



	anode	cathode
A	aluminium	carbon
B	carbon	carbon
C	carbon	steel
D	steel	aluminium

Q8 In which substance does nitrogen exhibit the highest oxidation state?

- A NO            B N<sub>2</sub>O            C N<sub>2</sub>O<sub>4</sub>            D NaNO<sub>2</sub>

Q9 Chlorine shows oxidation states ranging from -1 to +7 in its compounds.

What are the reagent(s) and conditions necessary for the oxidation of elemental chlorine into a compound containing chlorine in the +5 oxidation state?

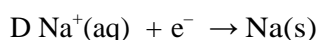
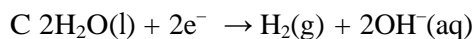
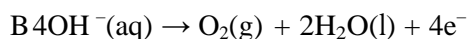
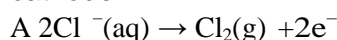
A AgNO<sub>3</sub>(aq) followed by NH<sub>3</sub>(aq) at room temperature

B concentrated H<sub>2</sub>SO<sub>4</sub> at room temperature

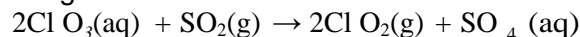
C cold dilute NaOH(aq)

D hot concentrated NaOH(aq)

Q10 During the electrolysis of brine using a diaphragm cell, which reaction occurs at the cathode?



Q11 Chlorine dioxide is produced on a large scale as it is used for bleaching paper pulp. It is made by the following reaction.



How do the oxidation numbers of chlorine and sulphur change in this reaction?

	chlorine	sulphur
A	decreases by 1	increases by 1
B	decreases by 1	increases by 2
C	decreases by 3	increases by 1
D	decreases by 3	increases by 2

Q12 In some early paintings, lead(II) carbonate was used as a white pigment. In the 19th century hydrogen sulphide from burning coal reacted with this pigment to form black lead(II) sulphide, PbS. The original colour of the painting may be restored by carefully treating the area with dilute hydrogen peroxide, producing lead(II) sulphate which is also white.

What is the role of the hydrogen peroxide?

A catalyst

B oxidising agent

C reducing agent

D solvent

Q13 In an experiment,  $50.0 \text{ cm}^3$  of a  $0.10 \text{ mol dm}^{-3}$  solution of a metallic salt reacted exactly with  $25.0 \text{ cm}^3$  of  $0.10 \text{ mol dm}^{-3}$  aqueous sodium sulphite.

The half-equation for oxidation of sulphite ion is shown below.



If the original oxidation number of the metal in the salt was +3, what would be the new oxidation number of the metal?

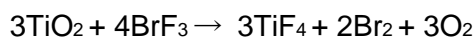
A+1

B+2

C+4

D+5

Q14 The amount of titanium dioxide in an ore can be determined by using the following reaction.



Which element increases in oxidation number in this reaction?

A bromine

B fluorine

C oxygen

D titanium

Q15 Chlorine can be manufactured from brine in a diaphragm cell.

Which row represents the correct electrodes?

	nature of anode	nature of cathode
A	graphite	titanium
B	steel	titanium
C	titanium	graphite
D	titanium	steel

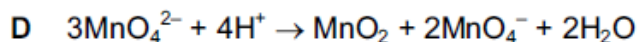
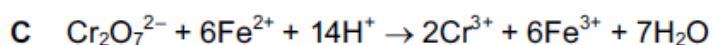
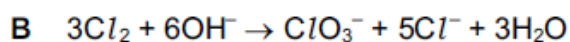
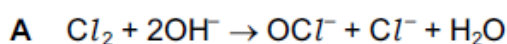
Q16 Sodium iodide reacts with concentrated sulfuric acid. The equation which represents one of the reactions that takes place is shown.



Which species has been oxidised in this reaction?

 $\text{AH}^+$  $\text{BI}^-$  $\text{CNa}^+$  $\text{DSO}_4^{2-}$ 

Q17 In which reaction does an element undergo the largest change in oxidation state?



Q18 Aluminium is extracted by the electrolysis of a molten mixture containing aluminium oxide. By a similar method, magnesium is extracted by the electrolysis of a molten mixture containing magnesium chloride.

Which statement about the extraction of magnesium is correct?

A Magnesium ions travel to the anode and are oxidised to magnesium metal.

