2 Jupiter has close to eighty moons, of which eight of them are in approximately circular orbits. Jupiter has a mass M_J, radius R_J and a Jupiter-day is approximately 0.417 Earth-days.

The orbital radii and periods of two of the moons of Jupiter are tabulated in Fig. 2.1. The orbital radii and the orbital periods of these moons are expressed in units of R_J and Earth-days respectively.

Name of Moon	**Orbital Radius / R_J**	**Orbital Period / Earth-days**
Amalthea	2.62	.....
Thebe	3.18	0.676

Fig. 2.1

(a) (i) Show that the period T of a circular orbit around Jupiter, expressed in terms of the radius of the orbit R is given by

$$T = \sqrt{\frac{4\pi^2 R^3}{GM_J}}$$

[2]

(ii) Using the data provided in Fig 2.1, complete Fig. 2.1 with the orbital period for Amalthea. Show all working in the space below.

orbital period = ... Earth-days [2]

(b) **(i)** Determine an expression for the orbital speed v of a moon in terms of its orbital radius R and any other constants.

[1]

(ii) It is suggested that Jupiter's rings are formed from material ejected from the moons as the moons collide with meteorites.

Assuming no change in the speed of a moon, explain whether the moon can stay in orbit if it experiences a constant loss of mass.

.....

..... [1]

(c) Using the data available for the moons of Jupiter, a graph of the orbital period was plotted against the orbital radius as shown in Fig 2.2.

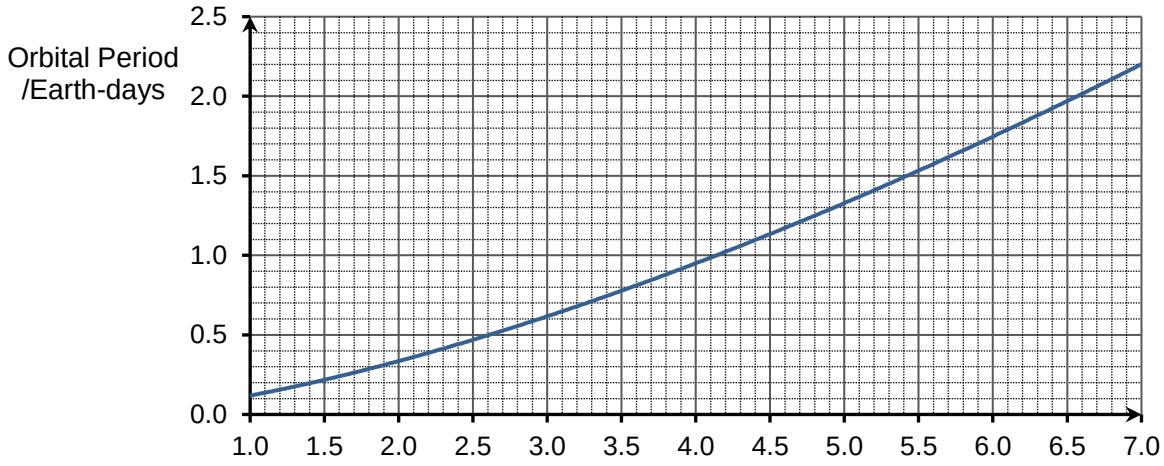

Fig. 2.2

(i) A satellite is moving in a "geostationary orbit" about Jupiter i.e. it is in an orbit above the same geographical spot on Jupiter. Using Fig. 2.2, estimate the radius of this "geostationary orbit".

radius = ... R_J [1]

(ii) Suggest a possible use for this "geostationary satellite" in **(c)(i)**.

.....

..... [1]

[Total: 8]