

GCSE Chemistry (9 – 1)

Covalent Bonding

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



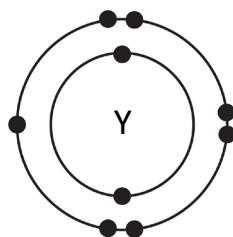
For markers use	
Question	Mark
1	/6
2	/6
3	/2
4	/2
5	/2
6	/6
7	/8
Total	/32
%	
Grade	

Information

- The maximum mark for this paper is 32 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. Covalent bonding occurs when two non-metal atoms share pairs of electrons in order to achieve a stable, full outer shell. Circle the letter of the correct answer for each of the following questions.
- a. Element Y is in Group 6 of the periodic table. Which statement describes how an atom of Element Y forms a stable covalent bond?



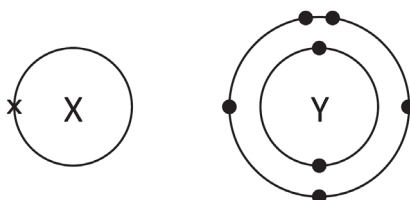
- A** It shares two electrons with another atom to obtain a full outer shell.
- B** It transfers two electrons to another atom to form an ionic bond.
- C** It gains one electron to fill its outer shell.
- D** It gains one electron to become a positive ion.

(1 mark)

- b. Which statement about the bonding in a molecule of ammonia (NH_3) is not correct?
- A** Nitrogen shares one of its own electrons with each hydrogen atom.
- B** Each hydrogen atom shares its one electron with the nitrogen atom.
- C** Nitrogen shares three of its own electrons with a single hydrogen atom.
- D** Both the nitrogen and hydrogen atoms achieve a noble gas electronic configuration.

(1 mark)

- c. Element X has 1 electron in its outer shell. Element Y is in Group 5 of the periodic table. When they react to form a covalent compound, what is the correct formula?



A

XY

B

XY_3

C

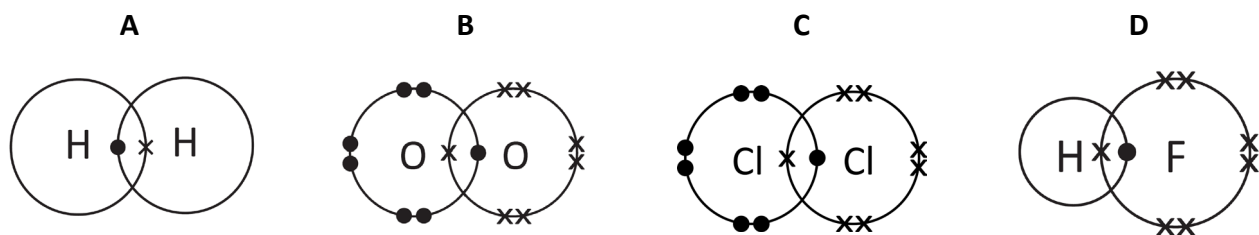
X_3Y

D

XY_5

(1 mark)

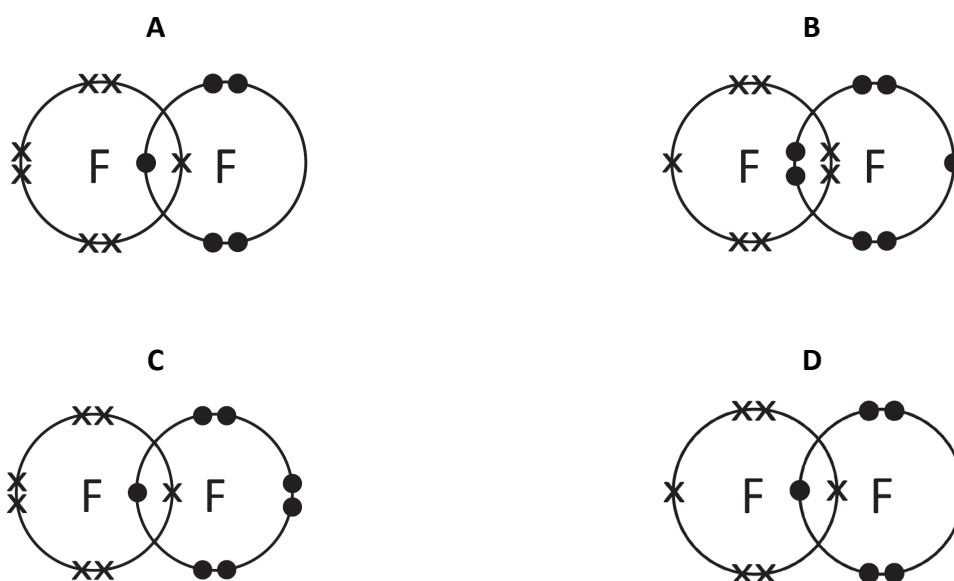
d. Which diagram does **not** show the outer shell electrons in the molecule correctly?



