Mark schemes

Q1.

(a) Electron is removed from 1(s) (rather than 2(s))

Mark independently

Lower in energy (than 2s)/Less/No shielding/closer to the nucleus

Stronger attraction between nucleus and outer electron

3

(b) Similarity: produce hydrogen/produce gas/produce white solids/produce Mg^{2+} compounds/produce a base

Difference: magnesium oxide formed with steam and magnesium hydroxide formed with (cold) water

2

(c) Oxidation state of Ca increases, so Ca is oxidised
OR
Oxidation state of Ca from 0 to +2, so Ca is oxidised

*If no marks awarded, then correct oxidation states of Ca **and** H before **and** after the reaction scores 1 mark*

Oxidation state of H decreases, so H is reduced
OR
Oxidation state of H from +1 to 0, so H is reduced

2

[7]

Q2.

(a) An electron acceptor

Do not accept electron pair acceptor or gain of electrons

1

(b) $Cu \rightarrow Cu^{2+} + 2e^-$

Ignore state symbols, even if incorrect.

Accept multiples

1

(c) $NO_3^- + 2\ H^+ + e^- \rightarrow NO_2 + H_2O$

Ignore state symbols, even if incorrect.

Accept multiples

1

(d) $Cu + 2\ NO_3^- + 4\ H^+ \rightarrow Cu^{2+} + 2\ NO_2 + 2\ H_2O$

Ignore state symbols, even if incorrect.

Accept multiples

1

[4]

Q3.

(a) $Cl_2 + H_2O \rightleftharpoons HCl + HOCl$

Allow →

OR

$2\ Cl_2 + 2\ H_2O \rightarrow 4\ HCl + O_2$

Allow multiples

1

(b) $Cl_2 + 2\ NaOH \rightarrow NaCl + NaOCl + H_2O$

Allow multiples

1

(c) **M1** $2\ Cl^- \rightarrow Cl_2 + 2\ e^-$

Allow multiples

M2 $2\ ClO_3^- + 12\ H^+ + 10\ e^- \rightarrow Cl_2 + 6\ H_2O$

M3 $2\ ClO_3^- + 12\ H^+ + 10\ Cl^- \rightarrow 6\ Cl_2 + 6\ H_2O$

M3 Allow
$ClO_3^- + 6\ H^+ + 5\ Cl^- \rightarrow 3\ Cl_2 + 3\ H_2O$

3

(d) $NaCl + H_2SO_4 \rightarrow HCl + NaHSO_4$

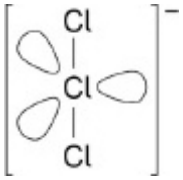
OR

$2\ NaCl + H_2SO_4 \rightarrow 2\ HCl + Na_2SO_4$

Base/proton acceptor

2

(e)



Ignore absence of minus sign

1

(f) 180°

(2) <u>bond pairs</u> repel to be as far apart as possible

Allow (2) bond pairs repel equally
Ignore linear

2

[10]

Q4.

(a) Electron acceptor / gains electrons

Do not allow

electron pair acceptor / gain of electrons

1

(b) Oxidation half equation

$2\ I^- \rightarrow I_2 + 2\ e^-$

Allow multiples.

1

Reduction half equation

$2\ IO_3^- + 12\ H^+ + 10\ e^- \rightarrow I_2 + 6\ H_2O$

Award 1 mark if the two equations are shown transposed

1

(c) Equation:

$6\ I^- + 6\ H^+ + H_2SO_4 \rightarrow S + 3\ I_2 + 4\ H_2O$

Allow 6HI

Allow $6I^- + 8H^+ + SO_4^{2-}$

1

Foul smelling gas – H_2S / hydrogen sulphide

1

[5]