St. Bede's Catholic School & Byron Sixth Form College

'With the Lord's help'
Faith, Excellence, Determination

19/09/2023

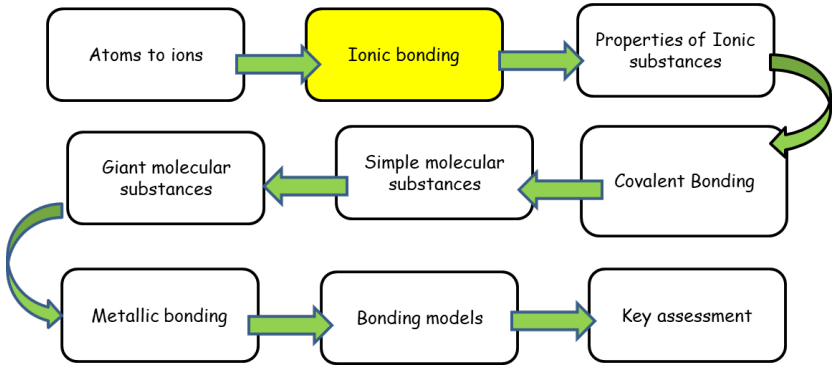
Ionic Bonding

Keywords: Electronic structure, Subatomic, atom, ion, proton, electron, neutron, cation, anion

LO: To explain how ionic bonding occurs

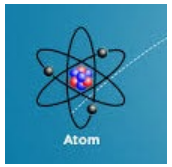
What outstanding progress will look like in this lesson:

- Recall when ionic bonds are formed
- Describe what an ionic bond is
- Explain how ionic bonds are formed using dot and cross diagrams

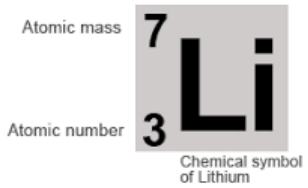


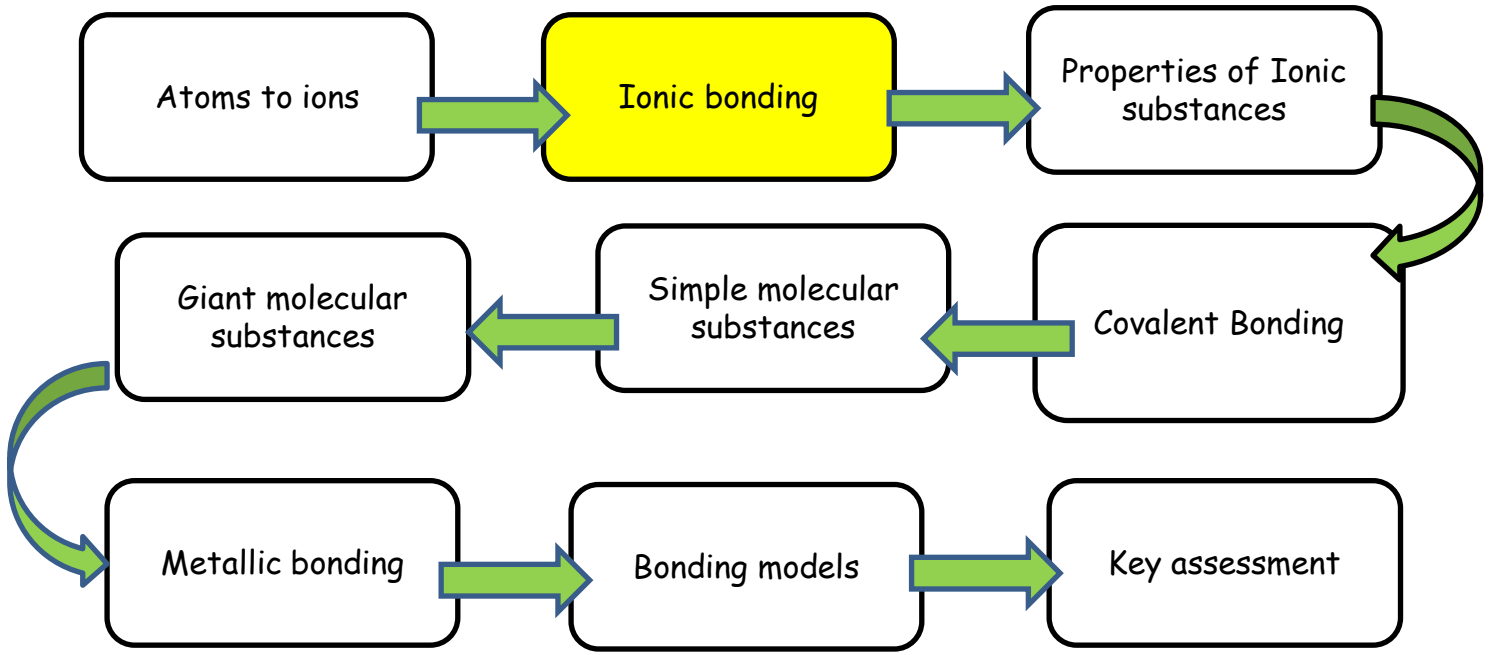
Retrieval Task - Complete the answers to the questions in full sentences.

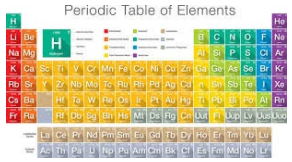
1. What is the charge of an electron?
2. Where are electrons located
3. What is the charge of an ion of an element in Group 2?
4. What types of elements does ionic bonding occur between?
5. What does it mean if an ion is + and if an ion is -?



