Motion in the Universe

Mark Scheme 1

Level	IGCSE(9-1)
Subject	Physics
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1P)
Topic	Astrophysics
Sub-Topic	Motion in the Universe
Booklet	Mark Scheme 1

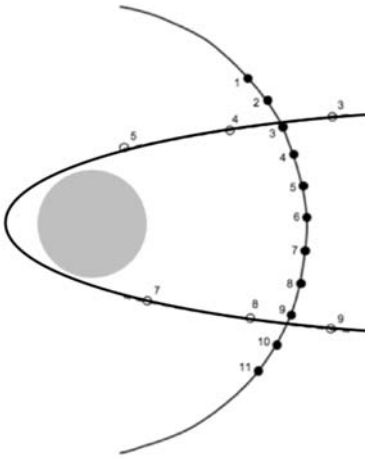
Time Allowed: **47 minutes**

Score: **/39**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'75%	70%	60%	55%	50%	<50%

Question number	Answer	Notes	Marks
1 (a) (i)	omet orbit behind Sun completed correctly;	Dashed or solid curved line	1
(ii)	X marked anywhere in grey area; e.g. 	No need to label X as "Sun" X should be left of the imaginary 5-7 line, reject X placed outside the orbit the curve should be 'pointy' not a part of a circle, such that distance week6-week 5 > distance week 5-week4	1
(iii)	Any one of the following ideas- MP1. comet was behind/near the Sun; MP2. comet was obscured/eclipsed by Sun; MP3. light from comet could not reach astronomer; MP4. Sun too bright to allow observation; MP5. we should not look directly at the Sun;	Allow labelled sketch	1
(iv)	C – week 9;		1
(v)	Any two of - MP1. Same time between observations; MP2. Different distances between observations; MP3. Speed = distance ÷ time;	Allow specific reference to 'a week' as the same time between observations	2

(vi)	Any one of - Energy argument – transfer of GPE to KE (ORA); Force argument, e.g. pulled by the Sun's gravitational force;	 Ignore • unqualified 'pulled by gravity' • gravitation from other bodies	1
(b)	Substitution into given formula; Conversion from days to hours; Calculation; e.g. v = 2 × π × 150 000 000 ÷ (365 x 24) = 110 000 (km/hour)	 24 seen 107 589/108 000 (km/hour) Allow due π (ONLY) a number that rounds to 110 000 2 582 130 = 2 (no 24 hr) 43 036 =2 (used 60 instead of 24)	3

Total 10 marks

Question number	Answer	Notes	Marks
2 (a)	any suitable from: e.g. • asteroid; • meteor(ite); • (artificial) satellite; • a moon; • comet; • named planet; • dwarf planet e.g. Pluto; • neutron star; • white dwarf; any two suitable from: • (the) Universe; • galaxy; • solar system; • star / Sun; • named planet (1); • named planet (2); galaxy;	accept appropriate correct answers planets: • Mercury • Venus • Mars 'Sun and star' is 1 mark only planets should be gas giants: • Jupiter • Saturn • Uranus • Neptune	4
(b) (i)	gravitational force / gravitational pull / (force of) gravity;		1
(ii)	B;		1
(iii)	single straight arrow directed towards the Sun;	judge by eye	1
(iv)	B;	total marks = 8	1

Question number	Answer	Notes	Marks
3 (a)	**B** galaxy – solar system – Sun – planet		1
(b) (i)	MP1. Idea that (orbit) shapes both (approximately) circular; MP2. Idea that both planets orbit the same star /Sun; MP3. similar plane of orbit; MP4. Same direction of orbit;	accept elliptical, oval, eccentricity Allow "Sun is at centre of orbit"	2
(ii)	different orbital radii ;	Allow • Earth (orbit) radius < Mars orbit radius • different time period • correct reference to speed of orbit • different circumference reject incorrect comparisons	1
(c)	Substitution into correct equation; Evaluation; Answer to two significant figures; e.g. $v = \frac{2 \times \pi \times 23\,500}{1.26}$ (1 mark) = 117 000 (2 marks) =120 000 (km/day) (3 marks)	$2 \pi r / T$ ONLY NO mark for equation as it is given on page 2 Bald correct answer to 3 or more s.f. scores 2 marks, e.g. 117186	3
(d)	MP1. Idea that the **orbital** radii of the two Moons are different; MP2. Idea that **orbit** radius of Enceladus is larger;	Ignore references to gravity ORA NB MP1 will be subsumed within MP2 response e.g orbit radius of Enceladus is ten times as big (ORA) gets both marks Allow response in terms of **orbit** / **orbit** diameter / **orbit** circumference	2

Total 9 marks

Question number	Answer	Notes	Marks
4 (a)	Venus;		1
(b)	because it has the largest mass;	ignore references to diameter/size	1
(c) (i)	density = $\frac{\text{mass}}{\text{volume}}$;	in words or accepted symbols e.g. $\rho = m/V$ condone D for density	1
(ii)	changing diameter to radius; substitution; evaluation; e.g. $\rho = \frac{100 \times 10^{24}}{[4/3 \times 3.14 \times 25000^3]}$ 1.5×10^{12} (kg/km^3)	if diameter used instead of radius (gives 1.9×10^{11}) max 2 -1 for POT error allow answers rounding down to 1.5×10^{12} (kg/km^3)	3
(d)	change of time into seconds (seen anywhere); use of orbital radius as 150×10^6 km; evaluation; e.g. $v = \frac{2 \times 3.14 \times (150 \times 10^6)}{365 \times 24 \times 60 \times 60}$ 29.9 (km/s)	no mark for eqn as this is given allow 30 (km/s)	3
(e)	an evaluation to include 3 of: MP1. identifying period as time of orbit; MP2. correct **detail** of why statement is right/wrong; MP3. correct use of data comparing 2 planets; MP4. period depends on distance from the Sun;	can refer to either mass or diameter of planet for 'size' must name planets must name planets	3

Total 12 marks