(1 mark)

e. Fluorine, F_2 , is in group 7 of the Periodic Table.

Which diagram shows the correct arrangement of the outer-shell electrons in a molecule of fluorine?



(1 mark)

f. Element **X** has 4 electrons in its outer shell. Element **Y** has 1 electron in its outer shell. They react to form a covalent compound with the formula XY_4 .

Which statement about the bonding in this molecule is **false**.

- A Atom X shares one of its own electrons with each of the four Y atoms.
- B There are four single covalent bonds in the molecule.
- C Atom X achieves a full outer shell of 8 electrons.
- D Atom X forms a double bond with two of the Y atoms.

(1 mark)

(Total for Question 1 is 6 marks)

2. Nitrogen is a non-metal. Unlike metals, it is a poor conductor of electricity.

a. Describe **two** additional physical differences you would expect to see between Nitrogen and a typical metal.

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(2 marks)

b. Ammonia contains nitrogen. Ammonia is a simple molecule with covalent bonds.
Describe a covalent bond.

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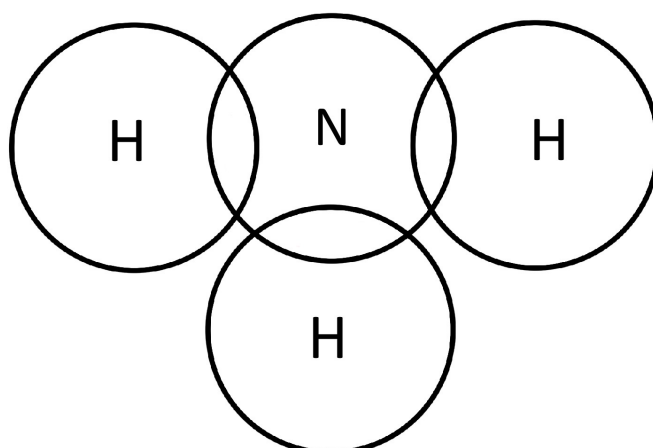
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(2 marks)

c. Complete the figure below to show the dot and cross diagram for a molecule of ammonia.
Show outer shell electrons only.

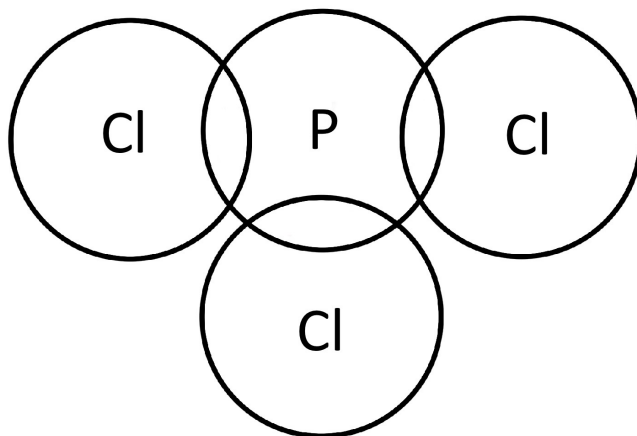


(2 marks)

(Total for Question 2 is 6 marks)

3. Phosphorus is in Group 5 of the periodic table. Chlorine is in Group 7.

Phosphorus reacts with chlorine to form the covalent compound phosphorus trichloride (PCl_3). Complete the **dot and cross diagram** to show the electron arrangement in a molecule of PCl_3 . Show outer shell electrons only.

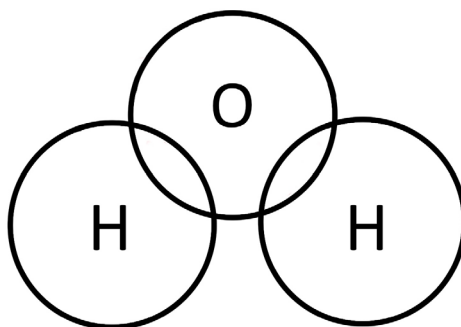


(2 marks)

(Total for Question 3 is 2 marks)

4. Oxygen is in Group 6 of the periodic table. Hydrogen is in Group 1.

Oxygen reacts with hydrogen to form the covalent compound water (H_2O). Complete the **dot and cross diagram** to show the electron arrangement in a molecule of water. Show outer shell electrons only.



