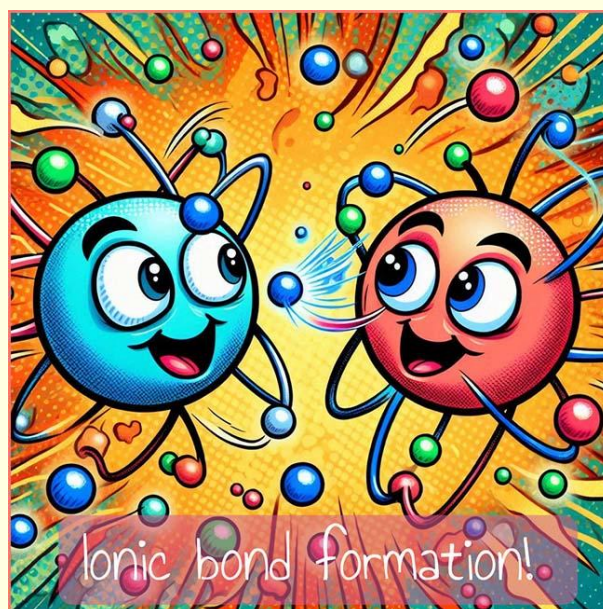




1. What is an ionic compound?
2. Describe the formation of an ionic bond.
3. Explain the octet rule and its relationship to noble gas configurations.
4. Write the electronic configuration of the following ions:

- a. N^{3-} b. Cr^{3+}
 c. Cl^{-} d. Ca^{2+}



- 4b. For each of the ions below write out the electronic configuration in terms of sub-shells.

- i. Na and Na^{+} ii. Cl and Cl^{-} iii. Al and Al^{3+} iv. O and O^{2-}

5. Write the formula for the following compounds:

- a. sodium oxide b. Magnesium nitride c. aluminium oxide
 d. iron(III) oxide e. Tin (IV) chloride f. calcium chloride
 g. copper(I) oxide h. copper(II) oxide

6. Draw dot and cross diagrams to show bonding in:

a. aluminium chloride

c. Magnesium oxide

7. Write a short sentence to explain the meaning of the following:

i. a cation

ii. an anion

iii. an ionic bond

iv. electrostatic attraction

8. Outline some of the limitations of the octet rule, providing examples.

9. Determine the formula of the following ionic compounds:

i. Sodium oxide:

ii. Magnesium chloride:

iii. Aluminium nitride:

iv. Calcium sulfide:

v. Potassium bromide:

10. Which of the following is NOT an ionic compound?

A) Sodium chloride (NaCl)

B) Carbon dioxide (CO₂)

C) Magnesium oxide (MgO)

D) Potassium iodide (KI)

11. Complete the following sentence by filling in the gaps:

Ionic compounds generally have _____ melting and boiling points due to the strong electrostatic forces between _____ ions.

12. Use the table below to compare and contrast ionic and covalent bonding.

| Feature | Ionic Bonding | Covalent Bonding |
|----------------|---------------|------------------|
| Bond formation | | |
| Particles | | |
| Bond strength | | |
| Physical state | | |
| Conductivity | | |

13. A student claims that an ionic compound formed between magnesium and nitrogen would have the formula MgN. Explain why this is incorrect and determine the correct formula.

Answers

1. What is an ionic compound?

An ionic compound is a chemical compound formed by the electrostatic attraction between oppositely charged ions.

2. Describe the formation of an ionic bond.

An ionic bond is formed when a metal atom transfers one or more electrons to a non-metal atom. The metal atom becomes a positively charged cation, and the non-metal atom becomes a negatively charged anion. The oppositely charged ions are attracted to each other, forming an ionic bond.

3. Explain the octet rule and its relationship to noble gas configurations.

The octet rule states that atoms tend to gain, lose, or share electrons in order to achieve a stable electron configuration with eight electrons in their outermost energy level. Noble gases have full outer energy levels, with eight electrons (or two for helium), and are therefore stable.

4. Write the electronic configuration of the following ions:

a. N^{3-} b. Cr^{3+} c. Cl^- d. Ca^{2+}

a. N^{3-} $1s^2 2s^2 2p^6$ or $[He] 2s^2 2p^6$

b. Cr^{3+} $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$ or $[Ar] 3d^3$

c. Cl^- $1s^2 2s^2 2p^6 3s^2 3p^6$ or $[Ar]$

d. Ca^{2+} $1s^2 2s^2 2p^6 3s^2 3p^6$ or $[Ar]$

b. For each of the ions below write out the electronic configuration in terms of sub-shells.

i. Na and Na⁺ ii. Cl and Cl⁻ iii. Al and Al³⁺ iv. O and O²⁻

i. Na and Na⁺ $1s^2 2s^2 2p^6 3s^1$ and $1s^2 2s^2 2p^6$

ii. Cl and Cl⁻ $1s^2 2s^2 2p^6 3s^2 3p^5$ and $1s^2 2s^2 2p^6 3s^2 3p^6$

iii. Al and Al³⁺ $1s^2 2s^2 2p^6 3s^2 3p^1$ and $1s^2 2s^2 2p^6$

iv. O and O²⁻ $1s^2 2s^2 2p^4$ and $1s^2 2s^2 2p^6$

You could also write shortened electronic configurations based on the noble gas configurations; I have done this for some of the answers below.

