



O-Level Chemistry (5070)

TOPICAL PAST PAPER

CHEMICAL BONDING

Theory: Structured Questions

2026 EDITION

IONIC BONDING

Q1

5070/21/M/J/21/Q4(a)

Ionic Bonding

4 Copper(II) chloride, copper(II) iodide and copper(II) carbonate are ionic compounds.

(a) Predict two physical properties, other than electrical conductivity, of copper(II) chloride.

1.

2.

[2]

Q2

5070/22/M/J/21/Q4(a-b)

Ionic Bonding

4 Zinc bromide and zinc carbonate are both ionic compounds.

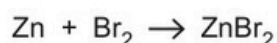
(a) Predict two physical properties, other than electrical conductivity, of zinc bromide.

1.

2.

[2]

(b) Zinc reacts with bromine to make zinc bromide.



Zinc bromide contains Zn^{2+} and Br^- ions.

Explain, in terms of the movement of electrons, how ZnBr_2 is formed from zinc atoms and bromine molecules.

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.....

..... [2]

IONIC BONDING

Q3

5070/21/M/J/22/Q4(e)

Ionic Bonding

(e) Potassium chloride is an ionic compound.

Potassium chloride has a high melting point and a high boiling point.

(i) Explain why potassium chloride has a high melting point.

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..... [2]

(ii) Predict two **other** physical properties of potassium chloride.

1

2 [2]

Q4

5070/21/M/J/23/Q4(d)

Ionic Bonding

(d) Calcium phosphate, $\text{Ca}_3(\text{PO}_4)_2$, is an ionic compound.

Explain why calcium phosphate has a high melting point.

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..... [2]

4 Calcium bromide, CaBr_2 , is an ionic solid composed of a lattice of calcium ions and bromide ions.

(a) Explain why calcium bromide has a high melting point.

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 [1]

(b) Describe how calcium atoms and bromine molecules react to form calcium ions and bromide ions. Use ideas about electron transfer.

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 [2]

COVALENT BONDING

Q6

5070/21/M/J/21/Q6(b)

Covalent Bonding

(b) Draw the dot-and-cross diagram to show the bonding in a molecule of carbon dioxide.

Only show the outer shell electrons.

[1]

Q7

5070/21/M/J/22/Q2(d)

Covalent Bonding

(d) Nitrogen exists as a diatomic molecule, N_2 .

(i) Draw the dot-and-cross diagram to show the bonding in N_2 .

Show only the outer shell electrons.

[1]

(ii) Explain, in terms of structure and bonding, why nitrogen has a low melting point.

.....

..... [1]

COVALENT BONDING

Q8

5070/21/M/J/23/Q7(f)(i)

Covalent Bonding

- (f) Methanol is a covalent substance.
- (i) Draw a dot-and-cross diagram to show the bonding in a molecule of methanol.
- Include only the outer shell electrons of each atom.

[2]

Q9

5070/22/O/N/23/Q4(e)

Covalent Bonding

- (e) Phosphorus(III) iodide is produced when phosphorus reacts with iodine.

Complete Fig. 4.1 to show the dot-and-cross diagram for a molecule of phosphorus(III) iodide.

Show only the outer shell electrons.

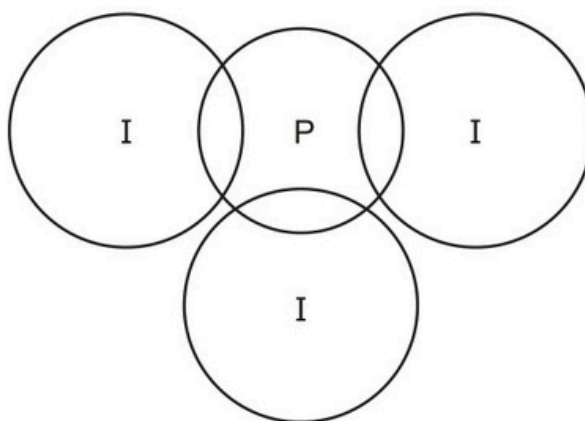


Fig. 4.1

[2]

COVALENT BONDING

Q10

5070/22/O/N/25/Q6(a)

Covalent Bonding

- 6 This question is about the covalent compound hydrogen peroxide.

Fig. 6.1 shows the displayed formula of hydrogen peroxide.



Fig. 6.1

- (a) Draw the dot-and-cross diagram to show the electronic arrangement in a molecule of hydrogen peroxide.

Only draw the outer shell electrons of oxygen and hydrogen.

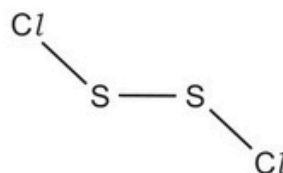
[2]

- 6 Fig. 6.1 shows the structures of zinc sulfide and disulfur dichloride.

Zinc sulfide has a structure similar to diamond.



zinc sulfide



disulfur dichloride

Key:

- zinc atoms
- sulfur atoms

Fig. 6.1

- (b) Explain why disulfur dichloride has a low melting point.

Use the information in Fig. 6.1.