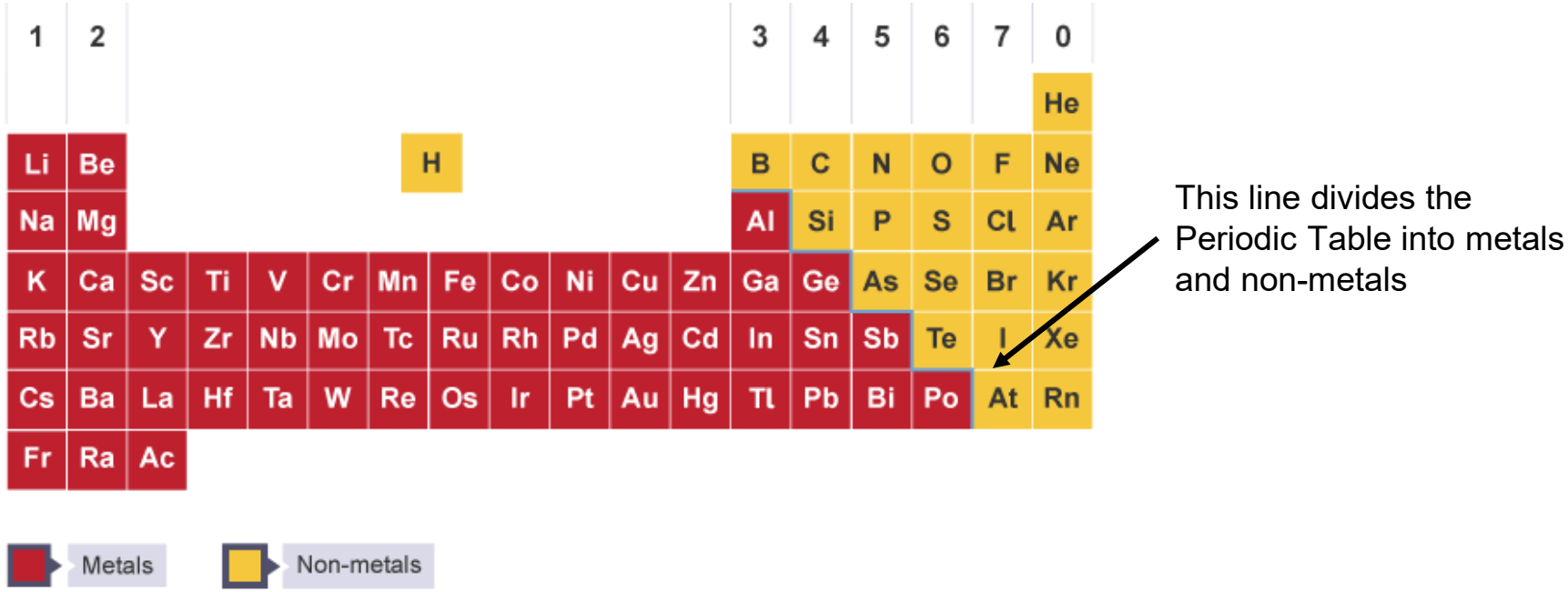
Year 10 Cycle 1: Chemistry - Bonding







REVIEW: Metals & Non-Metals



Task: Which of the following are metals?

Sodium (Na)

Oxygen (O)

Hydrogen (H)

Carbon (C)

Calcium (Ca)

Magnesium (Mg)

Neon (Ne)

Metals:

Sodium

Calcium

Magnesium

Ionic Bonds

- Ionic bonds form when a metal gives one or more electrons to a non-metal

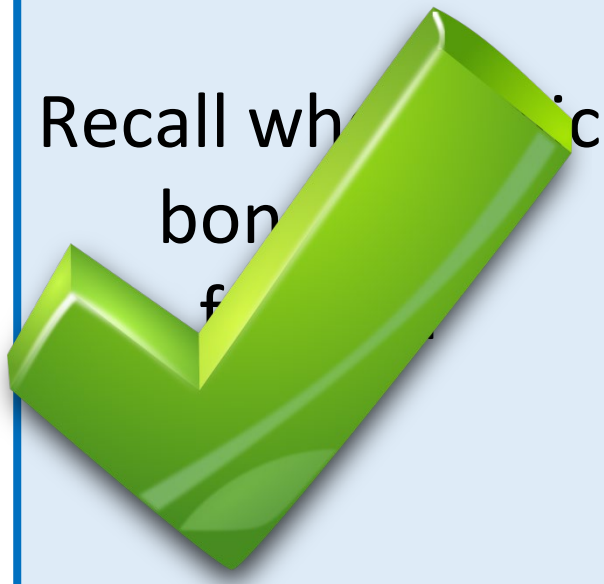
- In order to have an ionic bond, you need a metal and a non-metal.

Ionic Bonding

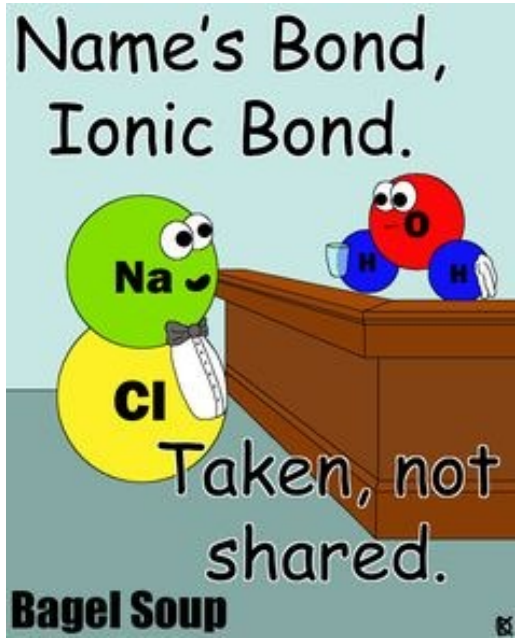
19/09/2023

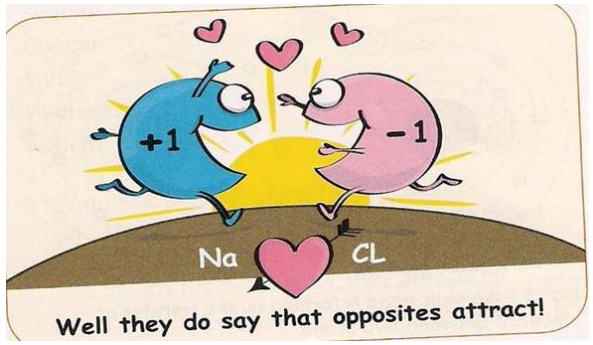
Learning outcomes

By the end of this lesson you need to be able to

Recall wh ic bon f 	Describe what an ionic bond is	Explain how ionic bonds are formed using dot and cross diagrams

Video – What is an ionic bond?





