

Name of the Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

Mark Schemes

Q1

Question Number	Answer	Mark
	electron emitted by absorption of light/UV/photon (1)	
	one photon absorbed by one electron (1)	
	if frequency above threshold frequency then electron emitted Or if photon energy above work function energy then electron emitted (1)	
	Use of $hf = \phi$ (using work function to find corresponding frequency or wavelength) Or Use photon energy = hf (using any identified frequency or wavelength of visible light or UV to find corresponding photon energy) (1)	
	Threshold frequency = 1.0×10^{15} Hz Or wavelength = 2.9×10^{-7} m Or Photon energy for light = a value between 2.9×10^{-19} J and 5.1×10^{-19} J Or photon energy for UV = a value between 5.1×10^{-19} J and 1.99×10^{-17} J (1)	
	State visible light frequency too low / wavelength too long Or compare photon energy to work function (1)	6
	<u>Example of calculation</u> $f = 6.88 \times 10^{-19} \text{ J} \div 6.63 \times 10^{-34} \text{ J s}$ $= 1.0 \times 10^{15} \text{ Hz}$	
	Total for question	6

Q2

Question Number	Acceptable Answer	Additional Guidance	Mark
	- the atoms have discrete energy levels (1) - atoms gain energy and get excited / electrons move to higher energy levels (1) - atoms/electrons move to lower energy levels and emit energy as photons (1) <u>different</u> energy changes cause photons with <u>different</u> frequencies/wavelengths (1)		(4)

Q3

Question Number	Acceptable answers	Additional guidance	Mark
(i)	(Moving) electrons collide with lattice/ions (1) - Transfer of energy to (lattice) ions so they vibrate with larger amplitude/speed (and the temperature increases) (1)		2
(ii)	- Electrons/ions in the tube collide with mercury/phosphor atoms and excite electrons (in the mercury/phosphor atoms) (1) - Energy is released in the form of photons as the electrons move back down (to the ground state) (1)	Mention of work function scores 0 MP2 Allow de-excite for move back down	2

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following points: • Only a real image will be produced on a screen (1) • The object cannot be closer than f for a real image (1) • Because light diverges after passing through the lens (1) OR • If object closer than f rays still diverge after passing through lens (1) • So a virtual image is formed (1) • which cannot be seen on a screen. (1)		3