

Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Q1.

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

* Explain why there is an exponential decrease in the rate of decay for a sample containing a large number of unstable nuclei.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q2.

Radioactive isotopes are often used as markers, so that chemical substances can be traced around the body. In one medical procedure tritium is used as a means of studying protein absorption by the intestine.

A patient was given a sample containing the tritium to drink and then monitored. The initial activity of the sample was 3450 Bq.

Tritium is a beta-emitter with a half-life of 3.89×10^8 s.

(a) State what is meant by the activity of a radioactive source.

(1)

.....
.....

(b) Show that the decay constant of the tritium is about $1.8 \times 10^{-9} \text{ s}^{-1}$ and hence calculate the number of tritium nuclei in the initial sample.

(3)

.....
.....
.....
.....
.....
.....
.....
.....

Number of nuclei =

(c) (i) Show that the time taken for the activity of the sample to fall to 10% of its initial value is about 40 years.

(3)

.....
.....
.....
.....
.....
.....
.....
.....

(ii) Comment on the time given in (c) (i).

(1)

.....
.....
.....

(Total for question = 8 marks)

Q3.

Actinium-225 and bismuth-210 are radioactive isotopes. A sample of each isotope is prepared so that each sample has the same number of nuclei initially.

Explain why the activity of each sample would be the same after 10 days.

half-life of actinium-225 = 10 days

half-life of bismuth-210 = 5 days

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)