<u>Task</u>: Watch the Video

Ionic Bonding

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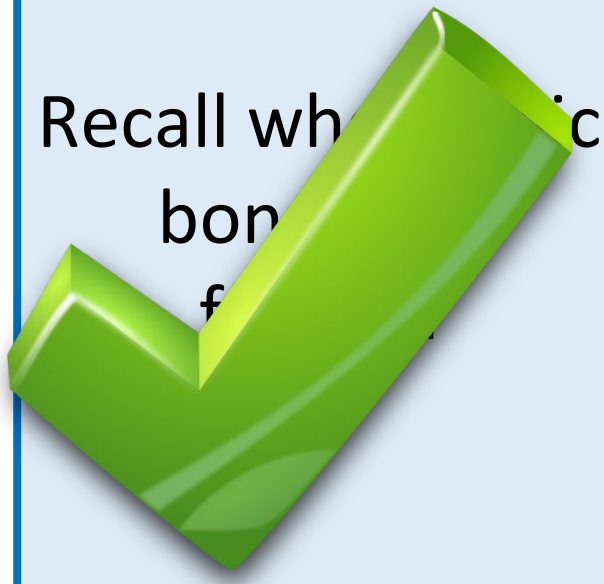
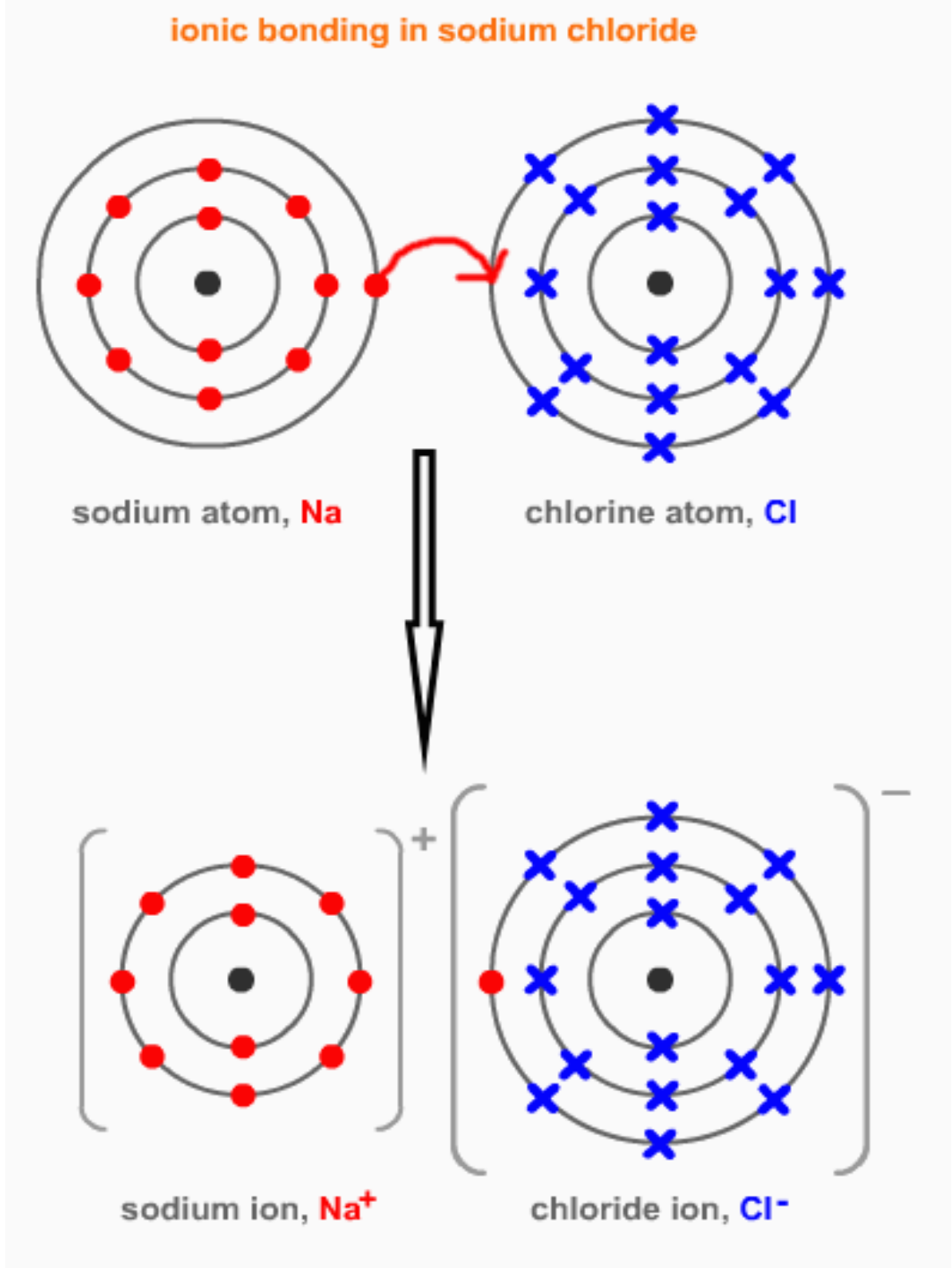
Learning outcomes

By the end of this lesson you need to be able to

- Recall wh… ic bon… f…
- Describe … ionic …
- Explain how ionic bonds are formed using dot and cross diagrams





