

QQQ – Mechanics Year 2 – Chapter 6 – Projectiles (Version 1)

Total Marks: 23

(23 = Platinum, 21 = Gold, 18 = Silver, 16 = Bronze)

1. A cannonball is fired from a point on horizontal ground at 100 m s^{-1} at an angle of 25° above the horizontal. Ignoring air resistance, calculate

(a) the greatest height the cannonball reaches, [3]

(b) the range of the cannonball. [4]

(Total 7 marks)

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2. A pebble is thrown horizontally at 14 m s^{-1} from a window which is 5 m above horizontal ground. The pebble goes over a fence 2 m high d m away from the window as shown in Fig. 9. The origin is on the ground directly below the window with the x -axis horizontal in the direction in which the pebble is thrown and the y -axis vertically upwards.

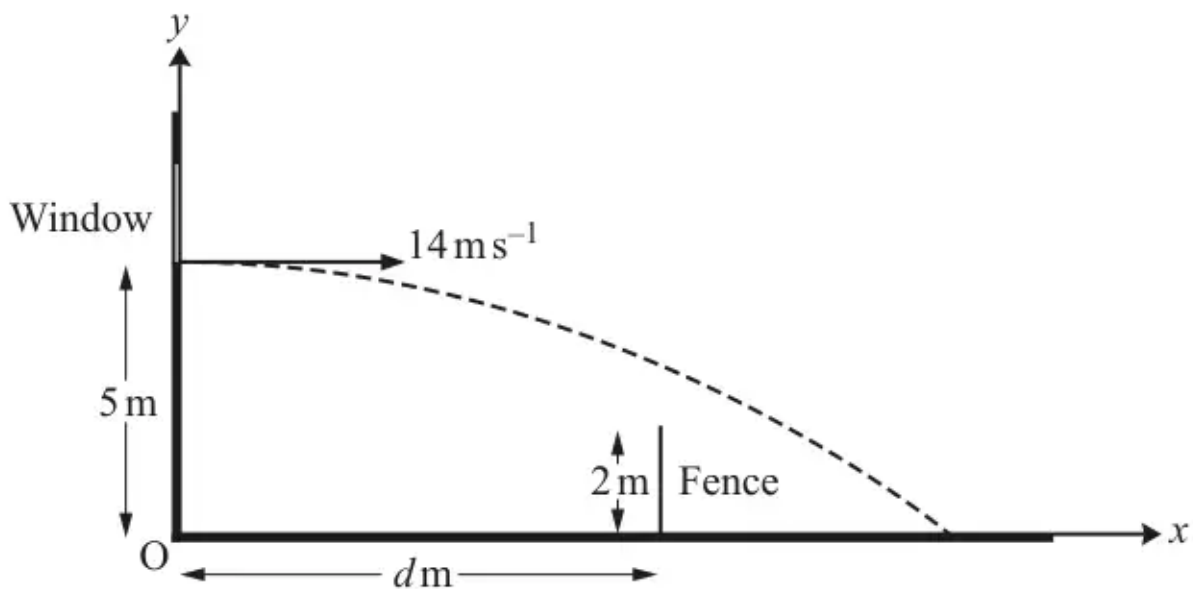


Fig. 9

(i) Find the time the pebble takes to reach the ground. [3]

(ii) Find the cartesian equation of the trajectory of the pebble. [4]

(iii) Find the range of possible values for d . [3]

(Total 10 marks)

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3. A ball is projected forward from a fixed point, P , on a horizontal surface with an initial speed $u \text{ m s}^{-1}$, at an acute angle θ above the horizontal.

The ball needs to first land at a point at least d metres away from P .

You may assume the ball may be modelled as a particle and that air resistance may be ignored.

Show that

$$\sin 2\theta \geq \frac{dg}{u^2}$$

[6 marks]

(Total 6 marks)