B Magnesium ions travel to the anode and are reduced to magnesium metal.

C Magnesium ions travel to the cathode and are oxidised to magnesium metal.

D Magnesium ions travel to the cathode and are reduced to magnesium metal.

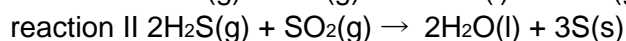
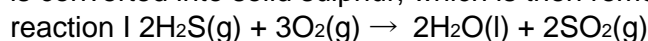
Q19 Which conversion involves a reduction of chromium?

- A**  $\text{CrO}_4^{2-} \rightarrow \text{CrO}_3$   
**B**  $\text{CrO}_4^{2-} \rightarrow \text{Cr}_2\text{O}_7^{2-}$   
**C**  $\text{CrO}_2\text{Cl}_2 \rightarrow \text{CrO}_4^{2-}$   
**D**  $\text{CrO}_2\text{Cl}_2 \rightarrow \text{Cr}_2\text{O}_3$

**Section B**

A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

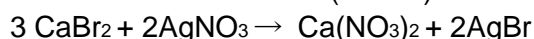
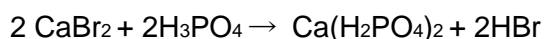
Q20 Many crude oils contain sulphur as  $\text{H}_2\text{S}$ . During refining, by the Claus process, the  $\text{H}_2\text{S}$  is converted into solid sulphur, which is then removed.



Which statements about the Claus process are correct?

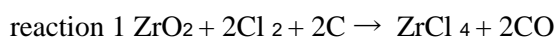
- $\text{H}_2\text{S}$  is oxidised in reaction I.
- $\text{SO}_2$  oxidises  $\text{H}_2\text{S}$  in reaction II.
- $\text{SO}_2$  behaves as a catalyst.

Q21 Which reactions are redox reactions?



Q22 Zirconium, Zr, proton number 40, is a metal which is used in corrosion-resistant alloys.

Zirconium metal is extracted from the oxide  $\text{ZrO}_2$  by the following sequence of reactions.



Which statements about this extraction process are correct?

- Carbon in reaction 1 behaves as a reducing agent.
- Magnesium in reaction 2 behaves as a reducing agent.
- Chlorine in reaction 1 behaves as a reducing agent.

1. A
2. D
3. C
4. C
5. C
6. D
7. B
8. C
9. D
10. C
11. B
12. B
13. B
14. C
15. D
16. B
17. B
18. D
19. D
20. B
21. D
22. B

Q1 During their electrolysis of aqueous radium bromide, a scientist obtained radium at the cathode and bromine at the anode. Write half-equations for the two electrode reactions that take place during this electrolysis.

anode .....

cathode .....

(NOV 2009 P21)

Q2 Magnesium burns in nitrogen to give magnesium nitride, a yellow solid which has the formula  $Mg_3N_2$ .

Magnesium nitride reacts with water to give ammonia and magnesium hydroxide.

(i) Construct an equation for the reaction of magnesium nitride with water.

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(ii) Does a redox reaction occur when magnesium nitride reacts with water?

Use the oxidation numbers of nitrogen to explain your answer.

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(June 2009)

Q3 Chlorine gas is manufactured by the electrolysis of brine using a diaphragm cell.

(a) Write half-equations, including state symbols, for the reactions occurring at each of the electrodes of a diaphragm cell.

anode.....

cathode .....

(b) In the diaphragm cell, Suggest why steel is never used for the anode.

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(c) One important product made in the diaphragm cell is formed in aqueous solution.

(i) What substance is produced in aqueous solution in the diaphragm cell?

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(ii) Explain, with the aid of appropriate half-equation(s), how this compound is formed by electrolysis.

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(NOV 2008)

**Q4** Chlorine is manufactured by electrolysis from brine, concentrated aqueous sodium chloride.

**(a)(i)** Describe, with the aid of a fully labelled diagram, the industrial electrolysis of brine in a diaphragm cell. State what each electrode is made of and show clearly the inlet for the brine and the outlets for the products.

**(ii)** Write a half-equation, with state symbols, for the reaction at **each** electrode.

anode .....

cathode .....

**(iii)** Name the chemical that is produced in solution in this electrolytic process.

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(June 2011 P22)