Forming ionic bonds

- How do we show an ionic bond has occurred?
- Look at your diagrams for sodium & chlorine
- What about magnesium & fluorine – draw a diagram

Forming ionic bonds

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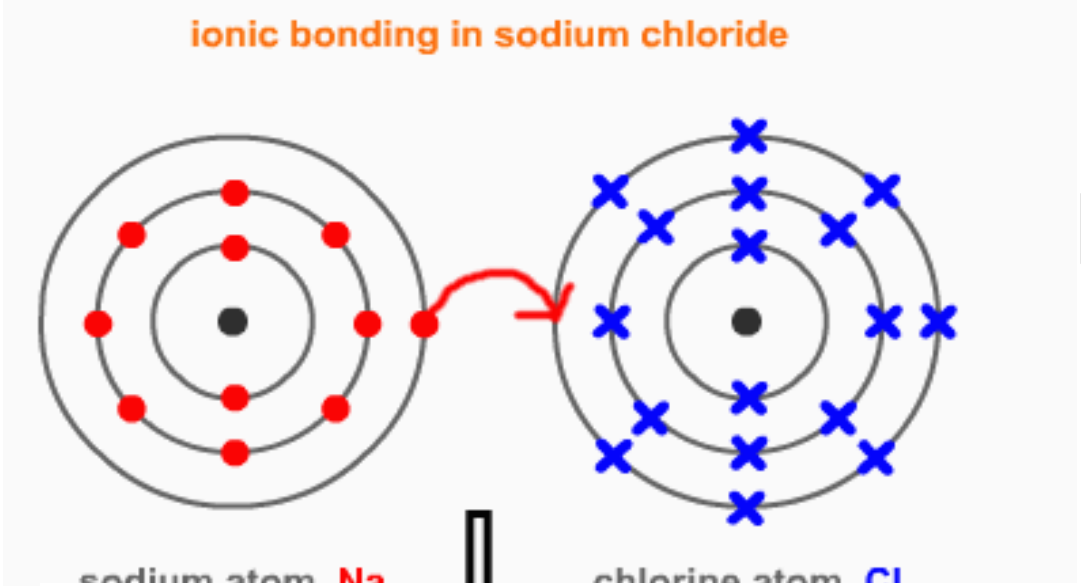

