

# Molecules and Covalent Bond

## Question Paper 1

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

**Time Allowed:** 48 minutes

**Score:** /40

**Percentage:** /100

### Grade Boundaries:

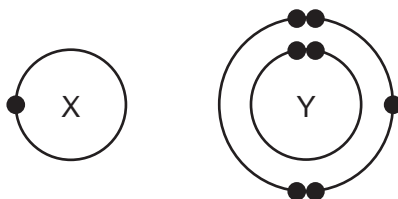
9	8	7	6	5	4	3	2	1
>85%	75%	68%	60%	53%	48%	40%	33%	<25%

1. Covalent bonds are formed when electrons are .....1..... . Covalent compounds have .....2..... electrical conductivity.

Which words correctly complete gaps 1 and 2?

	1	2
<b>A</b>	shared	high
<b>B</b>	shared	low
<b>C</b>	transferred	high
<b>D</b>	transferred	low

2. The electronic structures of atoms X and Y are shown.

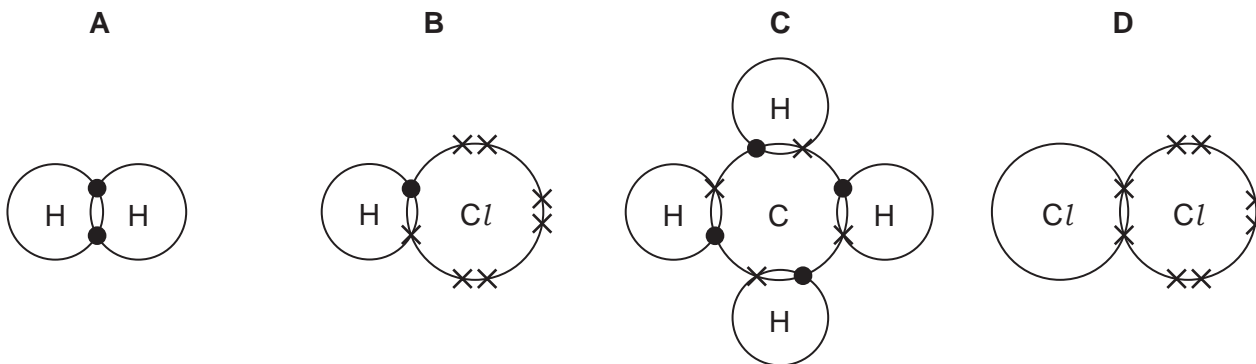


X and Y form a covalent compound.

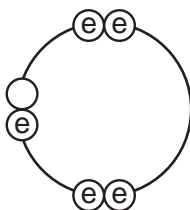
What is its formula?

- A**  $XY_5$       **B**  $XY_3$       **C**  $XY$       **D**  $X_3Y$

3. Which diagram does **not** show the outer shell electrons in the molecule correctly?



4. Element X has six electrons in its outer shell.



key

⊕ = electron

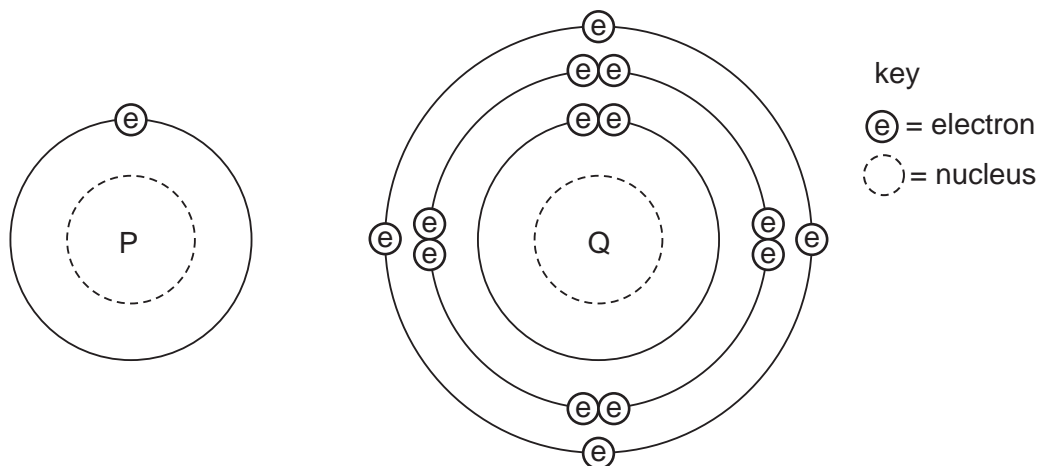
How could the element react?

