



Physics. *You work it out.*

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Essential Pre-Uni Chemistry K1.1



Give the oxidation number of nitrogen in the following compounds:

Part A NH_3



Part B NO



Part C N_2



Part D NO_2



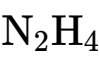
Part E HNO_3



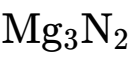
Part F $\text{Ca}(\text{NO}_3)_2$



Part G N_2H_4



Part H Mg_3N_2



Part I NCl_3



Part J NO^+

NO^+

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Essential Pre-Uni Chemistry K1.2

A Level
P P P

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^-

Gameboard:

STEM SMART Chemistry Week 10

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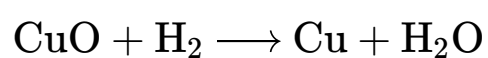
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Essential Pre-Uni Chemistry K1.3

A Level
P P P

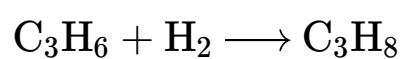
Select the element or species that is being reduced in the following reactions

Part A (a)



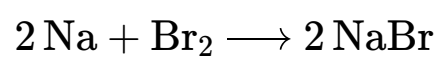
- ☐ Cu in CuO
- ☐ H in H₂
- ☐ O in CuO
- ☐ O in H₂O

Part B (b)



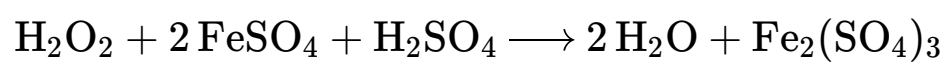
- ☐ H in H₂
- ☐ C₃H₆
- ☐ C₃H₈
- ☐ H in C₃H₆

Part C (c)



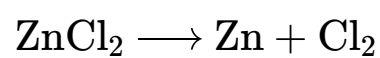
- ☐ Br in NaBr
 - ☐ Na
 - ☐ Na in NaBr
 - ☐ Br₂
-

Part D (d)



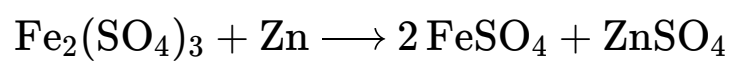
- ☐ S in FeSO₄
 - ☐ H₂O₂
 - ☐ S in H₂SO₄
 - ☐ Fe in FeSO₄
-

Part E (e)



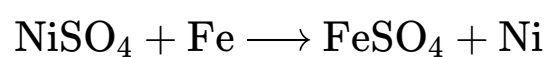
- ☐ Cl in Cl₂
 - ☐ Zn in ZnCl₂
 - ☐ Cl in ZnCl₂
-

Part F (f)



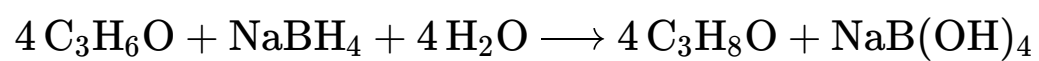
- ☐ Zn in ZnSO_4
 - ☐ Zn
 - ☐ Fe in $\text{Fe}_2(\text{SO}_4)_3$
 - ☐ S in $\text{Fe}_2(\text{SO}_4)_3$
-

Part G (g)



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

Part H (h)



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



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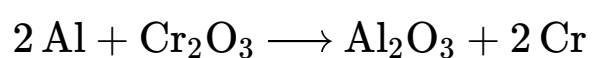
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Essential Pre-Uni Chemistry K1.4

A Level
P P P

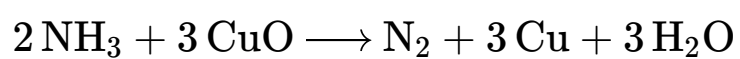
Select the element or species that is being oxidised in the following reactions.

Part A (a)



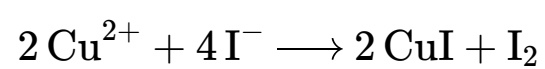
- ☐ O in Cr_2O_3
- ☐ Cr in Cr_2O_3
- ☐ Al in Al_2O_3
- ☐ Al

Part B (b)



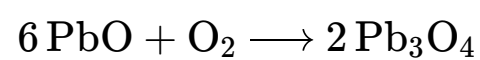
- ☐ Cu in CuO
- ☐ NH_3
- ☐ O in CuO
- ☐ N in N_2

Part C (c)



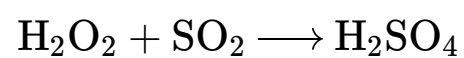
- ☐ I in CuI
 - ☐ Cu in CuI
 - ☐ Cu^{2+}
 - ☐ I^{-}
-

Part D (d)



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

Part E (e)