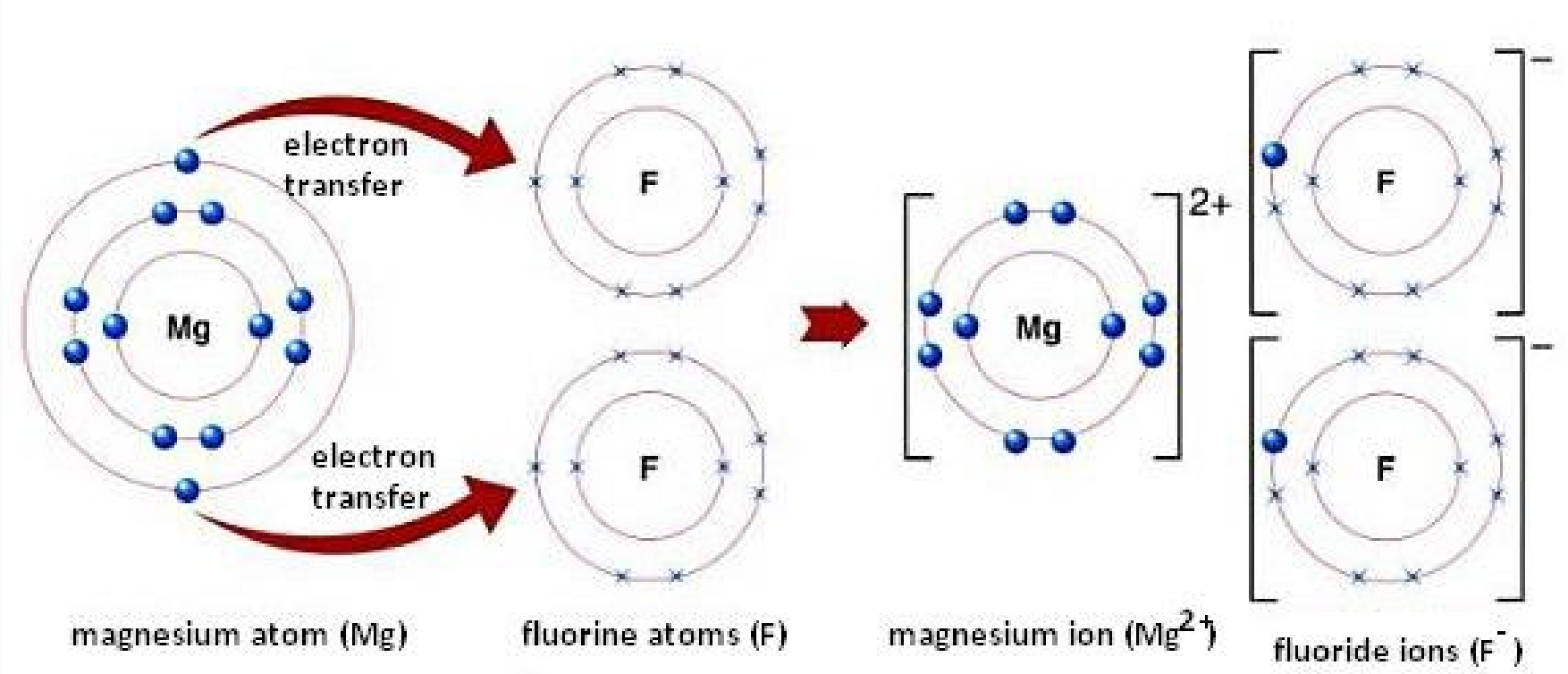

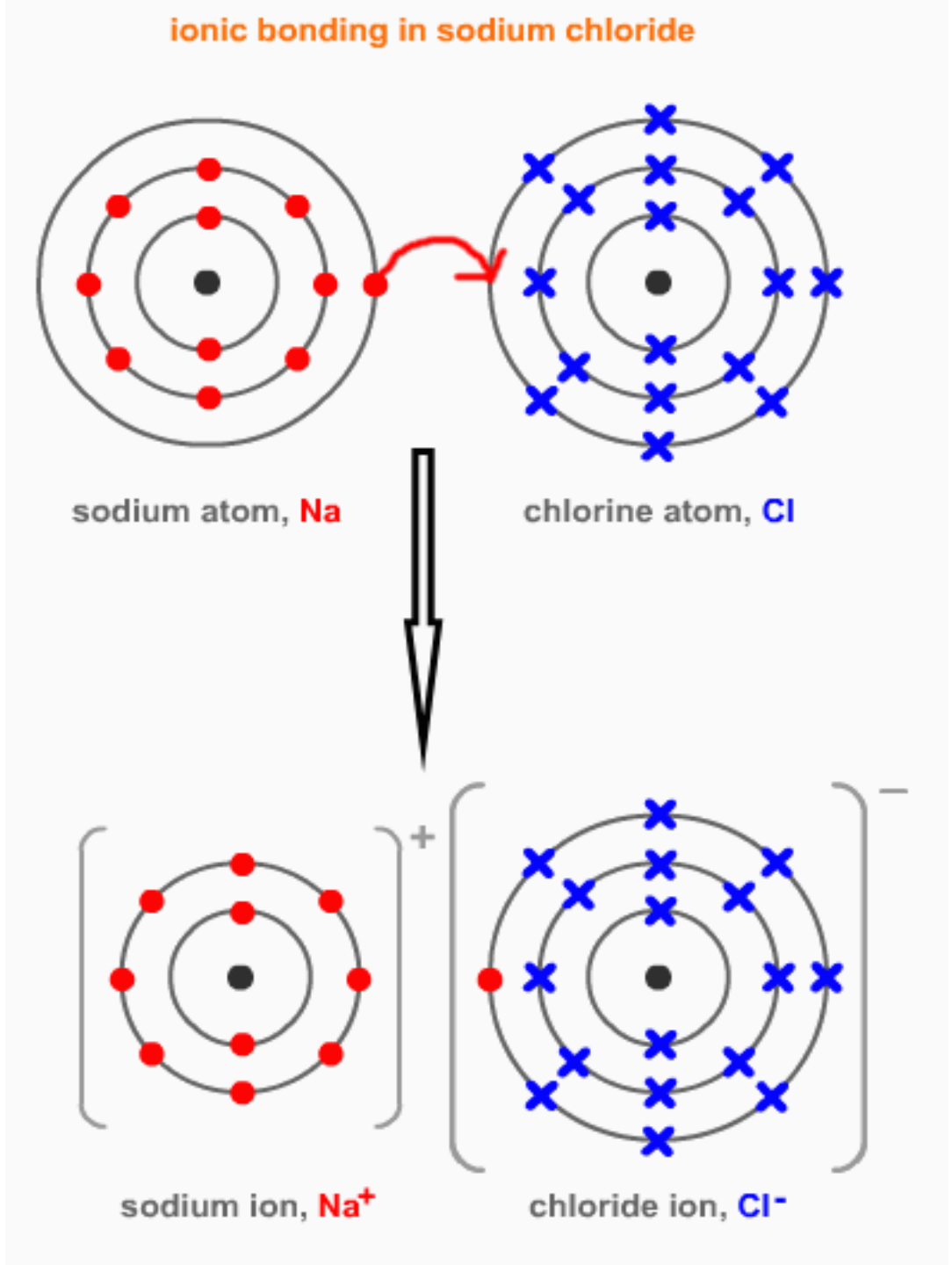

Now draw a dot & cross diagram for the following

Magnesium Oxide

Calcium Chloride

Sodium Oxide

Which of these form ionic bonds?

1. sodium chloride (NaCl)

IONIC
Na= metal
Cl = non-metal

2. water (H_2O)

3. magnesium oxide (MgO)

4. carbon dioxide (CO_2)

Which of these form ionic bonds?

1. sodium chloride (NaCl)

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Na= metal
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2. water (H_2O)

NOT ionic
H= non-metal
O = non-metal

3. magnesium oxide (MgO)

IONIC
Mg= metal
O = non-metal

4. carbon dioxide (CO_2)

NOT ionic
C= non-metal
O = non-metal

What is an ionic bond?

Task: Complete the word fill

An ionic bond is an …….. attraction between oppositely …….. ions.

When an ionic bond is formed, the …….. gives …….. to the ……..

Key Words:

Electrostatic	Covalent	Charged	Neutral	
Metal	Non-Metal	Electrons	Protons	Neutrons

What is an ionic bond?

Task: Complete the word fill

An ionic bond is an electrostatic ..... attraction between oppositely charged ..... ions.

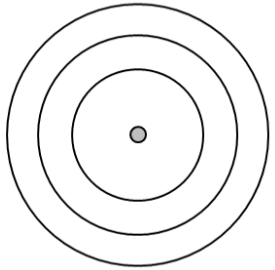
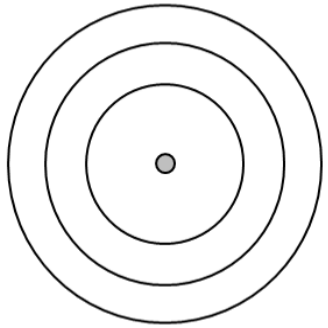
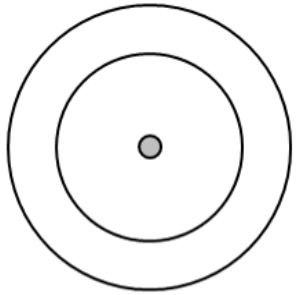
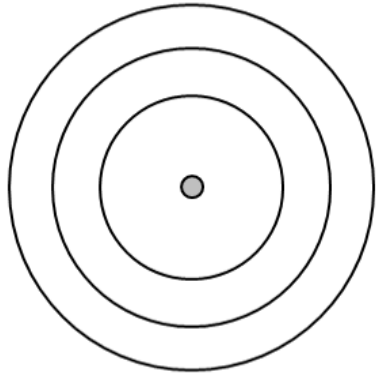
When an ionic bond is formed, the metal ..... gives electrons ..... to the non-metal .....

