Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 11_Nuclear Radiation

Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

Nuclear decay is described as being spontaneous and random.

(i) State what is meant by spontaneous and random in this context.

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(ii) Explain why the decay constant of an isotope can be determined even though nuclear decay is random.

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(Total for question = 4 marks)

Q2.

Radioactive decay is often described in textbooks as a spontaneous, random process.

State what is meant by spontaneous decay.

(1)

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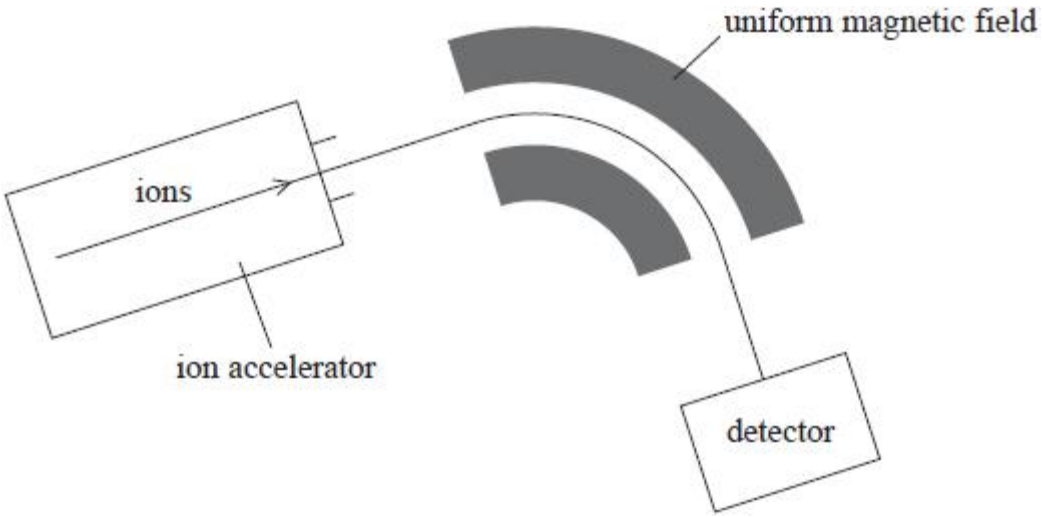
(Total for question = 1 mark)

Q3.

Mass spectrometry is a technique used to separate ions based on their charge to mass ratio.

The atoms in a sample are ionised and then accelerated and formed into a fine beam.
This beam is passed into a region of uniform magnetic field and the ions are deflected by different amounts according to their mass.



Analysis of mass spectrometer data shows that chlorine exists in nature as two isotopes, chlorine-35 and chlorine-37.

State what is meant by isotopes.

(1)

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(Total for question = 1 mark)

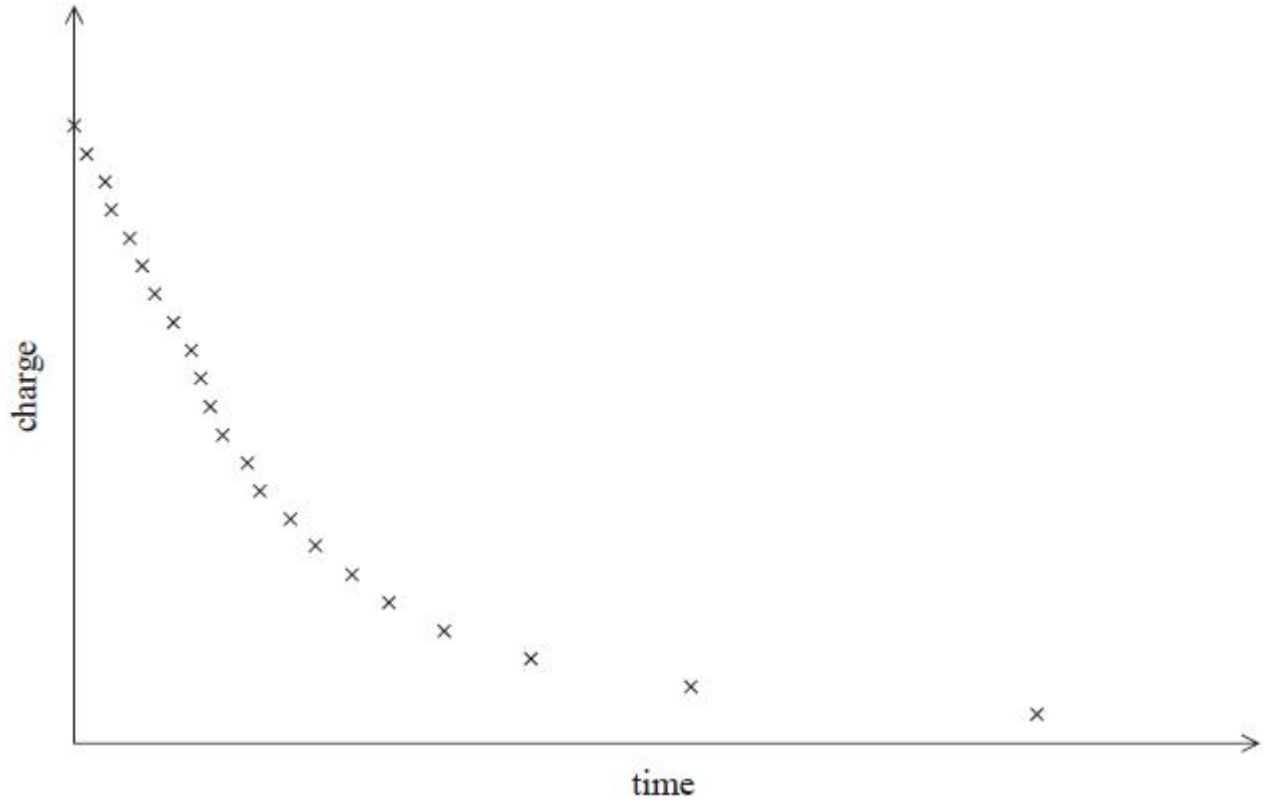
Q4.

