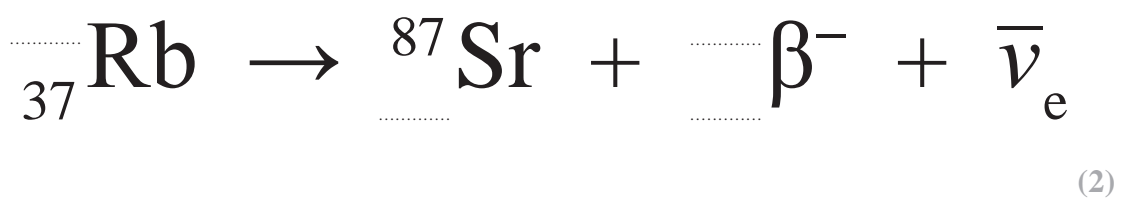


21 A hundred years ago, a method to determine the age of certain rocks was developed. An unstable isotope of rubidium is present in some rocks when they form. Over time the rubidium decays to a stable isotope of strontium.

- (a) Rubidium decays to strontium via β^- decay. Complete the nuclear equation representing the decay.



- (b) 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 the sample was $(N_{\text{R}} + N_{\text{S}})$.

From the analysis of the sample, it was determined that $\frac{N_{\text{S}}}{N_{\text{R}}} = 0.0532$

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)

- (c) Give a reason why the half-life of the rubidium isotope is hard to determine.

(1)

- (d) Recent investigations suggest that the half-life of the rubidium isotope may be larger than the traditionally accepted value.

Explain how this would affect the ages obtained by this dating method.

(2)