Section A

Answer **all** the questions in this section.

1 A tritium nucleus moves towards a deuterium nucleus as illustrated in Fig. 1.1.

Fig. 1.1

The nuclei initially have the same speed *v*. The tritium nucleus consists of two neutrons and a proton. The deuterium nucleus consists of a neutron and a proton. The proton and the neutron have the same mass *m*.

(a) (i) State why the two nuclei will repel one another.

.....

..... [1]

(ii) State what will happen if *v* is sufficiently high.

.....

..... [1]

(iii) Explain why it is **not** possible for the nuclei to stop at the same instant.

.....

.....

..... [2]

(b) At one instant during the interaction between the nuclei, they are both travelling **in the same direction** with the same speed. Calculate this speed, in terms of *v*.

speed = ... [2]

(c) Fig. 1.2 is a velocity-time sketch graph showing how the velocity of each nucleus varies. The interaction between the nuclei is elastic.

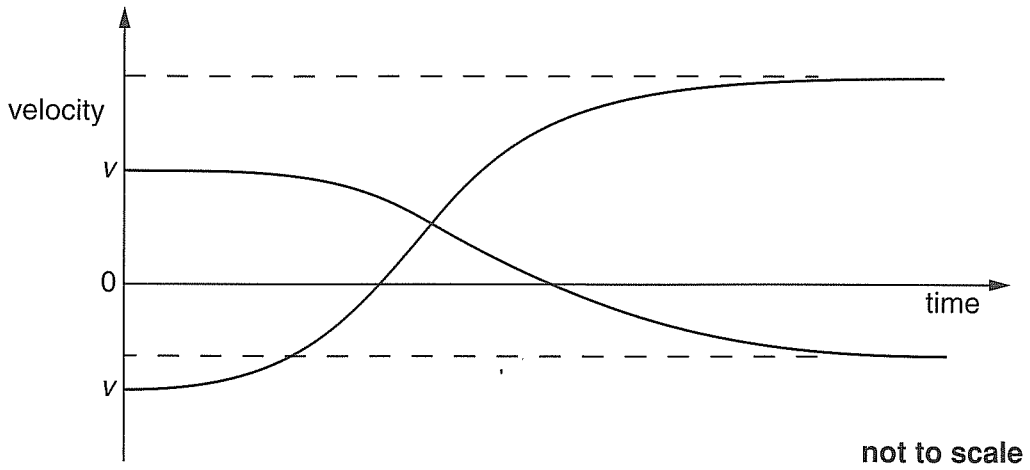

Fig. 1.2

(i) Label the graph to show

1. which curve is for the tritium nucleus,

2. the times at which each nucleus stops,

3. the time at which they are at their distance of closest approach. [3]

(ii) Determine the final speed of each nucleus in terms of *v*.

final speed of deuterium = ...

final speed of tritium = ... [4]