

- 3 A small magnet X of mass 30 g is released from rest on the top of a smooth slope of length 1.50 m inclined at  $40^\circ$  as shown in Fig. 3.1. Another small magnet Y was placed at rest on a smooth horizontal surface a long distance away from the slope.

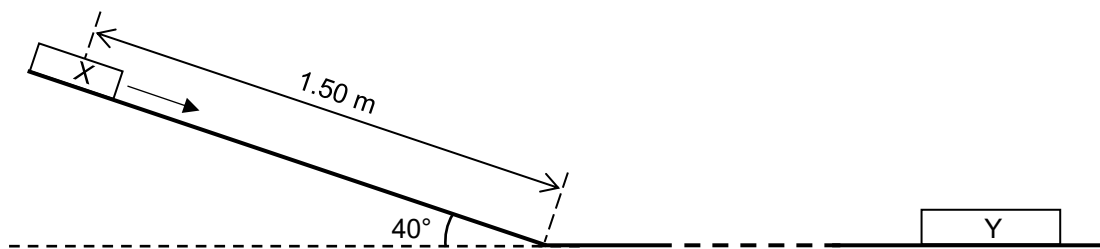


Fig. 3.1

- (a) Calculate the speed of magnet X as it reaches the bottom of the slope after being released.

speed of X = .....  $\text{m s}^{-1}$  [1]

- (b) The two magnets X and Y were positioned with **like** poles facing each other.

Magnet X reaches a point of closest approach with magnet Y before changing direction and going towards the slope. It stopped 0.80 m up the slope. Assume that the collision is elastic.

- (i) Calculate the final speed of magnet Y.

speed of Y = .....  $\text{m s}^{-1}$  [3]

- (ii) Show that the mass of magnet Y is 190 g. [2]

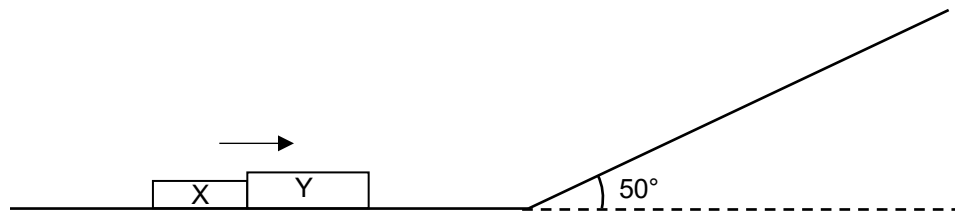
- (c) The two magnets are now aligned with **unlike** poles facing each other. X is released from rest at the top of the frictionless slope. As it touches Y, they stick and move off together.

- (i) Explain why such a collision is always inelastic.

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

- (ii) Show that the speed of X and Y after the collision is  $0.59 \text{ m s}^{-1}$ . [1]

- (iii) After the collision, X and Y travelled up a rough slope inclined at  $50^\circ$  to the horizontal as shown in Fig. 3.2. The slope exerts a constant frictional force of 2.2 N on the magnets.



**Fig. 3.2**

The magnets travelled a distance  $d$  up the rough slope before coming to a stop.  
Calculate the distance  $d$ .

$d = \dots\dots\dots$  m [3]

[Total: 11]

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