Practice Question Set For GCSE
Subject : Physics
Paper-1 Topic: Atomic Structure (High Demand)

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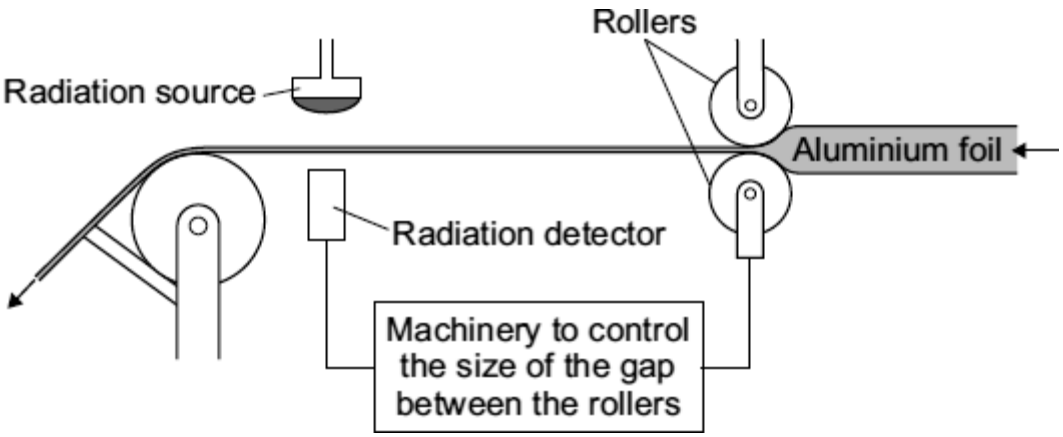
Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

The diagram shows a system used to control the thickness of aluminium foil as it is being rolled. A radiation source and detector are used to monitor the thickness of the foil.



(a) Which type of source, alpha, beta or gamma, should be used in this control system?

_____

Explain why each of the other two types of source would **not** be suitable.

_____

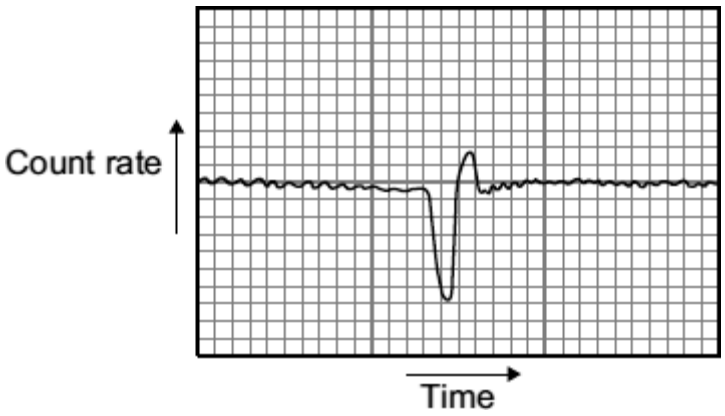
_____

_____

_____

(3)

(b) The chart shows how the count rate recorded by the detector varies over a short period of time.



Use the graph to explain how the thickness of the foil changes, and how the control system responds to this change.

