

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

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

Oxidation state of nitrogen in  $\text{NH}^+$ : -3 **(1)**

(iii)  $\text{I}_2$  **(1)**

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(b) (i)  $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$  **(1)**

(ii)  $\text{SO}_2 + 2\text{H}_2\text{O} \rightarrow \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^-$  **(1)**

(iii)  $\text{SO}_2 + 2\text{H}_2\text{O} + \text{Cl}_2 \rightarrow \text{SO}_4^{2-} + 2\text{Cl}^- + 4\text{H}^+$  **(1)**  
or  $\text{H}_2\text{SO}_4 + 2\text{HCl}$  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:-  $\text{H}^+ + \text{F}^- \rightarrow \text{HF}$  (or molecular / for a correct halide) **(1)**

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

Equation:-  $\text{H}_2\text{SO}_4$  (or  $2\text{H}^+ + \text{SO}_4^{2-}$ ) +  $2\text{H}^+ + 2\text{e}^- \rightarrow \text{SO}_2 + 2\text{H}_2\text{O}$  **(1)**

$2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$  **(1)**

$\text{H}_2\text{SO}_4 + 2\text{H}^+ + 2\text{Br}^-$  (or  $2\text{HBr}$ )  $\rightarrow \text{Br}_2 + \text{SO}_2 + 2\text{H}_2\text{O}$  **(1)**

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

- (iii) Products Sulphur (or S<sub>8</sub> not S<sub>4</sub>) (1)  
Hydrogen sulphide (1)  
Equation:- H<sub>2</sub>SO<sub>4</sub> (or 2H<sup>+</sup> + SO<sub>4</sub><sup>2-</sup>) + 6H<sup>+</sup> + 6e<sup>-</sup> → S + 4H<sub>2</sub>O (1)  
**OR**  
H<sub>2</sub>SO<sub>4</sub> (or 2H<sup>+</sup> + SO<sub>4</sub><sup>2-</sup>) + 8H<sup>+</sup> + 8e<sup>-</sup> → H<sub>2</sub>S + 4H<sub>2</sub>O

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*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*

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[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)  $\text{PbO}_2 + 4\text{H}^+ + 2\text{e}^- \rightarrow \text{Pb}^{2+} + 2\text{H}_2\text{O}$  (1)

(ii)  $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$  (1)

(iii)  $\text{PbO}_2 + 4\text{H}^+ + 2\text{Cl}^- \rightarrow \text{Pb}^{2+} + \text{Cl}_2 + 2\text{H}_2\text{O}$  (1)

*Or molecular*

3

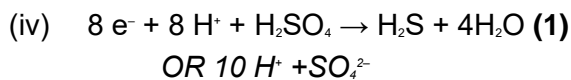
[8]

**M10.** (a) (i) -2 OR 2-

(ii) NaI or NaAt or I<sup>-</sup> or iodide or At<sup>-</sup> or Astatide (1)  
*Not atoms or molecules*

(iii) Smell of bad eggs (1)

*Allow PbAc<sub>2</sub> goes black and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>/H<sup>+</sup> goes cloudy green*



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(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<sup>-</sup> or Cl<sup>-</sup> given lose mark in (i)*

*Mark on if X is e.g. HF<sub>2</sub> or H<sub>2</sub>F*

(ii) NaF or NaCl or F<sup>-</sup> or Cl<sup>-</sup> (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*

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[8]

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

*Allow an electron*

*or just 'gains'*

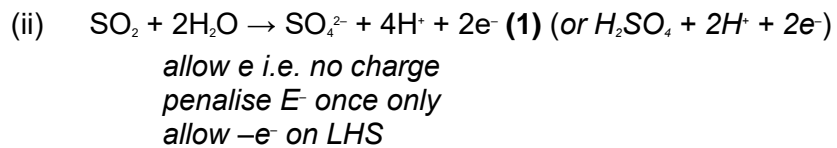
*or reduction is gain of electrons, but NOT OILRIG even if stated*

*Do not allow mention of electron pair(s)*

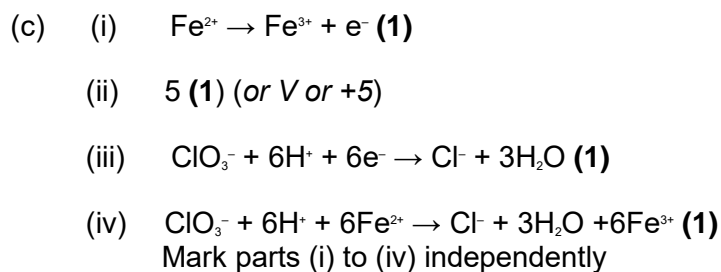
1

(b) (i) Oxidising agent: Ag<sup>+</sup> (1) (or Ag I)

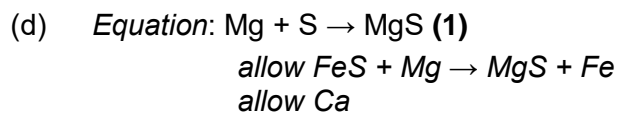
Reducing agent: SO<sub>2</sub> (1) (or S<sup>v</sup>, not sulphur)



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4



*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]**