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..... [1]

COVALENT BONDING

Q12

5070/22/O/N/24/Q6(b)

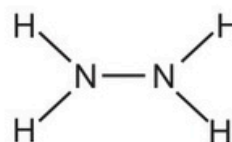
Covalent Bonding

- 6 Fig. 6.1 shows the structures of boron nitride and hydrazine.

Boron nitride has a structure similar to diamond.



boron nitride



hydrazine

Key : ● boron atoms
○ nitrogen atoms

Fig. 6.1

- (b) Explain why hydrazine is a poor electrical conductor.

Use the information in Fig. 6.1.

..... [1]

METALLIC BONDING

Q13

5070/22/M/J/21/Q8(b)

Metallic Bonding

(b) Describe, with the aid of a labelled diagram, the metallic bonding in lead.

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..... [3]

Q14

5070/21/M/J/22/Q7(c)

Metallic Bonding

(c) Describe, with the aid of a labelled diagram, the metallic bonding in solid aluminium.

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..... [2]

METALLIC BONDING

Q15

5070/22/O/N/22/Q8(a)

Metallic Bonding

8 This question is about metals and metal compounds.

(a) Describe, with the aid of a labelled diagram, the structure and bonding in metals.

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..... [3]

Q16

5070/21/O/N/25/Q5(b)

Metallic Bonding

(b) The physical properties of nickel can be explained using ideas about structure and bonding.

(i) Explain why nickel has good electrical conductivity.

.....

..... [1]

(ii) Explain why nickel is ductile.

.....

..... [1]

GIANT COVALENT STRUCTURES

Q17

5070/21/M/J/25/Q2(a)

Giant Covalent Structures

2 A concentrated aqueous solution of copper(II) bromide is electrolysed using graphite electrodes.

(a) Graphite has good electrical conductivity.

(i) Explain why graphite has good electrical conductivity.

Use ideas about structure and bonding.

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..... [2]

Q18

5070/21/O/N/23/Q9(a)(ii)

Giant Covalent Structures

9 (a) Table 9.1 shows the melting points and relative electrical conductivities of three elements.

Table 9.1

	carbon (graphite)	magnesium	phosphorus
melting point /°C	3652	649	44
relative electrical conductivity of solid	good	good	poor

Use ideas about structure and bonding to explain:

(ii) the difference in the electrical conductivities of graphite and phosphorus.

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.....

..... [2]

GIANT COVALENT STRUCTURES

Q19

5070/21/O/N/23/Q9(b)

Giant Covalent Structures

- (b) Diamond and graphite are different forms of carbon.

Explain, in terms of its structure and bonding, why diamond is used in cutting tools.

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..... [2]

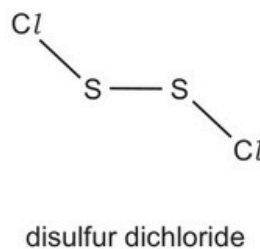
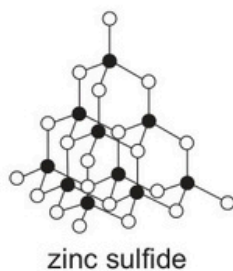
Q20

5070/21/O/N/24/Q6(a)

Giant Covalent Structures

- 6 Fig. 6.1 shows the structures of zinc sulfide and disulfur dichloride.

Zinc sulfide has a structure similar to diamond.



Key:

- zinc atoms
- sulfur atoms

Fig. 6.1

- (a) (i) Explain why zinc sulfide does **not** conduct electricity.

Use the information in Fig. 6.1.

..... [1]

- (ii) Predict one **other** physical property of zinc sulfide.

..... [1]

GIANT COVALENT STRUCTURES

Q21

5070/22/O/N/24/Q6(a)

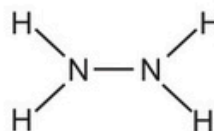
Giant Covalent Structures

- 6 Fig. 6.1 shows the structures of boron nitride and hydrazine.

Boron nitride has a structure similar to diamond.



boron nitride



hydrazine

Key : ● boron atoms
○ nitrogen atoms

Fig. 6.1

- (a) Explain why boron nitride has a high melting point.

Use the information in Fig. 6.1.

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..... [2]

MARKING SCHEME - IONIC BONDING

Q1 5070/21/M/J/21/Q4(a) Ionic Bonding		
4(a)	Any two from: soluble in water (1) insoluble in organic solvents (1) high melting point / solid at room temperature (1)	2
Q2 5070/22/M/J/21/Q4(a-b) Ionic Bonding		
4(a)	Any two from: soluble in water (1) insoluble in organic solvents (1) high melting point / solid at room temperature (1) white (1)	2
4(b)	zinc loses electrons and bromine gains electrons (1) reference to (transfer of) two electrons (1)	2
Q3 5070/21/M/J/22/Q4(e) Ionic Bonding		
4(e)(i)	lattice (structure) (1) strong attraction between positive and negative ions / strong electrostatic attraction between ions (1)	2
4(e)(ii)	any two from: conducts electricity as a molten liquid (1) does not conduct electricity as a solid (1) dissolves in water (1)	2
Q4 5070/21/M/J/23/Q4(d) Ionic Bonding		
4(d)	giant structure (1) strong attraction between positive and negative ions / strong electrostatic attraction between ions (1)	2
Q5 5070/22/M/J/24/Q4(a-b) Ionic Bonding		
4(a)	strong attraction between positive and negative ions	1
4(b)	calcium (atom) loses 2 electron (1) bromine (molecule) gains two electrons (1)	2

