

7 (a) Define

(i) half-life,

.....

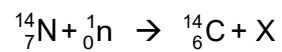
..... [1]

(ii) decay constant.

.....

..... [1]

(b) The presence of radioactive carbon-14 ($^{14}_6\text{C}$) is caused by the collision of neutrons with nitrogen-14 ($^{14}_7\text{N}$) in the upper atmosphere. The equation for the reaction is:



Data for some masses are given in Fig. 7.1.

nucleus	mass / <i>u</i>
carbon-14	14.003242
nitrogen-14	14.003158
neutron	1.008665

Fig. 7.1

- (i) Use the data from Fig. 7.1 to determine the mass of the particle X in u , given that the amount of energy released in one such reaction is 0.7060 MeV.

mass = u [3]

(ii) The mass of carbon-14 produced by this reaction in one year is 7.5 kg. The molar mass of carbon-14 is 14 g. The half-life of carbon-14 is 5.7×10^3 years.

1. Determine the number of carbon-14 atoms produced each year.

number of atoms = [1]

2. Determine the probability of decay of a carbon-14 nucleus in a time of 1.0 year.

probability = [1]

Section B

Answer **one** question from this Section in the spaces provided.