Technicians page:

Moly mods

Pre-starter retrieval practice Topic 2- Periodic table

Q1. How many electrons do the following elements have on the outer shell:

Be, B, He

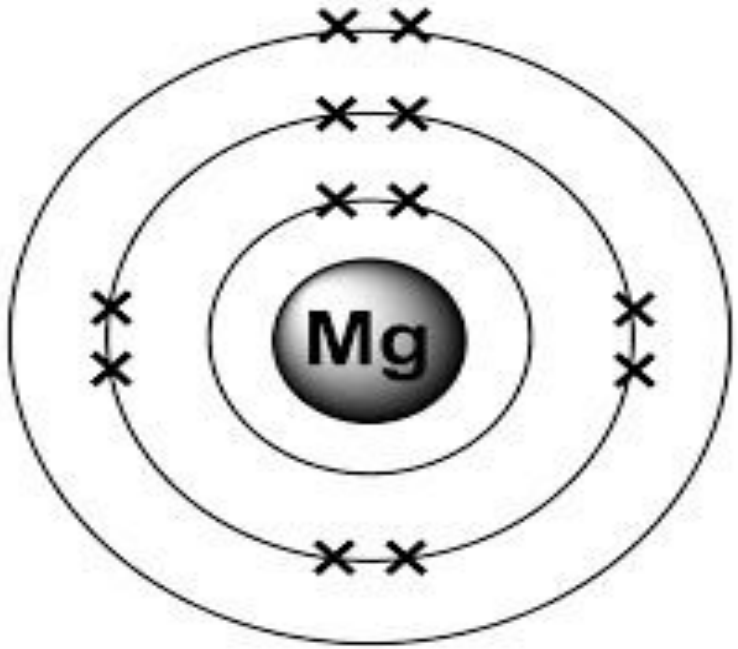
Q2. Draw the electron structure for Mg.

Q3. Draw the electron structure for Ne.

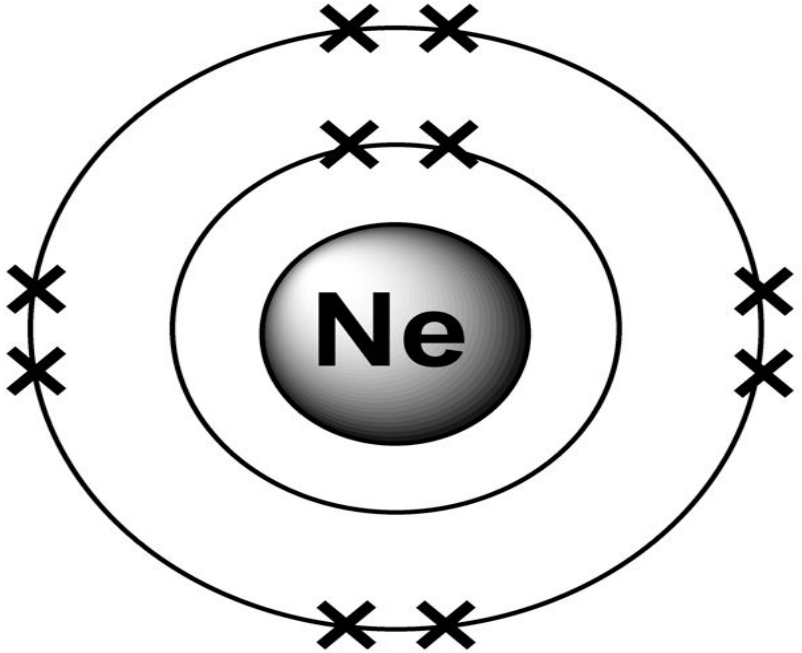
Pre-starter retrieval practice Topic 2- Periodic table

Q1. Be= 2, B= 3, He=2

Q2



Q3



C3.5 Covalent bonding

Learning objective: Describe how covalent bonds are formed

Learning outcomes

Grade 4-5 State how covalent bonds are formed to make simple molecules

Grade 6-7 Draw dot and cross diagrams to show simple molecules

Grade 8-9 Deduce the molecular formula of simple molecules

<u>Key words</u>

Simple/small molecule

British International School Riyadh

Learning objective: Describe how covalent bonds are formed

Watch video

Starter

Reactions between _____ and non-metals usually result in _____ bonding. However many compounds are also formed by _____ bonding.

These bonds are made when _____ react together and share _____.

Each atom has a _____ nucleus which attracts the _____ electrons, this strong force of _____ holds the atoms together – this force of attraction is the covalent bond.

