

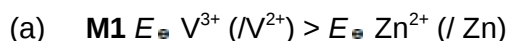
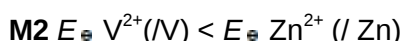
Name of the Student: _____

Max. Marks : 27 Marks

Time : 27 Minutes

Mark Schemes

Q1.

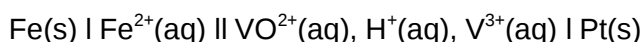
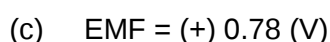
OR EMF of reaction between V^{3+} and Zn = (+)0.50 VOR EMF of reaction between V^{2+} and Zn = - 0.44 V

2

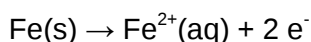


Only

1

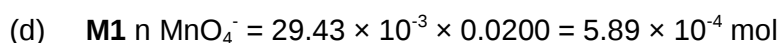
Allow $\text{Fe(s)} \mid \text{Fe}^{2+}(\text{aq}) \parallel \text{VO}^{2+}(\text{aq}), \text{V}^{3+}(\text{aq}) \mid \text{Pt(s)}$

Ignore state symbols



Ignore state symbols

3



M2 $n \text{ V}^{2+} = 5.89 \times 10^{-4} \times \frac{5}{3} = 9.81 \times 10^{-4} \text{ mol}$

M2 $= \text{M1} \times \frac{5}{3}$

M3 $\text{mass NH}_4\text{VO}_3 = 9.81 \times 10^{-4} \times 116.9 = 0.1147 \text{ g}$

M3 $= \text{M2} \times 116.9$

M4 $\% \text{ purity} = \frac{0.1147 \times 100}{0.151} = 76.0 \%$

M4 $= \text{M3} \times \frac{100}{0.151}$

Allow 75.9 or 76.2 %

Answer to 3 significant figures

4

[10]

Q2.

- (a) More shells

OR

more energy levels.

Allow Ca has 4 shells and Mg has 3 shells

Do not accept more outer shells

Ignore shielding

Ignore subshells/orbitals/more electrons

1

- (b) $\text{Mg(s)} + \text{H}_2\text{O(g)} \rightarrow \text{MgO(s)} + \text{H}_2\text{(g)}$

State symbols required

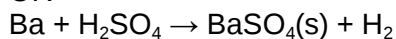
Allow multiples

1

- (c) **M1** (Ba is more reactive) because outer/valence electrons further from nucleus/less attracted to the nucleus/lost more easily

M2 Insoluble barium sulfate (is formed)

OR



M3 Barium sulfate prevents further reaction (with sulfuric acid)

OR

Barium gets coated with barium sulfate (so no more barium reacts)

3

- (d) **M1** $P = 100\,000\text{ Pa}$ and $V = 348 \times 10^{-6}\text{ m}^3$

$$\text{M2 } n = \frac{PV}{RT} \text{ Or } \frac{100\,000 \times 348 \times 10^{-6}}{8.31 \times 298}$$

$$\text{M3 } n = 0.01405\text{ mol}$$

$$\text{M4 } n \text{ metal nitrate} = 0.01405 \times \frac{2}{5} = 5.62 \times 10^{-3}\text{ mol}$$

$$\text{M4} = \text{M3} \times \frac{2}{5}$$

$$\text{M5 } M_r \text{ metal nitrate} = \frac{0.832}{5.62 \times 10^{-3}} = 148(.0)$$

$$\text{M5} = 0.832 \div \text{M4}$$

$$\text{M6 } A_r \text{ of metal} = 148.0 - (2 \times 14 + 2 \times 48) = 24(.0) = \text{Mg}$$

$$\text{M6} = \text{M5} - 124 \text{ and identity of a metal with } 2+ \text{ oxidation state}$$

6

- (e) **M1** $\text{Na} + \text{Al} + 2\text{H}_2 \rightarrow \text{NaAlH}_4$

M2 contains oppositely charged ions/ Na^+ and AlH_4^- ions

M3 strong attraction between (oppositely charged) ions

3

- (f) $3\text{NaOH} + \text{H}_3\text{PO}_4 \rightarrow \text{Na}_3\text{PO}_4 + 3\text{H}_2\text{O}$

Allow multiples and ignore state symbols

1

- (g) $\text{Li}^+ + \text{CoO}_2 + \text{e}^- \rightarrow \text{Li}^+(\text{CoO}_2)^-$

Allow $\text{Li}(\text{CoO}_2)$ as product

1

- (h) The electrode reactions can be reversed (by applying a reverse potential)
Allow reaction is reversible (by applying a reverse potential)