

As per the latest ICSE syllabus

9



# Living Science

# CHEMISTRY



Raymond Fernandes

Ratna Sagar

Based on the latest syllabus prescribed by the  
Council for the Indian School Certificate Examinations

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9

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Ratna Sagar

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# Preface

**Living Science Chemistry** for Class IX covers the latest syllabus for Chemistry as prescribed by the Council for the Indian School Certificate Examinations (ICSE), New Delhi. The sequencing of the chapters follows the distinct directives of the Board.

I have presented the various scientific concepts as vital, compelling and meaningful which might otherwise seem dull. Each part of the book has been carefully planned to make it student friendly and present Chemistry in an interesting, understandable and enjoyable manner. I have tried to stress the applications of what you are learning so that you can relate the facts to the living world.

Some questions that I have been often asked by the students and parents alike have been—“What do we do by learning Chemistry?” “For a student of Literature or even History what role can Chemistry play?” But the answers came very simply. A mother administering her child a tablet for fever should know the chemical composition of the tablet given. A student exposed to the polluted environment around his / her playing fields should know the ill-effects of chemicals that cause numerous diseases. The examples can go on and on. This is what I have kept in mind while writing the text.

From a teacher’s point of view, text needs to touch upon all the essentials that the student has to be informed about, yet not be excessively verbose and pedantic. There should also be a proper plan of instruction for each lesson to facilitate comprehensive and logical teaching.

From the student’s point of view, text has to be simple enough for them to read, understand and analyse concepts and notions. If chapters are only in point form, the essence of a subject is completely lost. It becomes purely an exercise of ‘learning by rote’, which contradicts the concept of holistic education of the 21st century.

The ‘SUMMARY’ section provides the synopsis, which on a systematic study will furnish all relevant answers to exam-based questions.

All relevant questions of previous ICSE examinations have been incorporated apart from other KNOWLEDGE, UNDERSTANDING and APPLICATION-BASED questions. A special section called RESEARCH QUESTIONS takes the student beyond the mere ‘Chemistry for examination’ concept.

For those who would like to go beyond the question-answer syndrome, the book has enough information to arouse their imagination.

Let the book be an effective tool to acquire basic knowledge of a subject so central to our very existence. With this confidence I present this book, which will be of worth for both the teachers and the students alike.

I wish to thank the publishers for their support in this endeavour.

Suggestions for any improvement will be gratefully acknowledged.

**Author**

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# The Language of Chemistry

“Science belongs to no one country.”

— LOUIS PASTEUR

As the name of the chapter most appropriately suggests, chemistry is indeed a language. Like all languages this language too has its alphabet, sentences and syntax. **Chemistry** is the branch of science that deals with the characteristics and composition of all materials. Chemicals are everywhere. Some chemicals are useful to us, some are harmful. In order to know them we need to understand the fundamentals of chemistry. With the advent of inventions and the quest to acquire more, individuals have frequently explored the realm of the unknown, to extend their boundaries of knowledge and to get ever so close to the truth. To comprehend and concise chemistry, alchemists invented a system of symbols for elements.

John Dalton used circular symbols with enclosed markings to represent elements. Dalton's symbol for an element represented one atom of that element.

In 1814, the Swedish chemist J J Berzelius proposed the current system of symbols for the elements.

He suggested that the symbols of elements be made from the first letter of the name of the element.

**TABLE 1.1** Some elements which derived their symbols from first letter of English names

Symbol	Element
C	Carbon
B	Boron
F	Fluorine
H	Hydrogen
I	Iodine
N	Nitrogen
O	Oxygen
P	Phosphorus
S	Sulphur
U	Uranium
V	Vanadium
Y	Yttrium

## SYLLABUS

*Symbol of an element; valency; formulae of radicals and formulae of compounds. Balancing of simple chemical equations.*

Symbol—definition; symbols of the elements used often.

Valency—definition; Hydrogen combination and number of valence electrons of the metals and non-metals; mono, di, tri and tetravalent elements.

Radicals—definition; formulae and valencies.

Compounds—name and formulae.

Chemical equation—definition and examples of chemical equations with one reactant and two or three products, two reactants and one product, two reactants and two products and two reactants and three or four products; balancing of equations (hit and trial method)

*Relative Atomic Masses (atomic weights) and Relative Molecular Masses (molecular weights): either - standard H atom or 1/12th of carbon 12 atom.*

Definitions: Calculation of Relative Molecular Mass and percentage composition of a compound.

