5 **(a)** State what is meant by *angular velocity*.

.....

..... [1]

(b) A spring is used to project a toy car along a track from point X, round a vertical loop, to point Y, as illustrated in Fig. 5.1.

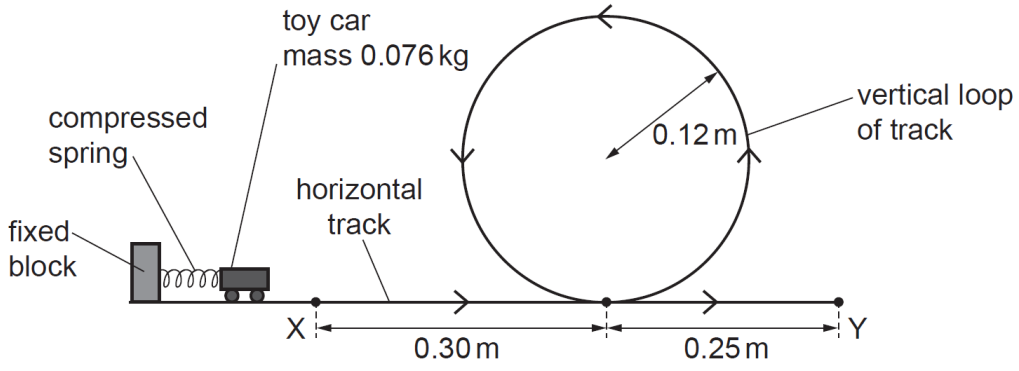

Fig. 5.1

The spring is initially given a compression of 16 cm. The car of mass 0.076 kg is held against one end of the compressed spring. When the spring is released, it projects the car forward. The car leaves the spring at point X with kinetic energy that is equal to the initial elastic potential energy of the compressed spring.

Assume that friction and air resistance are negligible.

(i) Calculate the minimum speed needed at the top of the circular path so that the toy car does not fall off the track.

minimum speed = ... m s^{-1} [3]

(ii) Calculate the value of the spring constant needed for the toy car to have the speed found in **(b)(i)** when it is at the top of the path.

spring constant = …… N m^{-1} [3]

(c) In practice, a resistive force due to friction and air resistance acts on the car so that its kinetic energy at Y is 0.23 J less than its kinetic energy at X.

Determine the average resistive force acting on the car for its movement from X to Y.

average resistive force = ... N [2]

[Total: 9]