



IGCSE Chemistry

REDOX

0620 - PAPER 4 THEORY

EXTENDED | 2021-2025

2026 EDITION | PAST PAPERS 2021-2025

Question and mark-scheme extracts © Cambridge University Press & Assessment.

SECTION - OXIDATION NUMBERS AND ROMAN NUMERALS

Q1

0620/42/F/M/23 Q4(e)(ii)

Easy

(ii) State the meaning of the Roman numeral (II) in the name copper(II) oxide.

..... [1]

Q2

0620/41/M/J/23 Q2(a)(vi)

Easy

2 (a) The symbols of the elements in Period 2 of the Periodic Table are shown.

Li Be B C N O F Ne

Use the symbols of the elements in Period 2 to answer the questions that follow.
Each symbol may be used once, more than once or not at all.

Give the symbol of the element that:

(vi) **only** has an oxidation number of zero. [1]

Q3

0620/41/M/J/23 Q6(a)(ii)

Easy

(ii) Name Fe_2O_3 . Include the oxidation number of iron.

..... [1]

SECTION - OXIDATION NUMBERS AND ROMAN NUMERALS

Q4

0620/43/M/J/23 Q2(a)(vi)

Easy

- 2 (a) The symbols of the elements in Period 3 of the Periodic Table are shown.

Na Mg Al Si P S Cl Ar

Use the symbols of the elements in Period 3 to answer the questions that follow.
Each symbol may be used once, more than once, or not at all.

Give the symbol of the element that:

- (vi) has an oxidation number of -1 when it forms a compound with hydrogen.

..... [1]

Q5

0620/43/M/J/23 Q5(a)(ii)

Easy

- (ii) State the term given to the Roman numeral, (II), in the name copper(II) sulfate.

..... [1]

Q6

0620/41/M/J/24 Q4(d)

Easy

- (d) Deduce the oxidation number of iodine, I, in:

HI

I₂ [2]

SECTION - OXIDATION NUMBERS AND ROMAN NUMERALS

Q7

0620/43/M/J/24 Q4(d)(ii)

Easy

(ii) Deduce the oxidation number of sulfur in:

S

SO₃

[2]

Q8

0620/43/O/N/24 Q5(c)(i)

Easy

(i) Explain the meaning of (IV) in manganese(IV) oxide.

.....
..... [2]

Q9

0620/42/F/M/25 Q5(b)(iii)

Easy

(iii) State the formula of manganese(II) oxide.

..... [1]

SECTION - OXIDATION NUMBERS AND ROMAN NUMERALS

Q10

0620/41/M/J/25 Q4(c)(ii),(iii)

Easy

(ii) Give the oxidation number of nitrogen in:

- NH_3
- NO

[2]

(iii) Define oxidation in terms of oxidation number.

..... [1]

Q11

0620/42/M/J/25 Q2(b)(i)

Easy

(b) Chlorine(I) oxide, Cl_2O , is a simple molecule with covalent bonds.

(i) State what is meant by (I) in the name chlorine(I) oxide.

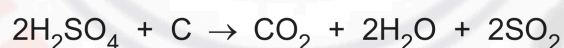
..... [2]

Q12

0620/43/M/J/25 Q4(c)

Easy

(c) Sulfuric acid reacts with carbon. The equation for the reaction is shown.



Give the oxidation number of carbon in:

- C
- CO_2

[2]

SECTION - OXIDATION NUMBERS AND ROMAN NUMERALS

Q13

0620/43/O/N/25 Q3(b)(iii),(iv),(f)

Easy

(iii) State the oxidation number of zinc in:

Zn^{2+}

Zn

[2]

(iv) Define the term reduction in terms of oxidation number.

..... [1]

(f) Deduce the formula of:

• gallium(III) bromide

• gallium(III) sulfate.

[2]

Q14

0620/42/M/J/23 Q3(c)

Hard

(c) Sulfuric acid contains SO_4^{2-} ions.

The oxidation number of O atoms in SO_4^{2-} ions is -2 .

Determine the oxidation number of S atoms in SO_4^{2-} ions. Show your working.

oxidation number = ... [2]

Q15

0620/41/O/N/23 Q6(c)(iii)

Hard

(iii) Determine the oxidation number of phosphorus in the PO_4^{3-} ion.

Show your working.

oxidation number = ... [2]

SECTION - OXIDATION NUMBERS AND ROMAN NUMERALS

Q16

0620/41/O/N/24 Q4(a)(i),(ii)

Hard

4 When magnesium nitrate is heated strongly, magnesium oxide is formed.

(a) The equation for this reaction is shown.



(i) State the change in oxidation number of nitrogen, N, in this reaction.

from to [2]

(ii) Identify the element which is oxidised in this reaction.

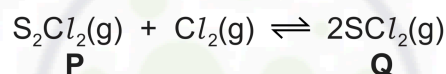
..... [1]

Q17

0620/42/O/N/24 Q3(f)

Hard

(f) The reaction of chloride **P** with chlorine is a redox reaction.



The oxidation number of Cl in chloride **P** and chloride **Q** is -1 .

