Question Number	Answer		Mark
14a	(In the wave model) <u>energy</u> is built up over time **Or** (in the wave model) the <u>energy</u> is spread across the wave	(1)	
	So (photo)<u>electron</u>s would not be released immediately/instantaneously **Or** so (photo)<u>electron</u>s would be released after a time delay	(1)	**2**
	(MP1 – allow any wording indicating a time delay e.g. 'slowly') (MP2 – do not allow "photoelectric emission" unless it is directly linked to <u>electron</u> release)		
14bi	Use of $hf = \Phi + \frac{1}{2}mv^2_{max}$	(1)	
	Converts from eV to J	(1)	
	Use of $E_k = \frac{1}{2}mv^2$ (with m = 9.11×10^{-31})	(1)	
	Maximum speed of electrons = 7.3×10^5 ms^{-1}	(1)	**4**
	<u>Example of calculation</u> Φ (in J) = 4.3 eV × (1.6×10^{-19} J eV^{-1}) = 6.9×10^{-19} J $hf - \Phi = \frac{1}{2}mv^2$ = (9.3×10^{-19} J) – (6.9×10^{-19} J) = 2.4×10^{-19} J 2.4×10^{-19} J = ½ (9.11×10^{-31} kg) v^2 $v = 7.3 \times 10^5$ ms^{-1}		
14bii	Lower work function (than zinc) would result in greater (maximum) speed (of electrons)	(1)	
	Greater wavelength (of ultraviolet light) would result in smaller (maximum) speed (of electrons) **Or** to achieve greater (maximum) speed (of electrons), a smaller wavelength would be required	(1)	
	The relative sizes of these changes are not known so no conclusion could be reached **Or** the first suggestion is correct, the second is incorrect	(1)	**3**
	(MP1/MP2 – ignore references to KE)		
	Total for question 14		**9**