Subject: Integrated Science/Chemistry

Level: Form 3

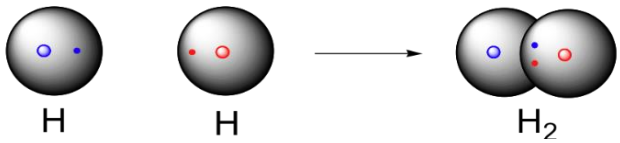
Topic: Covalent bonding

Key points:

- Atoms combine to achieve a stable outermost electronic configuration
- A stable outermost electronic configuration is attained when the outer shell is full.
- The first shell can hold a maximum of 2 electrons.
- The second shell can hold a maximum of 8 electrons.
- The third shell can hold a maximum of 8 electrons.

Shell Number	Maximum number of electrons
First shell	2
Second shell	8
Third shell	8

- A stable electronic configuration can be achieved by either gain, loss or sharing of electrons. The results of this means the first shell much achieve 2 electrons, the second shell, 8 electrons.
- Covalent bonding involves the **SHARING** of electron between two or more atoms where each atom attains a stable electronic configuration and a molecule is formed.
- A bond is formed when 2 electrons are shared
- The example below shows bonding between two hydrogen atoms to form a hydrogen molecule.



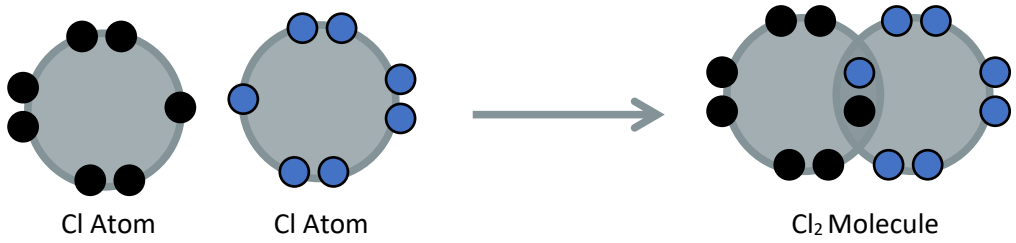
- Each hydrogen atom has one outer electron. However, the first shell requires two electrons for the atom to be stable. Sharing of electrons allows this to happen.
- The blue and red solid dots represent the electrons, one electron from one hydrogen atom (blue) and another from the other hydrogen atom(red).

- When bonded as H_2, both atoms share the electrons, as seen with blue and red dots in the middle.
- Each hydrogen atom now has two electrons in its outer shell and therefore has a stable electronic configuration.

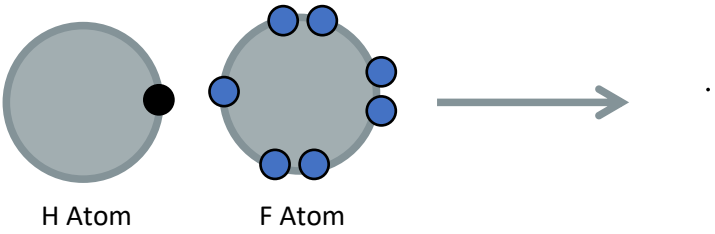
Activity:

The example below shows the sharing of electrons on the outer shells between two chlorine atoms to form a chlorine molecule.

Using this example, complete questions 1,2 and 3 by drawing the diagram to complete the equation, showing the sharing of electrons between/among the outer shells of the atoms.



1.



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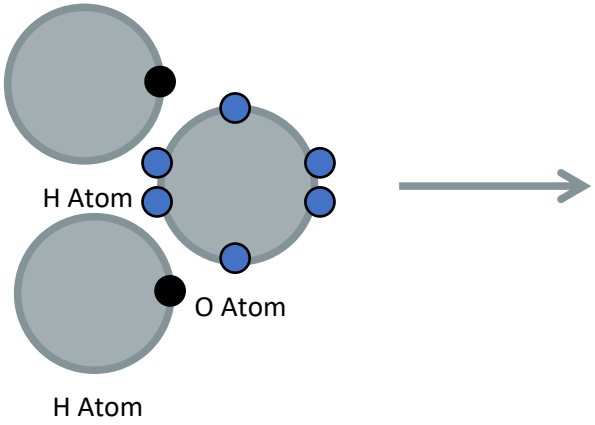

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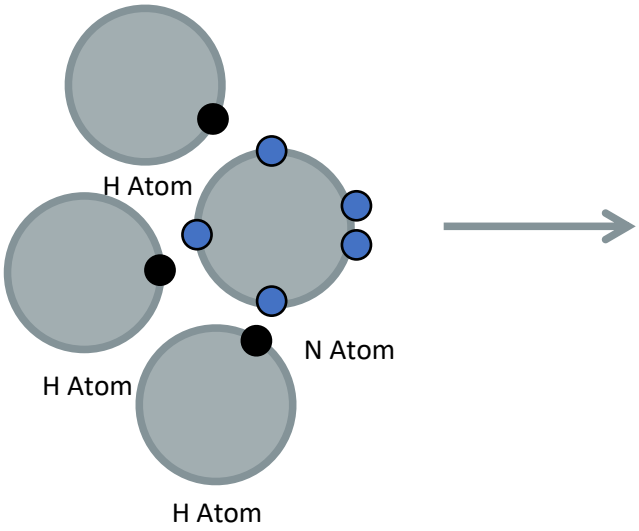
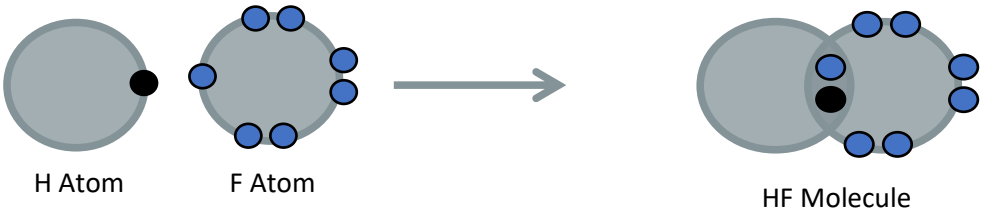


