Section A

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

1 **(a)** State Newton's law of gravitation.

.....

.....

..... [2]

(b) The planet Neptune has eight moons (satellites). Each moon orbits Neptune in a circular path of radius r with a period T.

Assuming that Neptune and each moon behave as point masses, show that r and T are related by the expression

$$GM_N = \frac{4\pi^2 r^3}{T^2}$$

where G is the gravitational constant and M_N is the mass of Neptune.

[3]

(c) Data for the moon Triton that orbits Neptune and for the moon Oberon that orbits the planet Uranus are given in Fig. 1.1.

planet	moon	radius of orbit $r/10^5$ km	period of orbit T/days
Neptune	Triton	3.55	5.9
Uranus	Oberon	5.83	13.5

Fig. 1.1

Use the expression in **(b)** to determine the ratio

$$\frac{\text{mass of Neptune}}{\text{mass of Uranus}}.$$

ratio = ... [3]