



**Soalan Objektif**

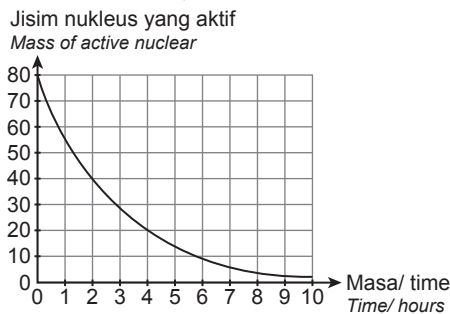
1. Aktiviti suatu sampel radioaktif hanya  $\frac{1}{8}$  daripada nilai asal selepas 2 jam. Berapakah separuh hayatnya?

*The activity of a remaining radioactive sample is only  $\frac{1}{8}$  its original value after 2 hours. What is its half-life?*

- A** 30 minit / minutes      **C** 60 minit / minutes  
**B** 40 minit / minutes      **D** 120 minit / minutes

2. Rajah 1 menunjukkan graf reputan bagi suatu nukleus yang aktif.

*Diagram 1 shows the decay graph of an active nucleus.*



Rajah 1 / Diagram 1

Berapa lama masa yang diambil oleh nukleus aktif itu untuk mereput 87.5% daripada nilai asalnya?

*How long does it take by the active nucleus to decay 87.5% of its original value?*

- A** 2 jam / hours      **C** 6 jam / hours  
**B** 4 jam / hours      **D** 8 jam / hours

3. Rajah 2 menunjukkan simbol suatu nuklid bagi suatu unsur radioaktif Teknitium-99.

*Diagram 2 shows a nuclide symbol for a radioactive element Technetium-99.*



Rajah 2 / Diagram 2

Bilangan neutron dalam unsur ialah  
*Number of neutrons in the element is*

- A** 43      **C** 99  
**B** 56      **D** 142

4. Dalam proses reputan Thorium-228, zarah- $\alpha$  dipancarkan.

*In the decay process of Thorium-228,  $\alpha$ -particle is emitted.*



Jisim Thorium-228 nukleus = 227.97929 u,  
*Mass of Thorium-228 nucleus = 227.97929 u,*

Jisim Radium-224 + zarah- $\alpha$  = 227.97340 u

*Mass of Radium-224 +  $\alpha$ -particle = 227.97340 u*

1 u =  $1.66 \times 10^{-27}$  kg, laju cahaya / speed of light,  
 $c = 3.0 \times 10^8$  m s<sup>-1</sup>

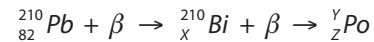
Berapakah jumlah tenaga yang dibebaskan semasa pereputan itu?

*What is the total energy released during the decay?*

- A**  $8.80 \times 10^{-13}$  J      **C**  $3.10 \times 10^{-12}$  J  
**B**  $3.98 \times 10^{-12}$  J      **D**  $5.94 \times 10^{-10}$  J

5. Rajah 2 menunjukkan proses pereputan bagi plumbum-214.

*Diagram 2 shows a decay process of lead-214.*



Rajah 2 / Diagram 2

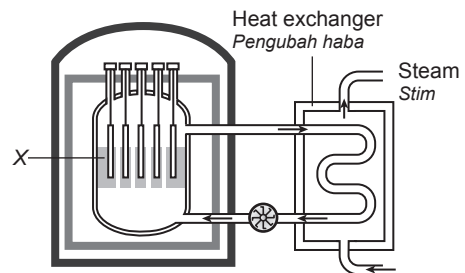
Apakah nilai X, Y dan Z?

*What are the values X, Y and Z?*

	X	Y	Z
<b>A</b>	83	210	84
<b>B</b>	84	218	86
<b>C</b>	82	214	83
<b>D</b>	83	216	83

6. Rajah 3 menunjukkan sebuah reaktor nuklear. Bahan X digunakan untuk memperlambatkan neutron semasa tindak balas rantai dalam sebuah reaktor nuklear.

*Diagram 3 shows a nuclear reactor. Material X is used to slow down the neutrons during the chain reaction in the nuclear reactor.*



Rajah 3 / Diagram 3

Apakah bahan X?

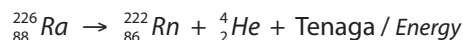
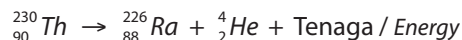
*What is material X?*

- A** Boron / Boron  
**B** Grafit / Graphite  
**C** Uranium / Uranium  
**D** Gas sejuk / Cold gas

Soalan Struktur

Bahagian A

1. Persamaan berikut menunjukkan proses pereputan radioisotop torium dan radium.  
 The following equation shows the decay process of radioisotopes of thorium and radium.



- (a) Berdasarkan persamaan di atas, lengkapkan ayat di bawah.  
 Based on the above equation, complete the sentence below.

Dalam pereputan alfa, nombor nukleon berkurang sebanyak \_\_\_\_\_ dan nombor proton berkurang sebanyak \_\_\_\_\_.

In alpha decay, the nucleon number decreases by \_\_\_\_\_ and the proton number decreases by \_\_\_\_\_.

