

GCSE Chemistry

Worksheet: Covalent bonding

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Covalent bonding

NAME _____

CLASS _____

DATE _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Covalent bonds form between non-metal atoms.

0 1 . 1

Which statement about a covalent bond is correct?

Tick (✓) **one** box.

One atom transfers an electron to another atom.

☐

A pair of electrons is shared between two atoms.

☐

Positive ions are surrounded by delocalised electrons.

☐

Oppositely charged ions attract each other.

☐

[1 mark]

0 2

The electronic structure of hydrogen is 1 and the electronic structure of chlorine is 2,8,7. A hydrogen molecule, H_2 , and a hydrogen chloride molecule, HCl , each contain one single covalent bond.

0 2 . 1

Draw a dot and cross diagram for a molecule of hydrogen, H_2 .

.....

.....

[1 mark]

0 2 . 2

Draw a dot and cross diagram for a molecule of hydrogen chloride, HCl. Show the outer-shell electrons only.

.....

.....

.....

.....

[2 marks]

0 3

Dot and cross diagrams show how the outer electrons are arranged in molecules.

0 3 . 1

How many pairs of electrons are shared in a molecule of ammonia, NH₃?

.....

.....

.....

[1 mark]

0 3 . 2

How many non-bonding pairs of electrons are there on the oxygen atom in a molecule of water, H₂O?

.....

.....

.....

[1 mark]

0 3 . 3

Explain why a hydrogen atom forms only one covalent bond.

.....

.....

[1 mark]

0 3 . 4

Describe the dot and cross diagram for a molecule of hydrogen chloride, HCl.

.....

.....

.....

.....

[2 marks]

0 4

Some molecules contain double or triple covalent bonds.

0 4 . 1

An oxygen atom has 6 outer electrons.

Explain why there is a double bond in an oxygen molecule, O₂.

.....

.....

.....

.....

[2 marks]

0 4 . 2

How many electrons are shared between the two atoms in a nitrogen molecule, N₂?

.....

.....

.....

.....
[1 mark]

0 4 . 3

Sulfur is in Group 6.

Predict the number of covalent bonds and the number of non-bonding pairs of electrons on the sulfur atom in hydrogen sulfide, H_2S .

.....

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.....

.....

[2 marks]

0 4 . 4

Describe the dot and cross diagram for a chlorine molecule, Cl_2 .

.....

.....

.....

.....

[2 marks]

0 5

The electronic structure of hydrogen is 1, of nitrogen is 2,5 and of oxygen is 2,6.

0 5 . 1

An oxygen molecule, O_2 , contains a double covalent bond.

Draw a dot and cross diagram for a molecule of oxygen. Show the outer-shell electrons only.

.....

.....

.....

.....

[2 marks]

0 5 . 2

Draw a dot and cross diagram for a molecule of ammonia, NH_3 . Show the outer-shell electrons only.

[2 marks]

0 6

The electronic structure of hydrogen is 1, of oxygen is 2,6 and of chlorine is 2,8,7.

0 6 . 1

Draw a dot and cross diagram for a molecule of chlorine, Cl_2 . Show the outer-shell electrons only.

[2 marks]

0 6 . 2

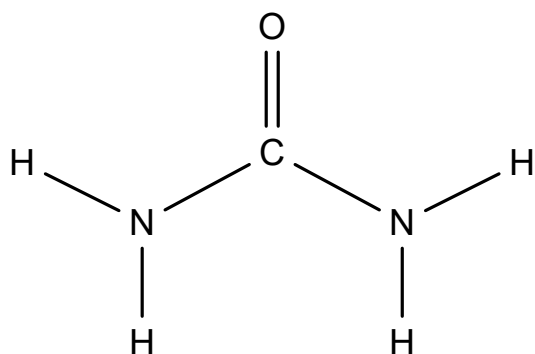
Draw a dot and cross diagram for a molecule of water, H_2O . Show the outer-shell electrons only.

[2 marks]

0 7

Figure 1 shows the displayed formula of urea.

Figure 1



0 7 . 1

Give the molecular formula of urea.

.....

.....

[1 mark]

0 7 . 2

How many pairs of electrons are shared in one molecule of urea?

.....

.....

.....

.....

[1 mark]

0 7 . 3

What is shown by the double line between the carbon atom and the oxygen atom?

.....

.....

[1 mark]

0 7 . 4

A nitrogen atom has 5 outer electrons.

How many non-bonding pairs of electrons does each nitrogen atom have in urea?

.....

.....

.....

.....

[1 mark]

0 7 . 5

Give **one** limitation of using a displayed formula to represent a molecule.

.....

.....

[1 mark]

0 8

A teacher shows a class a space-filling model of a water molecule and the displayed formula of water, H–O–H.

0 8 . 1

Give **one** advantage and **one** limitation of the space-filling model compared with the displayed formula.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: Covalent bonding · 31 marks

Question 1 (1 mark)

01.1 [1 mark]

Correct: A pair of electrons is shared between two atoms.

Question 2 (3 marks)

02.1 [1 mark]

Answer: One shared pair of electrons between the two hydrogen atoms, and no other electrons.

- one pair of electrons shared between the two hydrogen atoms, with no other electrons shown (1)

Notes: Any symbols (dots or crosses) may be used for the electrons, and circles for the shells are not required. Ignore inner-shell electrons if drawn correctly. Bonding pairs must be shown between (or in the overlap of) the two atoms they join.

