FREE REVISION PACK

Orbits & Geostationary Satellites

AQA A-level Physics · 7408 · Specification 3.7.2.4

Easy | Medium | Multiple choice · past-paper questions

5	5	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Speed of a satellite at height h	AQA June 2023 · A-level Paper 2 · Q12	1 mark
2	Easy	What is not true for a geostationary satellite	AQA June 2023 · A-level Paper 2 · Q13	1 mark
3	Easy	Fastest spin before equator material leaves	AQA June 2019 · A-level Paper 2 · Q10	1 mark
4	Medium	Graph linking T and r for planets	AQA June 2018 · A-level Paper 2 · Q18	1 mark
5	Medium	Synchronous orbit around another planet	AQA June 2024 · A-level Paper 2 · Q21	1 mark

Key ideas to have ready

- For a circular orbit, gravity provides the centripetal force: $GMm / r^2 = mv^2 / r = m\omega^2 r$.
- So $v = \sqrt{(GM / r)}$, and $T^2 = (4\pi^2 / GM)\, r^3$ (Kepler's third law). A higher orbit is slower and has a longer period.
- A graph of log T against log r is a straight line of gradient 3/2.
- A geostationary satellite orbits above the equator, west to east, with a period of 24 hours, so it stays above one point on the Earth.

How to use this pack

1. The questions are grouped into levels (Easy and Medium). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in AQA's examiner reports where that information exists, plus our own difficulty rating. *About 1.5 minutes per question.

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Easy

Definitions and one-step ideas. Most students get these right.

Questions 1–3

Only **one** answer per question is allowed. For each question, completely fill in the circle alongside the appropriate answer.

AQA June 2023 · A-level Paper 2 · Q12

1 A satellite is in a circular orbit at a height h above the surface of a planet of mass M and radius R.

What is the linear speed of the satellite?

[1 mark]

A $\frac{\sqrt{GM}}{(R+h)}$ ⬭

B $\sqrt{\frac{GM}{(R+h)}}$ ⬭

C $\frac{GM}{\sqrt{R+h}}$ ⬭

D $\frac{GM}{(R+h)}$ ⬭

AQA June 2023 · A-level Paper 2 · Q13

2 Which statement is **not** true for a satellite in a geostationary orbit?

[1 mark]

A The satellite orbits in the plane of the Earth's equator. ⬭

B The satellite has the same angular velocity as a point on the Earth's surface. ⬭

C The satellite takes 24 hours to orbit the Earth. ⬭

D Signals from the satellite can be sent to any point on the Earth's surface during one orbit. ⬭

AQA June 2019 · A-level Paper 2 · Q10

3 A planet of mass M and radius R rotates so quickly that material at its equator only just remains on its surface.

What is the period of rotation of the planet?

[1 mark]

A $2\pi\sqrt{\frac{R}{GM}}$ ⬭

B $2\pi\sqrt{\frac{GM}{R}}$ ⬭

C $2\pi\sqrt{\frac{R^3}{GM}}$ ⬭

D $2\pi\sqrt{\frac{GM}{R^3}}$ ⬭

Medium

Two or three steps. Roughly a third to a half of students get these right.

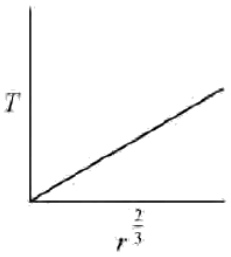
Questions 4–5

AQA June 2018 · A-level Paper 2 · Q18

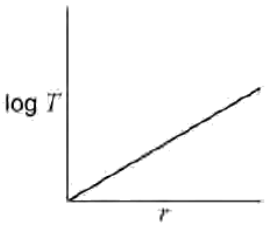
4 Which graph shows the relationship between the time period T and the orbital radius r of a planet in orbit around the Sun?

[1 mark]

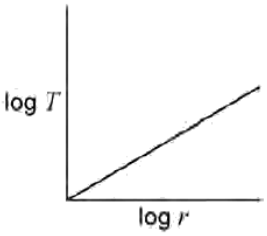
A



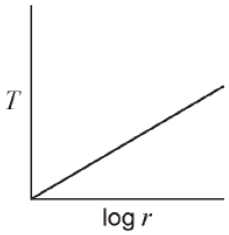
B



C



D



AQA June 2024 · A-level Paper 2 · Q21

5 A synchronous orbit of the Earth has a radius R.
A planet has a mass twice the mass of the Earth. A day on the planet is one quarter of an Earth day.

What is the radius of a synchronous orbit for this planet?

[1 mark]

A $\frac{R}{\sqrt[3]{2}}$ ⬭

B $\frac{R}{\sqrt[3]{16}}$ ⬭

C $\frac{R}{2}$ ⬭

D $\frac{\sqrt{2}R}{8}$ ⬭

End of questions. Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition:
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