

SECTION C

Answer **all** the questions.

36 The Moon is in circular orbit around Earth at constant speed.

(a) Explain why we describe the Moon as accelerating towards the Earth.

.....

 [2]

(b) (i) Starting from the equation for circular motion show that the acceleration of the Moon towards the Earth is given by $a = \frac{4\pi^2 R}{T^2}$ where the Moon's orbital radius is R and the Moon's orbital time is T .

[1]

(ii) Show that the Moon's acceleration is less than 3 mm s^{-2} .

$$R = 3.84 \times 10^8 \text{ m} \quad T = 2.35 \times 10^6 \text{ s}$$

[1]

(iii) The Moon's orbital radius $R = 60 \times R_{\text{Earth}}$.
 The gravitational acceleration at the Earth's surface $g = 9.8 \text{ m s}^{-2}$.
 Calculate the acceleration due to the Earth's gravity at the Moon's orbit.
 Compare this value to the value calculated in (ii).

acceleration = m s^{-2}

..... [3]

[1]

- 16 A satellite orbits the Earth in a circular orbit of height 2.3×10^6 m above the ground.

What is the angular velocity ω of the satellite?

radius of Earth = 6.4×10^6 m.

mass of Earth = 6.0×10^{24} kg

- A $6.1 \times 10^{-7} \text{ rad s}^{-1}$
B $3.3 \times 10^{-5} \text{ rad s}^{-1}$
C $7.8 \times 10^{-4} \text{ rad s}^{-1}$
D $5.7 \times 10^{-3} \text{ rad s}^{-1}$

Your answer

[1]