02.2 [2 marks]

Answer: One shared pair between H and Cl; six more (non-bonding) electrons on chlorine.

- one pair of electrons shared between the hydrogen atom and the chlorine atom (1)
- six more (non-bonding) electrons on the chlorine atom, so chlorine has 8 in its outer shell (1)

Notes: Any symbols (dots or crosses) may be used for the electrons, and circles for the shells are not required. Ignore inner-shell electrons if drawn correctly. Bonding pairs must be shown between (or in the overlap of) the two atoms they join.

Question 3 (5 marks)

03.1 [1 mark]

Answer: 3

- 3 (1)
-

03.2 [1 mark]

Answer: 2

- 2 (1)
-

03.3 [1 mark]

Answer: It has only one electron; sharing one pair gives it a full first shell (2 electrons).

- hydrogen has one electron / its (first) shell is full with 2 electrons after sharing one pair (1)
-

03.4 [2 marks]

Answer: One pair of electrons is shared between H and Cl (one electron from each); the chlorine atom also has three non-bonding pairs.

- one pair of electrons shared between H and Cl (one electron from each atom) (1)
 - the chlorine atom has three non-bonding pairs / 8 electrons in its outer shell (1)
-

Question 4 (7 marks)

04.1 [2 marks]

Answer: Each oxygen atom needs 2 more electrons to fill its outer shell, so the atoms share two pairs of electrons.

- each oxygen atom needs 2 more electrons (to fill its outer shell) (1)
- so the atoms share two pairs of electrons (1)

04.2 [1 mark]

Answer: 6

- 6 (1)

Notes: Do not accept 3.

04.3 [2 marks]

Answer: 2 covalent bonds and 2 non-bonding pairs

- 2 covalent bonds (1)
- 2 non-bonding pairs (1)

04.4 [2 marks]

Answer: One pair of electrons is shared (one from each atom); each chlorine atom also has three non-bonding pairs.

- one shared pair of electrons (one electron from each atom) (1)
 - each chlorine atom has three non-bonding pairs / 8 electrons in its outer shell (1)
-

Question 5 (4 marks)

05.1 [2 marks]

Answer: Two shared pairs (four electrons) between the O atoms; four non-bonding electrons on each O atom.

- two pairs (four electrons) shared between the two oxygen atoms (1)
- four non-bonding electrons (two pairs) on each oxygen atom (1)

Notes: Any symbols (dots or crosses) may be used for the electrons, and circles for the shells are not required. Ignore inner-shell electrons if drawn correctly. Bonding pairs must be shown between (or in the overlap of) the two atoms they join.

05.2 [2 marks]

Answer: Three shared pairs, one between N and each H; one non-bonding pair on N.

- three shared pairs, one between the nitrogen atom and each hydrogen atom (1)
- two non-bonding electrons (one pair) on the nitrogen atom (1)

Notes: Any symbols (dots or crosses) may be used for the electrons, and circles for the shells are not required. Ignore inner-shell electrons if drawn correctly. Bonding pairs must be shown between (or in the overlap of) the two atoms they join.

Question 6 (4 marks)

06.1 [2 marks]

Answer: One shared pair between the Cl atoms; six non-bonding electrons on each Cl atom.

- one pair of electrons shared between the two chlorine atoms (1)
- six non-bonding electrons (three pairs) on each chlorine atom (1)

Notes: Any symbols (dots or crosses) may be used for the electrons, and circles for the shells are not required. Ignore inner-shell electrons if drawn correctly. Bonding pairs must be shown between (or in the overlap of) the two atoms they join.

06.2 [2 marks]

Answer: Two shared pairs, one between O and each H; four non-bonding electrons (two pairs) on O.

- two shared pairs, one between the oxygen atom and each hydrogen atom (1)
- four non-bonding electrons (two pairs) on the oxygen atom (1)

Notes: Any symbols (dots or crosses) may be used for the electrons, and circles for the shells are not required. Ignore inner-shell electrons if drawn correctly. Bonding pairs must be shown between (or in the overlap of) the two atoms they join.

Question 7 (5 marks)

07.1 [1 mark]

Answer: $\text{CH}_4\text{N}_2\text{O}$

- $\text{CH}_4\text{N}_2\text{O}$ (1)

Notes: Atoms may be in any order. Allow $\text{CO}(\text{NH}_2)_2$.

07.2 [1 mark]

Answer: 8

- 8 (1)
-

07.3 [1 mark]

Answer: A double bond: two shared pairs of electrons.

- a double bond / two shared pairs of electrons (1)
-

07.4 [1 mark]

Answer: 1

- 1 (1)
-

07.5 [1 mark]

Answer: It does not show the three-dimensional shape of the molecule.

- does not show the 3D shape / bond angles / non-bonding electrons / which atom the electrons came from (1)
-

Question 8 (2 marks)

08.1 [2 marks]

Answer: Advantage: it shows the three-dimensional (bent) shape and the relative sizes of the atoms. Limitation: it does not show the covalent bonds clearly.

- advantage: it shows the 3D shape of the molecule / the relative sizes of the atoms (1)
- limitation: it does not show the covalent bonds (shared pairs) clearly / which atoms are bonded together (1)

Notes: Allow for the limitation: it does not show the electrons.
