O-LEVEL Chemistry

REDOX

5070 - PAPER 2 THEORY

2026 EDITION

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SECTION - OXIDATION NUMBERS

Q1	5070/22/M/J/22 Q2(e)(i)	Easy

(e) Selenium, Se, is a non-metal.

(i) Deduce the formula of selenium(IV) oxide.

..... [1]

Q2	5070/21/M/J/23 Q1(d)	Easy

1 Choose from the following oxides to answer the questions.

Al_2O_3
CO
CO_2
CaO
Fe_2O_3
H_2O
Na_2O
SO_2
SiO_2

Each oxide may be used once, more than once or not at all.

State which oxide:

(d) has an ion with an oxidation number of +2

..... [1]

SECTION - OXIDATION NUMBERS

Q3	5070/22/M/J/23 Q1(e),(f)	Easy

1 Choose from the following oxides to answer the questions.

CO
CO_2
CaO
CuO
Fe_2O_3
H_2O
SO_2
SiO_2
ZnO

Each oxide may be used once, more than once or not at all.

State which oxide:

(e) contains an ion with an oxidation number of +3

..... [1]

(f) decolourises acidified aqueous potassium manganate(VII).

..... [1]

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SECTION - OXIDATION NUMBERS

Q4 5070/21/M/J/25 Q6(c)(i),(ii) Easy

(c) The ionic equation for the reaction of chlorine with cold dilute aqueous sodium hydroxide is shown.

$$Cl_2 + 2OH^- \rightarrow ClO^- + Cl^- + H_2O$$

(i) State the oxidation number of chlorine in Cl_2 and in Cl^-.

Cl_2 .....

Cl^- .....

[2]

(ii) During the reaction chlorine is reduced.

Explain why, using ideas about electrons.

.....

..... [1]

Q5 5070/22/M/J/25 Q6(c)(i),(ii) Easy

(c) The ionic equation shows the reaction of bromine with warm concentrated aqueous sodium hydroxide.

$$3Br_2 + 6OH^- \rightarrow BrO_3^- + 5Br^- + 3H_2O$$

(i) State the oxidation number of bromine in Br_2 and in Br^-.

Br_2 .....

Br^- .....

[2]

(ii) During the reaction bromine is reduced.

Explain why, using ideas about electrons.

.....

..... [1]

SECTION - OXIDATION NUMBERS

Q6 5070/21/O/N/24 Q5(d)(ii) Hard

(ii) An ionic compound of copper has the formula Cu_2O.

Deduce the oxidation number of copper in Cu_2O.

..... [1]

Q7 5070/22/O/N/24 Q6(d)(i),(ii) Hard

(d) The ionic equation for the reaction of nitride ions with water is shown.

$$N^{3-} + 3H_2O \rightarrow NH_3 + 3OH^-$$

(i) The oxidation number of hydrogen in NH_3 is +1.

Deduce the oxidation number of nitrogen in NH_3.

..... [1]

(ii) Explain why this is **not** a redox reaction by referring to the oxidation number of nitrogen.

.....

..... [1]

SECTION - OXIDATION AND REDUCTION

Q8 5070/21/M/J/21 Q4(d)(i),(ii) Easy

(d) Copper(II) iodide decomposes to make iodine and copper(I) iodide.

The ionic equation for this reaction is shown.

$$2Cu^{2+} + 4I^{-} \rightarrow 2CuI + I_2$$

(i) Use the information to explain that oxidation takes place.

.....

..... [1]

(ii) Use the information to explain that reduction takes place.

.....

..... [1]

Q9 5070/22/M/J/21 Q4(c)(i),(ii) Easy

(c) Aqueous zinc bromide reacts with magnesium as shown.

$$Zn^{2+} + Mg \rightarrow Mg^{2+} + Zn$$

(i) Use the equation to explain that oxidation takes place.

.....

..... [1]

(ii) Use the equation to explain that reduction takes place.

.....

..... [1]

SECTION - OXIDATION AND REDUCTION

Q10 5070/21/O/N/21 Q5(a) Easy

5 Magnesium undergoes oxidation when it reacts with aqueous silver nitrate.

$$Mg + 2Ag^{+} \rightarrow Mg^{2+} + 2Ag$$

(a) Explain how this equation shows that magnesium is oxidised.

