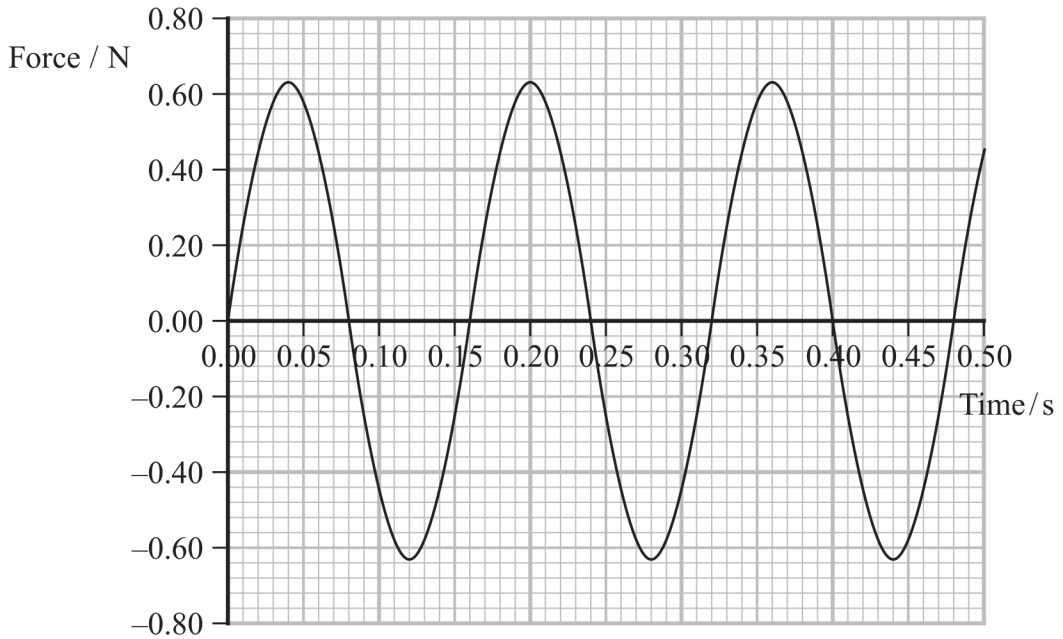
15 The photograph shows a toy car inside a plastic ball. The car has an electric motor and follows a circular path in a vertical plane. The car travels at a constant speed.

A student determined how the resultant vertical force on the car varied over a period of time.

The graph shows the student's data. A positive value represents an upwards force.



(a) (i) Show that the angular velocity of the car's motion about the centre of the ball is about 40 radian s^{-1}.

(3)

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(ii) The student took measurements of the ball and wrote down a value of 86 mm.

Deduce whether 86 mm was the radius or the diameter of the ball.

mass of car = 9.5 g

(4)

*(b) The magnitude of the force exerted by the ball on the car was greatest at 0.04 s and least at 0.12 s.

Discuss the position of the car at these two times.

You should consider the forces acting on the car.
You do not need to do any further calculations.

(6)

(Total for Question 15 = 13 marks)