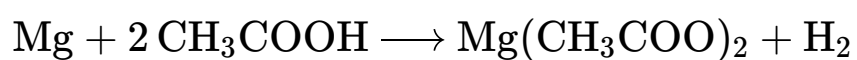
- ☐ H in H_2SO_4
 - ☐ S in H_2SO_4
 - ☐ SO_2
 - ☐ H_2O_2
-

Part F (f)



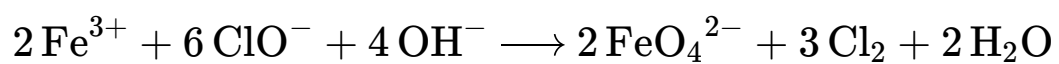
- ☐ Na in NaBr
 - ☐ H in H_2SO_4
 - ☐ S in H_2SO_4
 - ☐ Br in NaBr
-

Part G (g)



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

Part H (h)



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



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Oxidation States of S and N

A Level
P P P

Part A Oxidation states of sulfur

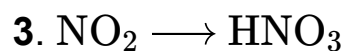
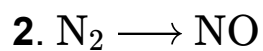
In which of the following pairs of species is the sulfur in the same oxidation state in both members of the pair?

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, 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 A adapted with permission from UCLES, A-Level Chemistry, June 1990, Paper 1, Question 35;

Part B adapted with permission from UCLES, A-Level Chemistry, June 1994, Paper 4, Question 34

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Rocket and Metal Reduction



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

Part B Metals and reduction

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

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



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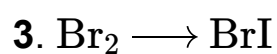
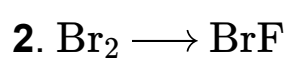
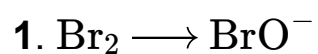
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Oxidation Numbers of Halides

A Level
P P P

Part A Oxidation of bromine

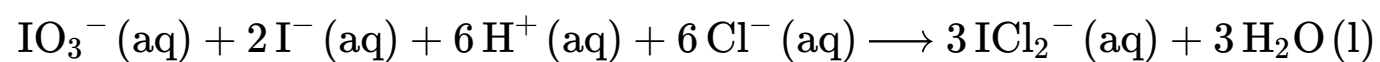
What changes can be regarded as oxidation of bromine?



- ☐ 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
-

Part A adapted with permission from UCLES, A-Level Chemistry, June 1996, Paper 3, Question 37;

Part B adapted with permission from UCLES, A-Level Chemistry, June 1989, Paper 3, Question 37

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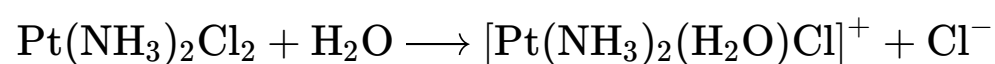


Platinum, Hydroquinone and Silver

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**

Part B Hydroquinone and silver bromide

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:

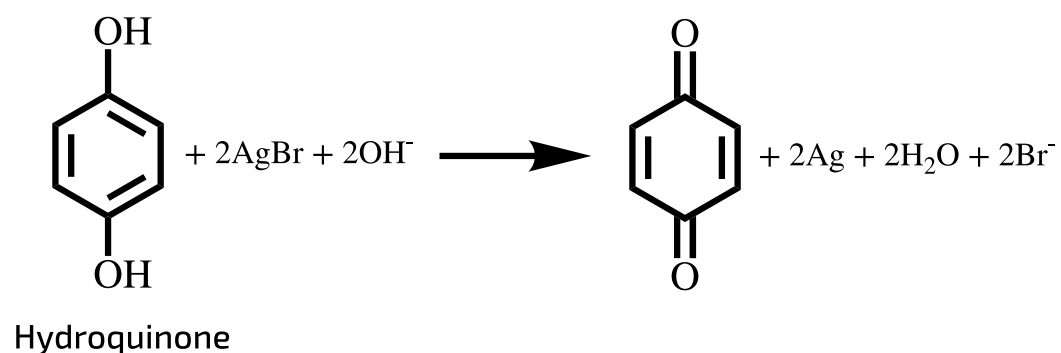


Figure 1: Hydroquinone and silver bromide in presence of base.

Which of the following describes the role of hydroquinone?

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

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

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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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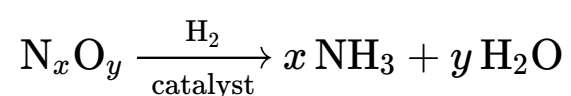
Oxides of Nitrogen

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.

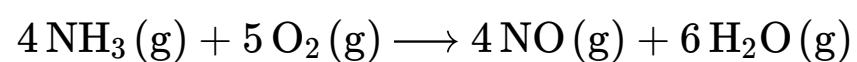
[Molar volume of gas at RTP = 24000 cm³ mol⁻¹]

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

- ☐ +1
- ☐ +2
- ☐ +3
- ☐ +4
- ☐ +5

Part B Oxidation numbers of nitrogen

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

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