SNC2D CHEMISTRY

CHEMICAL REACTIONS

- ☞ Polyatomic Ions & Compounds (P.160-161;163)

Polyatomic Ions

Polyatomic ions *are groups of atoms that tend to stay together and carry an overall ionic charge.*

POLYATOMIC ION (P.161)

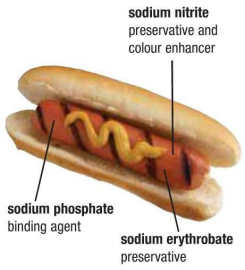
- group of atoms that tend to stay together and carry an overall ionic charge
- only one common positive polyatomic ion
  - ☞ ammonium (NH_4^+)

Name	Formula
ammonium	NH_4^+
carbonate	CO_3^{2-}
hydrogen carbonate (bicarbonate)	HCO_3^-
hydroxide	OH^-
nitrate	NO_3^-
nitrite	NO_2^-
permanganate	MnO_4^-
phosphate	PO_4^{3-}
phosphite	PO_3^{3-}
sulphate	SO_4^{2-}
sulphite	SO_3^{2-}

Compounds Containing Polyatomic Ions

NOTE!

Processed foods contain a lot of sodium, mostly from sodium chloride. Sodium chloride enhances the flavour and extends the shelf-life of food. Other additives in processed foods also contribute to your daily sodium intake. Preserved meats, such as hot dogs, stay red due to the addition of potassium nitrate and sodium nitrite.



Compounds Containing Polyatomic Ions

Polyatomic compounds *are pure substances that involve combinations of metals with polyatomic ions.*

POLYATOMIC COMPOUND

- pure substances that involve combinations of metals with polyatomic ions

Compound	Formula	Use/Source
calcium carbonate	$CaCO_3$	chalk & building mtl
magnesium hydroxide	$Mg(OH)_2$	stomach antacid
sulphuric acid	H_2SO_4	car battery acid
sodium hypochlorite	NaClO	bleach
copper (ii) sulphate	$CuSO_4$	fungicide
sodium carbonate	Na_2CO_3	laundry detergent
ammonium nitrate	NH_4NO_3	fertilizer

Compounds Containing Polyatomic Ions

There are many types of polyatomic ions, but one special group should be mentioned. ***Oxyacids*** *are compounds formed when hydrogen combines with polyatomic ions that contain oxygen.*

Ion Name & Formula		Oxyacid Name & Formula	
nitrate	NO_3^-	nitric acid	HNO_3
nitrite	NO_2^-	nitrous acid	HNO_2
chlorate	ClO_3^-	chloric acid	$HClO_3$
carbonate	CO_3^{2-}	carbonic acid	H_2CO_3
sulphate	SO_4^{2-}	sulphuric acid	H_2SO_4
sulphite	SO_3^{2-}	sulphurous acid	H_2SO_3
phosphate	PO_4^{3-}	phosphoric acid	H_3PO_4

Compounds Containing Polyatomic Ions

NOTE!

The hydrogen has an ionic charge of 1+ in these compounds.

Ion Name & Formula		Oxyacid Name & Formula	
nitrate	NO_3^-	nitric acid	HNO_3
nitrite	NO_2^-	nitrous acid	HNO_2
chlorate	ClO_3^-	chloric acid	$HClO_3$
carbonate	CO_3^{2-}	carbonic acid	H_2CO_3
sulphate	SO_4^{2-}	sulphuric acid	H_2SO_4
sulphite	SO_3^{2-}	sulphurous acid	H_2SO_3
phosphate	PO_4^{3-}	phosphoric acid	H_3PO_4

Compounds Containing Polyatomic Ions

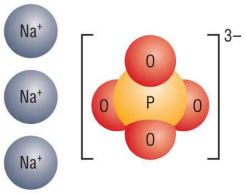
OXYACIDS

- acid compound formed when hydrogen combines with a polyatomic ion that contains oxygen
- hydrogen has an ionic charge of 1+ in these compounds

Compounds Containing Polyatomic Ions

NOTE!

When a compound containing a polyatomic ion, such as sodium phosphate (Na_3PO_4) dissolves, the four ions separate. However, the phosphate ion remains intact.



Activity: Names & Formulas for … (P.161 & 164)

DO NOT COPY!

1. The name for compounds that contain a polyatomic ion are simply a combination of the name of the metal and the name of the polyatomic ion.

2. Formulas for compounds that contain a polyatomic ion are written in the same way as other ionic compounds except brackets are necessary when more than one polyatomic ion is needed.

NOTE!

If a formula uses the ammonium ion NH_4^+ it will go first in the formula (since the positive ion goes first).

Activity: Names & Formulas for … (P.161 & 164)

QUESTIONS

1. Write the chemical names and formulas for the following combinations of elements.

(a) sodium & sulphate
sodium sulphate

^{1+}Na $^{2-}SO_4$ ☞ Na_2SO_4

(b) copper (II) & hydroxide
copper (II) hydroxide

^{2+}Cu ^{1-}OH ☞ $Cu(OH)_2$

(c) ammonium & sulphur
ammonium sulphide

$^{1+}NH_4$ ^{2-}S ☞ $(NH_4)_2S$

✔ Check Your Learning

1. A polyatomic ion, such as NH_4+ or CO_3^{2-}, has several atoms joined together. Why is a polyatomic ion not called a molecule?

a molecule is neutral – polyatomic ions are a group of atoms that tend to stay together and carry an overall ionic charge

✔ Check Your Learning

2. Write the chemical names for each of the following ionic compounds.

(a) $Al(HCO_3)_3$ aluminum bicarbonate
(b) $Mg_3(PO_4)_2$ magnesium phosphate
(c) K_2SO_4 potassium sulphate
(d) $Al(OH)_3$ aluminum hydroxide
(e) NH_4NO_3 ammonium nitrate
(f) $CuSO_4$ copper (II) sulphate ☞ *multivalent*
(g) $Fe(ClO_3)_3$ iron (III) chlorate ☞ *multivalent*
(h) $Pb_3(PO_4)_2$ lead (II) phosphate ☞ *multivalent*
(i) $Sn(ClO_3)_2$ tin (II) chlorate ☞ *multivalent*
(j) $CuNO_3$ copper (I) nitrate ☞ *multivalent*

✔ Check Your Learning

3. Write the chemical formulas for each of the following ionic compounds.
   (a) magnesium sulphate $MgSO_4$
   (b) ammonium chloride NH_4Cl
   (c) aluminum nitrate $Al(NO_3)_3$
   (d) lithium phosphate Li_3PO_4
   (e) sodium bicarbonate $NaHCO_3$
   (f) copper(II) phosphate $Cu_3(PO_4)_2$
   (g) copper(I) chlorate $CuClO_3$
   (h) magnesium hydroxide $Mg(OH)_2$
   (i) lead(II) nitrate $Pb(NO_3)_2$
   (j) calcium sulphate $CaSO_4$

✔ Check Your Learning

TEXTBOOK
P.161 Q.1-4
P.164 Q.1-4