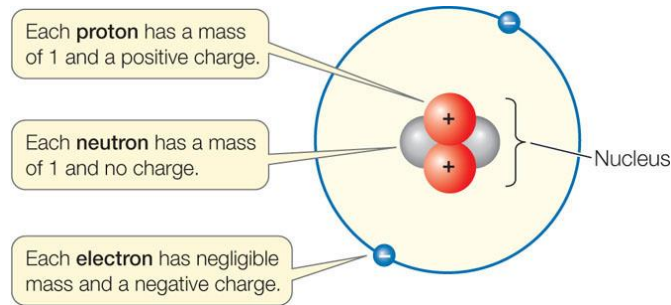
The diagram below shows the decay of Element X over the number of years. **Rajah di bawah menunjukkan pereputan unsur X dalam tempoh masa tertentu.**



Estimate the half life of element X . **Anggarkan jangka separuh hayat bagi unsur X**



Atoms



When a particle **loses electrons**, it becomes **positively charged**. When particle **gains electrons** it becomes **negatively charged**. Apabila zarah kehilangan elektron, ia akan dicaj positif. Apabila zarah memperoleh elektron, ia akan bercaj negatif.

Question 11

Complete the Chart Below . **Lengkapkan carta dibawah**

| Type | Protons | Electrons | Neutrons | Charge |
|----------|---------|-----------|----------|--------|
| P | 20 | 25 | 30 | -5 |
| Q | 21 | 24 | 32 | |
| R | 22 | 23 | 33 | |
| S | 23 | 22 | 34 | |
| T | 24 | 21 | 35 | |
| U | 25 | 20 | 36 | |
| V | 26 | 19 | 37 | |

Question 12

What is ionization radiation? **Apakah sinaran pengionan?**

.....

Question 13

Sources of ionization radiation. **Sumber sinaran pengionan ?**

| Natural Sources / Semulajadi | Man Made / Buatan Manusia |
|------------------------------|---------------------------|
| | |
| | |
| | |
| | |

Question 13

Complete the diagram below. **Lengkapkan rajah di bawah**

| Radioactive | Uses |
|--|------|
| Radioisotope Glucose Glukosa berradioisotop | |
| Sodium 24 Sodium 24 | |
| Iodine 131 Iodin 131 | |
| Plutonium 238 Plutonium 238 | |
| Gamma Radiation Sinaran Gamma | |
| Carbon 14 Karbon 14 | |

