2017 fund

24 SECTION C

Answer all the questions.

36	The Moon	is in	circular	orbit	around	Farth	at	constant	sneed
J U	THE MOON	15 11	i Cii Cuiai	OIDIL	around	Laitii	aι	CONSTAIN	specu.

(-)		•		_		•	toward	u _a
(a)	⊏xpiaiii	wily we	e describe	e ti le ivic	on as	accelerating towa	iius iiie ⊑aiiii.	

center DV is accel

[1]

(b) (i) Starting from the equation for circular motion show that the acceleration of the Moon towards the Earth is given by $a=\frac{4\pi^2R}{T^2}$

......[2]

where the Moon's orbital radius is R and the Moon's orbital time is T.

$$A = \frac{v^2}{V}$$

$$\Rightarrow A = \frac{4\pi^2 R^2}{V^2}$$

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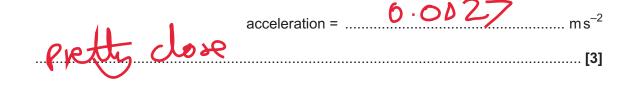
$$\Rightarrow A = \frac{4\pi^2 R^2}{V^2}$$
[1]

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

$$R = 3.84 \times 10^8 \text{ m}$$
 $T = 2.35 \times 10^6 \text{ s}$
= 2.7 x 10 m/s = 2.7 m/m s

(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).





[1]

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

What is the angular velocity ω of the satellite?

radius of Earth = 6.4×10^6 m. mass of Earth = $6.0 \times 10^{24} \text{kg}$

 $6.1 \times 10^{-7} \text{ rad s}^{-1}$ A

 $3.3\times10^{\text{--}5}\ rad\ s^{\text{--}1}$ \mathbf{B} $7.8\times10^{\text{--4}}~\text{rad}~\text{s}^{\text{--1}}$

 \mathbf{C}

 $5.7\times10^{-3}~rad~s^{-1}$ D

Your answer

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