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

1 **(a)** Explain how a satellite may be in a circular orbit around a planet.

.....

.....

.....[2]

(b) The Earth and the Moon may be considered to be uniform spheres that are isolated in space. The Earth has radius R and mean density ρ. The Moon, mass m, is in a circular orbit about the Earth with radius nR, as illustrated in Fig. 1.1.

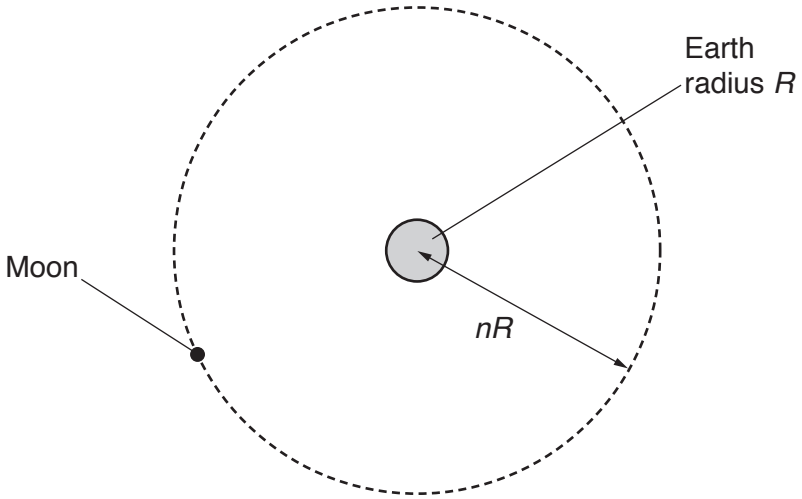

Fig. 1.1

The Moon makes one complete orbit of the Earth in time T.
Show that the mean density ρ of the Earth is given by the expression

$$\rho = \frac{3\pi n^3}{GT^2}.$$

[4]

(c) The radius R of the Earth is 6.38×10^3 km and the distance between the centre of the Earth and the centre of the Moon is 3.84×10^5 km.
The period T of the orbit of the Moon about the Earth is 27.3 days.
Use the expression in **(b)** to calculate ρ.

ρ = ... kg m^{-3} [3]

[Total: 9]

[Turn over