

- 2 (a) State the principle of conservation of momentum.

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 [2]

- (b) A firework is initially stationary. It explodes into three fragments A, B and C that move in a horizontal plane, as shown in the view from above in Fig. 2.1.

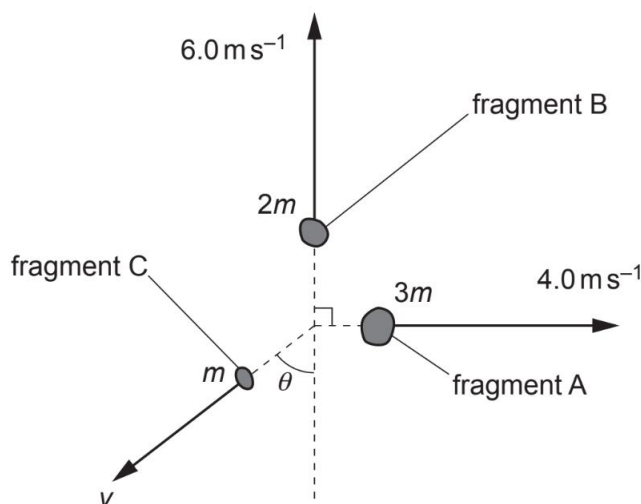


Fig. 2.1

Fragment A has a mass of $3m$ and moves away from the explosion at a speed of 4.0 m s^{-1} .

Fragment B has a mass of $2m$ and moves away from the explosion at a speed of 6.0 m s^{-1} at right angles to the direction of A.

Fragment C has a mass of m and moves away from the explosion at a speed v and at an angle θ as shown in Fig. 2.1.

Calculate:

- (i) the angle θ ,

$$\theta = \dots\dots\dots^\circ \text{ [3]}$$

(ii) the speed v .

$$v = \dots\dots\dots \text{ m s}^{-1} \text{ [2]}$$

- (c) The firework in (b) contains a chemical that has mass 5.0 g and has chemical energy per unit mass 700 J kg^{-1} . When the firework explodes, all the chemical energy is transferred to the kinetic energy of fragments A, B and C.

Calculate the mass m .

$$m = \dots\dots\dots \text{ kg [3]}$$