

Circular motion

Question Paper 2

Level	A Level
Subject	Physics
Exam Board	OCR
Topic	Newtonian world and astrophysics
Sub-Topic	Circular motion
Booklet	Question Paper 2

Time Allowed: 27 minutes

Score: / 22

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) Fig. 2.1 shows an aeroplane flying in a horizontal circle at constant speed. The weight of the aeroplane is W and L is the lift force acting at right angles to the wings.



Fig. 2.1

- (i) Explain how the lift force L maintains the aeroplane flying in a **horizontal** circle.

.....

.....

.....

..... [2]

- (ii) The aeroplane of mass 1.2×10^5 kg is flying in a horizontal circle of radius 2.0 km.

The centripetal force acting on the aeroplane is 1.8×10^6 N. Calculate the speed of the aeroplane.

speed = ms^{-1} [2]

- (b) Fig. 2.2 shows a satellite orbiting the Earth at a constant speed v . The radius of the orbit is r .

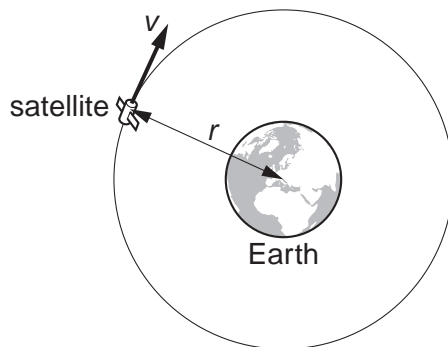


Fig. 2.2

Show that the orbital period T of the satellite is given by the equation

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

where M is the mass of the Earth and G is the gravitational constant.

[3]

- (c) The satellites used in television communication systems are usually placed in geostationary orbits.



In your answer, you should use appropriate technical words spelled correctly.

- (i) State two features of geostationary orbits.

1.

.....

2.

..... [2]

- (ii) Calculate the radius of orbit of a geostationary satellite.

The mass of the Earth is 6.0×10^{24} kg.

radius = m [3]

[Total: 12]

- 2 (a) (i) State, in terms of force, the conditions necessary for an object to move in a circular path at constant speed.

.....
..... [1]

- (ii) Explain why this object is accelerating. State the direction of the acceleration.

.....
..... [2]

- (b) A satellite moves in a circular orbit around the Earth at a constant speed of 3700 m s^{-1} .

The mass M of the Earth is $6.0 \times 10^{24} \text{ kg}$.

Calculate the radius of this orbit.

radius = m [4]

- (c) In order to move the satellite in (b) into a new smaller orbit, a decelerating force is applied for a brief period of time.

- (i) Suggest how the decelerating force could be applied.

.....
..... [1]

- (ii) The radius of this new orbit is $2.0 \times 10^7 \text{ m}$. Calculate the speed of the satellite in this orbit.

speed = m s^{-1} [2]

[Total: 10]