

Ions and ionic bonds

Question Paper 1

Level	IGCSE
Subject	Chemistry (0620/0971)
Exam Board	Cambridge International Examinations (CIE)
Topic	Atoms, elements and compounds
Sub-Topic	Ions and ionic bonds
Booklet	Question Paper 1

Time Allowed: 40 minutes

Score: /33

Percentage: /100

Grade Boundaries:

9	8	7	6	5	4	3	2	1
>85%	75%	68%	60%	53%	48%	40%	33%	<25%

1 Which change to an atom occurs when it forms a positive ion?

- A** It gains electrons.
- B** It gains protons.
- C** It loses electrons.
- D** It loses protons.

2 The electronic configuration of an ion is 2.8.8.

What could this ion be?

	S ²⁻	Ca ²⁺
A	✓	✓
B	✓	x
C	x	✓
D	x	x

3 When sodium chloride is formed from its elements, each chlorine atom1..... one2.....

Which words correctly complete gaps 1 and 2?

	1	2
A	gains	electron
B	gains	proton
C	loses	electron
D	loses	proton

4 Which two elements react together to form an ionic compound?

element	electronic structure
W	2,4
X	2,8
Y	2,8,1
Z	2,8,7

- A** W and X **B** X and Y **C** Y and Z **D** Z and W

5 The table shows the electronic structures of four atoms.

atom	electronic structure
W	2,1
X	2,7
Y	2,8,4
Z	2,8,8

Which two atoms combine to form an ionic compound?

- A** W and X **B** W and Y **C** X and Y **D** X and Z

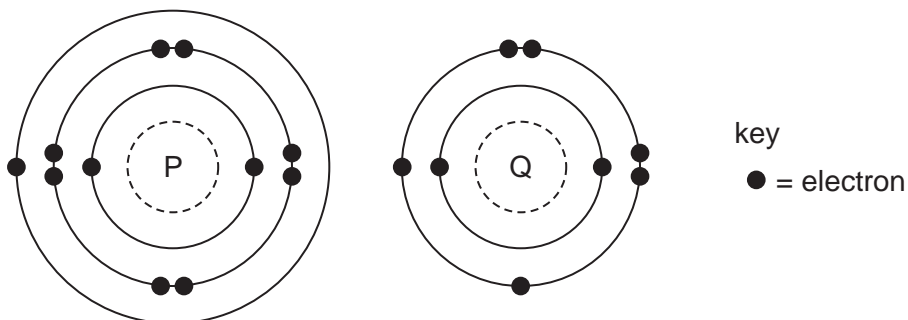
6 The element rubidium, Rb, is immediately below potassium in the Periodic Table.

It reacts with bromine to form the compound rubidium bromide.

Which descriptions of this compound are correct?

	type of bond	formula	colour
A	covalent	RbBr	brown
B	covalent	RbBr ₂	white
C	ionic	RbBr	white
D	ionic	RbBr ₂	brown

- 7 The electronic structures of atoms P and Q are shown.



P and Q react to form an ionic compound.

What is the formula of this compound?

- A** PQ_2 **B** P_2Q **C** P_2Q_6 **D** P_6Q_2
- 8 The table contains information about four substances.

Which substance is potassium chloride?

	melting point / $^{\circ}\text{C}$	conduction of electricity	
		when molten	in aqueous solution
A	11	no	yes
B	98	yes	yes
C	772	yes	yes
D	1410	no	insoluble

- 9 Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

	electron change	formula of ion formed
A	electron gained	Rb^+
B	electron gained	Rb^-
C	electron lost	Rb^+
D	electron lost	Rb^-

10 The electronic structures of atoms P and Q are shown.



P and Q react to form an ionic compound.

What is the formula of the compound?

- A** Q_7P **B** QP **C** QP_3 **D** QP_7

11 For which substance is the type of bonding **not** correct?

	substance	type of bonding		
		ionic	cova	metallic
A	chlorine		✓	
B	potassium bromide	✓		
C	sodium			✓
D	sodium chloride		✓	

12 Sodium chloride is an ionic solid.

Which statement is **not** correct?

- A** Ions are formed when atoms lose or gain electrons.
B Ions in sodium chloride are strongly held together.
C Ions with the same charge attract each other.
D Sodium chloride solution can conduct electricity.

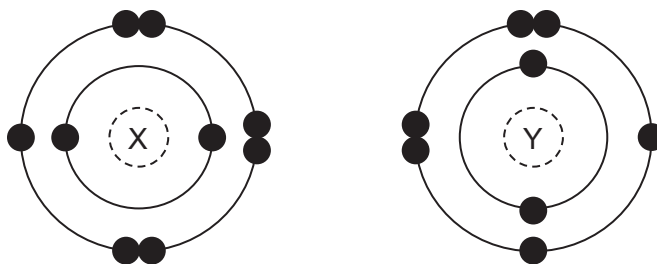
13 Caesium chloride and rubidium bromide are halide compounds of Group I elements.

Caesium chloride has the formula1....., a relative formula mass2..... that of rubidium bromide and bonds that are3..... .

