Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Mark Schemes
Q1.

Question Number	Acceptable Answers	Additional Guidance	Mark
(a)(i)	• measurements from page, 7 mm, 6.3 cm (1) • calculates area using 3 × 0.007 m × 0.063 m (1) • uses ± 1mm to calculate percentage uncertainties (1) • adds percentage uncertainties to calculate final uncertainty, 1.3 × 10^{-3} m^2 ± 0.2 × 10^{-3} m^2 (1)		**(4)**

Question Number	Acceptable Answers	Additional Guidance	Mark
(a)(ii)	• use of $I = P/A$ (1) • P= 1.61 W (1) • use of $P = IV$ (1) • use of efficiency = power output / power input (1) • efficiency = 0.096 or 9.6% (1) • comparison – this is about 10%, so correct (1)		**(5)**

Question Number	Acceptable Answers	Additional Guidance	Mark
(b)	• very small amount of energy (1) OR the hat is something we don't really need • so it isn't significant compared to the energy required to make it (1)		**(2)**

Q2.

Question Number	Answer	Mark
(a)	Quantum of … **Or** (discrete) packet of … **Or** discrete quantity of … **(1)** (To score the mark must refer to something relevant e.g. light / energy) **(1)** Of electromagnetic radiation/energy	**2**
*** (b)**	(QWC – Work must be clear and organised in a logical manner using technical wording where appropriate) **(1)** describe relevant interaction between single photon and single electron **(1)** photon energy depends on frequency **Or** reference to $E = hf$ (must be link to photons/light) **(1)** if photon energy greater than work function, electron emitted (immediately) **(1)** whereas for waves energy could build up **Or** with waves that the electron can absorb energy continuously or over time **(1)** so any frequency should work **Or** but this build up doesn't happen	**5**

(c)(i)	Use of $4.3 \times 1.6 \times 10^{-19}$ Use of $E = hf$ $f = 1.0 \times 10^{15}$ Hz Example of calculation $E = 4.3\ V \times 1.6 \times 10^{-19}\ C$ $= 6.9 \times 10^{-19}\ J$ $6.9 \times 10^{-19}\ J = 6.63 \times 10^{-34}\ Js \times f$ $f = 1.0 \times 10^{15}$ Hz	**(1)** **(1)** **(1)**	**3**
(c)(ii)	Ultraviolet Accept ultraviolet even if frequency in c(i) is incorrect, but allow ecf from candidate's value of frequency to appropriate part of electromagnetic spectrum	**(1)**	**1**
	Total for question		**11**