Attraction covalent positive electrons shared metals non-metals ionic

Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
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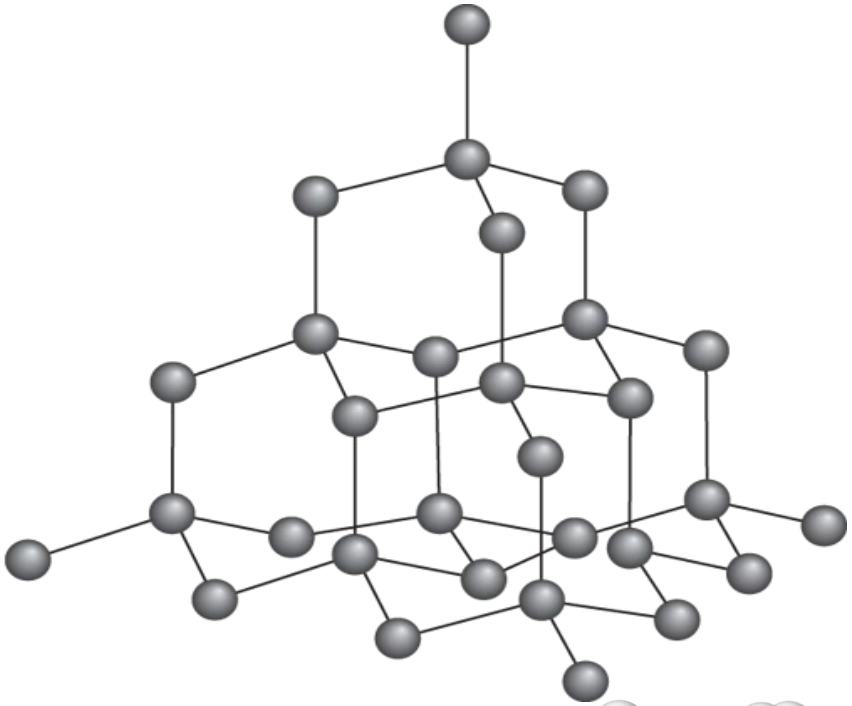
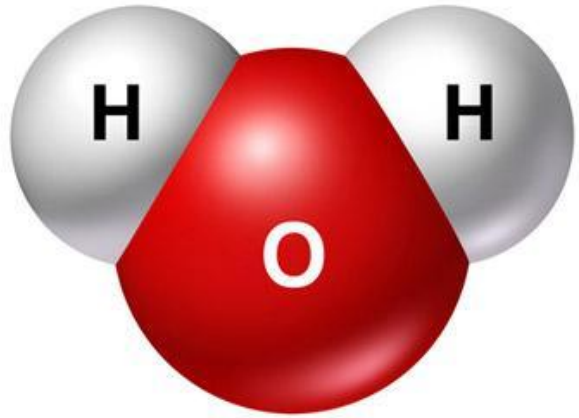
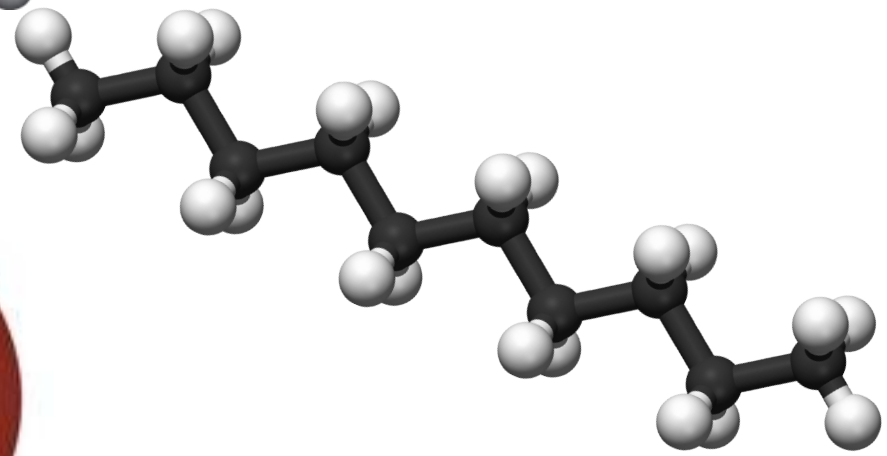
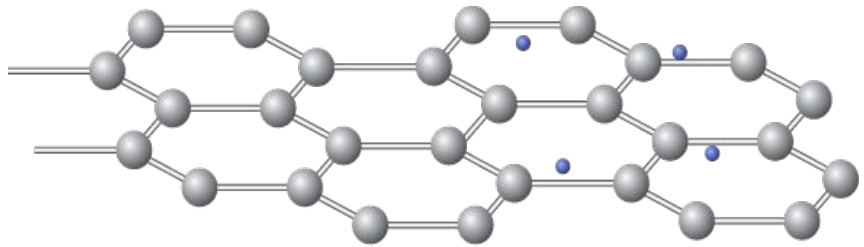
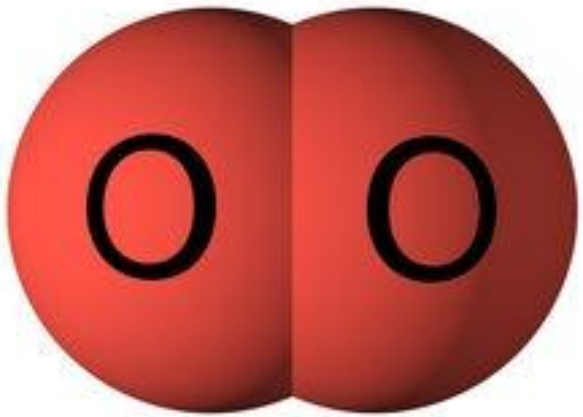
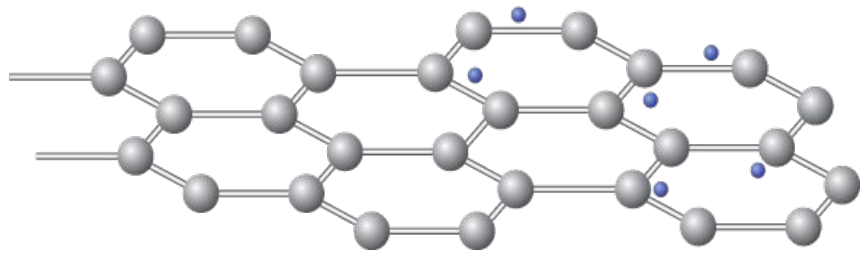



