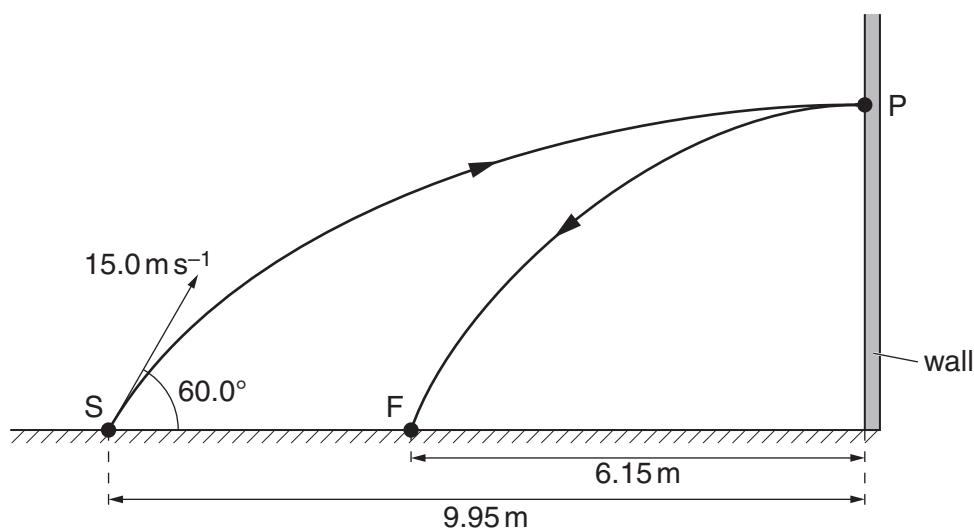**3** A ball is thrown against a vertical wall. The path of the ball is shown in Fig. 3.1.

Fig. 3.1 (not to scale)

The ball is thrown from S with an initial velocity of $15.0\,\text{m s}^{-1}$ at 60.0° to the horizontal. Assume that air resistance is negligible.

(a) the ball at S, calculate

(i) its horizontal component of velocity,

horizontal component of velocity = ... m s^{-1} [1]

(ii) its vertical component of velocity.

vertical component of velocity = ... m s^{-1} [1]

(b) The horizontal distance from S to the wall is 9.95 m. The ball hits the wall at P with a velocity that is at right angles to the wall. The ball rebounds to a point F that is 6.15 m from the wall.

Using your answers in **(a)**,

(i) calculate the vertical height gained by the ball when it travels from S to P,

height = ... m [1]

(ii) show that the time taken for the ball to travel from S to P is 1.33 s,

[1]

(iii) show that the velocity of the ball immediately after rebounding from the wall is about 4.6 m s⁻¹.

[1]

(c) The mass of the ball is 60×10^{-3} kg.

(i) Calculate the change in momentum of the ball as it rebounds from the wall.

change in momentum = ... N s [2]

(ii) State and explain whether the collision is elastic or inelastic.

....

....

.... [1]