Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) Manganate would oxidise / react with $\underline{Cl^-}$

1

Because $E^{\ominus}$ for MnO_4^- is more positive than that for Cl^2 / 1.51 – 1.36 = +0.15 (V)

Must refer to data from the table for M2.

1

(b) Moles of $H^+ = 25 \times 0.0200 \times 8 / 1000 = 4.00 \times 10^{-3}$

1

Moles of $H_2SO_4 = 2.00 \times 10^{-3}$ ($4.00 \times 10^{-3} / 2$)

Allow consequential marking on incorrect moles of H^+

1

Volume $H_2SO_4 = 4.00$ (cm^3) ($2.00 \times 10^{-3} \times 1000 / 0.500$)

Allow consequential marking on incorrect moles of H_2SO_4
Accept 4 cm^3.
8 cm^3 scores 2 marks.
Do not penalise precision.
Correct answer without working scores M3 only.

1

(c) (i) $MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$

Allow multiples, including fractions.
Ignore state symbols.

1

(ii) Can't see end point due to brown colour

1

$\underline{\text{Larger}}$ titre (than expected)

Allow the idea that with two reactions can't make use of titre in calculations.
Do not allow 'an inaccurate result' without qualification.

1

(d) Solution (very) dilute / lots of water

1

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Q2.

(a) Variable oxidation state

1

eg Fe(II) and Fe (III)

Any correctly identified pair

Allow two formulae showing complexes with different oxidation states even if oxidation state not given

1

(Characteristic) colour (of complexes)

1

eg Cu^{2+}(aq) / $[Cu(H_2O)_6]^{2+}$ is blue

Any correct ion with colour scores M3 and M4

Must show (aq) or ligands OR identified coloured compound e.g. $CoCO_3$)

1

(b) Tetrahedral

1

$[CuCl_4]^{2-}$ / $[CoCl_4]^{2-}$

Any correct complex

(Note charges must be correct)

1

Square planar

1

$(NH_3)_2PtCl_2$

Any correct complex

1

Linear

Do not allow linear planar

1

$[Ag(NH_3)_2]^+$

$[AgCl_2]^-$ etc

1

(c) (i) $[Ca(H_2O)_6]^{2+} + EDTA^{4-} \longrightarrow [CaEDTA]^{2-} + 6H_2O$

If equation does not show increase in number of moles of particles CE = 0/3 for (c)(ii)

If no equation, mark on

1

(ii) 2 mol of reactants form 7 mol of products

Allow more moles/species of products

Allow consequential to (c)(i)

1

Therefore disorder increases

1

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Entropy increases / +ve entropy change / free-energy change is negative

1

(iii) Moles EDTA = $6.25 \times 0.0532 / 1000 = (3.325 \times 10^{-4})$

1

Moles of Ca^{2+} in 1 $dm^3 = 3.325 \times 10^{-4} \times 1000 / 150 = (2.217 \times 10^{-3})$

Mark is for M1 × 1000 / 150 ***OR*** *M1 × 74.1*

If ratio of Ca^{2+} : EDTA is wrong or 1000 / 150 is wrong, CE and can score M1 only

This applies to the alternative

1

Mass of $Ca(OH)_2 = 2.217 \times 10^{-3} \times 74.1 = 0.164$ g

M1 × 74.1 × 1000 / 150

Answer expressed to 3 sig figs or better

Must give unit to score mark

Allow 0.164 to 0.165

1

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