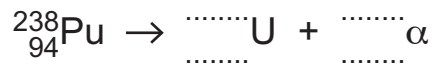


8 Plutonium-238 ($^{238}_{94}\text{Pu}$) is unstable and undergoes alpha decay.

(a) Complete the equation to show the decay of plutonium-238.



[2]

(b) The power source in a space probe contains 0.874 kg of plutonium-238. Each nucleus of plutonium-238 that decays emits 5.59 MeV of energy. The half-life of plutonium-238 is 87.7 years.

(i) Calculate the initial number N_0 of nuclei of plutonium-238 in the power source.

$N_0 = \dots\dots\dots$ [1]

(ii) Determine the initial activity of the source. Give a unit with your answer.

activity = $\dots\dots\dots$ unit $\dots\dots\dots$ [2]

(iii) Use your answer in (b)(ii) to determine the initial power output from the source due to the decay of plutonium-238.

power output = $\dots\dots\dots$ W [2]

- (iv) The space probe will continue to function until the power output from the plutonium in the source decreases to 65.3% of its initial value.

Calculate the time, in years, for which the space probe will function.

time = years [2]

- (c) An alternative power source uses energy generated from the radioactive decay of polonium-210. This isotope has a half-life of 0.378 years. The mass of the isotope needed for the same initial power output as in (b) is 3.37 g.

Suggest **one** advantage and **one** disadvantage of using polonium-210 as the source of energy.

advantage

.....

disadvantage

.....

[2]