For Examiner's Use

7 (a) Describe the experimental evidence for a small charged nucleus in the atom. You may include a diagram if you wish.

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**(b)** A stationary Uranium-235 nucleus absorbs a slow neutron and undergoes fission. Occasionally, a fission can take place in which no neutrons are emitted. One such fission is shown by the following nuclear equation.

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{x}_{52}Te + ^{98}_{y}Zr$$

The masses of these particles are

| | | |
|---|---|---|
| uranium | $^{235}_{92}U$ | 235.0439 u |
| tellurium | $^{x}_{52}Te$ | 137.9603 u |
| zirconium | $^{98}_{y}Zr$ | 97.9197 u |
| neutron | $^{1}_{0}n$ | 1.0087 u. |

**(i)** State the values of $x$ and $y$ in the equation.

$x$ = ..........................................

$y$ = .......................................... [2]

**(ii)** Deduce the energy released in the fission reaction.

energy released = .......................................... J [4]

**(iii)** Of the energy released, $2.3 \times 10^{-11}$ J becomes kinetic energy of the tellurium and zirconium nuclei. State one way in which the remaining energy may be released.

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**(iv)** Calculate

**1.** the ratio $\dfrac{\text{speed of zirconium nucleus}}{\text{speed of tellurium nucleus}}$,

ratio of speeds = .......................................... [2]

**2.** the ratio $\dfrac{\text{kinetic energy of zirconium nucleus}}{\text{kinetic energy of tellurium nucleus}}$.

ratio of kinetic energies = .......................................... [2]

**(v)** Deduce the speed of the zirconium nucleus.

speed of zirconium nucleus = .......................................... m $s^{-1}$ [3]

**(vi)** State two assumptions that you made in your calculation in **(iv) part 1**.

1. ..........................................................................................................

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2. ..........................................................................................................

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[2]