_____

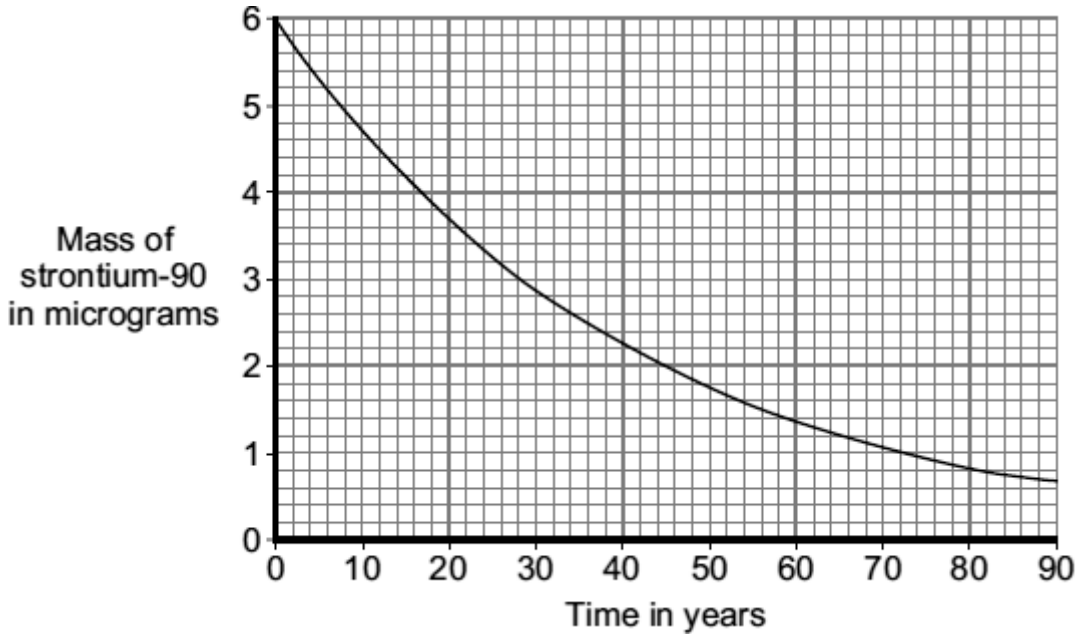
_____

_____

_____

(2)

(c) When first used, the radiation source contains 6 micrograms of strontium-90.
The graph shows how the mass of the strontium-90 will decrease as the nuclei decay.



The control system will continue to work with the same source until 75 % of the original strontium-90 nuclei have decayed.

After how many years will the source need replacing?

Show clearly your calculation and how you use the graph to obtain your answer.

_____

_____

_____

Number of years = _____

(2)

(Total 7 marks)

Q2.

(a) Carbon has three naturally occurring isotopes. The isotope, carbon-14, is radioactive.
An atom of carbon-14 decays by emitting a beta particle.

(i) Complete the following sentences.

The atoms of the three carbon isotopes are the same as each other because

_____

The atoms of the three carbon isotopes are different from each other because

_____

(2)

(ii) What is a beta particle and from what part of an atom is it emitted?

_____

_____

(1)

(b) Carbon-14 is constantly being made in the atmosphere, yet for most of the last million years, the amount of carbon-14 in the atmosphere has not changed.

How is this possible?

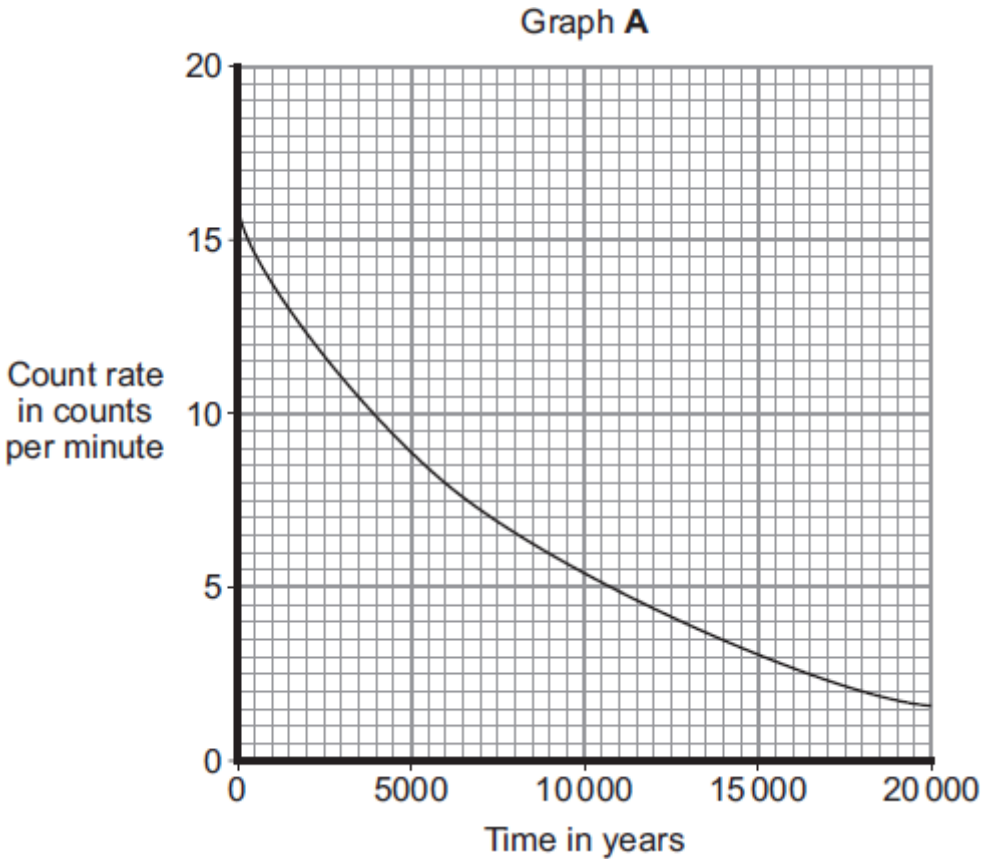
_____

_____

(1)

(c) Trees take in carbon-12 and carbon-14 from the atmosphere. After the tree dies, the proportion of carbon-14 that the tree contains decreases.

