Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Mark Schemes

Q1.

(a) (i) protons = 20 ✓
neutrons = 28 ✓
electrons = 18 ✓

3

(ii) $2 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-19}$ ✓(C)
-ve sign loses mark

1

(iii) specific charge = $3.2 \times 10^{-19} / (48 \times 1.67 \times 10^{-27} + 18 \times 9.11 \times 10^{-31})$ ✓

specific charge = 4.0×10^{6} C kg^{-1} ✓
Allow 1.66
Allow CE from (ii)
First mark is for mass if miss out electron mass and do not justify lose first mark

2

[6]

Q2.

(a) energy of photon is constant / fixed OR energy given to electron is fixed ✓
energy required for electron to leave / escape / emit from the surface / metal
OR electron has to overcome work function ✓
maximum kinetic energy is the energy of photon minus the work function ✓
deeper electrons require energy to get to the surface OR have less E_k than surface electrons ✓
mention of energy levels means can only score first mark
photoelectric equation alternative for third mark if φ and hf defined

3 max

(b) (i) (*use of E = hf*)
energy of photon = $6.63 \times 10^{-34} \times 3.0 \times 10^{15}$ ✓ = 1.989×10^{-18} (J)
work function = $hf - E_k = 1.989 \times 10^{-18} - 1.7 \times 10^{-18} = 2.89 \times 10^{-19}$ ✓
work function = $2.89 \times 10^{-19} / 1.6 \times 10^{-19}$ ✓= (1.8 eV)
hf gets first mark even if in wrong equation

3

(ii) work function = hf_0
$f_0 = 1.8 \times 1.6 \times 10^{-19} / 6.63 \times 10^{-34}$ ✓= 4.3×10^{14} ✓(Hz) ✓(2 sig figs)
2 sig . fig stand alone mark
Accept 4.4×10^{14}

(c) (i) decrease the energy of(incident) photons ✓
decrease the maximum kinetic energy of electrons ✓
OR
decrease the energy of(incident) photons ✓
hence fewer deeper electrons escape ✓
OR
below threshold frequency ✓
no electrons emitted ✓
OR
as energy of each photon decreases but intensity is constant (there are more photons / sec) ✓
number of emitted electrons(/sec) must increase ✓

for last two alternatives must get first mark before can qualify for second mark

2

(ii) increase in photons cause increase in (emitted) electrons ✓
double number of electrons / photons OR reference to rate /per second ✓

if refer to energy levels / atoms can only award first mark

2

[13]