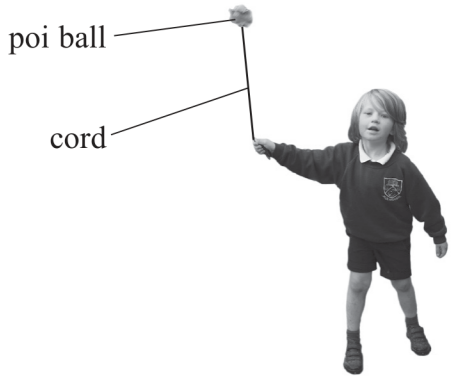
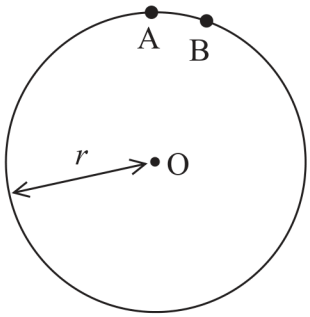
15 A poi ball is a ball attached to a person's hand by a cord. A child makes the poi ball undergo circular motion in a vertical plane as shown in the photograph.



(a) The poi ball moves clockwise in a circle of radius r, centre O, with a constant speed v.

The diagram shows two positions, A and B, of the poi ball.



Derive the equation for centripetal acceleration $a = \frac{v^2}{r}$ by considering the velocity of the poi ball at these two positions.

Your answer should include a vector diagram.

(5)

(b) The poi ball completes 1.3 revolutions per second.

Calculate the acceleration of the poi ball.

radius of circular motion = 0.58 m

(3)

Acceleration = ...

(c) The child comments that as the ball goes round the circle with a constant speed, the size of the force on his hand changes.

Discuss whether this comment is correct.

(4)

(Total for Question 15 = 12 marks)