Section A

For Examiner's Use

Answer **all** the questions in the spaces provided.

1 A planet of mass m is in a circular orbit of radius r about the Sun of mass M, as illustrated in Fig. 1.1.

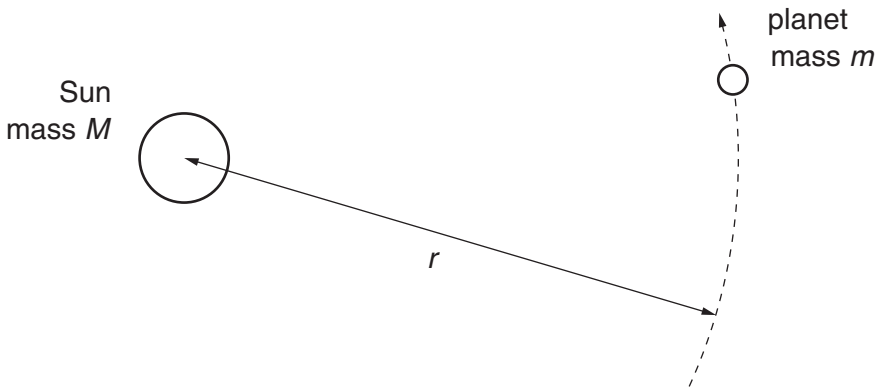

Fig. 1.1

The magnitude of the angular velocity and the period of revolution of the planet about the Sun are ω and T respectively.

(a) State

(i) what is meant by *angular velocity*,

.....

.....

.....[2]

(ii) the relation between ω and T.

.....[1]

(b) Show that, for a planet in a circular orbit of radius r, the period T of the orbit is given by the expression

$$T^2 = cr^3$$

where c is a constant. Explain your working.

[4]

(c) Data for the planets Venus and Neptune are given in Fig. 1.2.

For Examiner's Use

planet	r / 10^8 km	T / years
Venus	1.08	0.615
Neptune	45.0	

Fig. 1.2

Assume that the orbits of both planets are circular.

(i) Use the expression in **(b)** to calculate the value of T for Neptune.

T = ... years [2]

(ii) Determine the linear speed of Venus in its orbit.

speed = ... km s^{-1} [2]