[2 markah / marks]

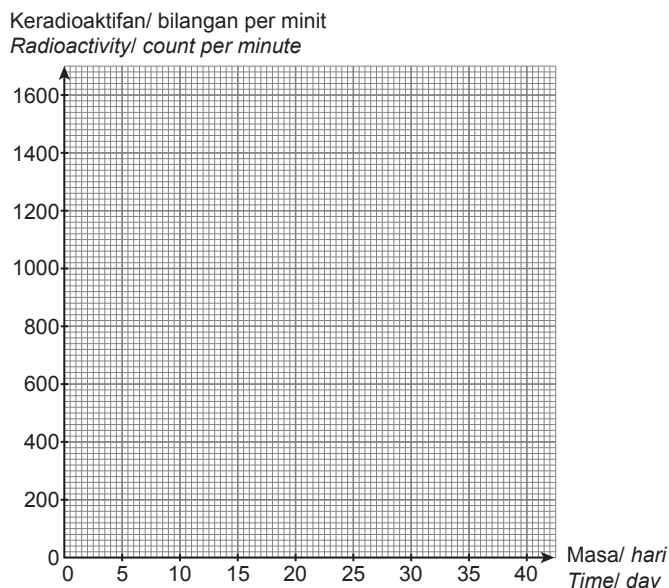
- (b) Suatu kawasan rumput telah dicemari dengan sisa radioaktif dari sebuah reaktor nuklear. Seorang penyelidik menjalankan kajian mengenai kandungan radioaktif dalam susu yang dikumpulkan dari lembu di kawasan itu. Dia mendapati bahawa kandungan radioaktif dalam setiap liter susu adalah 1600 bilangan per minut. Penyelidik terus mengukur radioaktif dalam susu dari kawasan itu dalam selang masa 10 hari. Hasil kajian ditunjukkan dalam Jadual.

A grazing pasture was polluted with radioactive waste from a nuclear reactor. A researcher carried out a study on the radioactive content in the milk collected from the cows in that area. He discovered the radioactive content in every liter of the milk was 1600 counts per minute. The researcher continued to measure the radioactive in the milk from that area in 10 days intervals. The results of the study are shown in Table.

Masa / Time (Hari / Day)	0	10	20	30	40
Keradioaktifan / Radioactivity (Bilangan per minut / Counts per minute)	1600	600	240	100	40

- (i) Pada kertas graf di bawah, lukiskan graf keradioaktifan melawan masa.  
 On the graph paper below, draw a graph of radioactivity against time.

[2 markah / marks]



- (ii) Dengan menggunakan graf di (b) (i), tentukan separuh hayat bahan radioaktif dalam susu. Tunjukkan pada graf bagaimana anda menentukan separuh hayat.  
*Using the graph in (d)(i), determine the half-life of the radioactive material in the milk. Show on the graph how you determined the half-life.*

[2 markah / marks]

- (iii) Susu adalah selamat diminum sekiranya keradioaktifan dalam setiap liter susu tidak melebihi 50 bilangan seminit. Dengan menggunakan nilai separuh hayat di (b) (ii), hitungkan masa ketika susu dari kawasan ini menjadi selamat untuk diminum.  
*Milk is safe to drink if the radioactivity in every litre of the milk is not more than 50 counts per minute. Using the half-life in (b) (ii), calculate the time when the milk from this area becomes safe to drink.*

[2 markah / marks]

2. (a) Terangkan apa yang dimaksudkan dengan  
*Explain what is meant by*

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- (i) reputan radioaktif / *the radioactive decay*

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[1 markah / mark]

- (ii) pembelahan nukleus / *nuclear fission*

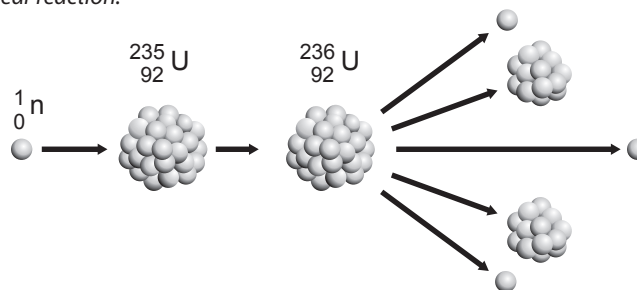
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[1 markah / mark]

- (b) Rajah 2 menunjukkan suatu jenis tindak balas nuklear.  
*Diagram 2 shows a type of nuclear reaction.*



Rajah 2 / *Diagram 2*

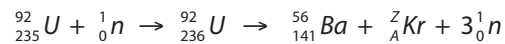
- (i) Nyatakan jenis tindak balas nuklear yang ditunjukkan dalam rajah di atas.  
*State the type of nuclear reaction that shown in the above diagram.*

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[1 markah / mark]



- (ii) Persamaan tindak balas nukleus pada rajah boleh ditulis seperti berikut.  
*The equation of the nuclear reaction at the diagram can be written as below.*



Lengkapkan persamaan dengan menentukan kuantiti A dan Z.  
*Complete the equation by determining the quantity A and Z.*

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[1 markah / mark]

- (c) Berdasarkan persamaan di atas, cacatan jisim semasa tindak balas ialah 0.18606 u.  
*Based on the equation above, the mass defect during the reaction is 0.18606 u.*  
[1 u =  $1.66 \times 10^{-27}$  kg;  $c = 3.0 \times 10^8$  m s<sup>-1</sup>]

Hitung / Calculate

- (i) cacat jisim dalam kg  
*mass defect in kg.*

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[2 markah / marks]

- (ii) energy released in the reaction  
*tenaga yang dibebaskan dalam tindak balas*

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[2 markah / marks]