A coulombmeter is used to measure charge.

In a laboratory demonstration of the photoelectric effect, a sheet of zinc was placed on top of a coulombmeter and the zinc was given a negative charge.

For one sheet of zinc, the charge at different times was measured.

The following graph was obtained.



A student suggests that this is an exponential decay curve.
Explain how this suggestion could be tested.

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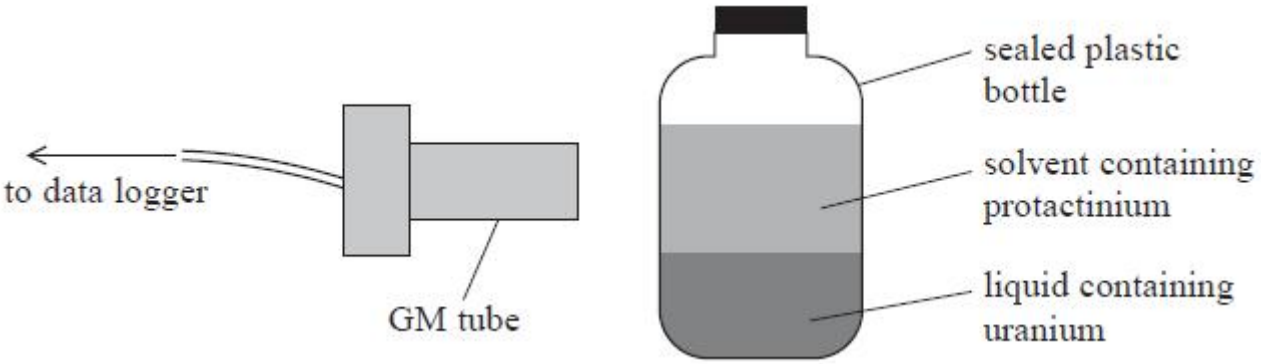
(Total for question = 3 marks)

Q5.

A teacher demonstrated the decay of protactinium using a Geiger-Müller (GM) tube connected to a data logger.

A sealed plastic bottle contains a solvent floating above a liquid containing a uranium salt. Protactinium is produced from the decay of uranium and is present in the solvent as shown.



Deduce whether alpha radiation or beta radiation from the inside of the bottle is detected by the GM tube.

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(Total for question = 2 marks)

Q6.

A fusion research centre was opened in Rotherham in 2021. The centre has a device which tests materials in the extreme conditions found inside a fusion reactor.

Describe the extreme conditions inside a fusion reactor.