## KNOW YOUR SCIENTIST



**Jöns Jakob Berzelius** (1779–1848) was a Swedish chemist. He invented the modern chemical symbols. Some elements such as silicon, selenium, cerium and thorium were discovered by him. He was the first person to make the distinction between organic and inorganic compounds. He introduced the classical system of chemical symbols in 1811, in which elements are abbreviated by one or two letters to make a distinct abbreviation from their Latin names. He developed the radical theory of chemical combination, which holds that reactions occur as stable groups of atoms called radicals, all exchanged between molecules.

For example, H for hydrogen and O for oxygen. In case, if elements start with the same letter, he proposed using two letters in the name. For example, Ca for calcium and Cl for chlorine.

The symbol of an element is the first letter or the first letter and another letter of the name of the element either the Latin or Greek name or the modern name. The first letter is always capitalized and the second letter is a lower case letter.

Now, the names of elements are approved by the International Union of Pure and Applied Chemistry (IUPAC).

1. The symbols of some elements were derived from the first letter of their English names.
2. The symbols of some elements were derived from the first two letters of their English names.
3. The symbols of some elements were derived from the Latin or German names.

**TABLE 1.2** Some elements which derived their symbols from first two letters of English names

Symbol	Element
Ca	Calcium
Al	Aluminium
Ba	Barium
Bi	Bismuth
Cl	Chlorine
Co	Cobalt
Cr	Chromium
Fr	Francium
Li	Lithium
Ni	Nickel
Ra	Radium
Rn	Radon
Si	Silicon

**TABLE 1.3** Some elements which derived their symbols from names in other languages

Name in English	Symbol	Name in a language other than English	Language
Antimony	Sb	Stibium	Latin
Copper	Cu	Cuprum	Latin
Gold	Au	Aurum	Latin
Iron	Fe	Ferrum	Latin
Lead	Pb	Plumbum	Latin
Mercury	Hg	Hydrargyrum	Latin
Potassium	K	Kalium	Latin
Silver	Ag	Argentum	Latin
Sodium	Na	Natrium	Latin
Tin	Sn	Stannum	Latin
Tungsten	W	Wolfram	German
Zinc	Zn	Zink	German

### Significance of the symbol of an element

1. Symbol represents name of the element.
2. It represents one atom of the element.
3. It represents a definite mass of the element (equal to atomic mass expressed in grams).
4. It represents mass of the element which contains one Avogadro's number of atoms of that element.

### VALENCY

Valency is the combining capacity of an element. **The number of hydrogen atoms that combine with one atom of an element to form a compound is called valency of that element.**

Consider the following examples:

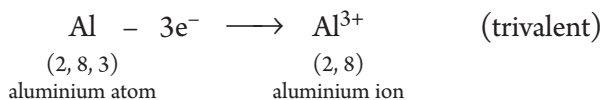
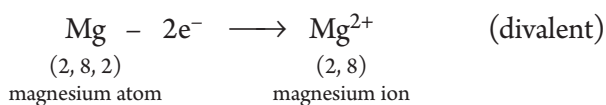
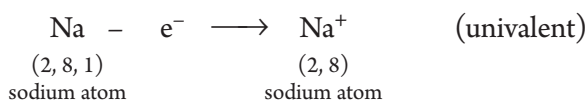
1. Two atoms of hydrogen combine with one atom of oxygen to form a molecule of water ( $\text{H}_2\text{O}$ ). Hence the valency of oxygen is 2.

- Three atoms of hydrogen combine with one atom of nitrogen to form a molecule of ammonia (NH<sub>3</sub>). Hence, the valency of nitrogen is 3.
- Four atoms of hydrogen combine with one atom of carbon to form a molecule of methane (CH<sub>4</sub>). Hence, the valency of carbon is 4.
- The valency of noble gas is zero as they do not undergo chemical reactions under normal conditions.

### Modern definition of valency

The valence electrons dictate the valency and chemical reactions of an element. **The number of valence electrons of an element which actually takes part in chemical reactions is called the valency of that element.**

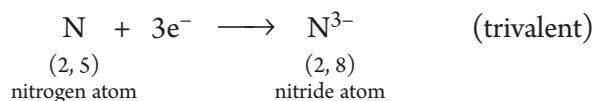
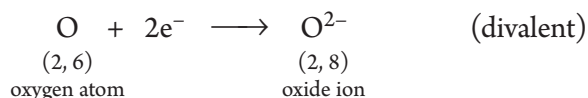
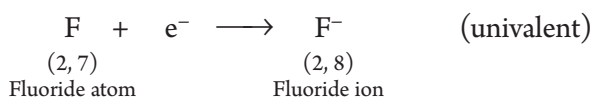
Metals such as sodium, magnesium and aluminium lose one, two or three valence electrons respectively to form positive ions or **cations**. Therefore, the valency of sodium, magnesium and aluminium is 1, 2 and 3 respectively.