Key Words:

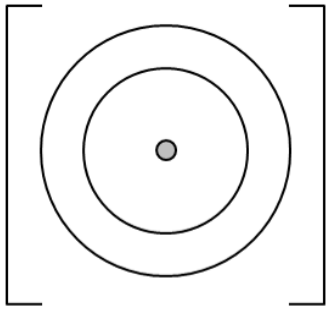
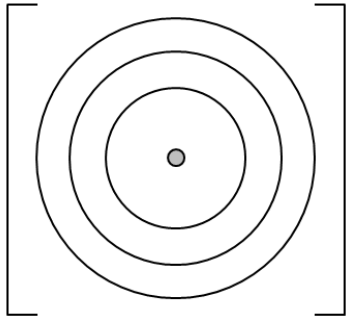
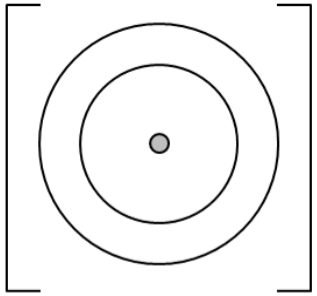
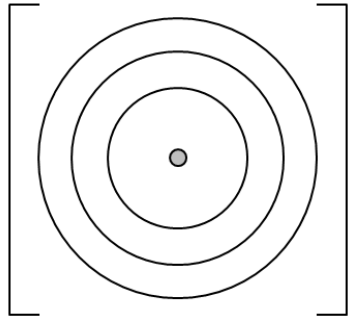
Electrostatic	Covalent	Charged	Neutral	
Metal	Non-Metal	Electrons	Protons	Neutrons

Task: Fill in the diagrams for each atom and ion.

Atoms

Na	Mg	O	Cl
2.8.1	2.8.2	2.6	2.8.7
			

Ions

Na^+	Mg^{2+}	O^{2-}	Cl^-
$(2.8)^+$	$(2.8)^{2+}$	$(2.8)^{2-}$	$(2.8.8)^-$
			

Dot & Cross Diagrams

Task: Draw a dot and cross diagram for the following:

1. Magnesium Oxide

2. Calcium Chloride

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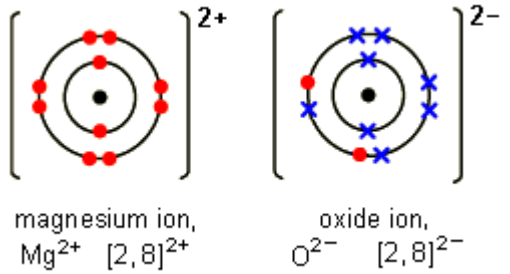
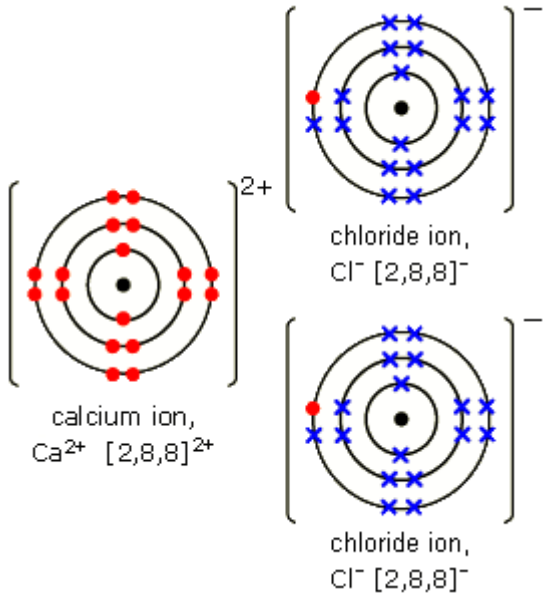


2. Calcium Chloride



Dot & Cross Diagrams

Task: Draw a dot and cross diagram for the following:

4. Sodium Oxide

Dot & Cross Diagrams

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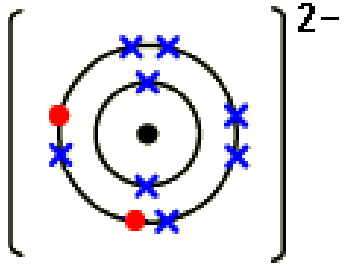
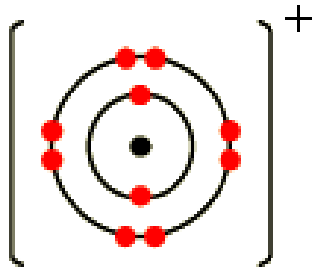
4. Sodium Oxide



oxide ion,
O^{2-} $[2,8]^{2-}$



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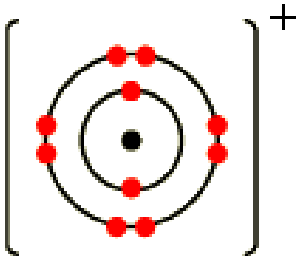

sodium ion,
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Exam Question - Foundation

Q1. Lithium fluoride, LiF, is an ionic compound.

It contains lithium cations and fluoride anions.

The electronic configurations of a lithium atom and of a fluorine atom are shown in Figure 16.

