M1.(a) (i) Loss (of electrons) **(1)**

(ii) *Oxidation state of nitrogen in NO:* (+) 2 **(1)**

Oxidation state of nitrogen in NH^+: –3 **(1)**

(iii) I_2 **(1)**

4

(b) (i) $Cl_2 + 2e^- \rightarrow 2Cl^-$ **(1)**

(ii) $SO_2 + 2H_2O \rightarrow SO_4^{2-} + 4H^+ + 2e^-$ **(1)**

(iii) $SO_2 + 2H_2O + Cl_2 \rightarrow SO_4^{2-} + 2Cl^- + 4H^+$ **(1)**
or H_2SO_4 + 2HCl etc

Ignore state symbols in equation

Allow multiples of all equations

3

[7]

M2.D

[1]

M3.D

[1]

M4. (a) (i) Halides:- Fluoride
Chloride **(1)**

Equation:- $H^+ + F^- \rightarrow HF$ *(or molecular / for a correct halide)* **(1)**

(ii) Halides:- Bromide and iodide **(1)**

Equation:- H_2SO_4 *(or* $2H^+ + SO_4^{2-}$*)* + $2H^+ + 2e^- \rightarrow SO_2 + 2H_2O$ **(1)**

$2Br^- \rightarrow Br_2 + 2e^-$ **(1)**

$H_2SO_4 + 2H^+ + 2Br^-$ (or 2HBr) $\rightarrow Br_2 + SO_2 + 2H_2O$ **(1)**

Q of L penalise wrong symbol for fluoride or bromide once
Ignore state symbols in equations

(iii) Products Sulphur (or S_8 not S_4) **(1)**
Hydrogen sulphide **(1)**
Equation:- H_2SO_4 *(or* $2H^+ + SO_4^{2-}$*)* $+6H^+ + 6e^- \rightarrow S + 4H_2O$ **(1)**
OR
H_2SO_4 *(or* $2H^+ + SO_4^{2-}$*)* $+ 8H^+ + 8e^- \rightarrow H_2S + 4H_2O$

9

Ignore halide if given even if incorrect
Do not allow elements, molecules or atoms in part (a)

(b) Addition of silver nitrate
Chloride gives white precipitate / solid **(1)**
Bromide gives cream precipitate / solid **(1)**
Iodide gives yellow precipitate / solid **(1)**
Addition of ammonia
Chloride precipitate soluble in dilute **(1)**
Bromide precipitate soluble in concentrated **(1)**
Iodide precipitate insoluble **(1)**

Do not allow halogen or sodium halide

6

[15]

M5.A

[1]

M6.B

[1]

M7.D

[1]

M8. B

[1]

M9. (a) A reducing agent gives electrons **(1)**

Not electron pairs

1

(b) Zero **(1)**

1

(c) (i) (+)3 **(1)**

(ii) –3 **(1)**

(iii) –1 **(1)**

Allow answers in roman

3

(d) (i) $PbO_2 + 4H^+ + 2e^- \rightarrow Pb_2^+ + 2H_2O$ **(1)**

(ii) $2Cl^- \rightarrow Cl_2 + 2e^{(-)}$ **(1)**

(iii) $PbO_2 + 4H^+ + 2Cl^- \rightarrow Pb^{2+} + Cl_2 + 2H_2O$ **(1)**

Or molecular

3

[8]

M10. (a) (i) –2 OR 2–

(ii) NaI or NaAt or I^- or iodide or At^- or Astatide **(1)**

<u>Not</u> atoms or molecules

(iii) Smell of bad eggs **(1)**

Allow $PbAc_2$ goes black and $K_2Cr_2O_7/H^+$ goes cloudy green

(iv) $8\ e^- + 8\ H^+ + H_2SO_4 \rightarrow H_2S + 4H_2O$ **(1)**

OR $10\ H^+ + SO_4^{2-}$

4

(b) (i) HF or HCl **(1)**

CE = 0 if redox answer given

If wrong halide given allow max one in b(iii)

If NaF or NaCl, or F^- or Cl^- given lose mark in (i)

Mark on if X is e.g. HF_2 or H_2F

(ii) NaF or NaCl or F^- or Cl^- **(1)**

(iii) A proton donor or an acid **(1)**

(iv) $H^+ + F^- \rightarrow HF$

OR $H_2SO_4 + NaF \rightarrow NaHSO_4 + HF$

OR $H_2SO_4 + 2\ NaF \rightarrow Na_2SO_4 + 2\ HF$

OR for chloride

4

[8]

M11. (a) gains electrons **(1)**
or accepts/takes electrons

Allow an electron
or just 'gains'
or reduction is gain of electrons, but NOT OILRIG even if stated
Do not allow mention of electron pair(s)

1

(b) (i) *Oxidising agent*: Ag^+ **(1)** (*or Ag I*)

Reducing agent: SO_2 **(1)** (*or S^{VI}, not sulphur*)

(ii) $SO_2 + 2H_2O \rightarrow SO_4^{2-} + 4H^+ + 2e^-$ **(1)** (*or* $H_2SO_4 + 2H^+ + 2e^-$)

allow e i.e. no charge
penalise E^- once only
allow $-e^-$ on LHS

3

(c) (i) $Fe^{2+} \rightarrow Fe^{3+} + e^-$ **(1)**

(ii) 5 **(1)** (*or V or +5*)

(iii) $ClO_3^- + 6H^+ + 6e^- \rightarrow Cl^- + 3H_2O$ **(1)**

(iv) $ClO_3^- + 6H^+ + 6Fe^{2+} \rightarrow Cl^- + 3H_2O + 6Fe^{3+}$ **(1)**
Mark parts (i) to (iv) independently

4

(d) *Equation*: Mg + S → MgS **(1)**

allow FeS + Mg → MgS + Fe
allow Ca

Oxidising agent: S **(1)**

Only award mark if first answer given unless no first answer then can allow

2

[10]

M12.B

[1]

M13.B

[1]

M14.C

[1]

M15.C

[1]