- A** by gaining two electrons to form a positive ion
  - B** by losing six electrons to form a negative ion
  - C** by sharing two electrons with two electrons from another element to form two covalent bonds
  - D** by sharing two electrons with two electrons from another element to form four covalent bonds
5. In which compounds are pairs of electrons shared between atoms?

- 1 sodium chloride
- 2 methane
- 3 lead bromide

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

6. The diagram shows the electronic structures of atoms P and Q.



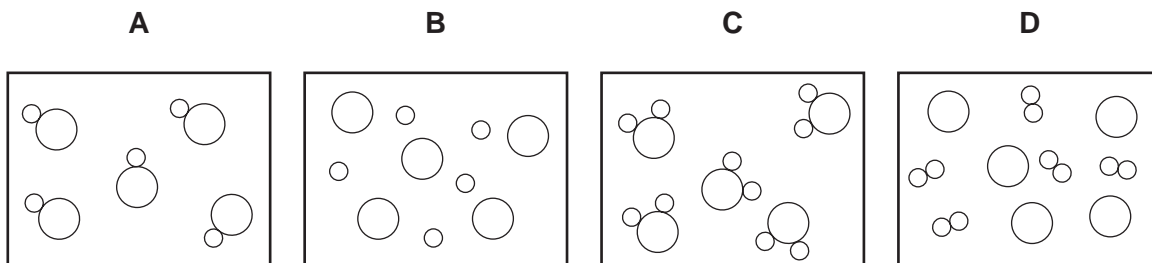
P and Q combine to form a molecule.

What is the formula of this molecule?

- A**  $PQ_4$       **B**  $PQ$       **C**  $P_2Q$       **D**  $P_4Q$

7. In the diagrams, circles of different sizes represent atoms of different elements.

Which diagram represents hydrogen chloride gas?



8. In the molecules  $CH_4$ ,  $HCl$  and  $H_2O$ , which atoms use **all** of their outer shell electrons in bonding?

- A** C and Cl      **B** C and H      **C** Cl and H      **D** H and O

9. Element X forms an acidic, covalent oxide.

Which row shows how many electrons there could be in the outer shell of an atom of X?

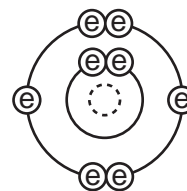
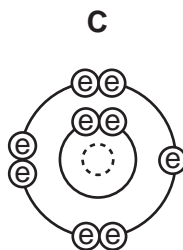
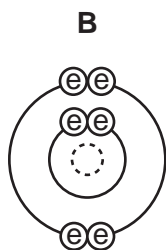
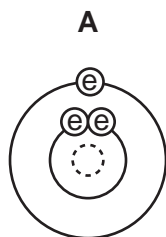
	1	2	6	7
<b>A</b>	✓	✓	x	x
<b>B</b>	✓	x	✓	x
<b>C</b>	x	x	✓	✓
<b>D</b>	x	✓	x	✓

10. Which is a simple covalent molecule?

	conducts electricity		volatile
	when solid	when molten	
<b>A</b>	✓	✓	x
<b>B</b>	✓	x	✓
<b>C</b>	x	✓	x
<b>D</b>	x	x	✓

11. The diagrams show the electron arrangements in the atoms of four elements.

Which element does **not** form a covalent bond?



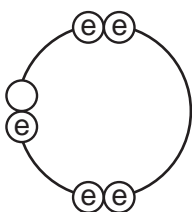
key


ⓔ electron

⊙ nucleus

12. Which statement about the bonding in a molecule of water is **not** correct?
- A Both hydrogen and oxygen have a noble gas configuration of electrons.
  - B Each hydrogen shares its one electron with oxygen.
  - C Oxygen shares one of its own electrons with each hydrogen.
  - D Oxygen shares two of its own electrons with each hydrogen.

13. Element X has six electrons in its outer shell.



key  
 = electron

How could the element react?

- A by gaining two electrons to form a positive ion
  - B by losing six electrons to form a negative ion
  - C by sharing two electrons with two electrons from another element to form two covalent bonds
  - D by sharing two electrons with two electrons from another element to form four covalent bonds
14. Electrons from each element are shared by both of the elements in a compound.

Which compound matches this description?

- A lead bromide
- B sodium chloride
- C water
- D zinc oxide

15. 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.

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

Caesium chloride has the formula .....1....., a relative formula mass .....2..... that of rubidium bromide and bonds that are .....3..... .

Which words correctly complete gaps 1, 2 and 3?