.....

..... [1]

Q11 5070/22/O/N/21 Q5(a),(c)(i) Easy

5 Lithium reacts with aqueous zinc iodide.

$$2Li + ZnI_2 \rightarrow 2LiI + Zn$$

(a) Explain, by referring to the equation, why this reaction involves both oxidation and reduction.

.....

.....

..... [2]

(c) **(i)** When aqueous bromine reacts with aqueous zinc iodide a brown solution is formed.

Name the products of this reaction.

..... and ..... [1]

SECTION - OXIDATION AND REDUCTION

Q12 5070/21/M/J/22 Q6(b)(i) Easy

(b) Carbon monoxide reacts with nitrogen monoxide as shown in the equation.

$$2CO + 2NO \rightarrow 2CO_2 + N_2$$

This reaction is extremely slow at room temperature but is much faster in the presence of a catalyst in a catalytic converter.

(i) Explain why this reaction involves **both** oxidation and reduction.

.....

.....

..... [2]

Q13 5070/22/M/J/22 Q7(d)(i) Easy

(d) Sulfur dioxide reacts with oxygen as shown.

$$2SO_2 + O_2 \rightarrow 2SO_3$$

(i) Explain why sulfur dioxide is oxidised in this reaction.

.....

..... [1]

SECTION - OXIDATION AND REDUCTION

Q14 **5070/21/O/N/22 Q5(a)** Easy

5 This question is about metals and metal compounds.

(a) Magnesium reacts with aqueous iron(II) ions.

$$Mg + Fe^{2+} \rightarrow Mg^{2+} + Fe$$

Explain why this reaction involves **both** oxidation and reduction.

Use the equation and ideas about electron transfer in your answer.

.....

.....

.....

..... [2]

Q15 **5070/22/O/N/22 Q5(a)** Easy

5 This question is about metals and metal compounds.

(a) Zinc reacts with aqueous copper(II) ions.

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

Explain why this reaction involves **both** oxidation and reduction.

Use the equation and ideas about electron transfer in your answer.

.....

.....

..... [2]

SECTION - OXIDISING AND REDUCING AGENTS

Q16 5070/21/M/J/23 Q2(b)(i),(ii) Easy

(b) Potassium reacts with cold water.

The ionic equation for the reaction is shown.

$$2K(s) + 2H_2O(l) \longrightarrow 2K^+(aq) + 2OH^-(aq) + H_2(g)$$

(i) State, in terms of electrons, why potassium is a reducing agent in this reaction.

.....

..... [1]

(ii) State the oxidation number of hydrogen in H_2.

..... [1]

Q17 5070/22/M/J/23 Q2(b)(i)-(iii) Easy

(b) Chlorine reacts with aqueous potassium iodide in a displacement reaction.

$$Cl_2(aq) + 2I^-(aq) \longrightarrow 2Cl^-(aq) + I_2(aq)$$

(i) Explain, in terms of electrons, why chlorine is an oxidising agent in this reaction.

.....

..... [1]

(ii) State the oxidation number of iodine in I_2.

..... [1]

(iii) Describe what is observed during the displacement reaction.

..... [1]

SECTION - OXIDISING AND REDUCING AGENTS

Q18 5070/21/O/N/23 Q4(d)(i),(ii) Easy

(d) Calcium reduces zinc ions to zinc.

$$Ca + Zn^{2+} \rightarrow Zn + Ca^{2+}$$

(i) Explain, in terms of the movement of electrons, how calcium acts as a reducing agent in this equation.

.....

..... [1]

(ii) State the oxidation number of the Zn^{2+} ion.

..... [1]

Q19 5070/22/O/N/23 Q4(d)(i),(ii) Easy

(d) Iodide ions reduce manganese(IV) oxide, MnO_2, to Mn^{2+} ions.

$$2I^- + MnO_2 + 4H^+ \rightarrow Mn^{2+} + I_2 + 2H_2O$$

(i) Explain, in terms of movement of electrons, how iodide ions act as a reducing agent in this reaction.

.....

..... [1]

(ii) State the name of the type of reaction that involves simultaneous oxidation and reduction.

