

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Mark Schemes

Q1.

- (a) (i) electrons passing through tube collide with electrons in mercury atom ✓
Allow mercury atoms collide with each other
transferring energy / atom gains energy from a collision ✓
causing orbital electrons / electrons in mercury atom to move to higher energy level ✓
Atomic electrons move from ground state 3
- (ii) (each) excited electron / atom relaxes to a lower (energy) level ✓
allow excited electron / atom de-excites / relaxes
Allow excited electron / atom relaxes to ground state
Condone moves for relaxes
emitting a photon of energy equal to the energy difference between the levels ✓ 2
- (b) coating absorb (uv) photons (causing excitation) / (uv)photons collide with electrons in the coating (causing excitation) / electrons in coating are excited
allow atoms in coating absorb (uv) photons (causing excitation)
Atomic electrons de-excite indirectly to previous lower level (and in doing so emit lower energy photons) ✓
Owtte (must convey smaller difference between energy levels in a transition) cascade 2

[7]

Q2.

- (a) proton 1
- (b) (i) β^+ identified even if numbers incorrect or correct numbers for β^+ **and** proton number on Mg correct

 β or β^+ identified and all numbers correct
i.e Second mark not awarded if numbers are correct but there is a minus on the β particle
Allow 1 for consistent equation for β^- decay 2
- (ii) W^+ (condone W but not W^-) 1

[4]

Q3.

- (a) (i) Energy required to remove an electron
Minimum energy required to remove an electron from a (metal) surface

2

- (ii) Read off $\lambda = 550$ (nm)
Use of $E = hc / \lambda$ or $E = hf$ and $c = f\lambda$
 3.6×10^{-19}
or
Reads st of coordinates correctly
Use of $hc/\lambda = \Phi + E_{k(\max)}$
 3.6×10^{-19} (J)

3

- (b) $E_k = 9.6 \times 10^{-20}$
J converted to eV / 0.6 eV
 4.35 to 4.40×10^{-7} (m), using graph
OR

$$E_k = 9.6 \times 10^{-20} \text{ or } \Phi = 6.4 \times 10^{-19}(\text{J})$$

$$hc/\lambda = 4.96 \times 10^{-19} \text{ (using given value in (a))}$$

$$\text{or } 4.6 \times 10^{-19} \text{ using calculated value}$$

$$\text{or } f = 7.5 \times 10^{14}(\text{Hz})$$

$$4 \times 10^{-7} \text{ to } 4.4 \times 10^{-7} \text{ (m)}$$

Allow ecf for second mark only (i.e. for adding incorrect KE to work function)

3

[8]