Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Inorganic 2

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Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Mark Schemes

Q1.

(a) A reaction that produces its own catalyst/ one of the products is the catalyst

1

Mn^{2+}

Allow Mn^{3+}

1

(b) H_2SO_4

1

(c) There is no/very little catalyst at the start OR the reaction only speeds up when the catalyst is produced

1

Two negative ions (MnO_4^- and $C_2O_4^{2-}$) repel

Reference to molecules loses M2

1

The activation energy for the reaction is high / heat is required to overcome the activation energy

1

(d) M1 $5\ C_2O_4^{2-}(aq) + 2\ MnO_4^-(aq) + 16\ H^+(aq) \longrightarrow 10\ CO_2(g) + 2\ Mn^{2+}(aq) + 8\ H_2O(l)$

Ignore state symbols

1

M2 $n(MnO_4^-) = \frac{26.40 \times 0.02}{1000}$ OR $n(MnO_4^-) = 5.28 \times 10^{-4}$

1

M3 $n(C_2O_4^{2-}) = \frac{5}{2} \times 5.28 \times 10^{-4} = 1.32 \times 10^{-3}$

M3 is for M2 × 5/2

If wrong ratio used then can only score M2, M4, M5 and M6

1

M4 $n(C_2O_4^{2-}$ in flask originally) $= 1.32 \times 10^{-3} \times 10 = 1.32 \times 10^{-2}$

M4 is for M3 × 10

1

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M5 $n(K_3[Fe(C_2O_4)_3].3H_2O) = \frac{1.32 \times 10^{-2}}{\quad} = 4.40 \times 10^{-3}$

(Mr $K_3[Fe(C_2O_4)_3].3H_2O = 491.1$)

M5 is for M4 ÷ 3

1

M6 Mass of $K_3[Fe(C_2O_4)_3].3H_2O$ reacted = $4.40 \times 10^{-3} \times 491.1 = 2.16$ g

M6 is for M5 × 491(.1)

1

M7 % purity = $\frac{2.16}{2.29}$ x100 = 94.3 or 94.4%

Answer must be to 3 s.f.

Correct answer scores 6 marks; mark equation separately

Alternative method using ratio by moles:

M5 $n(C_2O_4^{2-}) = 4.66 \times 10^{-3} \times 3 = 0.0140$ moles in $250cm^3$

M6 n(complex) = 2.29/491.1 = 4.66×10^{-3} moles in $250cm^3$

M7 % = 0.0132/0.0140 × 100 = 94.3 or 94.4%

1

(e) Make some known concentrations (of the coloured solution and read the absorbance of each one using a colorimeter)

Ignore addition of suitable ligand

1

Plot a graph of absorbance vs concentration

Not just "plot a calibration curve" / reference to Beer-Lambert graph is insufficient

Do not allow transmittance in M2

1

Read/compare unknown concentration from calibration curve/graph (and hence the concentration from the graph)

M3 can only be scored if graph/curve mentioned

1

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Q2.

(a) $[Fe(H_2O)_6]^{2+} + 2NH_3 \rightarrow Fe(H_2O)_4(OH)_2 + 2NH_4^+$

Allow equation with OH^- provided equation showing formation of OH^- from NH_3 given

1

Green precipitate

1

$[Fe(H_2O)_6]^{2+} + CO_3^{2-} \rightarrow FeCO_3 + 6H_2O$

1

Green precipitate

effervescence incorrect so loses M4

1

(b) (i) Colourless / (pale) green changes to pink / purple (solution)

Do not allow pale pink to purple

1

Just after the end−point MnO_4^- is in excess / present

1

(ii) $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$

1

Moles $KMnO_4 = 18.7 \times 0.0205 / 1000 = (3.8335 \times 10^{-4})$

Process mark

1

Moles $Fe^{2+} = 5 \times 3.8335 \times 10^{-4} = 1.91675 \times 10^{-3}$

Mark for M2 × 5

1

Moles Fe^{2+} in 250 $cm^3 = 10 \times 1.91675 \times 10^{-3} = 0.0191675$ moles in 50 cm^3

Process mark for moles of iron in titration (M3) × 10

1

Original conc $Fe^{2+} = 0.0191675 \times 1000 / 50 = 0.383$ $\underline{\text{mol dm}^{-3}}$

Answer for moles of iron (M4) × 1000 / 50

Answer must be to at least 2 sig. figs. (0.38)

1

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