


Question		Answer	Marks	AOs	Guidance									
11	i	$y = kx^n$	B1 [1]	3.3	Allow any letters used for constant of proportionality and power.									
	ii	$\ln y = \ln(kx^n)$ $\ln y = \ln k + \ln(x^n) = \ln k + n \ln x$	M1 E1 [2]	2.1 2.1	Taking natural logs of both sides and one correct use of laws of logs used. Convincing argument. AG									
	iii	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>$\ln x$</th> <th>$\ln y$</th> </tr> </thead> <tbody> <tr> <td>Mercury</td> <td>-1.179</td> <td>9.575</td> </tr> <tr> <td>Jupiter</td> <td>1.599</td> <td>4.022</td> </tr> </tbody> </table>		$\ln x$	$\ln y$	Mercury	-1.179	9.575	Jupiter	1.599	4.022	B1 B1 [2]	1.1b 1.1b	At least 2 correct values All correct and to 4sf
	$\ln x$	$\ln y$												
Mercury	-1.179	9.575												
Jupiter	1.599	4.022												
	iv	EITHER $b = \frac{9.575 - 4.022}{-1.179 - 1.599} = -1.999$ (-2.00 to 3sf) $a = 7.218$	M1 A1 A1 [3]	1.1a 3.1a 1.1b	using gradient formula Allow -2 a correct to at least 2 sf	These values could be found using the calculator STATS mode, so allow without working								
		OR $9.575 = a - 1.179b$ $4.022 = a + 1.599b$ Giving $a = 7.218$ $b = -1.999$ (-2.00 to 3sf)	M1 A1 A1 [3]		Setting up pair of equations by substitution of their values. Allow one slip. a correct to at least 2 sf b correct to at least 2 sf	Simultaneous equations can be solved using calculator								
	v	$y = 1363x^{-2.00}$	B1 B1 [2]	2.2a 3.3	FT their equation in (i) awrt 1300 or 1400, or $e^{7.2}$ or better. FT their a Allow for x^{-2} or better. FT their b									
	vi		B1 B1 [2]	1.2 1.1b	Appropriate curve with at least one horizontal asymptote or vertical asymptote shown Both asymptotes correct Ignore $x < 0$ if shown	FT their equation in (v) provided their function is a decreasing function								
	vii	Earth $x = 1, y = 1363 \times 1^{-2} = 1360 \text{ W m}^{-2}$ (3sf)	B1 [1]	3.4	FT their (v)									

Question		Answer			Marks	AOs	Guidance
		SCHEME FOR CANDIDATES USING LOG BASE 10					
ii					SC1		Correct use of log instead of ln and no other error
iii			lnx	lny	B0 B1		All correct. Must be 4 sf
		Mercury	-0.5122	4.158			
		Jupiter	0.6946	1.747			
iv		As in main scheme $a = 3.1336$ $b = -1.999$			M1 A1 A1		
v		$y = 1360x^{-2}$			B1 B1		FT their equation in (i) awrt 1300 or 1400, or $e^{3.1}$ (= 22.2), $10^{3.1}$ or better. FT their a allow for x^{-2} or better. FT their b
vii		Earth $x = 1$, $y = 1363 \times 1^{-2} = 1360 \text{ W m}^{-2}$ (3sf)			B1		FT their (v)