H
H
O



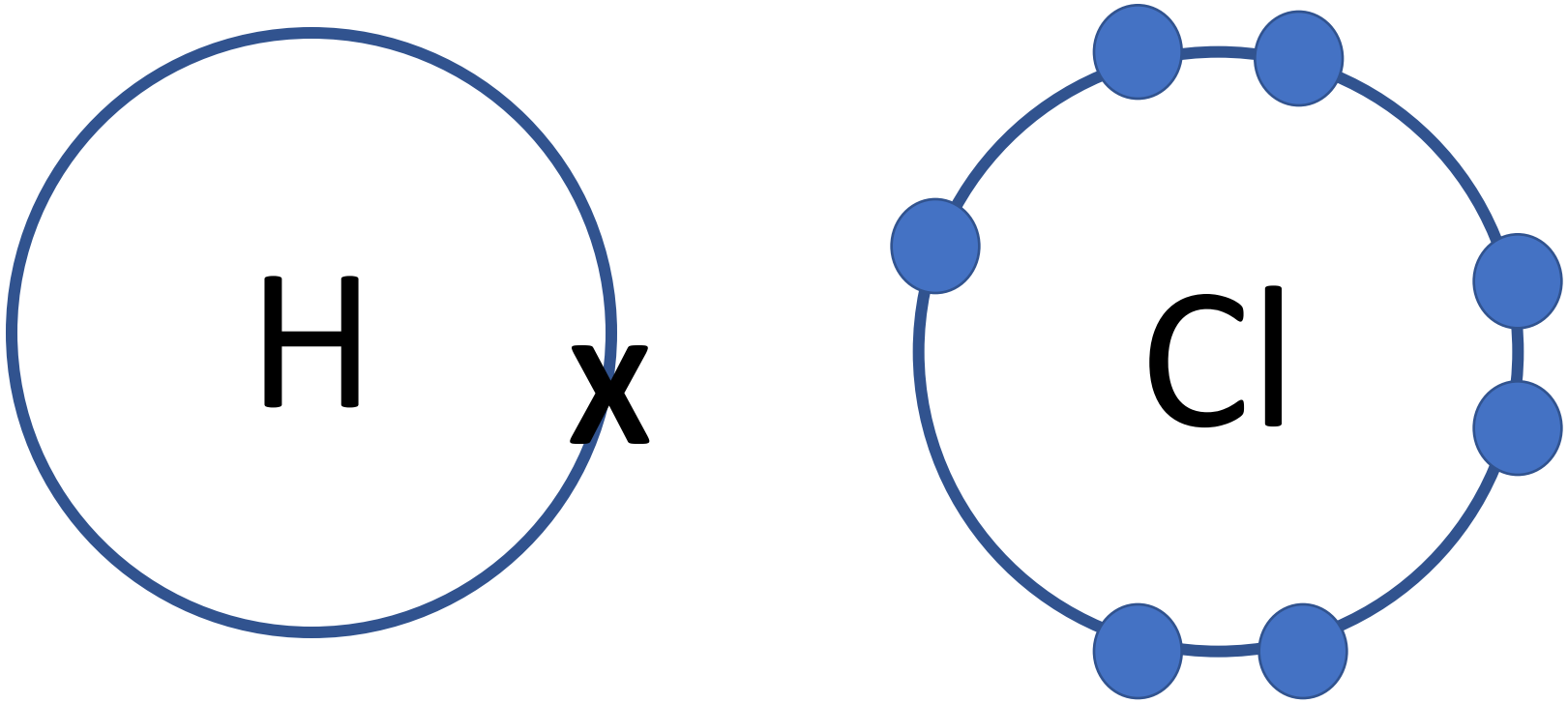



O
O



Learning objective: Describe how covalent bonds are formed

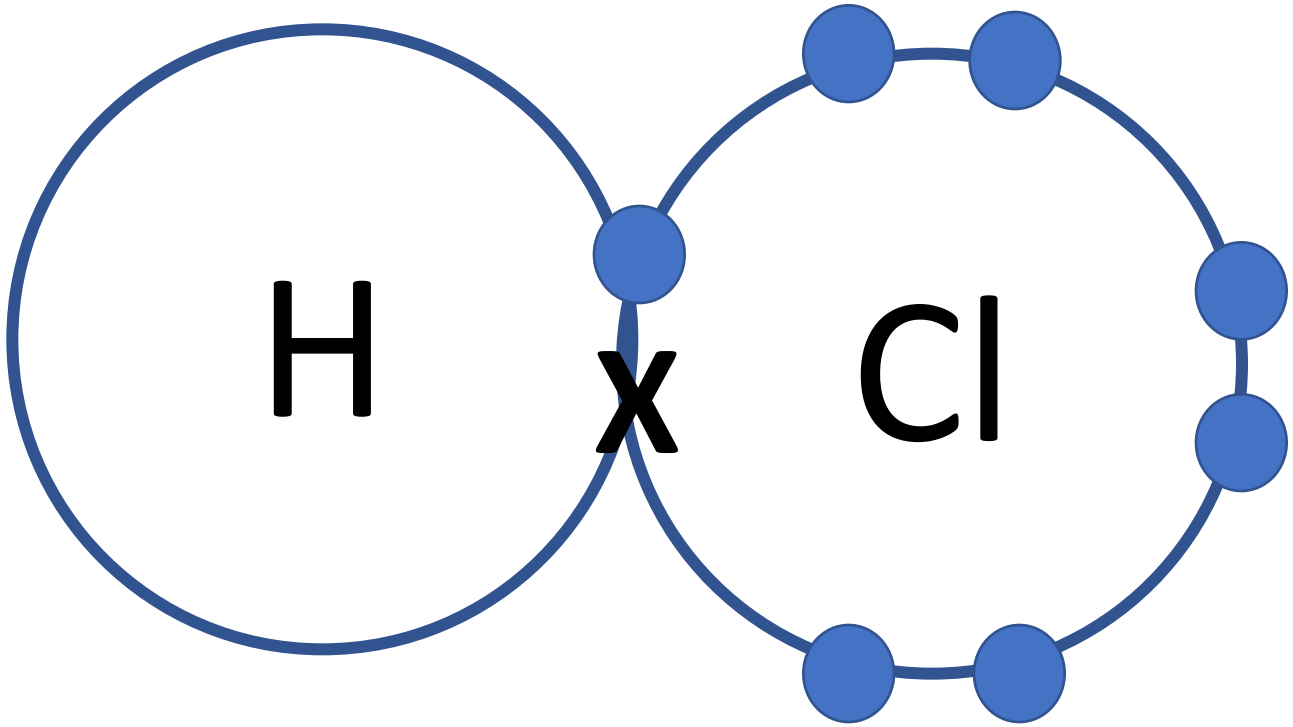
Example



Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

Example



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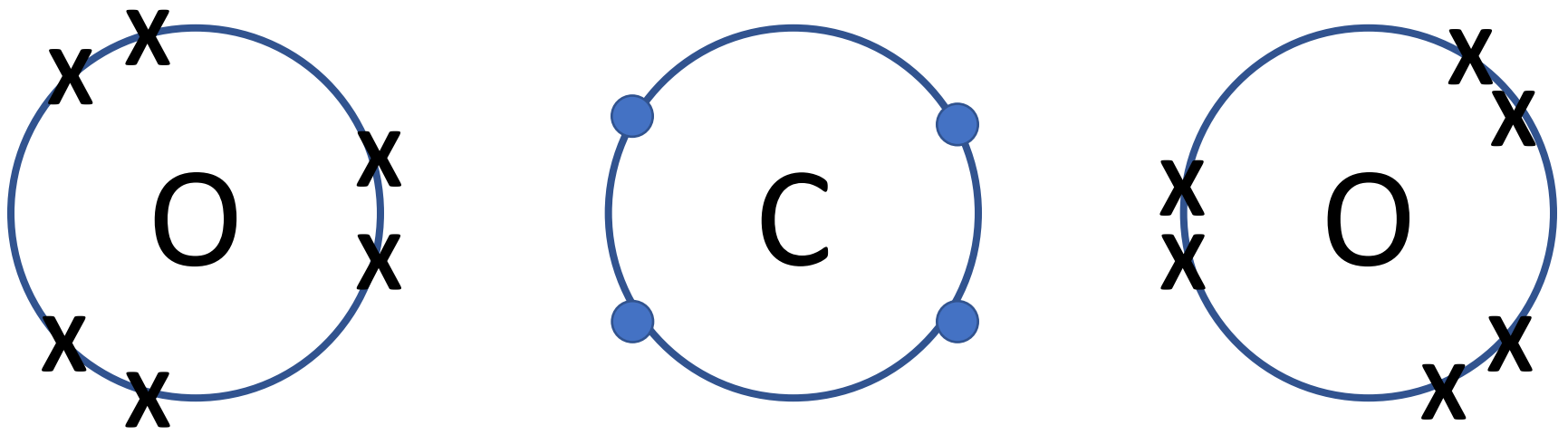
