

A Level Physics A

H556/02 Exploring physics

Question Set 28

- 1 (a) Fig. 21 shows stable and unstable nuclei of some light elements plotted on a grid. This grid has number of neutrons N on the vertical axis and number of protons Z on the horizontal axis.

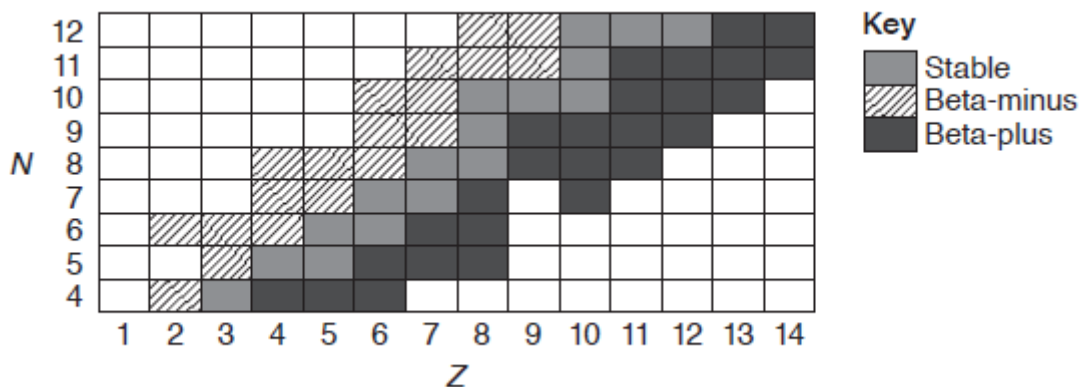


Fig. 21

The key on Fig. 21 shows whether a nucleus is stable, emits a beta-plus particle or emits a beta-minus particle to become stable.

For $Z = 7$, suggest in terms of N why an isotope may emit

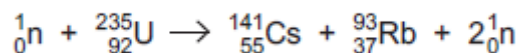
- (i) a beta-minus particle

.....
 [1]

- (ii) a beta-plus particle.

.....
 [1]

- (b) Inside a nuclear reactor, fission reactions are controlled and **chain reactions** are prevented. A typical fission reaction of the uranium-235 nucleus ($^{235}_{92}\text{U}$) is illustrated below.



The neutron triggering the fission reaction moves slowly. The neutrons produced in the fission reaction move fast.

- (i) Describe what is meant by **chain reaction**.

[2]

(ii) Explain how chain reactions are prevented inside a nuclear reactor.

[2]

(iii) The energy released in each fission reaction is equivalent to a decrease in mass of 0.19 u.

A fuel rod in a nuclear reactor contains 3.0% of uranium-235 by mass.

Estimate the total energy produced from 1.0 kg of fuel rod.

molar mass of uranium-235 = 0.235 kg mol⁻¹

1 u = 1.66 × 10⁻²⁷ kg

energy = J [4]

Total Marks for Question Set 28: 10

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