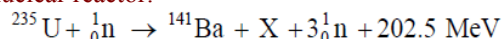


State Examination Commission – Physics Higher Level, 2010

Question 12b

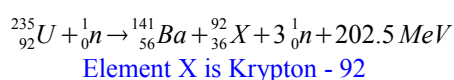
The following reaction occurs in a nuclear reactor:



- (i) Identify the element X. (6)
- (ii) Calculate the mass difference between the reactants and the products in the reaction. (9)
- (iii) What is a chain reaction? (9)
- Give one condition necessary for a chain reaction to occur. (9)
- (iv) Give one environmental impact associated with a nuclear reactor. (4)

(speed of light = $3.0 \times 10^8 \text{ m s}^{-1}$; $1\text{eV} = 1.6 \times 10^{-19} \text{ J}$)

-
- (i) Identify the element X. (6)



- (ii) Calculate the mass difference between the reactants and the products in the reaction. (9)

$$m = E/c^2 = (202.5 \times 10^6 \times 1.6 \times 10^{-19}) / (3.0 \times 10^8)^2 = 3.6 \times 10^{-28} \text{ kg}$$

- (iii) What is a chain reaction?

A chain reaction is a reaction where one of the products causes additional reactions to take place, amplifying the whole process.

- Give one condition necessary for a chain reaction to occur. (9)

The mass of fuel must exceed a certain critical value

- (iv) Give one environmental impact associated with a nuclear reactor. (4)

Ability to store toxic waste for long periods of time is required – increased risk leakage into the environment.