In general, the valency of a metal element is equal to the number of valence electrons in its atom.

$$\text{Valency of a metal element} = \frac{\text{No. of valence electrons}}{\text{in its atom}}$$

Non-metals such as fluorine, oxygen and nitrogen gain one, two and three electrons respectively in their valence shell to form negative ions or **anions**. Therefore, the valency of fluorine, oxygen and nitrogen is 1, 2 and 3 respectively.



The valency of a non-metal element is usually equal to eight minus the number of valence electrons in its atom.

$$\text{Valency of a non-metal element} = 8 - \text{No. of valence electrons in its atom}$$

But there is one exception to this rule. The valency of hydrogen is 1 which is equal to the number of valence electrons.

### Variable valency

Some elements exhibit more than one valency. These elements are said to possess variable valency.

TABLE 1.4 Some elements which possess variable valency

Element	Symbol	Variable valency
Chromium	Cr	2, 3 and 6
Copper	Cu	1 and 2
Gold	Au	1 and 3
Iron	Fe	2 and 3
Lead	Pb	2 and 4
Manganese	Mn	2, 3, 4, 6 and 7
Mercury	Hg	1 and 2
Nitrogen	N	1, 2, 3 and 5
Phosphorus	P	3 and 5
Sulphur	S	4 and 6
Tin	Sn	2 and 4

If an element exhibits variable valency then the name of the lower valency is denoted by the suffix **-ous** and that of higher valency with **-ic**.

### RADICAL

A radical may be defined as **an atom or group of atoms of the same or different elements which carries charge and behaves as a single unit.**

There are two types of radicals depending upon the charges on them.

- Basic radical
- Acid radical

**TABLE 1.5** List of basic radicals or electropositive radicals or cations

Monovalent basic radical		Divalent basic radical		Trivalent basic radical		Tetravalent basic radical	
Radical	Symbol	Radical	Symbol	Radical	Symbol	Radical	Symbol
Hydrogen	H <sup>+</sup>	Beryllium	Be <sup>2+</sup>	Aluminium	Al <sup>3+</sup>	Carbon	C <sup>4+</sup>
Lithium	Li <sup>+</sup>	Magnesium	Mg <sup>2+</sup>	Bismuth	Bi <sup>3+</sup>	Lead(IV) [Plumbic]	Pb <sup>4+</sup>
Sodium	Na <sup>+</sup>	Calcium	Ca <sup>2+</sup>	Iron(III) [Ferric]	Fe <sup>3+</sup>	Silicon	Si <sup>4+</sup>
Potassium	K <sup>+</sup>	Copper(II) [Cupric]	Cu <sup>2+</sup>	Gold(III) [Auric]	Au <sup>3+</sup>	Platinum(IV) [Platinic]	Pt <sup>4+</sup>
Silver(I) [Argentous]	Ag <sup>+</sup>	Iron(II) [Ferrous]	Fe <sup>2+</sup>	Arsenic(III) [Arsenous]	As <sup>3+</sup>	Tin(IV) [Stannic]	Sn <sup>4+</sup>
Copper(I) [Cuprous]	Cu <sup>+</sup>	Strontium	Sr <sup>2+</sup>	Chromium	Cr <sup>3+</sup>		
Mercury(I) [Mercurous]	Hg <sup>+</sup>	Manganese	Mn <sup>2+</sup>	Antimony	Sb <sup>3+</sup>		
Ammonium	NH <sub>4</sub> <sup>+</sup>	Zinc	Zn <sup>2+</sup>	Boron	B <sup>3+</sup>		
Phosphonium	PH <sub>4</sub> <sup>+</sup>	Cadmium	Cd <sup>2+</sup>				
		Barium	Ba <sup>2+</sup>				
		Cobalt	Co <sup>2+</sup>				
		Mercury(II) [Mercuric]	Hg <sup>2+</sup>				
		Nickel	Ni <sup>2+</sup>				
		Lead(II) [Plumbous]	Pb <sup>2+</sup>				
		Tin(II) (Stannous)	Sn <sup>2+</sup>				
		Platinum(II) [Platinous]	Pt <sup>2+</sup>				

**Basic radical:** The radical carrying positive charge is called **basic radical**. It is also called **electropositive radical** or **cation**. The radicals having a unit positive (+) charge are called monovalent basic radicals. The radicals having two units of positive (2+) charge are called divalent radicals. Similarly radicals have three, four and five units of positive charge are called trivalent, tetravalent and pentavalent basic radicals respectively. The list of basic radicals are given in Table 1.5.

