

4 (a) (i) State the principle of conservation of linear momentum.

.....  
.....[1]

(ii) State the relation between force and momentum.

.....  
.....[1]

(b) A fast-moving neutron of mass  $m$  collides head-on with a stationary nitrogen atom of mass  $14m$  as illustrated in Fig. 4.1.

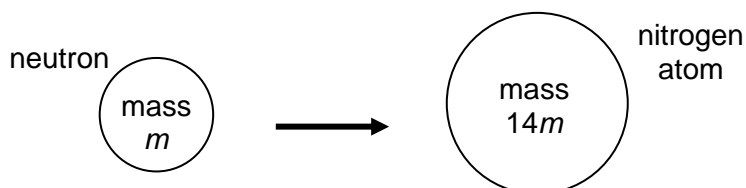


Fig. 4.1

The neutron is captured by the atom to form a heavy isotope of nitrogen of  $15m$ .

(i) Explain the subsequent motion of the isotope given that the collision is head-on.

.....  
..... [1]

(ii) Calculate the ratio of kinetic energy of the heavy isotope of nitrogen to the initial kinetic energy of the neutron.

ratio of kinetic energy = ..... [3]

- (iii) Hence or otherwise, explain whether the collision process whereby the neutron is captured is elastic or inelastic.

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..... [2]