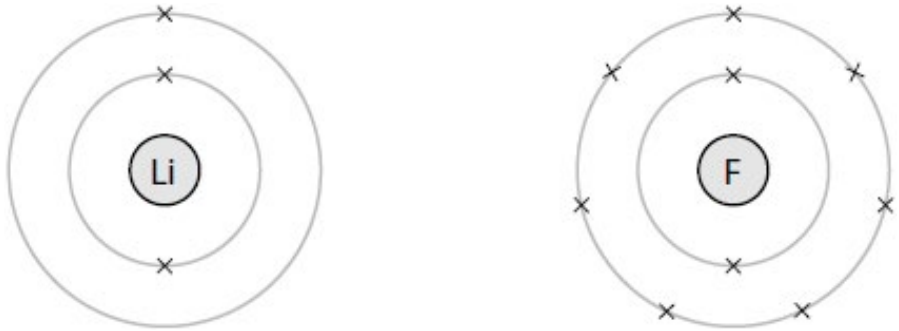
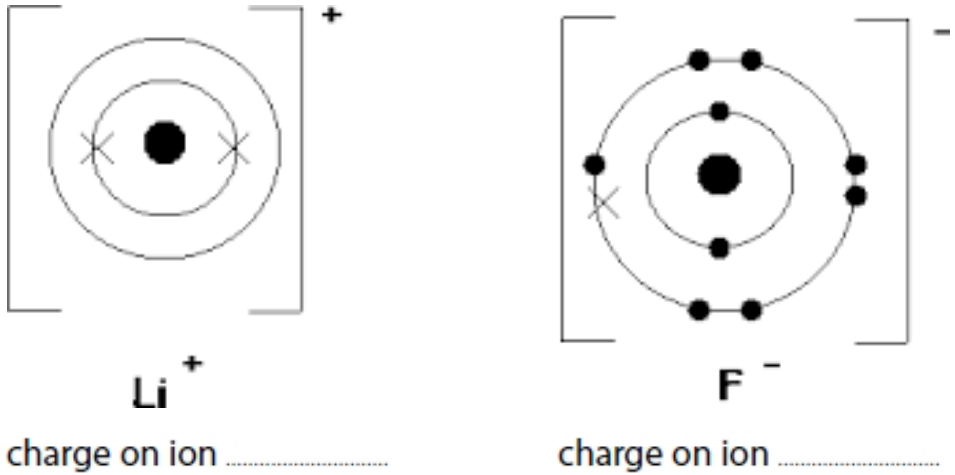


Figure 16

Complete Figure 17 to show the electronic configurations and charges of the ions in lithium fluoride.

(4)



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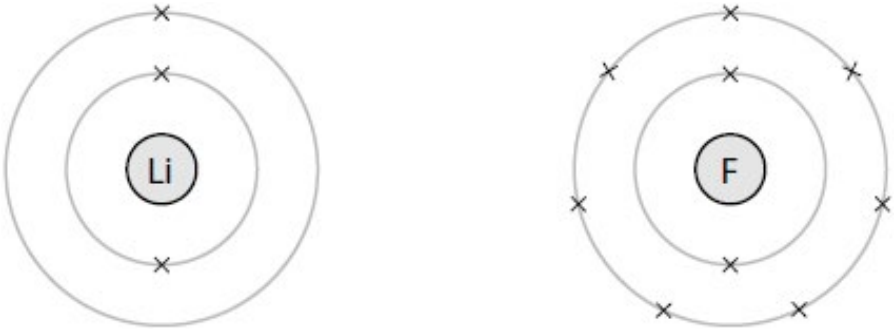

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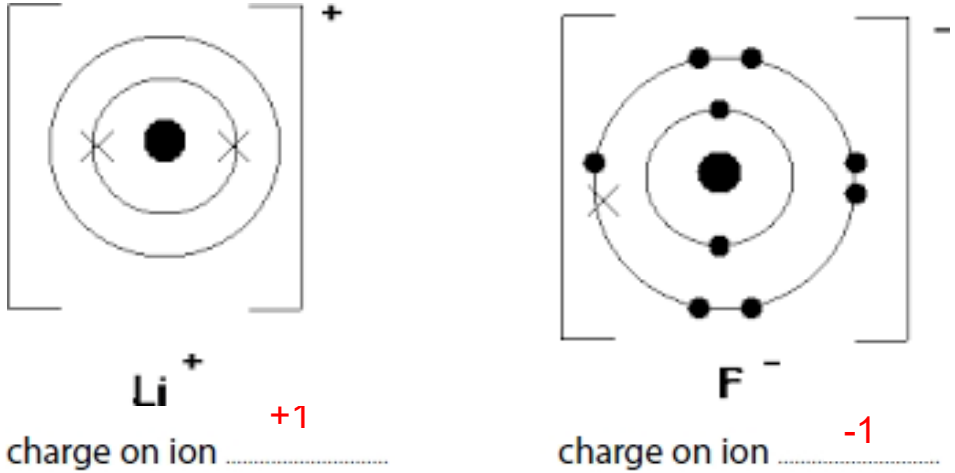
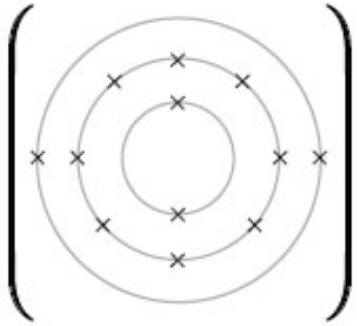


Figure 17

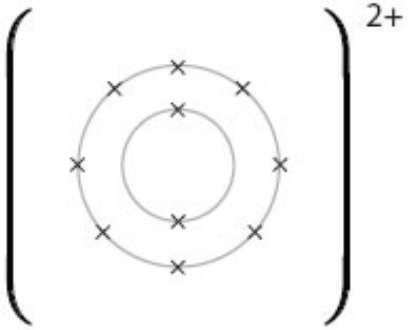
Exam Question

Q2. When magnesium reacts with oxygen, one magnesium atom and one oxygen atom form one magnesium ion and one oxide ion.