(2 marks)

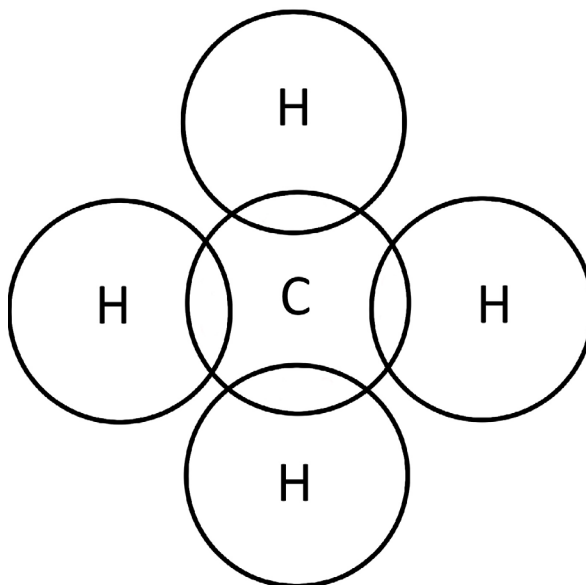
(Total for Question 4 is 2 marks)

5. Carbon is in Group 4 of the periodic table. Hydrogen is in Group 1.

Carbon reacts with hydrogen to form the covalent compound methane (CH_4).

Complete the **dot and cross diagram** to show the electron arrangement in a molecule of methane.

Show outer shell electrons only.



(2 marks)

(Total for Question 5 is 2 marks)

6. This question is about covalent bonding in different molecules.

a. Oxygen (O) is in Group 6 of the periodic table.

Complete the **dot and cross diagram** to show the bonding in a **molecule** of oxygen.

Show outer shell electrons only.

(2 marks)

b. Carbon dioxide (CO₂) is a covalent compound.

Carbon is in group 4 of the periodic table and oxygen is in group 6.

Draw the **dot and cross diagram** to show the bonding in a **molecule** of carbon dioxide.

Show outer shell electrons only.

(2 marks)

c. Sulfur Dioxide (SO₂). Sulfur and oxygen are both in Group 6.

Draw a **dot and cross diagram** to show the bonding in a **molecule** of sulfur dioxide.

Show outer shell electrons only.

(2 marks)

(Total for Question 6 is 6 marks)

7. Ethanoic acid is a weak acid found in vinegar. Its formula is CH_3COOH .

a. Ethanoic acid is described as a “**weak**” acid.

Describe what happens to the ethanoic acid molecules when they are dissolved in water.

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(2 marks)

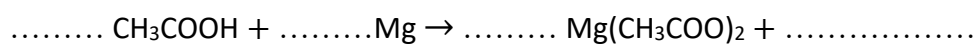
b. A student reacts ethanoic acid with magnesium metal.

i. State **one** observation that proves a gas is being produced.

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(1 mark)

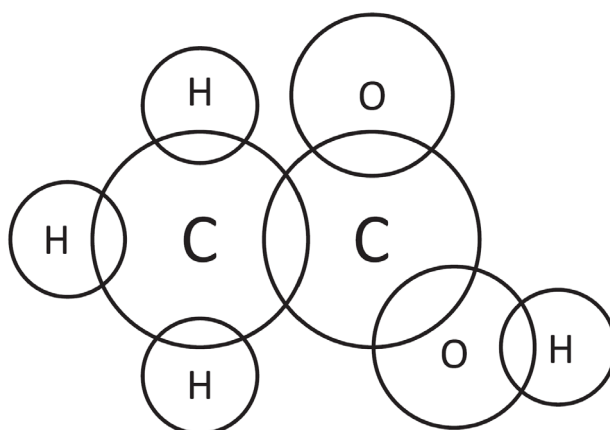
ii. Complete the balanced symbol equation for this reaction.



(2 marks)

c. Complete the **dot and cross diagram** to show the electron arrangement in a molecule of ethanoic acid.

The structure has been outlined for you. Show outer shell electrons only.



(3 marks)

(Total for Question 7 is 8 marks)