2 (a) An object of mass 0.80 kg is placed at a distance *r* from the centre P of a flat disc rotating horizontally with an angular speed ω. It undergoes circular motion with the disc, as shown in Fig. 2.1.

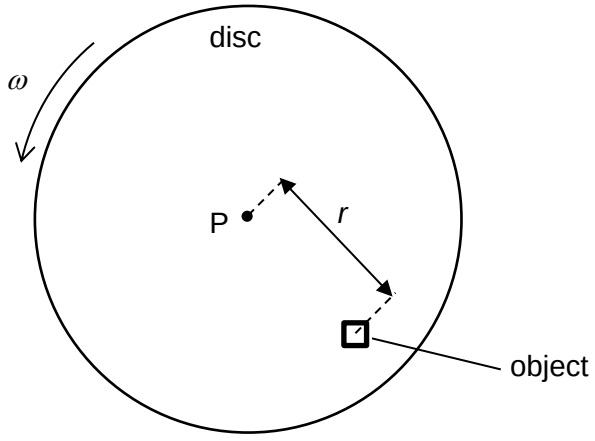

Fig. 2.1 (top view)

To determine the maximum frictional force acting on the object, the angular speed is slowly increased until the object starts to slide. For different values of *r*, this value of the angular speed is recorded as ω_{max}. The variation with $\frac{1}{r}$ of ω_{max}^2 is shown in Fig. 2.2.

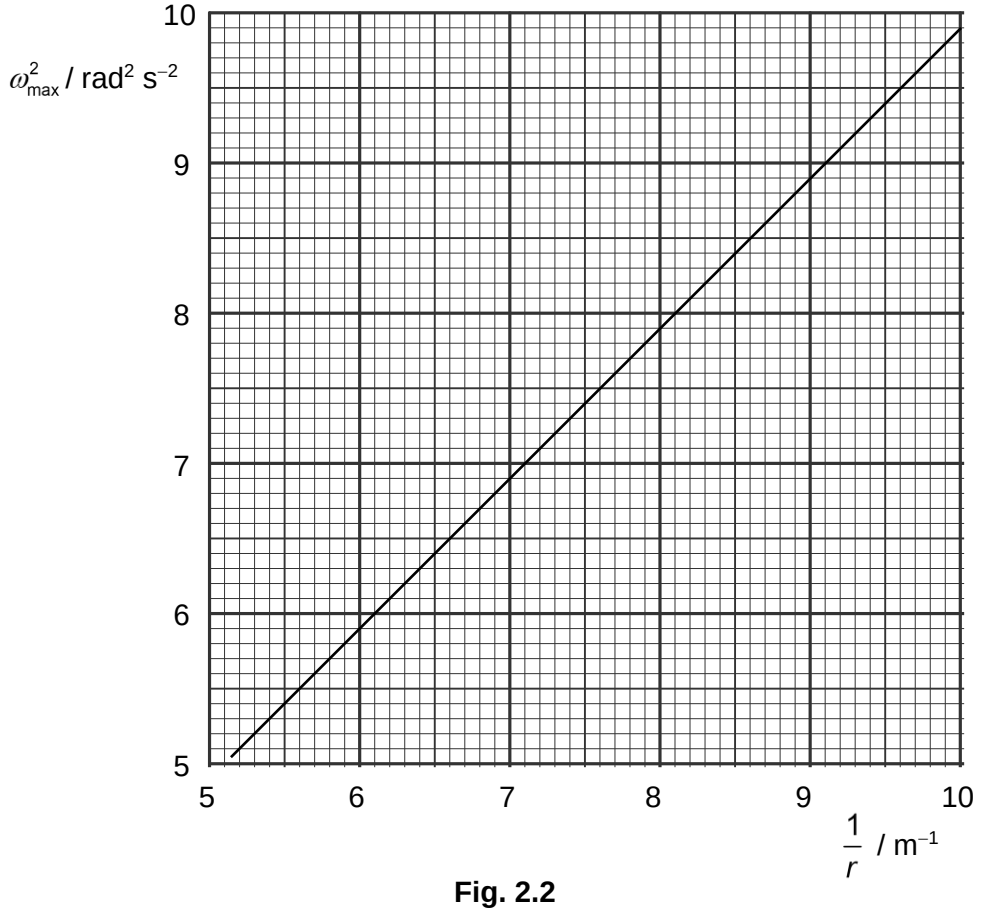

Fig. 2.2

(i) On Fig. 2.1, draw an arrow to show the direction of the frictional force acting on the object at the instant shown. Label this arrow Z. [1]

(ii) Explain the direction of the frictional force in **(a)(i)**.

……

…… [1]

(b) **(i)** Determine the gradient of the line in Fig. 2.2.

gradient = …….. [2]

(ii) Suggest the physical significance of the gradient. Show any necessary working.

……

…… [2]

(c) Determine the maximum frictional force acting on the object.

maximum frictional force = ……..N [2]

(d) Explain why the object starts to slide as angular speed increases.

……..

……..

……..

……..… [2]

[Total: 10]