These diagrams show the arrangement of electrons in a magnesium atom and in a magnesium ion.



magnesium atom

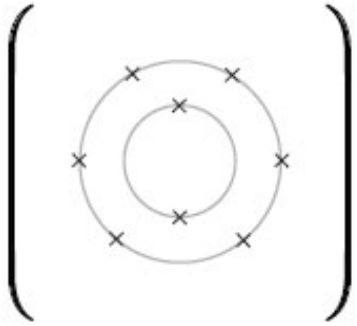


magnesium ion

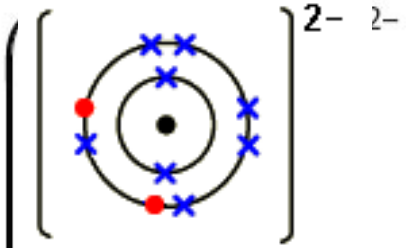
(i) In the diagram below the arrangement of electrons in an oxygen atom is given.

Draw the arrangement of electrons in the oxide ion.

(1)



oxygen atom



oxide ion,
O^{2-} $[2,8]^{2-}$

(ii) Explain, in terms of their electrons, how a magnesium atom, Mg, and an oxygen atom, O, react together to form a magnesium ion, Mg^{2+}, and an oxide ion, O^{2-}.

(2)

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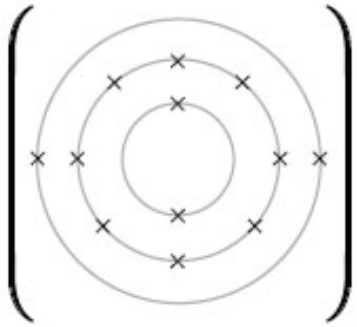
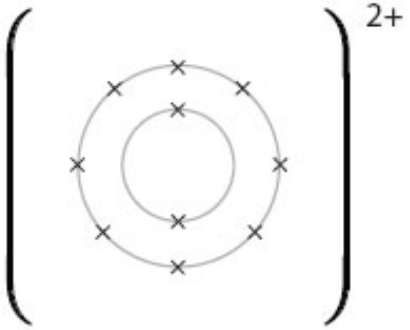
Exam Question

Q2. When magnesium reacts with oxygen, one magnesium atom and one oxygen atom form one magnesium ion and one oxide ion.

These diagrams show the arrangement of electrons in a magnesium atom and in a magnesium ion.



magnesium atom



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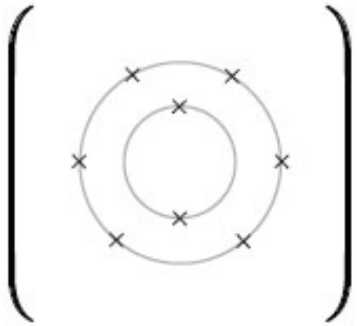
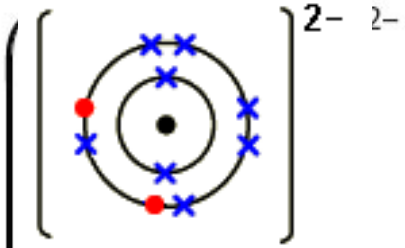


oxygen atom



oxide ion,
O^{2-} $[2,8]^{2-}$

(ii) Explain, in terms of their electrons, how a magnesium atom, Mg, and an oxygen atom, O, react together to form a magnesium ion, Mg^{2+}, and an oxide ion, O^{2-}.

(2)

.....

.....

.....

An explanation including two of the following points idea of electron(s) transfer in correct direction (1) two (electrons transferred) (1)

Exam Question - Higher

Q10. The table gives some information about the elements sodium and sulfur.

	sodium	sulfur
metal or non-metal	metal	non-metal
atomic symbol	Na	S
number of electrons in one atom	11	16

Sodium sulfide is an ionic compound.
Describe, in terms of electron transfer, how sodium atoms react with sulfur atoms to form sodium sulfide.
Your description should include the charges on the ions formed.

(4)

Exam Question - Higher

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Describe, in terms of electron transfer, how sodium atoms react with sulfur atoms to form sodium sulfide.
Your description should include the charges on the ions formed.

(4)

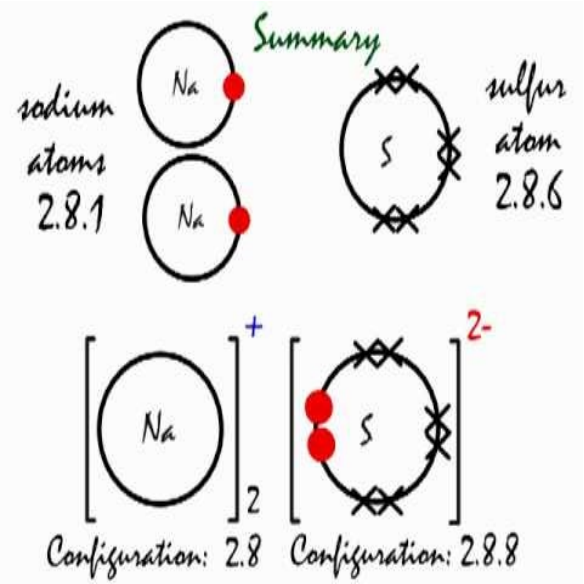
Exam Question – Mark Scheme

Description including four of the following

- sodium - 2.8.1 / 1 electron in outer shell (1)
- sodium (atoms) lose electrons (1)
- one per atom (1)
- (forms) Na^+ (1)
- sulphur - 2.8.6 / 6 electrons in outer shell (1)
- sulfur (atoms) gain electrons (1)
- two per atom (1)
- (forms) S^{2-} (1)
- two sodium atoms / ions combine with one sulfur atom / ion (1)

NOTE: You can get marks from a diagram

- formula is Na_2S (1)



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Learning outcomes

By the end of this lesson you need to be able to

Describe wh
ionic bo

Explain hov
bonds are
d
d
ams