Question Number	Answer		Mark
14a	Minimum energy required to release a(n) (photo)electron (from the surface of a metal)	(1)	**1**
14b	Use of $E = hf$	(1)	**3**
	Use of $hf = \Phi + \frac{1}{2} mv^2_{max}$	(1)	
	$\Phi = 5.90 \times 10^{-19}$ (J) so metal is magnesium	(1)	
	Example of calculation $E = hf = (6.63 \times 10^{-34}$ Js) $\times (6.32 \times 10^{15}$ Hz) $= 4.19 \times 10^{-18}$ J $hf - \frac{1}{2} mv^2_{max} = 4.19 \times 10^{-18}$ J $- 3.60 \times 10^{-18}$ J $= 5.90 \times 10^{-19}$ J so metal used is magnesium.		
14ci	Use of $I = P/A$	(1)	**3**
	Use of $P = W/t$ with $W = 3.62 \times 10^{-19}$ (J)	(1)	
	$t = 118$ s	(1)	
	Example of calculation $I = P/A$, $(38.0 \times 10^{-3}$ Wm$^{-2}) \times (8.10 \times 10^{-20}$ m$^2) = 3.08 \times 10^{-21}$ W. $t = W/P$, $(3.62 \times 10^{-19}$ J) / $(3.08 \times 10^{-21}$ W) = 118 seconds.		
14cii	One photon releases one electron	(1)	**2**
	Photons transfer all of their energy to the electrons **Or** Photons are packets/quanta of energy	(1)	
	Total for question 14		**9**