..... [1]

SECTION - OXIDISING AND REDUCING AGENTS

Q20	5070/22/M/J/24 Q1(b)	Easy

1 Choose from the following substances to answer the questions.

anhydrous copper(II) sulfate

calcium carbonate

carbon monoxide

chlorine

ethanoic acid

iron

methanoic acid

methanol

nickel

silicon(IV) oxide

vanadium(V) oxide

Each substance can be used once, more than once or not at all.

State which substance:

(b) is a reducing agent in the blast furnace

..... [1]

SECTION - OXIDISING AND REDUCING AGENTS

Q21 5070/21/O/N/24 Q2(a)(i),(ii) Easy

2 **(a)** Iron is extracted in a blast furnace by the reduction of iron(III) oxide with carbon monoxide.

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

(i) This reaction is a redox reaction.

State the meaning of the term redox reaction.

.....

..... [1]

(ii) Explain how carbon monoxide acts as a reducing agent in this reaction.

..... [1]

SECTION - REDOX TESTS AND COLOUR CHANGES

Q22 5070/21/M/J/21 Q7(d)(i),(ii) Easy

(d) NH_4NO_2(aq) is added to a sample of aqueous potassium iodide.

A brown solution is formed.

(i) Name the brown solution.

..... [1]

(ii) Name the type of reaction that causes this brown solution to form.

..... [1]

Q23 5070/22/M/J/21 Q3(b)(iv) Easy

(iv) Aqueous lactic acid reacts with acidified potassium manganate(VII).

There is a colour change from purple to colourless.

Suggest what happens to the lactic acid in this reaction.

..... [1]

SECTION - REDOX TESTS AND COLOUR CHANGES

Q24 5070/21/O/N/21 Q3(d) Easy

(d) Concentrated sulfuric acid is an oxidising agent.

Describe a test for oxidising agents.

test .....

observations .....

.....

[2]

Q25 5070/21/O/N/21 Q6(b)(i) Easy

(b) **(i)** When chlorine reacts with aqueous potassium iodide a brown solution is formed.

Name the products of this reaction.

..... and ..... [1]

Q26 5070/22/O/N/21 Q3(d) Easy

(d) Magnesium is a good reducing agent.

Describe a test for reducing agents.

test .....

observations .....

.....

[2]

SECTION - REDOX TESTS AND COLOUR CHANGES

Q27	5070/21/M/J/22 Q1(f)	Easy

1 Choose from the following compounds to answer the questions.

NH_4Cl

$BaSO_4$

KI

K_2SO_3

$Mg(NO_3)_2$

$NaOCOCH_3$

Na_2CO_3

Na_3PO_4

$ZnSO_4$

Each compound may be used once, more than once or not at all.

State which compound:

(f) is used to test for an oxidising agent.

..... [1]

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SECTION - REDOX TESTS AND COLOUR CHANGES

Q28	5070/22/M/J/22 Q1(c),(f)	Easy

1 Choose from the following compounds to answer the questions.

$AgCl$

$Ba(NO_3)_2$

KI

$KMnO_4$

K_2SO_3

$Mg(NO_3)_2$

Na_2CO_3

Na_3N

NH_4Cl

$ZnSO_4$

Each compound may be used once, more than once or not at all.

State which compound:

(c) reacts with aqueous chlorine to give a brown solution

..... [1]

(f) is used to test for a reducing agent.

..... [1]

SECTION - REDOX TESTS AND COLOUR CHANGES

Q29	5070/21/M/J/25 Q1(d)	Easy

1 Choose from the following salts to answer the questions.

aluminium chloride

barium sulfate

calcium chloride

copper(II) sulfate

magnesium chloride

potassium iodide

potassium manganate(VII)

silver nitrate

sodium bromide

sodium sulfite

Each salt can be used once, more than once or not at all.

State which salt:

(d) has an aqueous solution that is used to test for an oxidising agent

..... [1]

SECTION - REDOX TESTS AND COLOUR CHANGES

Q30 5070/22/M/J/25 Q1(e) Easy

1 Choose from the following salts to answer the questions.

aluminium sulfate

barium chloride

copper(II) nitrate

copper(II) sulfate

magnesium chloride

potassium iodide

potassium manganate(VII)

silver chloride

sodium bromide

Each salt can be used once, more than once or not at all.

State which salt:

(e) has an aqueous solution that reacts with aqueous bromine.

