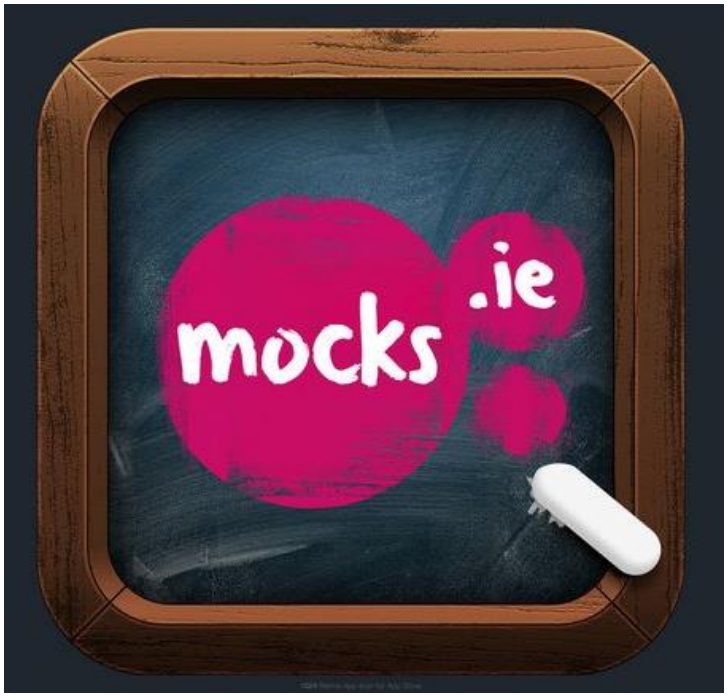

Radioactivity

Chemistry Past Exam Questions

Higher Level

2013

Section B - Question 10 C

(*c*) Caesium–137 is a radioactive isotope of the alkali metal caesium. Caesium–137 was released into the atmosphere when Japanese nuclear reactors were damaged by a tsunami in 2011. Caesium–137 decays by beta-particle emission with a half-life of 30 days.

(*i*) Define *radioactivity*. (6)

(*ii*) Give **two** differences between chemical reactions and nuclear reactions. (6)

(*iii*) Give **two** properties of beta-particles. (6)

(*iv*) A certain mass of caesium–137 leaked on a particular day. What fraction of this mass remained as caesium–137 after 90 days? (7)

2012

Section B - Question 4 B

(*b*) Write a balanced nuclear reaction for the beta particle decay of iodine-131. [See formulae and tables booklet, page 79.]

2011

Section B - Question 10 C

(*c*) What are *isotopes*? (5)

Define (*i*) *radioactivity*, (*ii*) *radioisotope*. (8)

Carbon–14 decays by beta particle emission. Write a balanced equation to describe beta-decay of the carbon–14 nucleus. (6)

The world's oldest shoe, found in a cave in Armenia, is pictured on the right. In June 2010, having been radiocarbon dated, it was reported to be 5500 years old.

Explain why the carbon–12 to carbon–14 isotope ratio in the shoe leather changed over the 5500 years since the shoe was made. (6)

2010

Section B - Question 10 C

(*b*) Define (*i*) *radioactivity*, (*ii*) the *half-life* of a radioactive isotope. (10)

Americium–241 is a radioactive isotope used in domestic smoke detectors. Americium–241 has a half-life of 432 years and decays by emitting alpha particles to produce neptunium.

Determine the value of A and the value of Z in the following nuclear equation for the alpha decay of an americium–241 nucleus. (6)

$$^{241}_{95}\mathbf{Am} \rightarrow {}^{A}_{Z}\mathbf{Np} + {}^{4}_{2}\mathbf{He} + \mathbf{energy}$$

Alpha particles are hazardous to human health. State one risk associated with exposure to alpha radiation. (3)

Explain why the occupants of a house fitted with smoke detectors containing americium–241 are not at risk from alpha radiation emitted by these devices. (3)

Householders are advised to replace the batteries in smoke detectors regularly. Explain whether or not the americium–241 needs to be replaced regularly also. (3)

2007

Section B - Question 11 A

11. Answer any **two** of the parts (*a*), (*b*) and (*c*). (2 × 25)

(*a*) In 1910 Rutherford (pictured right) and his co-workers carried out an experiment in which thin sheets of gold foil were bombarded with alpha particles. The observations made during the experiment led to the discovery of the atomic nucleus.

(*i*) Describe the model of atomic structure which existed immediately *prior* to this experiment. (7)

(*ii*) In this experiment it was observed that most of the alpha particles went straight through the gold foil. Two other observations were made. State these other observations and explain how each helped Rutherford deduce that the atom has a nucleus. (12)

In November 2006 former Soviet agent, Alexander Litvinenko, died in London. The cause of his death was identified as radiation poisoning by polonium-210.

(*iii*) Polonium-210 decays emitting an alpha particle.
Copy and complete the equation for the alpha-decay of polonium-210, filling in the values of x (atomic number), y (mass number) and **Z** (elemental symbol). (6)

$$^{210}_{84}\mathbf{Po} \rightarrow {}^{y}_{x}\mathbf{Z} + {}^{4}_{2}\mathbf{He}$$