Use oxidation numbers to explain why:

- sulfur is oxidised in the forward reaction

.....

- chlorine is oxidised in the reverse reaction.

.....

[4]

SECTION - OXIDATION NUMBERS AND ROMAN NUMERALS

Q18

0620/42/M/J/25 Q4(c)(i),(ii)

Hard

(c) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ is a compound containing chromium.

The negative ion in $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ is $\text{Cr}_2\text{O}_7^{2-}$.

(i) State the sum of the oxidation numbers in the $\text{Cr}_2\text{O}_7^{2-}$ ion.

..... [1]

(ii) The oxidation number of each O in $\text{Cr}_2\text{O}_7^{2-}$ ions is -2 .

Determine the oxidation number of each Cr in $\text{Cr}_2\text{O}_7^{2-}$ ions. Show your working.

..... [2]

Q19

0620/42/O/N/25 Q4(b)(iv)

Hard

(iv) The oxidation number of the O atoms in $\text{Al}(\text{NO}_3)_3$ is -2 .

The formula of the aluminium ion in $\text{Al}(\text{NO}_3)_3$ is Al^{3+} .

Determine the oxidation number of the N atoms in $\text{Al}(\text{NO}_3)_3$.
Show your working.

oxidation number of N = ... [2]

SECTION - OXIDATION AND REDUCTION

Q20

0620/42/F/M/22 Q3(d)(i)-(iii)

Hard

(d) The ammonia formed reacts with nitrogen dioxide to form nitrogen and water.

(i) Balance the equation for this reaction.



(ii) State how the equation shows that the nitrogen in nitrogen dioxide is reduced.

..... [1]

(iii) This reaction is a redox reaction.

State the meaning of the term *redox*.

..... [1]

Q21

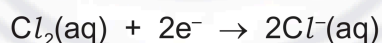
0620/41/M/J/22 Q7(d)(ii)

Hard

(d) Some Group VII elements react with aqueous solutions containing halide ions.

When aqueous chlorine is added to aqueous potassium bromide a reaction occurs.

The ionic half-equations for the reaction are shown.



(ii) Identify the species that is oxidised.

Explain your decision.

species oxidised

explanation

[2]

SECTION - OXIDATION AND REDUCTION

Q22

0620/42/F/M/23 Q4(e)(v)

Hard

- (v) Powdered aluminium reduces copper(II) oxide.

Write the symbol equation for this reaction.

..... [2]

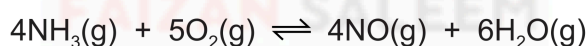
Q23

0620/43/O/N/23 Q3(b)(ii),(iii)

Hard

- (b) Ammonia is converted into nitric acid.

The first stage of this conversion uses a catalyst and occurs at a temperature of 900 °C and a pressure of 5 atmospheres.



The forward reaction is exothermic.

- (ii) State the oxidation number of nitrogen in:

NH₃

NO [2]

- (iii) Use your answer to (ii) to explain whether the nitrogen in ammonia undergoes oxidation or reduction.

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

SECTION - OXIDISING AND REDUCING AGENTS

Q24

0620/42/O/N/25 Q2(d)(i)-(iii),(e)

Hard

(d) An oxidising agent converts Fe^{2+} ions to Fe^{3+} ions.

(i) Define the term oxidising agent.

.....
..... [2]

(ii) Explain why the conversion of Fe^{2+} ions to Fe^{3+} ions is described as oxidation.

..... [1]

(iii) The oxidising agent for the conversion of Fe^{2+} ions to Fe^{3+} ions is aqueous potassium manganate(VII).

State **one** condition needed for the oxidation to take place.

..... [1]

(e) Iodide ions, I^- , reduce Fe^{3+} ions to Fe^{2+} ions in aqueous solution.

Suggest the identity of the other product formed in this reaction.

..... [1]

SECTION - REDOX TESTS AND COLOUR CHANGES

Q25

0620/42/M/J/24 Q5(d)(i),(ii)

Easy

(d) Na_2SO_3 is oxidised by acidified aqueous potassium manganate(VII).

(i) State what VII refers to in the name potassium manganate(VII).

..... [1]

(ii) State the colour change when this reaction happens.

from to [2]

SECTION - REDOX TESTS AND COLOUR CHANGES

Q26

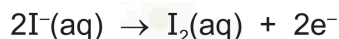
0620/43/M/J/22 Q6(c)(i)-(iii)

Hard

- (c) Some Group VII elements react with aqueous solutions containing halide ions.

When aqueous bromine is added to aqueous potassium iodide a reaction occurs.

The ionic half-equations for the reaction are shown.



- (i) Describe the colour change of the solution.

original colour of potassium iodide solution

final colour of reaction mixture

[2]

- (ii) State the name of the general term given to the type of reaction in which electrons are transferred from one species to another.

