

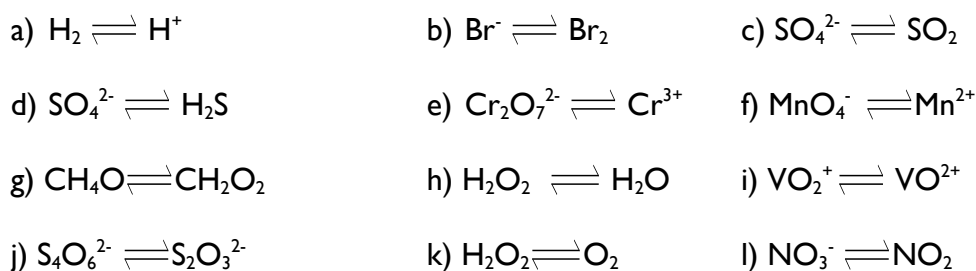
Half Equations

- 1) a) Calculate the oxidation state of each underlined element in the following: [14]

<u>S</u> O ₂	<u>S</u> O ₃	<u>S</u> O ₄ ²⁻	<u>Cr</u> ₂ O ₃	<u>Cr</u> O ₃	<u>Mn</u> O ₄ ²⁻	<u>Mn</u> O ₄ ⁻
<u>Fe</u> Cl ₄ ²⁻	<u>Cu</u> ₂ O	<u>Cu</u> O	<u>N</u> O ₃ ⁻	<u>C</u> ₂ O ₄ ²⁻	<u>C</u> H ₄ O ₂	<u>C</u> H ₄ O

- b) name the IONS in part (a) [6]

- 2) Write a half equation for each of the following conversions in acidic solution. [10]

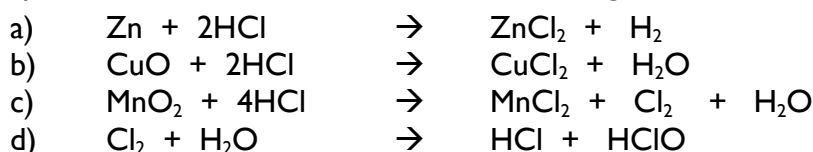


- 3) Using your answers to Q2, combine them to create overall equations for the following reactions: (all in acidic conditions) [10]

- a) Oxidation of Fe^{2+} by MnO_4^-
b) Oxidation of Fe^{2+} by O_2
c) Oxidation of H_2O_2 by MnO_4^-
d) Reduction of Br_2 by Fe^{2+}
e) Reduction of $\text{Cr}_2\text{O}_7^{2-}$ by CH_4O

- 4) Chlorine reacts differently with sodium hydroxide depending on temperature. [5]
At high temp it forms NaCl and NaClO_3 but at low temperatures it forms NaCl and NaOCl .
By considering the oxidation states involved, create balanced equations for both reactions.

- 5) State whether the following are redox reactions or not, by showing the oxidation numbers of each of the elements involved. If the reaction is a redox reaction state which species have been oxidized and reduced during the reaction.



[14]

- 6) A solution of the NO_2^- ion can be reduced to the ion, $\text{N}_2\text{O}_2^{2-}$. This ion is a strong reducing agent which reacts with MnO_4^- in acidic conditions to form Mn^{2+} ions and a second product that could be NO , NO_3^- , NO_2^- , N_2O or NO_2 .
- a) State the oxidation number of nitrogen in NO , NO_3^- , NO_2^- , N_2O , NO_2 and $\text{N}_2\text{O}_2^{2-}$. [6]
- b) 8 moles of MnO_4^- react with 5 moles of $\text{N}_2\text{O}_2^{2-}$.
- i) Use this information to identify the second product of the reaction. [1]
- ii) Write a balanced equation for the reaction of 8 moles of MnO_4^- react with 5 moles of $\text{N}_2\text{O}_2^{2-}$. [4]
- 7) Use oxidation states to create half equations for each of these reactions and use them to help balance the following reactions all in acidic solution [20]
- a) $\text{Zn} + \text{NO}_3^- + \text{H}^+ \rightarrow \text{Zn}^{2+} + \text{NH}_4^+ + \text{H}_2\text{O}$
- b) $\text{UO}_2^{2+} + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{UO}_2^{2+} + \text{Cr}^{3+}$
- c) $\text{Mn}^{2+} + \text{BiO}_3^- \rightarrow \text{MnO}_4^- + \text{Bi}^{3+}$
- d) $\text{Cl}^- + \text{Sn} + \text{NO}_3^- \rightarrow \text{SnCl}_6^{2-} + \text{NO}_2(\text{g}) + \text{H}_2\text{O}$
- e) $\text{MnO}_4^- + \text{I}^- \rightarrow \text{Mn}^{2+} + \text{I}_2$
- f) $\text{MnO}_2 + \text{Cl}^- \rightarrow \text{MnCl}_2 + \text{Cl}_2$
- g) $\text{MnO}_4^{2-} \rightarrow \text{MnO}_4^- + \text{MnO}_2$
- h) $\text{VO}_2^+ + \text{Zn} \rightarrow \text{VO}^{2+} + \text{Zn}$
- i) $\text{MnO}_4^- + \text{Ni} \rightarrow \text{Mn}^{2+} + \text{Ni}^{2+}$
- j) $\text{CrO}_4^{2-} + \text{Cr}^{2+} \rightarrow \text{Cr}^{3+}$