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
A	CaCl	different from	ionic
B	CaCl	the same as	covalent
C	CsCl	different from	ionic
D	CsCl	the same as	covalent

14 The electronic structures of two atoms, X and Y, are shown.



X and Y combine together to form a compound.

What is the type of bonding in the compound and what is the formula of the compound?

	type of bonding	formula
A	covalent	X_2Y
B	covalent	XY_2
C	ionic	XY_2
D	ionic	X_2Y

15 Element X is in Group I of the Periodic Table. X reacts with element Y to form an ionic compound.

Which equation shows the process that takes place when X forms ions?

- A** $\text{X} + \text{e}^- \rightarrow \text{X}^+$
- B** $\text{X} - \text{e}^- \rightarrow \text{X}^-$
- C** $\text{X} + \text{e}^- \rightarrow \text{X}^-$
- D** $\text{X} - \text{e}^- \rightarrow \text{X}^+$

16 Compound X melts at 801 °C and is a good electrical conductor when dissolved in water.

Compound Y boils at 77 °C, is insoluble in water and is a non-conductor of electricity.

Which type of bonding is present in X and in Y?

	X	Y
A	covalent	covalent
B	covalent	ionic
C	ionic	covalent
D	ionic	ionic

17 Q^+ is an ion of element Q.

What has the highest value in the ion?

- A** the nucleon number
- B** the number of electrons
- C** the number of neutrons
- D** the proton number

18 Which substance is an ionic compound?

	volatility	electrical conductivity when molten	solubility in water
A	high	good	soluble
B	high	poor	insoluble
C	low	good	soluble
D	low	poor	insoluble

19 Lithium is in Group I of the Periodic Table. Nitrogen is in Group V of the Periodic Table.

Lithium reacts with nitrogen to form the ionic compound lithium nitride.

What happens to the electrons when lithium atoms and nitrogen atoms form ions?

	lithium atoms	nitrogen atoms
A	each lithium atom loses one electron to form a Li^+ ion	each nitrogen atom gains three electrons to form an N^{3-} ion
B	each lithium atom loses one electron to form a Li^+ ion	each nitrogen atom gains five electrons to form an N^{5-} ion
C	each lithium atom gains one electron to form a Li^- ion	each nitrogen atom loses three electrons to form an N^{3+} ion
D	each lithium atom gains one electron to form a Li^- ion	each nitrogen atom loses five electrons to form an N^{5+} ion

20 Potassium, K, forms a compound with fluorine, F.

Which statements about this compound are correct?

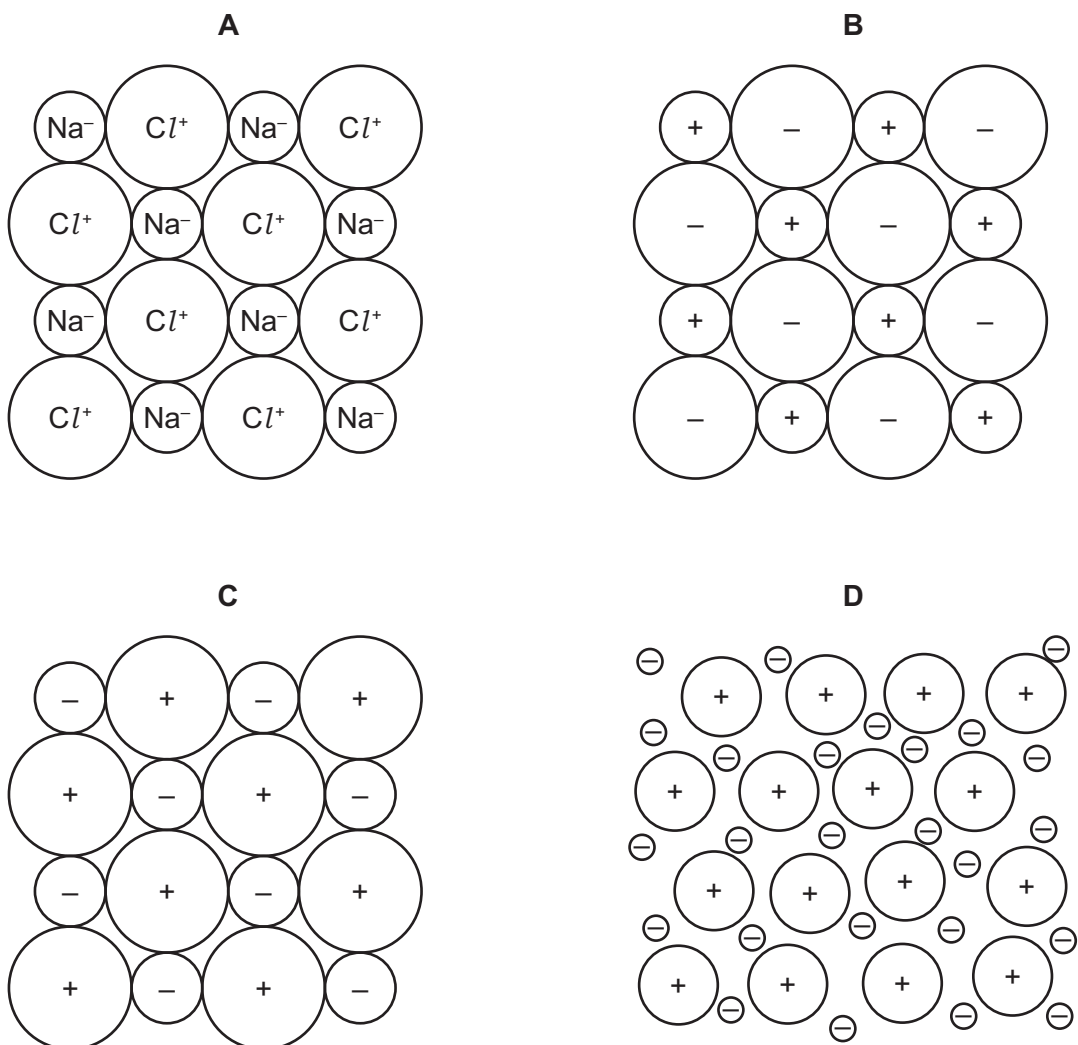
- 1 The compound is ionic.
- 2 The formula of the compound is KF.
- 3 The compound is soluble in water.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