..... [1]

- (iii) Identify the oxidising agent in this reaction. Give a reason for your answer.

oxidising agent

reason

[2]

MARKING SCHEME

Q1 0620/42/F/M/23 Q4(e)(ii)

4(e)(ii)	the oxidation number of copper is +2	1
----------	---	---

Q2 0620/41/M/J/23 Q2(a)(vi)

2(a)(vi)	Ne	1
----------	----	---

Q3 0620/41/M/J/23 Q6(a)(ii)

6(a)(ii)	iron(III) oxide	1
----------	-----------------	---

Q4 0620/43/M/J/23 Q2(a)(vi)

2(a)(vi)	Cl	1
----------	----	---

Q5 0620/43/M/J/23 Q5(a)(ii)

5(a)(ii)	oxidation number (of copper)	1
----------	------------------------------	---

Q6 0620/41/M/J/24 Q4(d)

4(d)	M1 -1 (1) M2 zero (1)	2
------	--	---

Q7 0620/43/M/J/24 Q4(d)(ii)

4(d)(ii)	M1 (the oxidation number of sulfur in S) = zero M2 (the oxidation number of sulfur in SO ₃) = +6	2
----------	---	---

Q8 0620/43/O/N/24 Q5(c)(i)

5(c)(i)	M1 oxidation number of manganese M2 + 4	2
---------	--	---

Q9 0620/42/F/M/25 Q5(b)(iii)

5(b)(iii)	MnO	1
-----------	-----	---

Q10 0620/41/M/J/25 Q4(c)(ii),(iii)

4(c)(ii)	M1 -3 M2 +2	2
4(c)(iii)	increase in oxidation number	1

Q11 0620/42/M/J/25 Q2(b)(i)

2(b)(i)	M1 the oxidation number of chlorine / Cl M2 (oxidation number) is +1	2
---------	---	----------

Q12 0620/43/M/J/25 Q4(c)

4(c)	M1 zero M2 + 4	2
------	---------------------------------	----------

Q13 0620/43/O/N/25 Q3(b)(iii),(iv),(f)

3(b)(iii)	M1 $Zn^{2+} = +2$ M2 $Zn = 0$ / zero	2
3(b)(iv)	decrease in oxidation number	1
3(f)	M1 $GaBr_3$ M2 $Ga_2(SO_4)_3$	2

Q14 0620/42/M/J/23 Q3(c)

3(c)	M1 4×-2 or -8 M2 $S + (4 \times -2) = -2 \therefore S = +6$	2
------	---	----------

Q15 0620/41/O/N/23 Q6(c)(iii)

6(c)(iii)	M1 4×-2 or -8 (1) M2 $P + (4 \times -2) = -3 \therefore P = +5$ (1)	2
-----------	---	----------

Q16 0620/41/O/N/24 Q4(a)(i),(ii)

4(a)(i)	M1 +5 M2 +4	2
4(a)(ii)	oxygen	1

Q17

0620/42/O/N/24 Q3(f)

3(f)	M1 oxidation number of S goes from +1 M2 oxidation number of S goes to +2 M3 oxidation number of Cl (goes from -1) to 0 (in Cl_2) M4 oxidation numbers of Cl AND S increase	4
------	---	---

Q18

0620/42/M/J/25 Q4(c)(i),(ii)

4(c)(i)	-2	1
4(c)(ii)	M1 use of -14 or 7×-2 M2 +6	2

Q19

0620/42/O/N/25 Q4(b)(iv)

4(b)(iv)	M1 use of -18 or (9×-2) or $(3 \times 3 \times -2)$ M2 +5	2
----------	---	---

Q20

0620/42/F/M/22 Q3(d)(i)-(iii)

3(d)(i)	6NO_2 8NH_3 7N_2 either 6NO_2 or 8NH_3 all three balanced	2
3(d)(ii)	(nitrogen) loses oxygen	1
3(d)(iii)	reduction and oxidation occur	1

Q21

0620/41/M/J/22 Q7(d)(ii)

7(d)(ii)	Br^- (1) loses electron(s) (1)	2
----------	--	---

Q22

0620/42/F/M/23 Q4(e)(v)

4(e)(v)	$2\text{Al} + 3\text{CuO} \rightarrow \text{Al}_2\text{O}_3 + 3\text{Cu}$ M1 correct products (1) M2 rest of equation correct (1)	2
---------	---	---

Q23

0620/43/O/N/23 Q3(b)(ii),(iii)

3(b)(ii)	M1 -3 (1) M2 +2 (1)	2
3(b)(iii)	oxidation AND oxidation number increases	1

Q24

0620/42/O/N/25 Q2(d)(i)-(iii),(e)

2(d)(i)	a substance that oxidises another substance and is itself reduced M1 'a substance' oxidises another substance M2 is itself reduced	2
2(d)(ii)	loss of (one) electron	1
2(d)(iii)	acidified	1
2(e)	iodine	1

Q25

0620/42/M/J/24 Q5(d)(i),(ii)

5(d)(i)	the oxidation number of manganese / Mn is +7	1
5(d)(ii)	M1 purple to M2 colourless	2

Q26

0620/43/M/J/22 Q6(c)(i)-(iii)

6(c)(i)	colourless (1) brown (1)	2
6(c)(ii)	redox	1
6(c)(iii)	Br ₂ (1) (bromine) is reduced (1)	2