Graph **A** shows the decay curve for carbon-14.



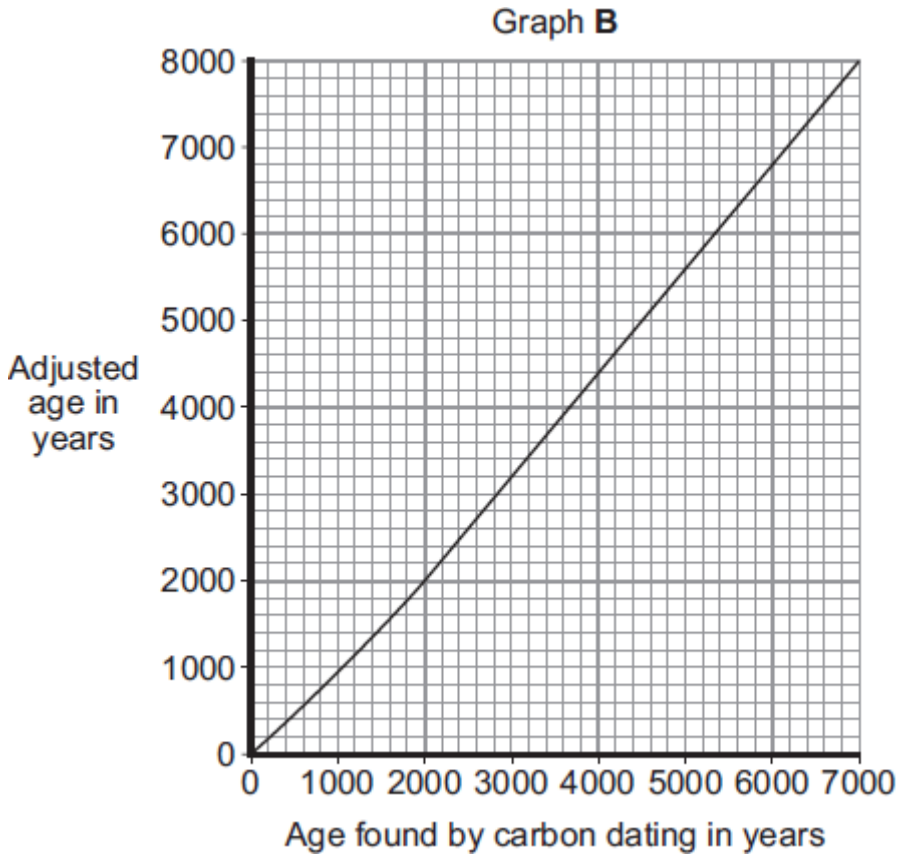
(i) Lake Cuicocha in Ecuador was formed after a volcanic eruption.
Carbon taken from a tree killed by the eruption was found to have a count rate of 10.5 counts per minute.
At the time of the eruption, the count rate would have been 16 counts per minute.

Use graph **A** to find the age of Lake Cuicocha.

Age of Lake Cuicocha = _____ years

(1)

(ii) Finding the age of organic matter by measuring the proportion of carbon-14 that it contains is called carbon dating. This technique relies on the ratio of carbon-14 to carbon-12 in the atmosphere remaining constant. However, this ratio is not constant so the age found by carbon dating needs to be adjusted.



Graph **B** is used to adjust the age of an object found by carbon dating.
The value obtained from graph **B** will be no more than 50 years different to the true age of the object.

Use graph **B** and the information above to find the maximum age that Lake Cuicocha could be.

Show clearly how you obtain your answer.

_____

_____

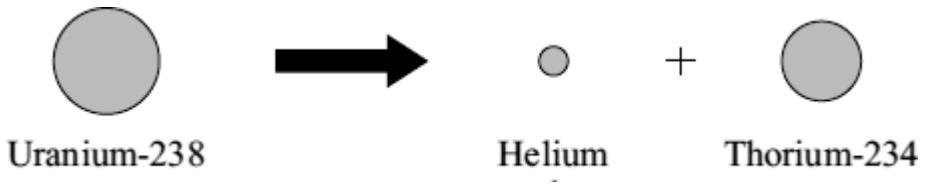
Maximum age of Lake Cuicocha = _____ years

(2)

(Total 7 marks)

Q3.