MARKING SCHEME - COVALENT BONDING

Q6	5070/21/M/J/21/Q6(b)	Covalent Bonding
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6(b)		1
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Q7	5070/21/M/J/22/Q2(d)	Covalent Bonding
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2(d)(i)	correct dot-and-cross diagram	1
2(d)(ii)	weak intermolecular forces / intermolecular forces are easy to break or overcome	1

Q8	5070/21/M/J/23/Q7(f)(i)	Covalent Bonding
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7(f)(i)	3 C—H bonds and one C—O bond around carbon (1) rest of structure correct (1)	2
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MARKING SCHEME - COVALENT BONDING

Q9

5070/22/O/N/23/Q4(e)

Covalent Bonding

4(e)	pair of electrons between each P and I (1) 6 non-bonding electrons on each I AND 2 non-bonded electrons on P (1)	2
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Q10

5070/22/O/N/25/Q6(a)

Covalent Bonding

6(a)	M1 single bond between O—O shown as a bond pair (1) M2 each oxygen to have one O—H bonds shown and all lone pairs on oxygen (1)	2
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Q11

5070/21/O/N/24/Q6(b)

Covalent Bonding

6(b)	weak intermolecular forces	1
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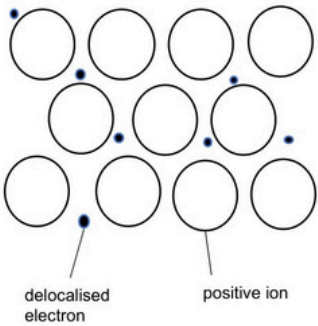
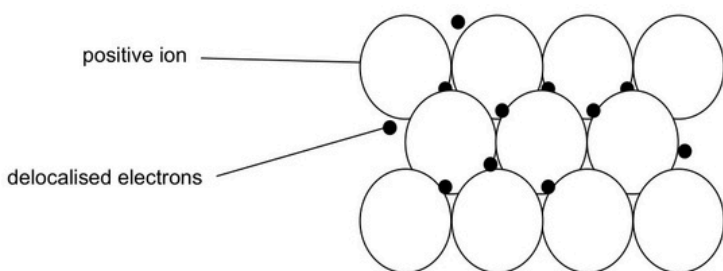
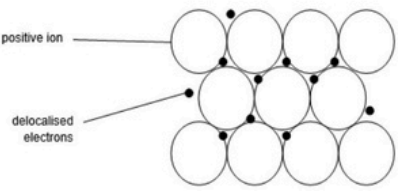
Q12

5070/22/O/N/24/Q6(b)

Covalent Bonding

6(b)	there are no mobile electrons	1
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MARKING SCHEME - METALLIC BONDING

Q13	5070/22/M/J/21/Q8(b)	Metallic Bonding
8(b)	 delocalised electron positive ion closely packed positive ions in regular arrangement (1) delocalised electrons / sea of electrons (1) strong attraction between the (positive) ions and the electrons (1)	3
Q14	5070/21/M/J/22/Q7(c)	Metallic Bonding
7(c)	 positive ion delocalised electrons closely packed positive ions surrounded by delocalised electrons (1) strong attraction between electrons and positive ions (1)	2
Q15	5070/22/O/N/22/Q8(a)	Metallic Bonding
8(a)	 positive ion delocalised electrons closely packed positive ions (1) (particles) surrounded by delocalised electrons (1) strong attraction between electrons and positive ions (1)	3

MARKING SCHEME - METALLIC BONDING

Q16

5070/21/O/N/25/Q5(b)

Metallic Bonding

5(b)(i)	has electrons that can move / presence of mobile electrons	1
5(b)(ii)	layers of (metal) ions can slide (over one another)	1

Q17

5070/21/M/J/25/Q2(a)

Giant Covalent Structures

2(a)(i)	each carbon atom in the structure uses three outer shell electrons in forming covalent bonds (1) presence of mobile electrons (between layers) (1)	2
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Q18

5070/21/O/N/23/Q9(a)(ii)

Giant Covalent Structures

9(a)(ii)	graphite has (delocalised) mobile electrons / (delocalised) electrons which can move (1) phosphorus has no mobile electrons / charge carriers (1)	2
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Q19

5070/21/O/N/23/Q9(b)

Giant Covalent Structures

9(b)	M1 diamond has a giant structure of covalent bonds (1) M2 diamond has strong bonding between all the atoms (1)	2
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Q20

5070/21/O/N/24/Q6(a)

Giant Covalent Structures

6(a)(i)	there are no mobile electrons	1
6(a)(ii)	high melting point	1

Q21

5070/22/O/N/24/Q6(a)

Giant Covalent Structures

6(a)	M1 it is a giant (structure) (1) M2 the bonds are strong (1)	2
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