

Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Mark Schemes

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark
	- Gradient of graph determined (1) $v = Hd$, so $t = 1/H = 1/\text{gradient}$ (1) $t = 4.7 \times 10^{17} \text{ s}$ (1)	Example of calculation: Gradient = $\frac{(44000-1000) \text{ km s}^{-1}}{(2.00-0.00) \times 10^{22} \text{ km}} = 2.15 \times 10^{-18} \text{ s}^{-1}$ $t = \frac{1}{2.15 \times 10^{-18} \text{ s}^{-1}} = 4.65 \times 10^{17} \text{ s}$	3

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	MAX 3 - Intensity of light varies as an inverse square law Or reference to $I = \frac{P}{4\pi d^2}$ (1) - the light intensity would not increase uniformly (decreasing the distance as suggested) (1) - The student should decrease the distance at decreasing intervals (1) - The student should use a greater range (of distances, as lamp is not a point source of light) (1)		3

(ii)	An explanation that makes reference to the following points: EITHER - Carry out experiment under subdued lighting (1) - As the ambient lighting will increase the ammeter reading	Allow: Keep the intensity of the lamp constant Or Keep angle of lamp constant As this would change the ammeter reading [dependent upon MP1]	
	(1) [dependent upon MP1] OR (1) - Take readings at eye level (1) - As this will reduce parallax error [dependent upon MP3] OR - Take multiple readings of intensity and calculate a mean (1) - As this will reduce the effect of <u>random</u> error (1) [dependent upon MP5]		2

Q3.

Question Number	Answer	Mark
(b)(i)	$T = 11\,500\text{ K}$ (allow $11\,250\text{ K}$ to $11\,750\text{ K}$) (1)	1
(b)(ii)	At least 2 pairs of values read from graph (1) Use of $\lambda_{\text{max}} T = \text{constant}$ (1) Use values to show $\lambda_{\text{max}} T = \text{a constant}$ (1) <u>Example of calculation:</u> $\lambda_{\text{max}} T = 0.25 \times 10^{-6} \times 11500 = 2.9 \times 10^{-3}$ $\lambda_{\text{max}} T = 0.5 \times 10^{-6} \times 5800 = 2.9 \times 10^{-3}$	3

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
	Either • (Inverse square law states that) the intensity is inversely proportional to the square of the distance (1) Or $I \propto \frac{1}{x^2}$ with symbols defined • So $I \rightarrow \frac{I}{4}$ and statement is incorrect (1) Or intensity/brightness falls to one quarter and statement is incorrect OR • The power is spread over 4 times the area (1) • So intensity/brightness falls to one quarter and statement is incorrect (1)		2

Q5.

Question Number	Answer	Mark
(a)*	(QWC – Work must be clear and organised in a logical manner using technical wording where appropriate) Electrons/atoms move to higher energy levels / get excited (1) They then move to lower energy levels (accept ground state) (1) The energy from the move is given out in the form of a <u>photon</u> (1) The energy levels are discrete Or only certain energy levels are possible (1) The energy of the photon must be equal to the difference in energy levels Or $hf = E_2 - E_1$ (1) There are only a limited number of energy differences and only a corresponding number of frequencies (looking for differences /changes not levels) (1) (The marks above may be obtained from a suitably labelled diagram – but the order of excitation and de-excitation cannot be assumed for two marks just from the presence of both)	6
(b)	Doppler (accept blue shift) (1) The wavelength of the radiation is decreased / frequencies increases (1) Star moving towards Earth or vice versa (1)	3
(c)	Light behaves as both particle and wave Or wave-particle duality (1)	1
	Total for question	10