..... [1]

Q31 5070/21/O/N/25 Q4(c)(i),(ii) Easy

(c) Chlorine gas is bubbled into aqueous potassium iodide. A reaction takes place.

Chlorine is an oxidising agent.

(i) Name the **two** products of this reaction.

..... [1]

(ii) Describe the observations made during the reaction.

..... [1]

SECTION - REDOX TESTS AND COLOUR CHANGES

Q32	5070/21/M/J/24 Q4(d),(e)	Hard

(d) Aqueous potassium iodide reacts with aqueous acidified potassium manganate(VII).

Suggest the colour changes that happen during this reaction.

.....

..... [2]

(e) The ionic equation for the reaction between aqueous potassium iodide and aqueous chlorine is shown.

$$2I^-(aq) + Cl_2(aq) \rightarrow I_2(aq) + 2Cl^-(aq)$$

Explain, in terms of electrons, why this reaction involves both oxidation and reduction.

.....

.....

.....

..... [2]

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SECTION - REDOX TESTS AND COLOUR CHANGES

Q33 5070/22/M/J/24 Q4(d)(i),(ii),(e) Hard

(d) **(i)** Ozone is an oxidising agent.

Describe the colour change when ozone gas is bubbled through aqueous potassium iodide.

..... [1]

(ii) Zinc is a reducing agent.

Describe the colour change when excess zinc is added to acidified potassium manganate(VII).

..... [1]

(e) The ionic equation for the reaction between aqueous calcium bromide and aqueous chlorine is shown.

$$2Br^-(aq) + Cl_2(aq) \rightarrow Br_2(aq) + 2Cl^-(aq)$$

Explain, in terms of electrons, why this reaction involves both oxidation and reduction.

.....

.....

..... [2]

Q34 5070/22/O/N/25 Q6(c) Hard

(c) When aqueous hydrogen peroxide reacts with acidified aqueous potassium manganate(VII) there is a colour change from purple to colourless.

When aqueous hydrogen peroxide reacts with aqueous potassium iodide there is a colour change from colourless to brown.

Explain what these observations indicate about the chemical properties of aqueous hydrogen peroxide.

.....

.....

.....

..... [2]

MARKING SCHEME

Q1 **5070/22/M/J/22 Q2(e)(i)**

2(e)(i)	SeO_2 / O_2Se	**1**

Q2 **5070/21/M/J/23 Q1(d)**

1(d)	CaO (1)	**1**

Q3 **5070/22/M/J/23 Q1(e),(f)**

1(e)	Fe_2O_3 (1)	**1**
1(f)	SO_2 (1)	**1**

Q4 **5070/21/M/J/25 Q6(c)(i),(ii)**

6(c)(i)	$Cl_2 = 0$ (1) $Cl^- = -1$ (1)	**2**
6(c)(ii)	chlorine gains electrons	**1**

Q5 **5070/22/M/J/25 Q6(c)(i),(ii)**

6(c)(i)	$Br_2 = 0$ (1) $Br^- = -1$ (1)	**2**
6(c)(ii)	bromine gains electrons	**1**

Q6 **5070/21/O/N/24 Q5(d)(ii)**

5(d)(ii)	+1	**1**

Q7 **5070/22/O/N/24 Q6(d)(i),(ii)**

6(d)(i)	–3	**1**
6(d)(ii)	no change in (any of) the oxidation number	**1**

Q8 **5070/21/M/J/21 Q4(d)(i),(ii)**

4(d)(i)	iodide (ion) loses electrons	**1**
4(d)(ii)	Cu^{2+} (ion) gains electrons / copper(II) ions gain electrons	**1**

MARKING SCHEME

Q9 **5070/22/M/J/21 Q4(c)(i),(ii)**

4(c)(i)	magnesium (atom) loses electrons	**1**
4(c)(ii)	Zn^{2+} (ion) gains electrons / zinc ions gain electrons	**1**

Q10 **5070/21/O/N/21 Q5(a)**

5(a)	(magnesium) loses electrons (1)	**1**

Q11 **5070/22/O/N/21 Q5(a),(c)(i)**

5(a)	lithium oxidised because it loses electrons (1) zinc **ions** reduced because they gain electrons (1)	**2**
5(c)(i)	iodine **AND** zinc bromide	**1**