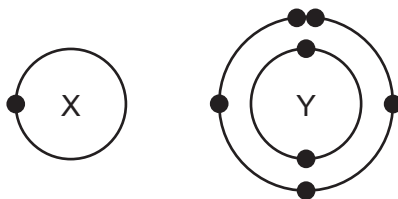
	1	2	3
<b>A</b>	$\text{CaCl}$	different from	ionic
<b>B</b>	$\text{CaCl}$	the same as	covalent
<b>C</b>	$\text{CsCl}$	different from	ionic
<b>D</b>	$\text{CsCl}$	the same as	covalent

17. 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**  $\text{X} - \text{e}^- \rightarrow \text{X}^+$

18. The electronic structures of atoms X and Y are shown.



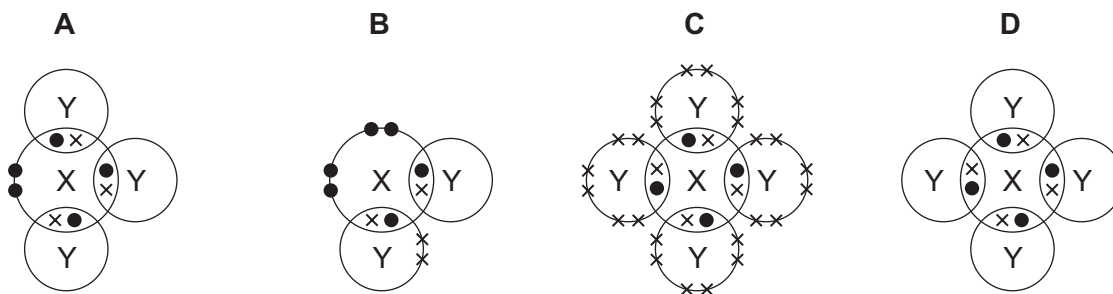
X and Y form a covalent compound.

What is its formula?

- A**  $XY_5$       **B**  $XY_3$       **C**  $XY$       **D**  $X_3Y$

19. In the following diagrams, X and Y are atoms of different elements.

Which diagram correctly shows the arrangement of outer electrons in a molecule of methane?



20. In which compounds are pairs of electrons shared between atoms?

- 1 methane
- 2 lead bromide
- 3 sodium chloride

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



21. Which statement about bonding is **not** correct?
- A** Carbon can form four single covalent bonds.
  - B** Chlorine atoms react to gain a noble gas electronic structure.
  - C** Covalent bonding involves losing and gaining electrons.
  - D** Hydrogen molecules have the formula H<sub>2</sub>.

22. Covalent bonds are formed when electrons are .....1..... .  
 Most covalent compounds have .....2..... electrical conductivity.

Which words correctly complete gaps 1 and 2?

	1	2
<b>A</b>	shared	high
<b>B</b>	shared	low
<b>C</b>	transferred	high
<b>D</b>	transferred	low

23. The table shows the electronic structure of four atoms.

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

Which two atoms combine to form a covalent compound?

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

24 An atom of element Q contains 19 electrons, 19 protons and 20 neutrons.

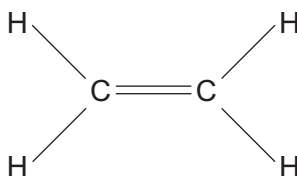
What is Q?

- A calcium
- B potassium
- C strontium
- D yttrium

25. Which molecule contains only single covalent bonds?

- A  $Cl_2$                       B  $CO_2$                       C  $N_2$                       D  $O_2$

26. Ethene is an unsaturated hydrocarbon.



Which description of the bonding in ethene is correct?

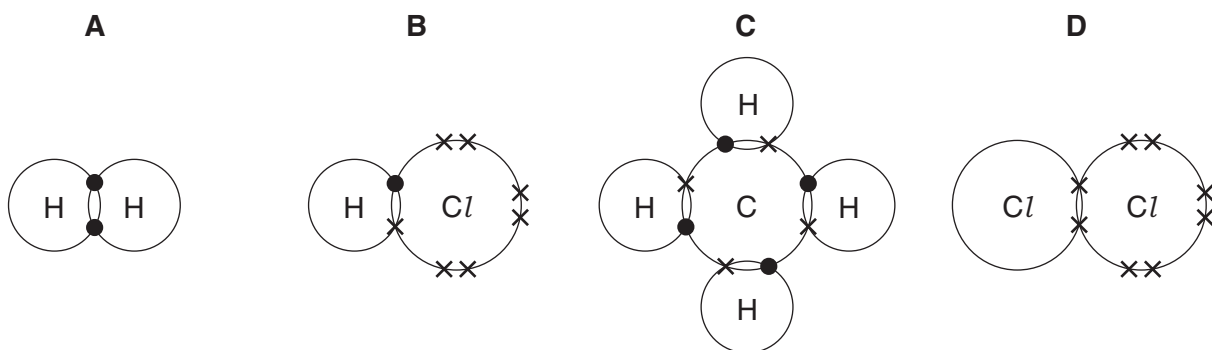
- A All atoms in the molecule have a share of eight electrons.
- B Each carbon atom shares two of its electrons with hydrogen atoms and two of its electrons with a carbon atom.
- C Each carbon atom shares two of its electrons with hydrogen atoms and one of its electrons with a carbon atom.
- D The two carbon atoms share a total of six electrons with other atoms.