(a) Some rocks inside the Earth contain uranium-238, a radioactive isotope of uranium. When an atom of uranium-238 decays, it gives out radiation and changes into a thorium-234 atom.



(i) What type of radiation is emitted when a uranium-238 atom decays?

_____

(1)

(ii) From which part of a uranium-238 atom is the radiation emitted?

_____

(1)

(iii) Uranium-235 is another isotope of uranium.

How is an atom of uranium-235 similar to an atom of uranium-238?

_____

(1)

(b) Uranium-238 has a half-life of 4500 million years.

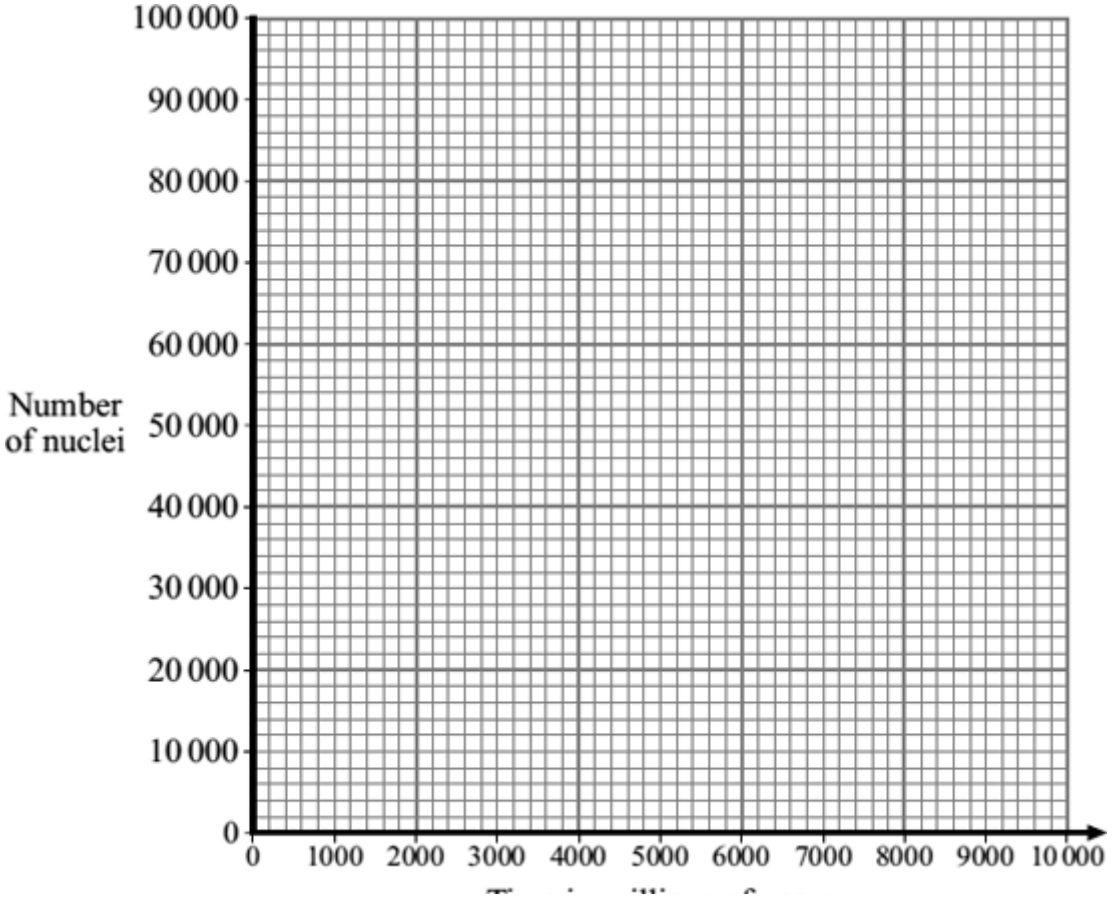
(i) When the Earth was formed, there was twice as much uranium-238 in the rocks as there is now.

What is the age of the Earth?

_____

(1)

(ii) Complete the graph to show how the number of nuclei in a sample of uranium-238 will change with time.
Initially, there were 100 000 nuclei in the sample.



(2)

(Total 6 marks)