5. Write the formula for the following compounds:

a. sodium oxide

b. Magnesium nitride

c. aluminium oxide

d. iron(III) oxide

e. Tin (IV) chloride

f. calcium chloride

g. copper(I) oxide

h. copper(II) oxide

a. sodium oxide Na_2O

b. Magnesium nitride Mg_3N_2

c. aluminium oxide Al_2O_3

d. iron(III) oxide Fe_2O_3

e. Tin (IV) chloride $SnCl_4$

f. calcium chloride $CaCl_2$

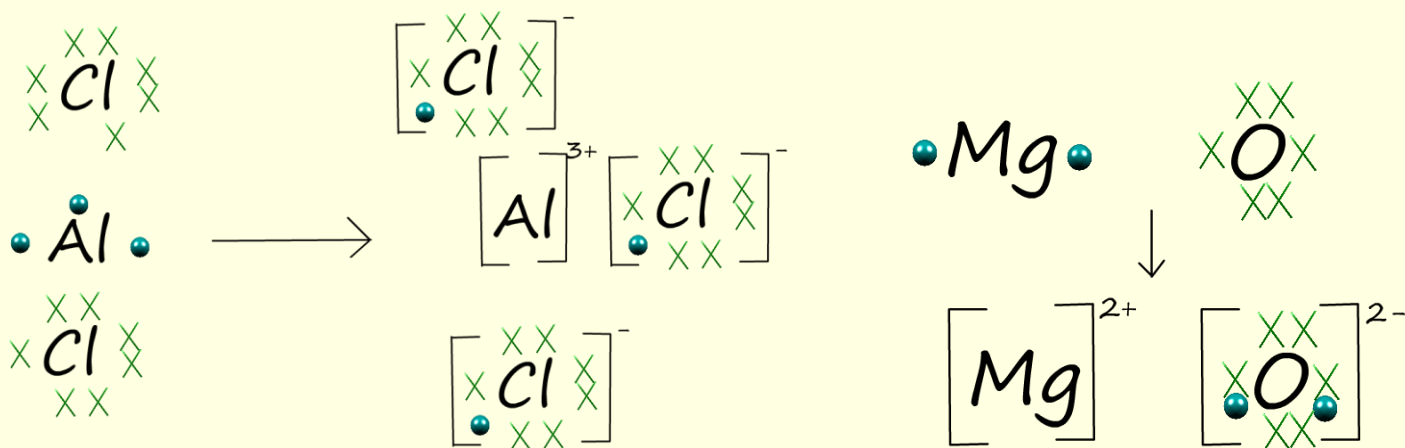
g. copper(I) oxide Cu_2O

h. copper(II) oxide CuO

6. Draw dot and cross diagrams to show bonding in:

a. aluminium chloride

c. Magnesium oxide



7. Write a short sentence to explain the meaning of the following:

a. a cation -a positively charged ion.

b. an anion -a negatively charged ion.

c. an ionic bond -electrostatic attraction of oppositely charged ions.

d. electrostatic attraction- attraction between + and - charges/ions.

8. Outline some of the limitations of the octet rule, providing examples.

The octet rule has limitations:

Some elements, such as hydrogen and lithium, can be stable with only two electrons.

Elements in periods 3 and below can accommodate more than eight electrons in their outer energy level due to the availability of d orbitals. Examples include sulfur hexafluoride (SF_6) and phosphorus pentachloride (PCl_5). Many transition metal compounds are fully stable with more or less than eight electrons in their valence shell.

9. Determine the formula of the following ionic compounds:

i. Sodium oxide: Na_2O ii. Magnesium chloride: MgCl_2

iii. Aluminium nitride: AlN iv. Calcium sulfide: CaS

v. Potassium bromide: KBr

10. Which of the following is NOT an ionic compound?

A) Sodium chloride (NaCl) B) Carbon dioxide (CO_2)

C) Magnesium oxide (MgO) D) Potassium iodide (KI)

Answer: B) Carbon dioxide (CO_2)

11. Complete the following sentence by filling in the gaps:

Ionic compounds generally have _____ melting and boiling points due to the strong electrostatic forces between _____ ions.

Answer: Ionic compounds generally have high melting and boiling points due to the strong electrostatic forces between oppositely charged ions.

12. Compare and contrast ionic and covalent bonding.

| Feature | Ionic Bonding | Covalent Bonding |
|----------------|------------------------------------------|------------------------------|
| Bond formation | Transfer of electrons | Sharing of electrons |
| Particles | Ions | Atoms |
| Bond strength | Strong | Generally weaker |
| Physical state | Usually solid | Can be solid, liquid, or gas |
| Conductivity | Good conductors when molten or dissolved | Poor conductors |

13. A student claims that an ionic compound formed between magnesium and nitrogen would have the formula MgN. Explain why this is incorrect and determine the correct formula.

The student's claim is incorrect because magnesium forms Mg^{2+} ions, and nitrogen forms N^{3-} ions to achieve stable electron configurations. To balance the charges, three magnesium ions are needed for every two nitrogen ions. Therefore, the correct formula is Mg_3N_2 .