

Name of the Student: _____

Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

Q1.

- (a)
- M1:**
- P dissolved or put in/added to a solvent

M1: Allow named solvent eg water or methanol

1

M2: (injected through) a needle or nozzle or capillary and at high voltage/4000 volts or high potential**M2:** Allow needle is positively charged

1

M3: Gains a proton / H^+ **M3:** Not atoms gain a proton**M3:** Could be scored from equation

1

M4: $P + H^+ \rightarrow PH^+$ Correct equation gains **M3** and **M4**

Ignore state symbols

1

- (b) 555

1

- (c)
- M1**
- $V = d/t$
- or
- $= 1.22 \times 10^5 \text{ ms}^{-1}$

Recall this equation

1

$$\mathbf{M2} \quad m = \frac{2KE}{v^2} \quad \text{or} \quad \frac{2 \times 2.09 \times 10^{-15}}{(1.22 \times 10^5)^2}$$

or

$$\mathbf{M2} \quad m = \frac{2KE \times t^2}{d^2} \quad \text{or} \quad \frac{2 \times 2.09 \times 10^{-15} \times (1.23 \times 10^{-5})^2}{1.50^2}$$

Rearrangement to give m

1

$$\mathbf{M3} \quad m = \underline{2.8(1) \times 10^{-25}} \text{ (kg)}$$

M3: Calculation of m .

1

$$\mathbf{M4} = 2.81 \times 10^{-25} \underline{\times L} = 0.169$$

M4: Allow **M3** $\times L$

1

M5 $0.169 \times \underline{1000} = 169.(2)$

M5: Allow **M4** $\times 1000$

169 only scores 5 marks

Allow answers to 2 significant figures or more ignore units

1

[10]

Q2.

(a) **M1** Amount of $\text{S}_2\text{O}_3^{2-} = \frac{9.00 \times 0.0800}{1000} = 7.20 \times 10^{-4} \text{ mol}$

1

(From equations $\text{mol S}_2\text{O}_3^{2-} = \text{mol Cu}^{2+}$)

M2 Amount of Cu^{2+} in $25 \text{ cm}^3 = 7.20 \times 10^{-4} \text{ mol}$

M2 = answer to **M1** (1:1 ratio)

1

M3 Amount of Cu^{2+} in $250 \text{ cm}^3 = 7.20 \times 10^{-4} \times 10 = 7.20 \times 10^{-3} \text{ mol}$

M3 = **M2** $\times 10$

1

M4 Mass of copper = $7.20 \times 10^{-3} \text{ mol} \times 63.5 = 0.457 \text{ g}$

M4 = **M3** $\times 63.5$

1

M5 mass = 0.985 g

M5 converting 985 mg to g

1

$\% \text{ Cu} = 0.457 \times \frac{100}{0.985} = 46.4 \%$

M6

M6 is for the answer to **3 sf**

Allow $\% \text{ Cu} = 457 \times \frac{100}{985} = 46.4 \%$ for **M5** and **M6**

Allow $(\text{M4} \times 1000) / 985 \times 100$ for **M5** and **M6**

1

(b) Use more of the alloy

1

Use a lower concentration of the thiosulfate solution/lower mass of $\text{Na}_2\text{S}_2\text{O}_3$ to make solution

1

(c) Oxidizing agent

Allow electron acceptor

1

(d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$

Do not allow $[\text{Ar}]3d^9$

1

(e) Full (3)d (sub)shell or $(3)d^{10}$

1

No (d-d) transitions possible/ cannot absorb visible/white light

M2 is dependent on **M1**

Ignore reflects visible/white light

1

(f) **M1**: $n = (5.00/253.8) = 0.0197 \text{ mol}$

Allow 254

If 126.9 or 127 used lose **M1** only

1

M2: $T = 458 \text{ K}$ and $P = 100\,000 \text{ Pa}$

1

M3 $V = \frac{nRT}{P} \text{ or } \frac{0.0197 \times 8.31 \times 458}{100\,000} \text{ or } 7.50 \times 10^{-4} \text{ (m}^3\text{)}$

M3 If rearrangement incorrect can only score **M1** and **M2**

1

M4: $V = 750 \text{ (cm}^3\text{)}$

M4: Allow **M3** $\times 10^6$

M4: Allow 749

1

[16]