

Question Number	Answer	Mark
14a	Minimum energy required to release/emit a (photo)electron (from the surface of the metal) (1)	(1)
14b	Ultraviolet has a higher (photon) energy (than visible light) (1) Ultraviolet (photons) have an energy greater than the work function Or Visible light (photons) have an energy less than the work function (1) OR Ultraviolet has a higher frequency (than visible light) (1) Ultraviolet has a frequency greater than the threshold frequency Or Visible light has a frequency less than the threshold frequency (1) (Allow converse statements for MP1)	
14ci	(Increased intensity means) more <u>photons</u> per second (1) (More photons leads to) more electrons emitted (per second) (1) Reading on ammeter is increased (1) Or Current is increased (For MP1 there needs to be an indication of rate e.g. “per unit time”)	(3)
14cii	Use of $E = hf$ (1) Use of $V = W/Q$ (1) Use of $hf = \Phi + \frac{1}{2} mv_{\max}^2$ (1) Work function = 7.6×10^{-19} (J) (1) <u>Example of Calculation</u> $hf = \Phi + \frac{1}{2} mv_{\max}^2 = hf = \Phi + QV$ $hf = (6.63 \times 10^{-34} \text{ Js}) (2.00 \times 10^{15} \text{ Hz}) = 1.33 \times 10^{-18} \text{ J}$ $QV/eV = (1.60 \times 10^{-19} \text{ C}) (3.59 \text{ V}) = 5.74 \times 10^{-19} \text{ J}$ $hf - eV = 7.56 \times 10^{-19} \text{ J}$	(4)
Total for question 14		10