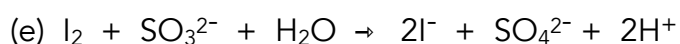
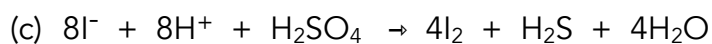
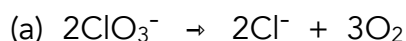


Oxidation states and redox reactions

1. What are the oxidation states of the elements in each of these substances?



2. Identify which element is oxidised and which is reduced in each of the following equations - in each case give the oxidation states before and after the reaction.



3. Identify the oxidising and reducing agent in 2(b), (c) and (e).

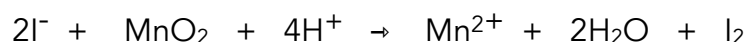
4. Use oxidation states to name the following ions or compounds.



Oxidation states and redox reactions

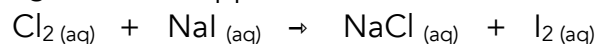
5. In the compound $[\text{ICl}_2]^+[\text{SbCl}_6]^-$ the oxidation state of chlorine is -1. What are the oxidation numbers of iodine and antimony?

6. (a) Determine the initial and final oxidation states of both iodine and manganese in the following equation



(b) Explain in terms of electrons why manganese is said to be reduced.

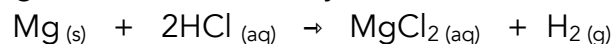
7. When aqueous solutions of chlorine and sodium iodide are added together, the following reaction happens



(a) Identify the oxidising agent in the reaction

(b) Write the ionic half equation for the oxidation reaction

8. Magnesium reacts with hydrochloric acid



(a) Write a half equation to show the oxidation reaction

(b) Explain why the half equation represents oxidation

(c) Identify the oxidising agent

9. Chlorine reacts with bromide ions in sea water to produce bromine. Which of the following statements is NOT correct?

A. Bromide ions are oxidised

B. The chlorine is obtained from sea water

C. Bromine forms because it is more reactive than chlorine

D. Chlorine molecules are reduced



Oxidation states and redox reactions

10. Which process is NOT oxidation?

- A. $\text{NH}_4^+ \rightarrow \text{NO}_2^-$
- B. $\text{NO}_3^- \rightarrow \text{N}_2$
- C. $\text{N}_2 \rightarrow \text{NO}$
- D. $\text{NO}_2^- \rightarrow \text{NO}_3^-$

11. Chromium is produced from its ore by the following series of reactions

- i. $4\text{FeCr}_2\text{O}_4 + 8\text{Na}_2\text{CO}_3 + 7\text{O}_2 \rightarrow 8\text{Na}_2\text{CrO}_4 + 2\text{Fe}_2\text{O}_3 + 8\text{CO}_2$
- ii. $2\text{Na}_2\text{CrO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{Cr}_2\text{O}_7 + \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
- iii. $\text{Na}_2\text{Cr}_2\text{O}_7 + 2\text{C} \rightarrow \text{Cr}_2\text{O}_3 + \text{CO} + \text{Na}_2\text{CO}_3$
- iv. $\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Cr} + \text{Al}_2\text{O}_3$

Complete the following table.

Equation	Oxidation state of Cr in the reactant	Oxidation state of Cr in the product	Oxidised / reduced / neither?
i			
ii			
iii			
iv			