27. Element X forms an acidic, covalent oxide.

Which row shows how many electrons there could be in the outer shell of an atom of X?

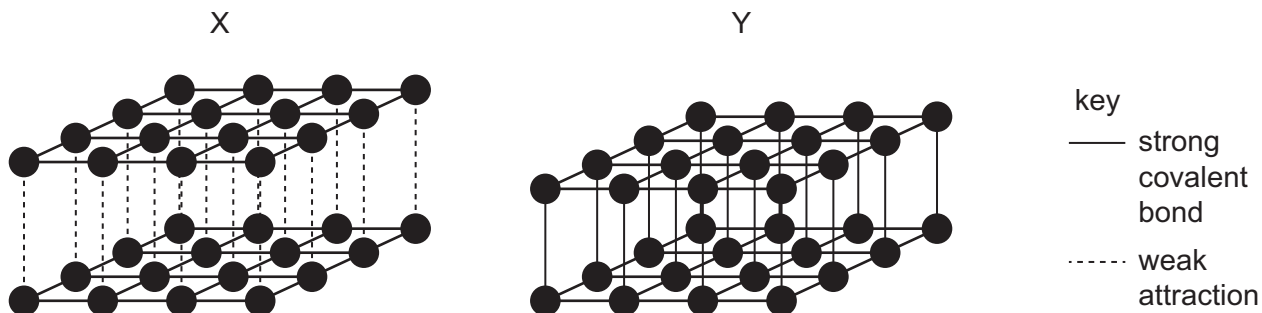
	1	2	6	7
A	✓	✓	x	x
B	✓	x	✓	x
C	x	x	✓	✓
D	x	✓	x	✓

28. Which diagram does **not** show the outer shell electrons in the molecule correctly?



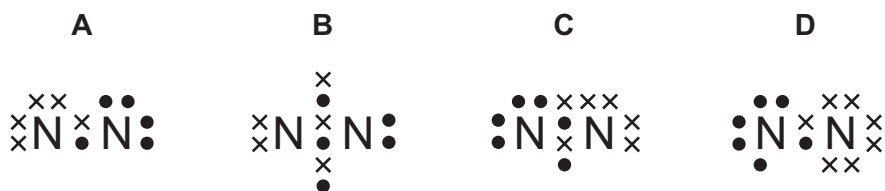
- 29 Substances with giant covalent structures can be used as lubricants and as cutting tools for hard materials.

The diagram shows how the atoms are arranged in two giant covalent substances, X and Y.

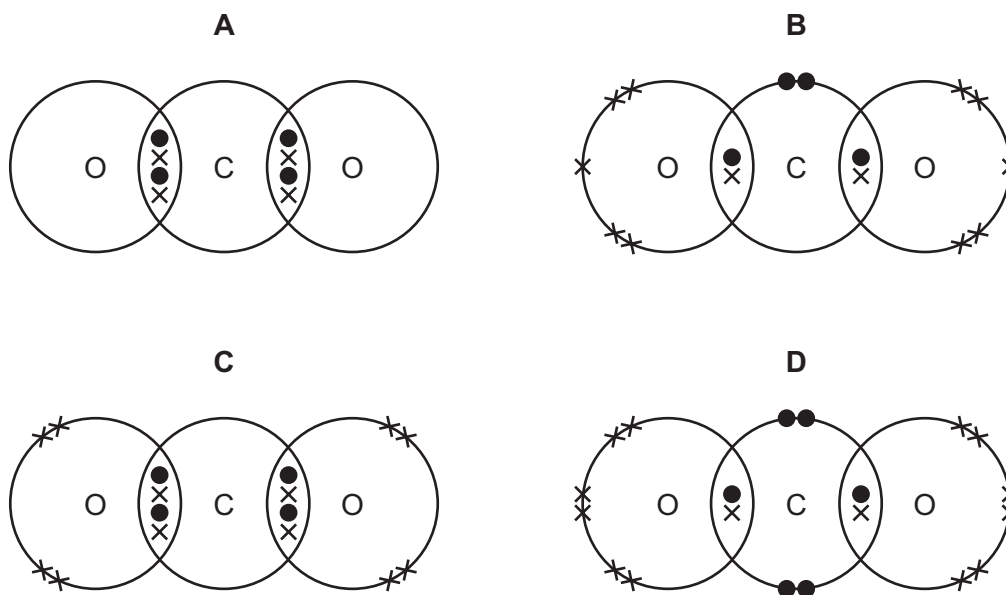


Which statement is correct?

