

Platinum, hydroquinone and silver

A Level

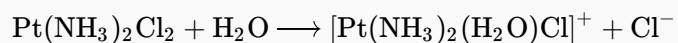


Part A Oxidation numbers of platinum



The anti-cancer drug *cis-platin* has the formula $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$.

In the human body, one of the chloride ions of *cis-platin* is replaced by one water molecule.



What is the oxidation number of platinum in each of these complexes?

	<i>cis-platin</i>	<i>in the aquo complex</i>
A	+2	+1
B	+2	+2
C	+4	+3
D	+4	+4

☐ **A**

☐ **B**

☐ **C**

☐ **D**

When exposed film from a camera is developed, one step involves reacting the light-activated silver bromide crystals with hydroquinone in alkali according to the following equation:

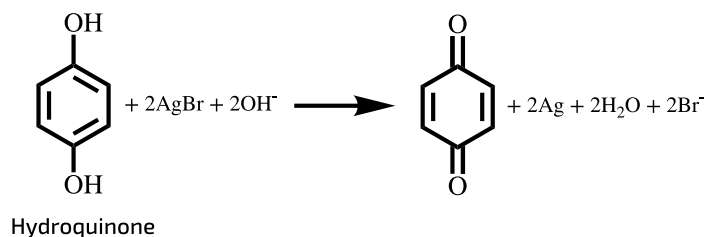


Figure 1: Hydroquinone and silver bromide in presence of base.

Which of the following describes the role of hydroquinone?

- ☐ It acts only as a reducing agent
- ☐ It acts as both an acid and a reducing agent
- ☐ It acts only as an oxidising agent
- ☐ It acts as both a base and a reducing agent
- ☐ It acts only as an acid

Part A adapted with permission from UCLES, A-Level Chemistry, June 1996, Paper 3, Question 9;

Part B adapted with permission from OCSEB, A-Level Chemistry, June 1994, Paper 1, Question 3



Oxidation states of S and N

A Level



Part A Oxidation states of sulfur

In which of the following pairs of species is the sulfur in the same oxidation state in both members of the pair?

1. SF_6 and SO_4^{2-}
2. SO_2 and HSO_3^-
3. $\text{S}_2\text{O}_3^{2-}$ and $\text{S}_4\text{O}_6^{2-}$

- ☐ 1, 2 and 3 are correct
- ☐ 1 and 2 only are correct
- ☐ 2 and 3 only are correct
- ☐ 1 only is correct
- ☐ 3 only is correct

Part B Oxidation states of nitrogen

In which of the following conversions does the oxidation number of the nitrogen change by two?

1. $\text{NH}_2\text{OH} \longrightarrow \text{NH}_3$
2. $\text{N}_2 \longrightarrow \text{NO}$
3. $\text{NO}_2 \longrightarrow \text{HNO}_3$

- ☐ 1, 2 and 3 are correct
- ☐ 1 and 2 only are correct
- ☐ 2 and 3 only are correct
- ☐ 1 only is correct
- ☐ 3 only is correct



Oxides of nitrogen

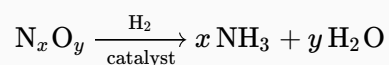
A Level



Part A Oxides of nitrogen



In an attempt to establish the formula of an oxide of nitrogen, a known volume of the pure gas was mixed with hydrogen and passed over a catalyst at a suitable temperature. 100% conversion of the oxide to ammonia and water was shown to have taken place.



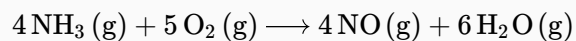
2400 cm³ of the nitrogen oxide, measured at room temperature and pressure (RTP) produced 7.200 g of water. The ammonia produced was neutralised by 200 cm³ of 1.0 mol dm⁻³ HCl.

[Molar volume of gas at RTP = 24000 cm³ mol⁻¹]

What was the oxidation number of nitrogen in the solid oxide?

- ☐ +1
- ☐ +2
- ☐ +3
- ☐ +4
- ☐ +5

The key stage in the manufacture of nitric acid is the reaction of ammonia with air in the presence of a platinum-rhodium gauze:



What is the oxidation number of nitrogen in

NH_3

NO

Part A adapted with permission from UCLES, A-Level Chemistry, November 1989, Paper 3, Question 2;

Part B adapted with permission from UCLES, A-Level Chemistry, November 1995, Paper 3, Question 1



Oxidation numbers of halides

A Level



Part A Oxidation of bromine

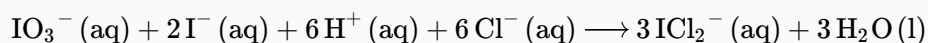
What changes can be regarded as oxidation of bromine?

