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

Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

The Sun is believed to be about 4.5 billion years old. To determine this, scientists measure the ratios of the lead isotopes found in meteorites. Since uranium undergoes radioactive decay in a chain to eventually become an isotope of lead, the ratios of lead isotopes can be used to find the age of a meteorite.

(i) $^{238}_{92}U$ decays to $^{206}_{82}Pb$ via the emission of α and β^- radiation.
In the transition of U-238 to Pb-206 eight alpha decays must occur.
State the number of beta decays that must occur. Justify your answer.

(2)

.....

.....

.....

Number of β^- decays = ...

(ii) One isotope produced in the chain is thorium-230, which decays to an isotope of radium with a half-life of 75,000 years.
Calculate the time in years it would take for 90% of an initial sample of thorium to have decayed.

(4)

.....

.....

.....

.....

.....

.....

.....

Time taken = ... years

(Total for question = 6 marks)

Q2.

&Radium is a radioactive element. The most common isotope of radium has a half-life of almost two thousand years. A sample of radium can remain at a higher temperature than its surroundings for a long period of time.

Explain how a sample of radium is able to release significant amounts of energy over a long period of time.

Downloaded from www.merit-minds.com

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q3.

Radon is a radioactive gas. One isotope of radon, $^{220}_{86}Rn$, decays to polonium, Po, by emitting an alpha particle.

Radon is produced in the ground and escapes into the atmosphere.

Explain why this is a safety hazard.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q4.

A hundred years ago, a method to determine the age of certain rocks was developed. An unstable isotope of rubidium is present in some rocks when they form. Over time the rubidium decays to a stable isotope of strontium.

A sample of Moon rock from the Apollo 11 mission was analysed to determine the age of the rock. When the sample was analysed the number of rubidium atoms was N_R and the number of strontium atoms was N_S.

As strontium atoms have all been produced from the decay of rubidium, the original number of rubidium atoms in

Downloaded from www.merit-minds.com

the sample was (N_R + N_S).

From the analysis of the sample, it was determined that $\frac{N_S}{N_R} = 0.0532$

Deduce whether this ratio is consistent with the Earth and the Moon forming at the same time.

age of Earth = 4.5×10^9 years
half-life of rubidium isotope = 4.88×10^{10} years

(5)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 5 marks)

Downloaded from www.merit-minds.com