GET BETTER AT PHYSICS · MARK SCHEME

Orbits & Geostationary Satellites: tiered multiple choice

AQA A-level Physics · 7408 · Specification 3.7.2.4 · 5 questions · 5 marks

1 mark per correct letter | Worked reasoning for every question | **How students did** = from AQA examiner reports, where available

Answer key

Q1	Q2	Q3	Q4	Q5
B	D	C	C	C

Easy

Questions 1–3

1 **B**

Speed of a satellite at height h · AQA June 2023 · A-level Paper 2 · Q12

The orbital radius is R + h. $GMm / (R + h)^2 = mv^2 / (R + h)$, so $v = \sqrt{(GM / (R + h))}$.

Watch out: Measure the orbital radius from the centre of the planet, not from its surface.

How students did: At least 70% of students got this right in June 2023.

2 **D**

What is not true for a geostationary satellite · AQA June 2023 · A-level Paper 2 · Q13

A geostationary satellite stays above one point on the equator, so it can only send signals to the part of the Earth that faces it. It cannot reach any point on the surface. D is not true; A, B and C all are.

Watch out: This asks for the statement that is **not** true.

3 **C**

Fastest spin before equator material leaves · AQA June 2019 · A-level Paper 2 · Q10

Material at the equator just stays on when gravity exactly provides the centripetal force: $GMm / R^2 = m\omega^2R = m(2\pi / T)^2R$. So $T^2 = 4\pi^2R^3 / GM$ and $T = 2\pi\sqrt{(R^3 / GM)}$.

Watch out: This is the same as the period of a satellite orbiting just above the surface.

Medium

Questions 4–5

4 **C**

Graph linking T and r for planets · AQA June 2018 · A-level Paper 2 · Q18

$T^2 \propto r^3$, so $\log T = 1.5 \log r + \text{constant}$. A graph of log T against log r is a straight line: graph C.

Watch out: T against $r^{2/3}$ (A) has the power upside down; it would need $r^{3/2}$.

How students did: 30.8% of students got this right in June 2018.

5 **C**

Synchronous orbit around another planet · AQA June 2024 · A-level Paper 2 · Q21

$r^3 = GMT^2 / 4\pi^2$, so $r^3 \propto MT^2$. Double the mass and a quarter of the period: r^3 changes by $2 \times (1/4)^2 = 1/8$, so $r = R / 2$.

Watch out: Take the cube root of the factor 1/8 at the end.

How students did: Fewer than 35% of students got this right in June 2024, and the correct answer was not the most popular choice.

End of mark scheme. Answers from AQA's published keys; explanations written for this pack. AQA material is © AQA. More free packs and 1-to-1 tuition: **www.getbetteratphysics.co.uk**

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