

Topic C.7C Half-life (HL)

Past Exam Questions (Paper 3)

1. [1 mark]

In the 20th Century, both fission and fusion were considered as sources of energy but fusion was economically and technically unattainable.

Outline how nuclear ionising radiation can damage DNA and enzymes in living cells.

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2a. [1 mark]

The Sun's energy is produced by the fusion of hydrogen nuclei.

Nuclear energy produces ionizing radiation which leads to the formation of free radicals.

Deduce a Lewis (electron dot) structure of the superoxide, O_2^- , free radical.

2b. [2 marks]

Explain why free radicals are harmful to living cells.

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3. [2 marks]

Red supergiant stars contain carbon-12 formed by the fusion of helium-4 nuclei with beryllium-8 nuclei.

Mass of a helium-4 nucleus = 4.002602 amu

Mass of a beryllium-8 nucleus = 8.005305 amu

Mass of a carbon-12 nucleus = 12.000000 amu

Beryllium-8 is a radioactive isotope with a half-life of 6.70×10^{-17} s.

Calculate the mass of beryllium-8 remaining after 2.01×10^{-16} s from a sample initially containing 4.00 g of beryllium-8.

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4. [2 marks]

Uranium-235, ^{235}U , is bombarded with a neutron causing a fission reaction.

The daughter product, ^{89}Kr , has a half-life of 3.15 min.

Calculate the time required, in minutes, for its radioactivity to fall to 10% of its initial value, using section 1 of the data booklet.

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5. [2 marks]

This question is about nuclear reactions.

Calculate the half-life of an isotope whose mass falls from $5.0 \times 10^{-5} \text{ g}$ to $4.0 \times 10^{-5} \text{ g}$ in 31.4 s, using section 1 of the data booklet.

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