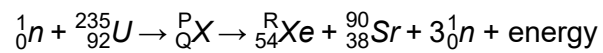


**8**

**(a)**

**(i)**

A slow neutron and a uranium-235 nucleus undergo a fission process, which includes the formation of strontium-90 nucleus,  ${}_{38}^{90}\text{Sr}$ , summarised by the following equation.



State the numerical values of P, Q and R.

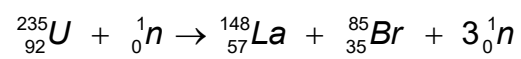
P = .....

Q = .....

R = .....

(ii)

In another fission process involving uranium-235,



Given the following data, calculate the energy released in this process for one uranium nucleus.

mass of U-235 = 235.1 u

mass of neutron = 1.009 u

mass of La-148 = 148.0 u

mass of Br-85 = 84.9 u





energy = ..... J

[2]



**(b)**

A strontium-90 nucleus emits a  $\beta^-$  particle and undergoes a *spontaneous and random* decay to yttrium (Y). The decay has a half-life of 28 years.

**(i)**

State what is meant by

spontaneous: .....



.....

random: .....

.....

[2]

(ii)

Write the nuclear transformation equation for the emission of the  $\beta^-$  particle.

[1]





**(iii)**

In a laboratory source of strontium-90, the number of atoms present in the year 2023 was  $2.36 \times 10^{13}$ .

Calculate the number of strontium atoms that will be present in the source in the year 2135 (112 years later).





number = .....

[2]



## Section B

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