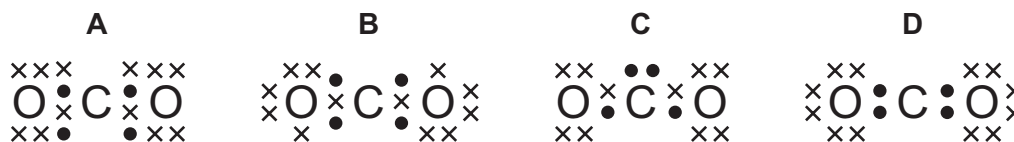
- A Only X is used as a cutting tool and only Y is used as a lubricant.
  - B Only X is used as a lubricant and only Y is used as a cutting tool.
  - C X and Y are both used as cutting tools.
  - D X and Y are both used as lubricants.
- 30 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of nitrogen?



31 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?



32 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?



33 Which molecule contains exactly two single covalent bonds?



34 Which electron arrangement for the outer shell electrons in a covalent compound is correct?



35 Which statement about a molecule of ammonia,  $\text{NH}_3$ , is correct?

- A Each hydrogen atom donates a pair of electrons to a nitrogen atom.
- B There are double covalent bonds between the nitrogen atom and the hydrogen atoms.
- C There are single covalent bonds between its hydrogen atoms.
- D There are three shared pairs of electrons in the molecule.

36 A covalent molecule M contains a total of four shared electrons.

What is M?

- A ammonia,  $\text{NH}_3$
- B hydrogen chloride,  $\text{HCl}$
- C methane,  $\text{CH}_4$
- D water,  $\text{H}_2\text{O}$

- 37 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 is .....1..... and that G is .....2..... with .....3..... bonds.

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
<b>A</b>	diamond	$\text{AgCl}$	covalent
<b>B</b>	diamond	$\text{NaCl}$	ionic
<b>C</b>	graphite	$\text{AgCl}$	ionic
<b>D</b>	graphite	$\text{NaCl}$	covalent

- 38 Compound X melts at  $801^\circ\text{C}$  and is a good electrical conductor when dissolved in water.  
Compound Y boils at  $77^\circ\text{C}$ , is insoluble in water and is a non-conductor of electricity.

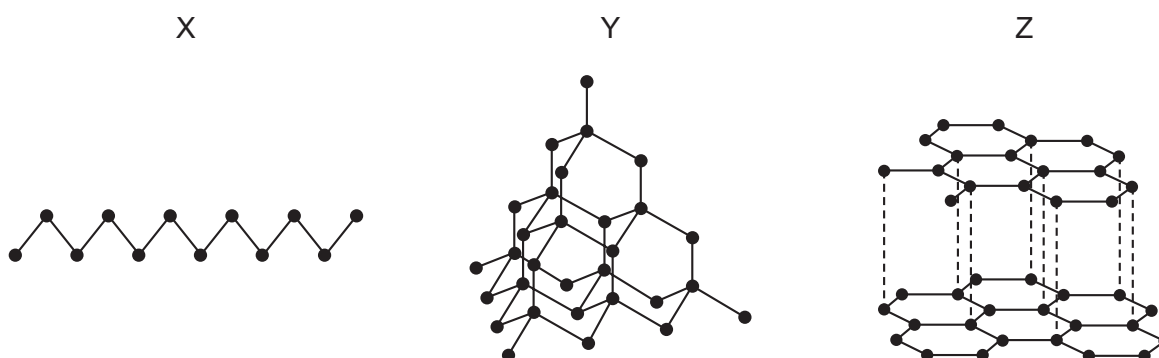
Which type of bonding is present in X and in Y?

	X	Y
<b>A</b>	covalent	covalent
<b>B</b>	covalent	ionic
<b>C</b>	ionic	covalent
<b>D</b>	ionic	ionic

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

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

40 The diagrams, X, Y and Z, show part of a polymer and two giant covalent structures.



Which of X, Y or Z could be used as a cutting tool and which of X, Y or Z could be used to reduce friction?

	cutting tool	reduce friction
<b>A</b>	X	Y
<b>B</b>	Y	Z
<b>C</b>	Z	X
<b>D</b>	Z	Y