

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	<p>Working:</p> <p>Use of $\frac{T^2}{r^3}$</p> <p>T^2 for Io = (1.77 days)² = 3.13 days (1)</p> <p>r^3 for Io = (421 600 km)³ = 7.49 × 10²⁷ (1)</p> <p>$\frac{T^2}{r^3}$ = Constant X for Io = same constant X for Europa = 4.17638 × 10⁻¹⁷ (1)</p> <p>r^3 for Europa = 670 900³ = 3.02 × 10¹⁷ (1)</p> <p>T^2 for Europa = 12.6</p> <p>T for Europa = 3.55 days (1)</p>	<p>Award full marks for correct numerical answer without working</p> <p>Accept values that round to 4 days</p>	(5)

Question number	Answer	Additional guidance	Mark
(ii)	<p>Convert to km from AU 0.0012 AU = 180 000 km (1)</p> <p>Calculation of $\frac{T^2}{r^3}$ for Mimas</p> $\frac{0.9^2}{180\,000^3} =$ $= 1.388 \times 10^{-16} \text{ (1)}$ <p>Divide this by the value for constant X from (b)(i) to find the ratio:</p> $\frac{1.388 \times 10^{-16}}{4.176 \times 10^{-17}}$ <p>Jupiter's mass = 3.325 (3½) × Saturn's mass (1)</p>	<p>Allow ecf</p> <p>Award full marks for correct numerical answer without working</p> <p>Accept values that round to 3.3</p>	(3)

Q2.

Question number	Answer	Notes	Marks
	27(years) Evidence of $9^3 (=729)$		2 1

Q3.

Question number	Answer	Mark
	(i) A double B is incorrect because the force of gravity is proportional to mass C is incorrect because the force of gravity is proportional to mass D is incorrect because the force of gravity is proportional to mass	(1) (1)
	(ii) D drop to one quarter A is incorrect because the force of gravity is inversely proportional to distance squared B is incorrect because the force of gravity is inversely proportional to distance squared C is incorrect because the force of gravity is inversely proportional to distance squared	

Q4.

Question number	Answer	Acceptable Answers	Marks
	<p>D Perihelion</p> <p>The only correct answer is D</p> <p>A is not correct because Aphelion is the point where the Earth is furthest from the Sun</p> <p>B is not correct because Elongation is a point in the orbit of another planet, as viewed from Earth</p> <p>C is not correct because it refers to the days of the year when day and night are of equal length</p>		1

Q5.

Question number	Answer	Mark
	<p>(i) C Epicycles</p> <p>A is incorrect because it is an observation.</p> <p>B is incorrect because it was proposed by Kepler</p> <p>D is incorrect because it is an ancient idea.</p> <p>(ii) B Elliptical orbits</p> <p>A is incorrect because it is an observation.</p> <p>C is incorrect because it was proposed by Ptolemy</p> <p>D is incorrect because it is an ancient idea.</p>	<p>(1)</p> <p>(1)</p>

Q6.

Question number	Answer	Notes	Marks
	<p>It made predictions of the positions of the planets easier/quicker to calculate.</p> <p>OR:</p> <p>Explained retrograde motion of planets</p>	<p><i>Accept: Better predictions</i></p> <p><i>Reject: It had the Sun at the centre / didn't have the Earth at the centre</i></p>	1

Q7.

Question number	Answer	Notes	Marks
	100 10 (or evidence of squaring)		2 1

Q8.

Question number	Answer	Mark
(i)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): Direction of the axial tilt has shifted since the building of the monument (1) so the star in constellation X would be located at a different place in the sky during the solstice now (1)	(2)

Question number	Answer	Additional guidance	Mark
(ii)	$35.4 \div 1.38 =$ 25.7 centuries (2570 y) (1) 554 BCE (1)	Award full marks for correct numerical answer without working Accept: BC Accept answers in the range of 560 BCE to 484 BCE	(2)

Question number	Answer	Mark
(iii)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (2 marks): The Earth's axis points to the pole star (Polaris) rather than the pole of the ecliptic which stays fixed (1) which means that precession causes the Earth's axis to describe a circle round the pole of the ecliptic every 26 000 years (1) and so the Earth's axis will point to different stars (e.g. Thuban/Alderamin) on the circle at different times (1).	(3)