Q12 **5070/21/M/J/22 Q6(b)(i)**

6(b)(i)	carbon monoxide gains oxygen so is oxidised (1) and nitrogen monoxide loses oxygen so is reduced (1)	**2**

Q13 **5070/22/M/J/22 Q7(d)(i)**

7(d)(i)	(sulfur or sulfur dioxide) gains oxygen	**1**

Q14 **5070/21/O/N/22 Q5(a)**

5(a)	magnesium loses electrons and is oxidation (1) iron(II) ions gain electrons and is reduction (1)	**2**

Q15 **5070/22/O/N/22 Q5(a)**

5(a)	oxidation because zinc loses electrons (1) reduction because copper(II) ions gain electrons (1)	**2**

Q16 **5070/21/M/J/23 Q2(b)(i),(ii)**

2(b)(i)	potassium loses electrons	**1**
2(b)(ii)	0 (1)	**1**

MARKING SCHEME

Q17 **5070/22/M/J/23 Q2(b)(i)-(iii)**

2(b)(i)	chlorine gains electrons (1)	**1**
2(b)(ii)	0 (1)	**1**
2(b)(iii)	(colourless) to orange / brown (1)	**1**

Q18 **5070/21/O/N/23 Q4(d)(i),(ii)**

4(d)(i)	calcium gives electrons to zinc ions / electrons transferred from calcium to zinc ions	**1**
4(d)(ii)	+2	**1**

Q19 **5070/22/O/N/23 Q4(d)(i),(ii)**

4(d)(i)	iodide (ions) give electrons to the Mn in MnO_2	**1**
4(d)(ii)	redox	**1**

Q20 **5070/22/M/J/24 Q1(b)**

1(b)	carbon monoxide	**1**

Q21 **5070/21/O/N/24 Q2(a)(i),(ii)**

2(a)(i)	oxidation **and** reduction occur **simultaneously**	**1**
2(a)(ii)	CO removes oxygen **from** iron oxide / CO gains oxygen **from** the iron oxide	**1**

Q22 **5070/21/M/J/21 Q7(d)(i),(ii)**

7(d)(i)	(aqueous) iodine	**1**
7(d)(ii)	oxidation	**1**

Q23 **5070/22/M/J/21 Q3(b)(iv)**

3(b)(iv)	oxidised	**1**

Q24 **5070/21/O/N/21 Q3(d)**

3(d)	add (aqueous) potassium iodide (1) colourless to brown solution (1)	**2**

MARKING SCHEME

Q25 **5070/21/O/N/21 Q6(b)(i)**

6(b)(i)	iodine **AND** potassium chloride	**1**

Q26 **5070/22/O/N/21 Q3(d)**

3(d)	add (aqueous acidified) potassium manganate(VII) (1) turns from purple to colourless (1)	**2**

Q27 **5070/21/M/J/22 Q1(f)**

1(f)	KI	**1**

Q28 **5070/22/M/J/22 Q1(c),(f)**

1(c)	KI	**1**
1(f)	$KMnO_4$	**1**

Q29 **5070/21/M/J/25 Q1(d)**

1(d)	potassium iodide	**1**

Q30 **5070/22/M/J/25 Q1(e)**

1(e)	potassium iodide	**1**

Q31 **5070/21/O/N/25 Q4(c)(i),(ii)**

4(c)(i)	potassium chloride and iodine	**1**
4(c)(ii)	(colourless solution) goes brown	**1**

Q32 **5070/21/M/J/24 Q4(d),(e)**

4(d)	purple (1) to brown (1)	**2**
4(e)	I^- or iodide oxidised since it loses electrons (1) Cl_2 or chlorine reduced since it gains electrons (1)	**2**

MARKING SCHEME

Q33 **5070/22/M/J/24 Q4(d)(i),(ii),(e)**

4(d)(i)	colourless to brown	**1**
4(d)(ii)	purple to colourless	**1**
4(e)	Br^- or bromi**d**e oxidised since it loses electrons (1) Cl_2 or chlori**n**e reduced since it gains electrons (1)	**2**

Q34 **5070/22/O/N/25 Q6(c)**

6(c)	it is a reducing agent (1) it is an oxidising agent (1)	**2**

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