21 Which statement describes positive ions?

- A** Positive ions have more electrons than neutrons.
- B** Positive ions have more protons than neutrons.
- C** Positive ions have more electrons than protons.
- D** Positive ions have more protons than electrons.

22 Which structure represents the sodium chloride lattice?



23 Magnesium nitride is formed when magnesium burns in air. Magnesium nitride is an ionic compound.

What is the formula of magnesium nitride?

- A** MgN_2 **B** Mg_2N_2 **C** Mg_2N_3 **D** Mg_3N_2

24 Which two elements react together to form an ionic compound?

element	electronic structure
R	2,4
T	2,8
X	2,8,1
Z	2,8,7

- A** R and T **B** T and X **C** X and Z **D** Z and R

25 Which row describes the type of bonding present in substances 1 and 2?

	substance 1	substance 2
A	methane has ionic bonding	graphite has covalent bonding
B	graphite has ionic bonding	potassium chloride has covalent bonding
C	potassium chloride has ionic bonding	methane has covalent bonding
D	potassium chloride has ionic bonding	graphite has ionic bonding

26 In which row do the properties described match the type of bonding?

	melting point	electrical conductivity when liquid	type of bonding
A	high	does not conduct	ionic
B	low	conducts	covalent
C	low	conducts	ionic
D	low	does not conduct	covalent

27 Four statements about atoms and ions are shown.

- 1 F^- has more electrons than Na^+ .
- 2 Mg^{2+} has the same number of electrons as Na^+ .
- 3 N^+ has more electrons than Li^+ .
- 4 An atom of P has more outer shell electrons than an atom of N.

Which statements are correct?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

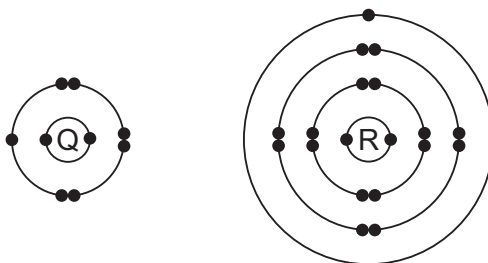
28 Sodium reacts with chlorine to form sodium chloride.

Which statements describe what happens to the sodium atoms in this reaction?

- 1 Sodium atoms form positive ions.
- 2 Sodium atoms form negative ions.
- 3 Sodium atoms gain electrons.
- 4 Sodium atoms lose electrons.

- A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

29 The electronic structures of atoms Q and R are shown.



Q and R form an ionic compound.

What is the formula of the compound?

- A** QR_7 **B** Q_2R_4 **C** QR **D** Q_7R

- 30 Solid F is an element.
Solid G is a compound.
Neither solid conducts electricity but G conducts electricity when dissolved in water.

These properties suggest that F is1..... and that G is2..... with3..... bonds.

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
A	diamond	AgCl	covalent
B	diamond	NaCl	ionic
C	graphite	AgCl	ionic
D	graphite	NaCl	covalent

- 31 The nucleon number and proton number of the lithium atom are shown by the symbol ${}^7_3\text{Li}$.

What is the correct symbol for the lithium ion in lithium chloride?

- A** ${}^6_2\text{Li}^-$ **B** ${}^6_3\text{Li}^+$ **C** ${}^7_3\text{Li}^+$ **D** ${}^7_3\text{Li}^-$

- 32 The table shows the structure of different atoms and ions.

particle	number	nucleon number	number of protons	number of neutrons	number of electrons
Mg	12	24	12	W	12
Mg ²⁺	X	24	12	12	10
F	9	19	9	Y	9
F ⁻	9	19	9	10	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	10	10	9	9
B	10	12	10	9
C	12	10	9	10
D	12	12	10	10

- 33 Which element does **not** form a stable ion with the same electronic structure as argon?
- A aluminium
 - B chlorine
 - C phosphorus
 - D potassium