Learning objective: Describe how covalent bonds are formed

Example 2



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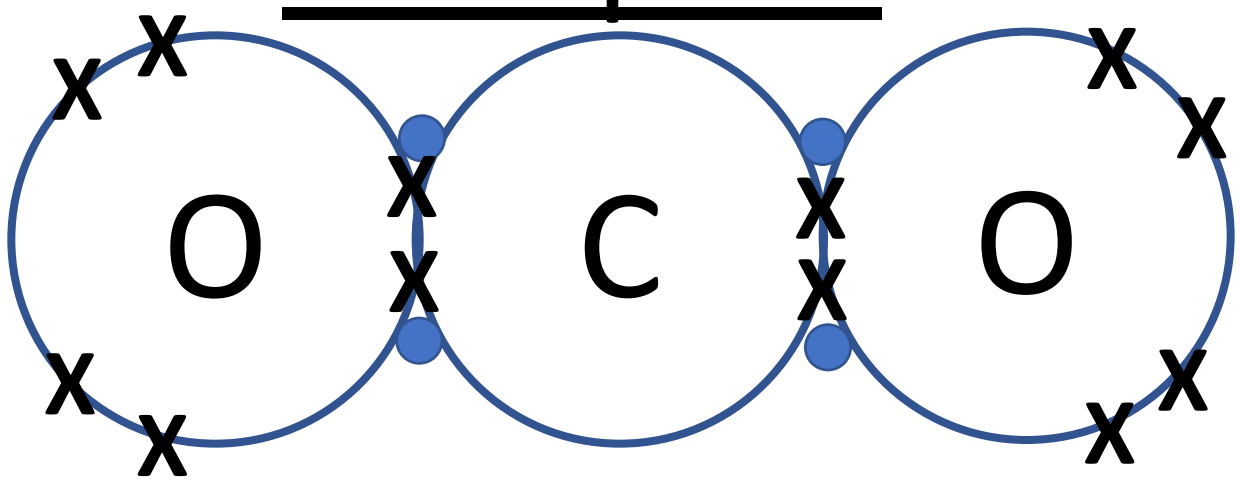
Learning objective: Describe how covalent bonds are formed

Example 2



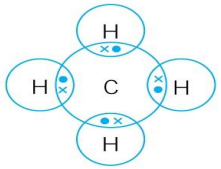
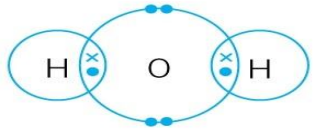
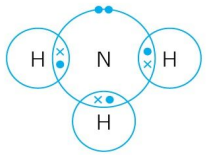
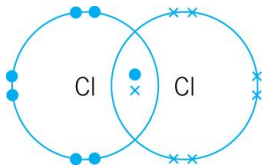
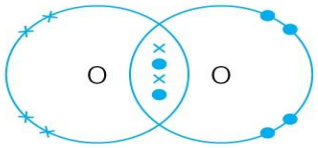
This is a double bond as each atom shares 2 pairs of electrons to each gain 8 electrons in their outer shell.

Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

Task 1 – Simple molecules

Match the name and formula of each covalent compound

Chlorine Cl_2	
Ammonia NH_3	
Water H_2O	
Oxygen O_2	
Methane CH_4	

Learning objective: Describe how covalent bonds are formed

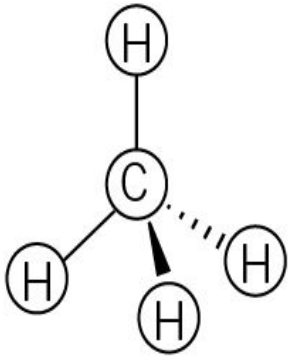
Task 2: Definitions

Molecule	Formed when positive nuclei of atoms have an attraction for the shared pair of electrons
Covalent bond	Group of atoms held together by a covalent bond
Ionic bond	Molecules containing two atoms of the same element e.g. H_2, O_2, I_2
Diatomic	Formed when there are electrostatic attractions between positive metal and negative non metal ions

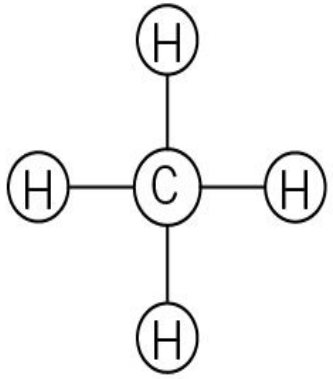
Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

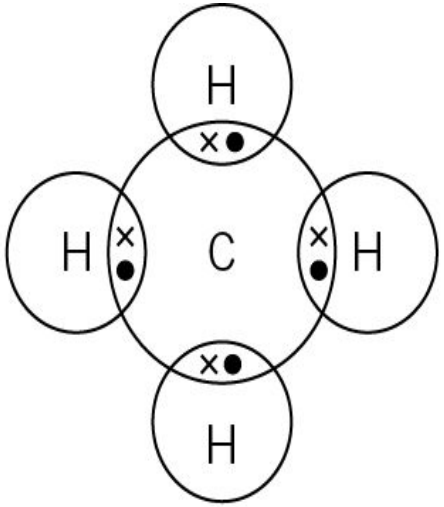
Showing simple molecules



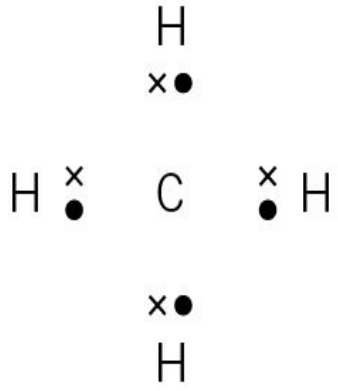
3D 'ball and stick' model



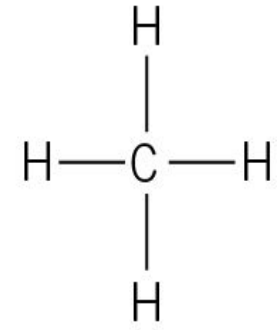
2D 'ball and stick' model



dot and cross diagram (showing outer shells as circles)



dot and cross diagram showing outer shell electrons



displayed formula showing bonds

Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

Task 3 - Covalent bonding

1. Chlorine has seven outer electrons. It forms Cl_2 molecules by sharing a pair of electrons.

A Draw a ball and stick diagram of Cl_2.

B Draw a dot and cross diagram of Cl_2 showing the outer electrons only

C What type of bond is formed in a Cl_2 molecule?

2. Nitrogen has five outer electrons. It forms N_2 gas molecules.

A Suggest how many pairs of electrons are shared in N_2 molecules.

B Suggest why N_2 is relatively unreactive.

Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

3. State the type of bonding (ionic or covalent) in the following chemicals. Explain your answer in each case. If the bonding is covalent, state whether you think the bond(s) are single or double.