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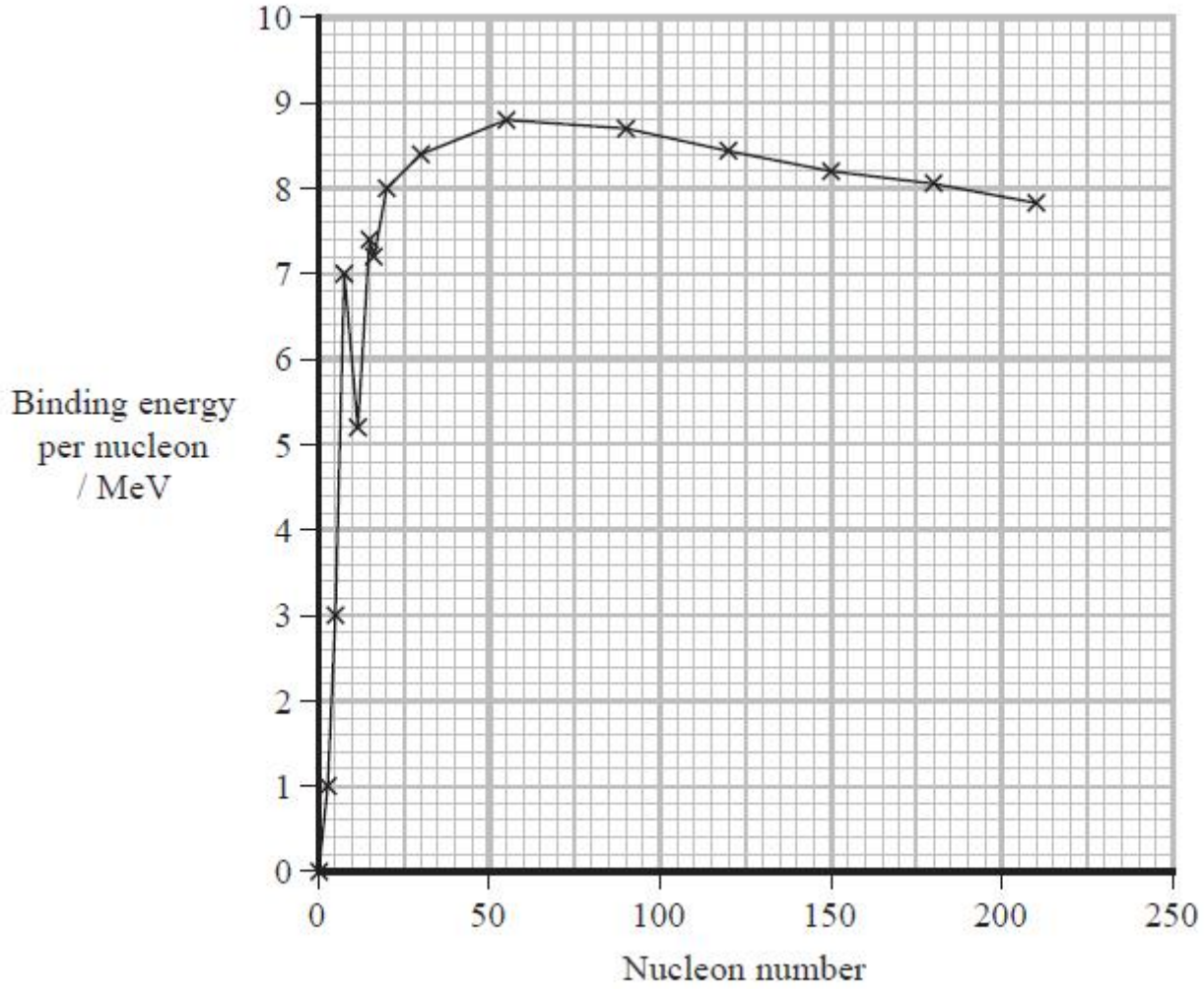
(Total for question = 3 marks)

Q7.

A fusion research centre was opened in Rotherham in 2021. The centre has a device which tests materials in the extreme conditions found inside a fusion reactor.

The graph shows how the binding energy per nucleon varies with nucleon number for a range of nuclides.



Explain why the fusion of nuclei can produce large amounts of energy. Your answer should refer to information from the graph.

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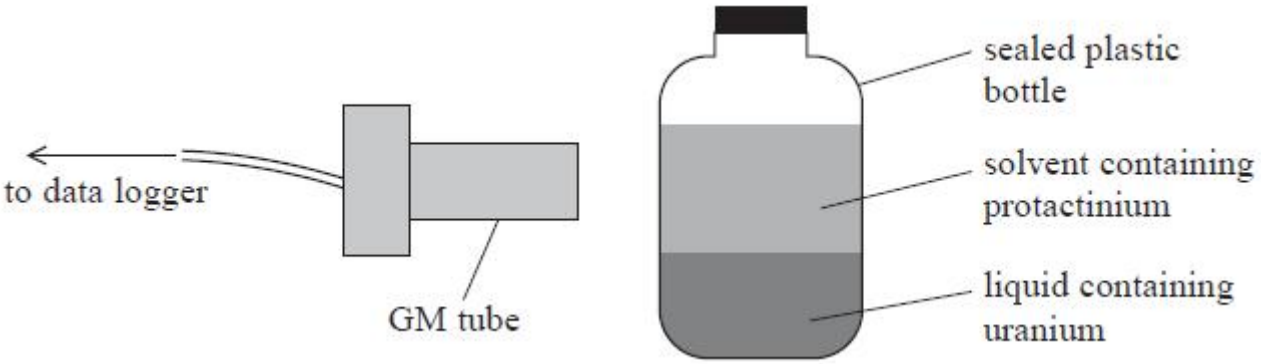
(Total for question = 3 marks)