1. $\text{Br}_2 \longrightarrow \text{BrO}^-$
2. $\text{Br}_2 \longrightarrow \text{BrF}$
3. $\text{Br}_2 \longrightarrow \text{BrI}$

- ☐ 1, 2 and 3 are correct
- ☐ 1 and 2 only are correct
- ☐ 2 and 3 only are correct
- ☐ 1 only is correct

Part B Oxidation numbers of halides

Which of the statements about the reaction below are correct?



1. The oxidation number of chlorine changes from -1 to -2 .
2. The oxidation number of the iodine in the iodide ion $\text{I}^- (\text{aq})$ changes from -1 to $+1$.
3. The oxidation number of the iodine in the iodate ion $\text{IO}_3^- (\text{aq})$ changes from $+5$ to $+1$.

- ☐ 1, 2 and 3 are correct
- ☐ 1 and 2 only are correct
- ☐ 2 and 3 only are correct
- ☐ 1 only is correct



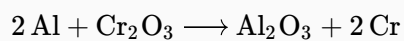
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A Level



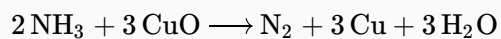
Select the element or species that is being oxidised in the following reactions.

Part A (a)

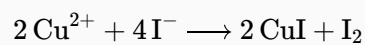


- ☐ O in Cr_2O_3
- ☐ Al
- ☐ Al in Al_2O_3
- ☐ Cr in Cr_2O_4

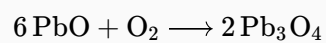
Part B (b)



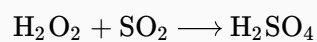
- ☐ Cu in CuO
- ☐ NH_3
- ☐ O in CuO
- ☐ N in N_2

Part C (c)

- ☐ I^{-}
- ☐ I in CuI
- ☐ Cu^{2+}
- ☐ Cu in CuI
-

Part D (d)

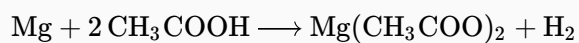
- ☐ Pb in Pb_3O_4
- ☐ O in O_2
- ☐ O in PbO
- ☐ Pb in PbO
-

Part E (e)

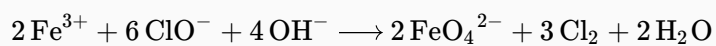
- ☐ H in H_2SO_4
- ☐ S in H_2SO_4
- ☐ SO_2
- ☐ H_2O_2
-

Part F (f)

- ☐ S in H_2SO_4
 - ☐ H in H_2SO_4
 - ☐ Na in NaBr
 - ☐ Br in NaBr
-

Part G (g)

- ☐ H_2
 - ☐ C in CH_3COOH
 - ☐ Mg in $\text{Mg}(\text{CH}_3\text{COO})_2$
 - ☐ Mg
-

Part H (h)

- ☐ Fe^{3+}
 - ☐ O in ClO^-
 - ☐ Cl in ClO^-
 - ☐ OH^-
-



Rocket and metal reduction

A Level



Part A Solid rocket booster



The propellant used in the solid rocket booster of a space shuttle is a mixture of aluminium and compound **X**. Compound **X** contains chlorine in an oxidation state of +7.

Which of the following could be compound **X**?

- ☐ NH_4ClO_4
- ☐ $\text{N}_2\text{H}_5\text{Cl}$
- ☐ NH_4ClO_3
- ☐ NCl_3
- ☐ NH_4Cl

Part B Metals and reduction



In which of the following changes has the metal undergone reduction?