A Magnesium chloride ($MgCl_2$)

B Oxygen gas (O_2)

C Hydrogen bromide (HBr)

D Ammonia (NH_3)

E Calcium iodide (CaI_2)

F Copper(I) chloride (CuCl)

G Sulfur hexafluoride (SF_6)

H Aluminium fluoride (AlF_3)

I Carbon dioxide (CO_2)

Grade 4-5 State how covalent bonds are formed to make simple molecules

Grade 6-7 Draw dot and cross diagrams to show simple molecules

Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

Self assess

1. Chlorine has seven outer electrons. It forms Cl_2 molecules by sharing a pair of electrons.

A 

B 

C Single covalent bond.

2. Nitrogen has five outer electrons. It forms N_2 gas molecules.

A 3

B The triple bond in nitrogen is very strong and difficult to break, making it relatively unreactive.

Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

3. State the type of bonding (ionic or covalent) in the following chemicals. Explain your answer in each case. If the bonding is covalent, state whether you think the bond(s) are single or double.

A Ionic (metal and non-metal)

B Covalent (two non-metals) – double bond

C Covalent (two non-metals) – single bond

D Covalent (two non-metals) – single bonds

E Ionic (metal and non-metal

F Ionic (metal and non-metal)

G Covalent (two non-metals) – single bonds

H Ionic (metal and non-metal)

I Covalent (two non-metals) – double bonds

Grade 4-5 State how covalent bonds are formed to make simple molecules

Grade 6-7 Draw dot and cross diagrams to show simple molecules

Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

Summary

Are these substances ionically bonded or covalently bonded?

1. H_2O
2. NaCl
3. NH_3
4. CO_2
5. CaO
6. SO_2
7. MgO
8. K_2O

Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

How many bonds?

Working out the number of covalent bonds an atom can have you must count the number of electrons it needs to complete its outer shell.

- E.g. fluorine, 1 more electron needed to have a full shell, only makes **1 covalent bonds.**
- E.g. silicon, 4 more electrons needed to have a full shell, so makes **4 covalent bonds.**

Grade 4-5 State how covalent bonds are formed to make simple molecules
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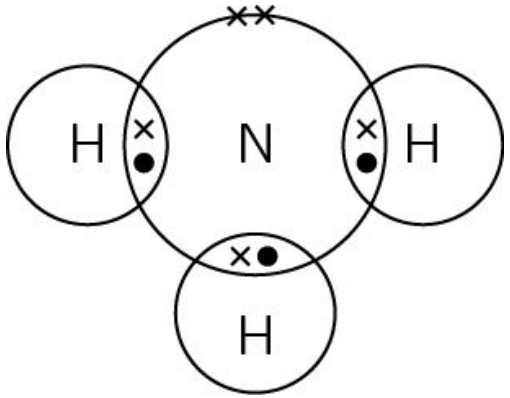
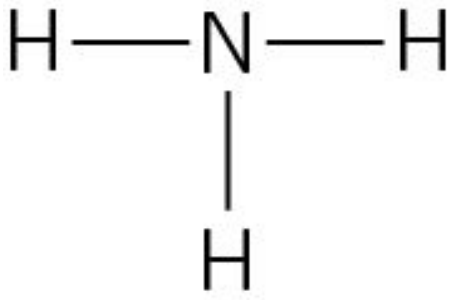
Learning objective: Describe how covalent bonds are formed

Nitrogen needs to gain 3 electrons and so has a valency of 3

Each hydrogen atom needs to gain 1 electron and so has a valency of 1





Molecular formula = NH_3

Grade 4-5 State how covalent bonds are formed to make simple molecules

Grade 6-7 Draw dot and cross diagrams to show simple molecules

Grade 8-9 Deduce the molecular formula of simple molecules

Learning objective: Describe how covalent bonds are formed

Task 4 - Number of bonds

Element	Metal/ non-metal?	No of electrons needed to complete outer shell	No of covalent bonds it can form (1,2,3,4 or none)
Sulfur			
Hydrogen			
Carbon			
Phosphorus			
Nitrogen			
Oxygen			

Grade 4-5 State how covalent bonds are formed to make simple molecules
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Learning objective: Describe how covalent bonds are formed

Number of bonds

Element	Metal/ non-metal?	No of electrons needed to complete outer shell	No of covalent bonds it can form (1,2,3,4 or none)
Sulfur	NM	2	2
Hydrogen	NM	1	1
Carbon	NM	4	4
Phosphorus	NM	3	3
Nitrogen	NM	3	3
Oxygen	NM	2	2

Grade 4-5 State how covalent bonds are formed to make simple molecules
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Learning objective: Describe how covalent bonds are formed

Checklist

Make sure that you know the formula, displayed formula and dot cross for each of these:

Hydrogen

Oxygen

Methane

Chlorine

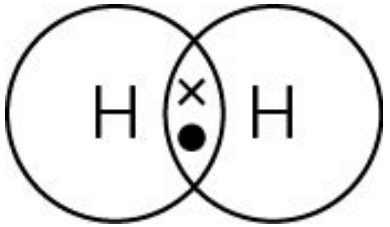
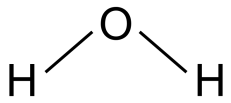
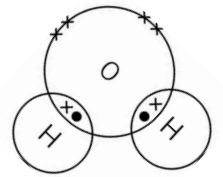
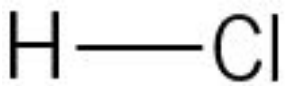
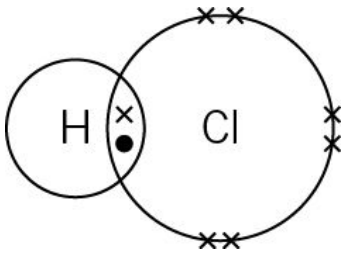
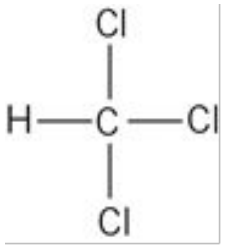
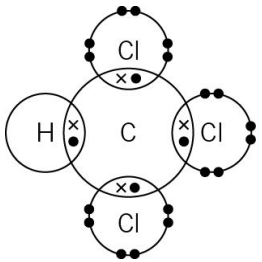
Nitrogen

Water

Hydrogen chloride

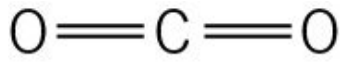
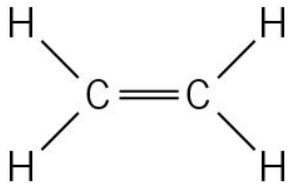
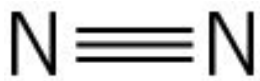
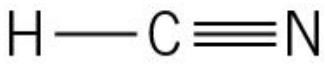
Extension

Name	Formula	Displayed formula	Dot cross diagram
Hydrogen			
Water			
Hydrogen chloride	HCl		
trichloromethane	$CHCl_3$		

Name	Formula	Displayed formula	Dot cross diagram
Hydrogen	H_2		
Water	H_2O		
Hydrogen chloride	HCl		
trichloromethane	$CHCl_3$		

Extension - For each of the molecules below, state the molecular formula and draw a dot and cross diagram.

Use the displayed formula to help you.

Name	Formula	Displayed formula	Dot cross diagram
Carbon dioxide			
Ethene			
Nitrogen			
Hydrogen cyanide			

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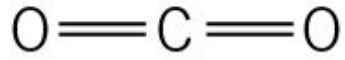
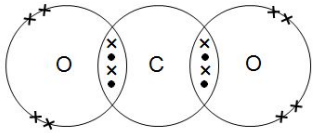
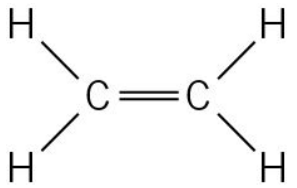
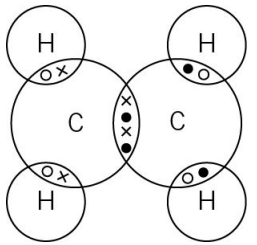
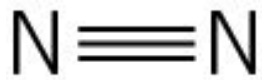
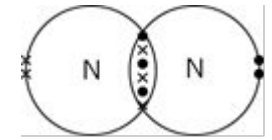
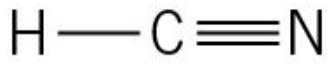
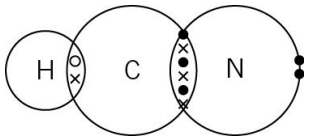
Use the displayed formula to help you.

Name	Formula	Displayed formula	Dot cross diagram
Carbon dioxide	CO_2		
Ethene	C_2H4		
Nitrogen	N_2		
Hydrogen cyanide	HCN		

Learning objective: Describe how covalent bonds are formed

Plenary

When atoms share **pairs/parts/triplets** of electrons, they form covalent bonds. These bonds are **strong/unbreakable/weak**. Substances containing covalent bonds may consist of small molecules , such as **$Mg(OH)_2$/H_2/NaCl**. When drawing small molecules, you use a **wavy/single/double** line to represent a single bond.

Grade 4-5 State how covalent bonds are formed to make simple molecules
Grade 6-7 Draw dot and cross diagrams to show simple molecules
Grade 8-9 Deduce the molecular formula of simple molecules

Exampro link

https://dyweyew.exampro.net/