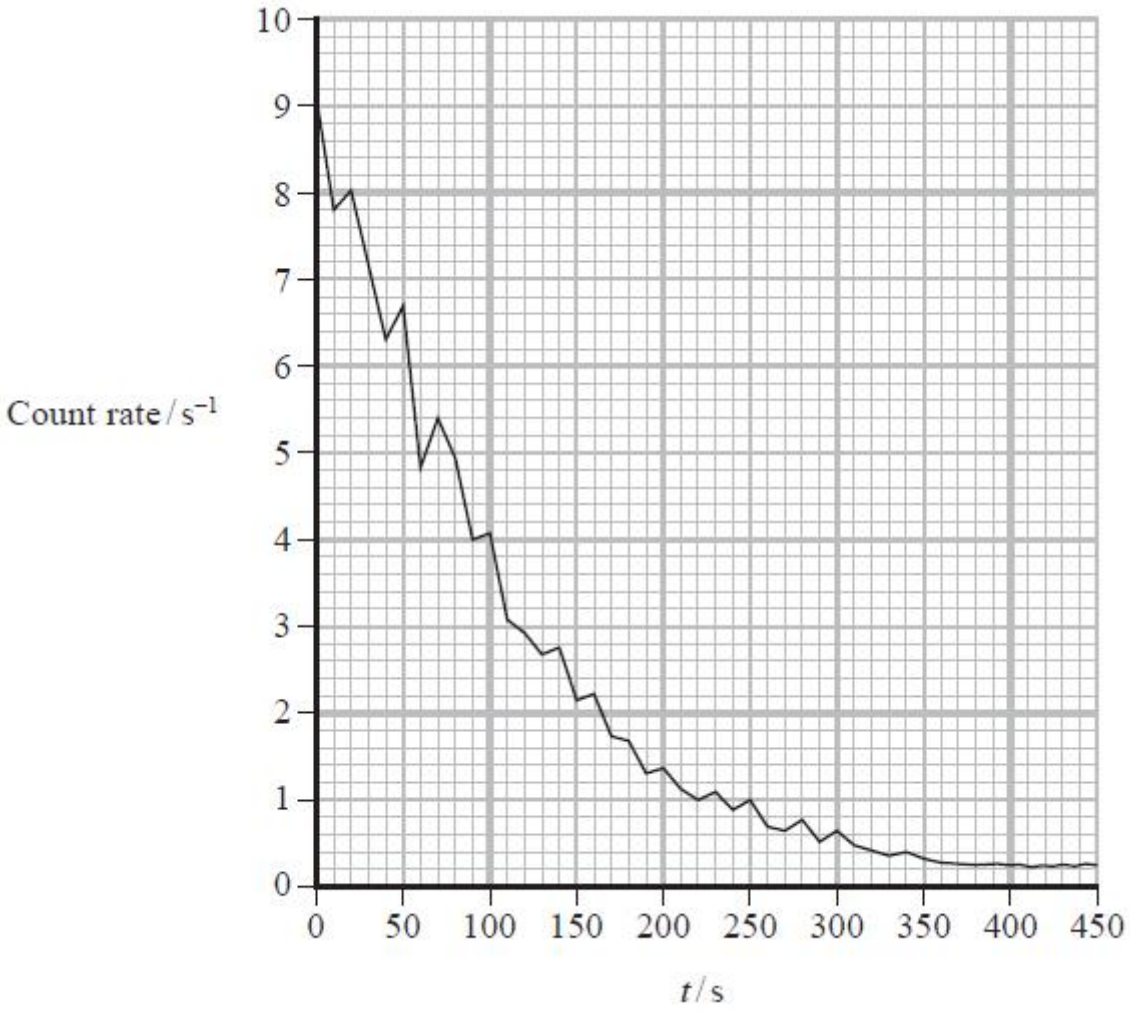
Q8.

A teacher demonstrated the decay of protactinium using a Geiger-Müller (GM) tube connected to a data logger.

A sealed plastic bottle contains a solvent floating above a liquid containing a uranium salt. Protactinium is produced from the decay of uranium and is present in the solvent as shown.



The data logger output is shown below.



(i) Determine the half-life of the protactinium.

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Half-life of protactinium = ...

(ii) Explain why the count rate doesn't reach zero.

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(Total for question = 6 marks)