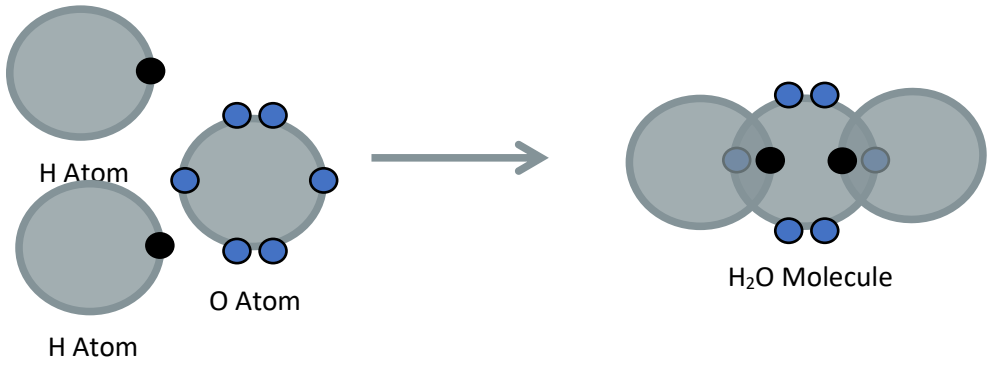
Assessment: The table below summarises covalent bonding using several molecules Complete the table by filling the blanks.

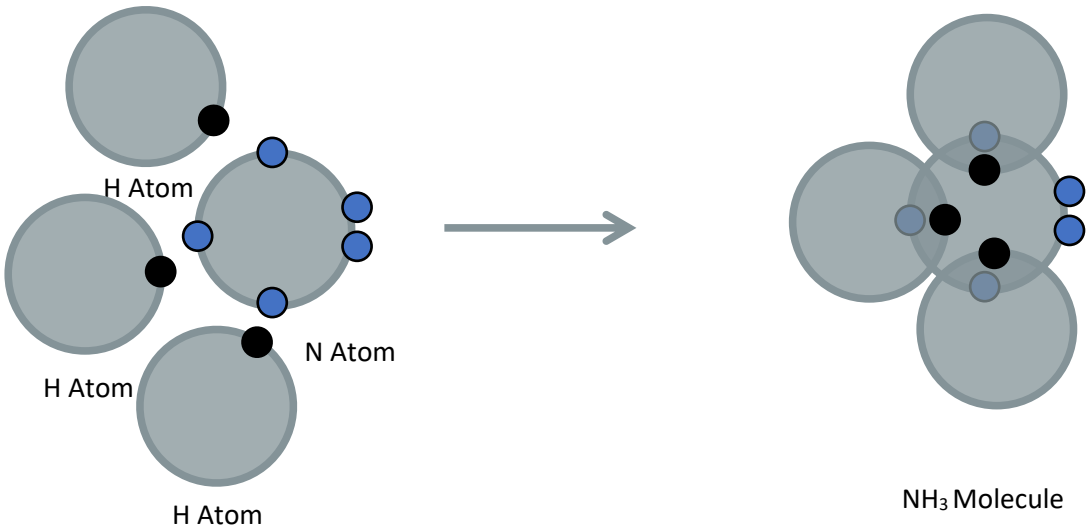
Molecule	# of electrons required to attain full/stable electronic configuration for each atom	# of atom required to form the molecule	# of electrons shared by each atom	Total # of electrons shared	# of bonds formed
H_2S	H-1 S-2	H H S	H-1 H-1 S- 2	4	2
HCl	H- Cl-	H Cl	H- Cl-		1
CH_4	C- H- H- H- H-			8	
PCl_3		P Cl Cl Cl			

Answer Key

1.


H Atom
F Atom
HF Molecule


H Atom
O Atom
H Atom
H_2O Molecule


H Atom
N Atom
H Atom
H Atom
NH_3 Molecule

Answer Key

Assessment

Molecule	# of electrons required to attain full/stable electronic configuration	# of atom required to form the molecule	# of electrons shared by each atom	Total # of electrons shared	# of bonds formed
H_2S	H-1 S-2	H H S	H-1 H-1 S- 2	4	2
HCl	H-1 Cl-1	H Cl	H-1 Cl-1	2	1
CH_4	C- 4 H- 1 H- 1 H- 1 H- 1	C H H H H	C-4 H-1 H-1 H-1 H-1	8	4
PCl_3	P-3 Cl-1 Cl-1 Cl-1	P Cl Cl Cl	P-3 Cl-1 Cl-1 Cl-1	6	3