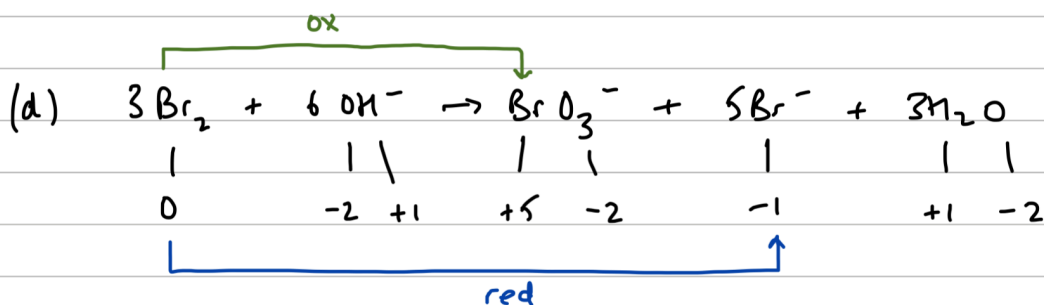
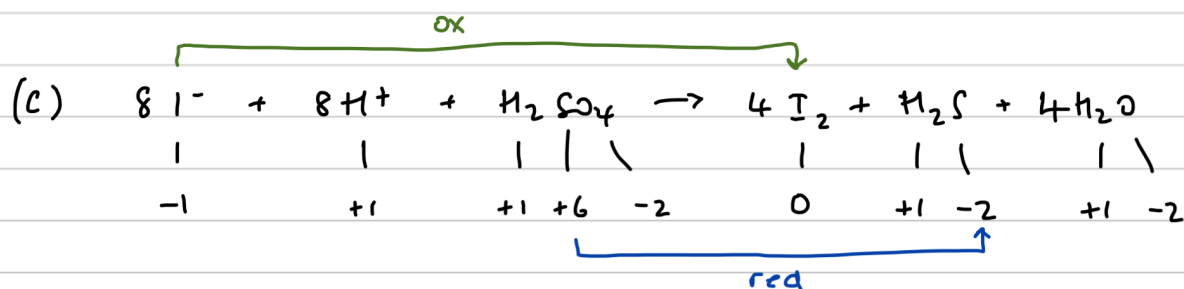
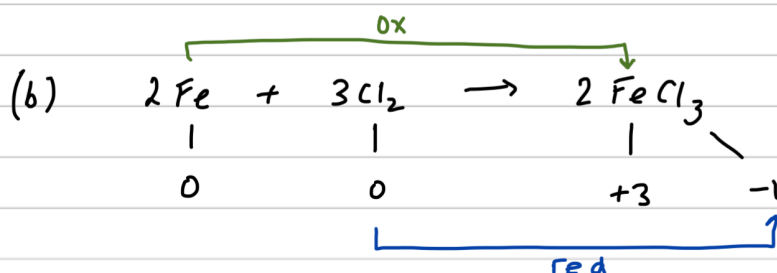
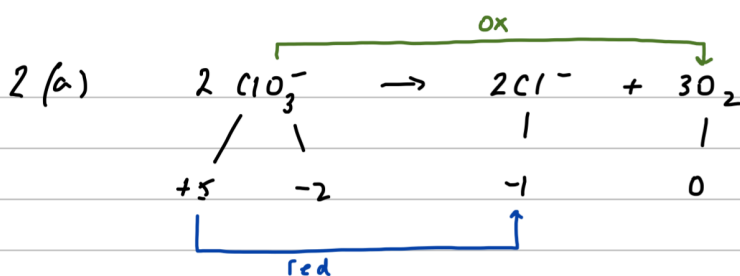
12. Molybdenum can form an oxyanion with the formula $[\text{Mo}_{36}\text{O}_{112}(\text{H}_2\text{O})_{16}]^{8-}$. Calculate the oxidation state of molybdenum in this ion.

13. The salt sodium amide, NaNH_2 , can be made in a redox reaction between molten sodium and gaseous ammonia. Write a balanced equation for the reaction and state what has been oxidised and what has been reduced.

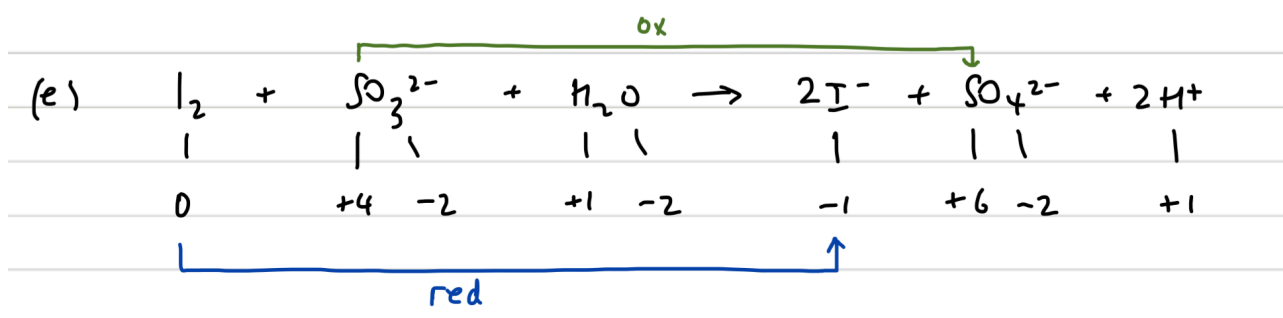
Oxidation states and redox reactions

Answers

- (a) element (0)
(b) simple ion (-3)
(c) carbon +4; oxygen -2
(d) nitrogen +5; oxygen -2
(e) manganese +7; oxygen -2



Oxidation states and redox reactions



3. (b) iron is the reducing agent; chlorine is the oxidising agent
 (c) iodide is the reducing agent; sulphuric acid is the oxidising agent
 (e) sulphate(IV) is the reducing agent; iodine is the oxidising agent

4. (a) tin(IV) oxide
 (b) manganese(II) hydroxide
 (c) manganate(VII) ion
 (d) chromate(VI) ion
 (e) vanadate(V) ion
 (f) copper(II) nitrate(V)

5. I is +3; Sb is +5

6. (a) Mn changes oxidation state from +4 to +2; iodine from -1 to 0
 (b) Mn gains 2 electrons during the reaction

7. (a) chlorine / Cl_2
 (b) $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$

8. (a) $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$
 (b) Mg loses 2 electrons
 (c) H^+ / hydrogen ion



Oxidation states and redox reactions

9. C

10. B (only one where oxygen is lost rather than gained)

11.

Equation	Oxidation state of Cr in the reactant	Oxidation state of Cr in the product	Oxidised / reduced / neither?
i	+3	+6	Oxidised
ii	+6	+6	Neither
iii	+6	+3	Reduced
iv	+3	0	Reduced

12. +6

13. $\text{Na} + \text{NH}_3 \rightarrow \text{NaNH}_2 + \frac{1}{2} \text{H}_2$; Na is oxidised from 0 to +1; H is reduced from +1 to 0