- ☐ $[\text{Al}(\text{H}_2\text{O})_6]^{3+} \longrightarrow [\text{Al}(\text{OH})_2(\text{H}_2\text{O})_4]^+$
- ☐ $[\text{Cr}(\text{OH})_6]^{3-} \longrightarrow \text{CrO}_4^{2-}$
- ☐ $[\text{Co}(\text{NH}_3)_6]^{2+} \longrightarrow [\text{CoCl}_4]^{2-}$
- ☐ $\text{MnO}_4^{2-} \longrightarrow \text{MnO}_4^-$
- ☐ $[\text{CuCl}_4]^{2-} \longrightarrow [\text{CuCl}_2]^-$

Part A adapted with permission from UCLES, A-Level Chemistry, June 1992, Paper 4, Question 15;

Part B adapted with permission from OCSEB, A-Level Chemistry, June 1994, Paper 1, Question 12



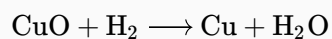
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A Level



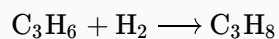
Select the element or species that is being reduced in the following reactions

Part A (a)

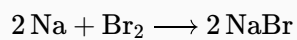


- ☐ O in H_2O
- ☐ Cu in CuO
- ☐ H in H_2
- ☐ O in CuO

Part B (b)



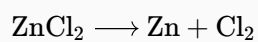
- ☐ H in H_2
- ☐ C_3H_8
- ☐ H in C_3H_6
- ☐ C_3H_6

Part C (c)

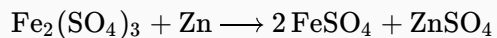
- ☐ Br₂
- ☐ Na in NaBr
- ☐ Br in NaBr
- ☐ Na
-

Part D (d)

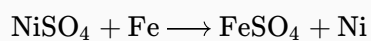
- ☐ Fe in FeSO₄
- ☐ H₂O₂
- ☐ S in FeSO₄
- ☐ S in H₂SO₄
-

Part E (e)

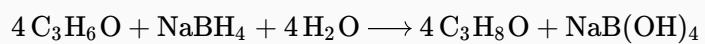
- ☐ Cl in Cl₂
- ☐ Cl in ZnCl₂
- ☐ Zn in ZnCl₂
-

Part F (f)

- ☐ S in $\text{Fe}_2(\text{SO}_4)_3$
 - ☐ Zn in ZnSO_4
 - ☐ Zn
 - ☐ Fe in $\text{Fe}_2(\text{SO}_4)_3$
-

Part G (g)

- ☐ Fe
 - ☐ Ni in NiSO_4
 - ☐ O in NiSO_4
 - ☐ S in NiSO_4
-

Part H (h)

- ☐ H in NaBH_4
 - ☐ H in $\text{C}_3\text{H}_6\text{O}$
 - ☐ $\text{C}_3\text{H}_6\text{O}$
 - ☐ B in NaBH_4
-



Essential Pre-Uni Chemistry K1.2

A Level



Write down the oxidation number of:

Part A H_2O



Oxygen in H_2O

Part B H_2SO_4



Sulfur in H_2SO_4

Part C H_3PO_4



Phosphorus in H_3PO_4

Part D H_3PO_3



Phosphorus in H_3PO_3

Part E ClO_2



Chlorine in ClO_2

Part F OF_2



Oxygen in OF_2

Part G **Sodium nitrite**



Nitrogen in sodium nitrite NaNO_2

Part H **Ammonium sulfate**



Nitrogen in ammonium sulfate $(\text{NH}_4)_2(\text{SO}_4)$

Part I **Hydrogen peroxide**



Oxygen in hydrogen peroxide H_2O_2

Part J VO_2^+



V in VO_2^+

Part K VO^{2+}



V in VO^{2+}

Part L Hg_2^{2+}



Hg in Hg_2^{2+}

Part M $\text{Cr}_2\text{O}_7^{2-}$



Cr in $\text{Cr}_2\text{O}_7^{2-}$

Part N MnO_4^-



Mn in MnO_4^-

Part O I_3^-



I in I_3^-



Essential Pre-Uni Chemistry K1.1

A Level



Give the oxidation number of nitrogen in the following compounds:

Part A NH_3



NH_3

Part B NO



NO

Part C N_2



N_2

Part D NO_2



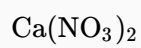
NO_2

Part E HNO_3



HNO_3

Part F $\text{Ca}(\text{NO}_3)_2$



Part G N_2H_4



Part H Mg_3N_2



Part I NCl_3



Part J NO^+





Ferrite

A Level



Aerials in portable radios are made of a mixed oxide of calcium and iron known as 'Ferrite'. It contains 18.5 % calcium and 51.9 % iron by mass. Calculate the empirical formula of 'Ferrite' and hence deduce the oxidation number of the iron it contains.

Part A Empirical formula



Empirical Formula:

Part B Oxidation number



Oxidation number:

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