**Acid radical:** The radical having a negative charge on it is called the acid radical. It is also called the **electronegative radical** or **anion**.

The radicals having a unit negative charge are called monovalent acid radicals. The radicals having two, three and four units of charge are called divalent, trivalent and tetravalent acid radicals respectively. The list of acid radicals are given in Table 1.6.

## CHEMICAL FORMULA

The chemical formula of a compound is a symbolic representation of a molecule of the compound. It denotes the number of atoms of different elements present in one molecule of the compound.

### Writing the chemical formula

Every compound is represented by a chemical formula. The following steps should be followed in writing the chemical formula.

**Step 1** The symbol of the positive atom or basic radical is placed on the left-hand side and the symbol of the negative atom or acid radical is placed on the right-hand side.

**Step 2** The valencies of the symbols are written below them.

**TABLE 1.6** List of acid radicals or electronegative radicals or anions

Monovalent acid radical		Divalent acid radical		Trivalent acid radical		Tetravalent acid radical	
Radical	Symbol	Radical	Symbol	Radical	Symbol	Radical	Symbol
Hydride	H <sup>-</sup>	Carbonate	CO <sub>3</sub> <sup>2-</sup>	Nitride	N <sup>3-</sup>	Carbide	C <sup>4-</sup>
Fluoride	F <sup>-</sup>	Sulphate	SO <sub>4</sub> <sup>2-</sup>	Phosphide	P <sup>3-</sup>	Ferrocyanide	[Fe(CN) <sub>4</sub> ] <sup>4-</sup>
Chloride	Cl <sup>-</sup>	Sulphide	S <sup>2-</sup>	Phosphite	PO <sub>3</sub> <sup>3-</sup>		
Bromide	Br <sup>-</sup>	Sulphite	SO <sub>3</sub> <sup>2-</sup>	Phosphate	PO <sub>4</sub> <sup>2-</sup>		
Iodide	I <sup>-</sup>	Oxide	O <sup>2-</sup>	Ferricyanide	[Fe(CN) <sub>6</sub> ] <sup>2-</sup>		
Iodate	IO <sub>3</sub> <sup>-</sup>	Peroxide	O <sub>2</sub> <sup>2-</sup>	Borate	BO <sub>3</sub> <sup>3-</sup>		
Nitrate	NO <sub>3</sub> <sup>-</sup>	Pyrite	S <sub>2</sub> <sup>2-</sup>	Aluminate	AlO <sub>3</sub> <sup>3-</sup>		
Nitrite	NO <sub>2</sub> <sup>-</sup>	Thiosulphate	S <sub>2</sub> O <sub>3</sub> <sup>2-</sup>	Arsenite	AsO <sub>3</sub> <sup>3-</sup>		
Hydroxide	OH <sup>-</sup>	Silicate	SiO <sub>3</sub> <sup>2-</sup>	Arsenate	AsO <sub>4</sub> <sup>3-</sup>		
Superoxide	O <sub>2</sub> <sup>-</sup>	Stannate	SnO <sub>3</sub> <sup>2-</sup>				
Metaborate	BO <sub>2</sub> <sup>-</sup>	Stannite	SnO <sub>2</sub> <sup>2-</sup>				
Meta aluminate	AlO <sub>2</sub> <sup>-</sup>	Chromate	CrO <sub>4</sub> <sup>2-</sup>				
Metaphosphate	PO <sub>3</sub> <sup>-</sup>	Zincate	ZnO <sub>2</sub> <sup>2-</sup>				
Hydrogen carbonate or Bicarbonate	HCO <sub>3</sub> <sup>-</sup>	Dichromate	Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup>				
Hydrogen sulphate or Bisulphate	HSO <sub>4</sub> <sup>-</sup>	Manganate	MnO <sub>4</sub> <sup>2-</sup>				
Hydrogen sulphite or Bisulphite	HSO <sub>3</sub> <sup>-</sup>	Oxalate	C <sub>2</sub> O <sub>4</sub> <sup>2-</sup>				
Hydrogen sulphide or Bisulphide	HS <sup>-</sup>						
Cyanide	CN <sup>-</sup>						
Cyanate	CNO <sup>-</sup>						
Chlorate	ClO <sub>3</sub> <sup>-</sup>						
Hypochlorite	ClO <sup>-</sup>						
Hypobromite	BrO <sup>-</sup>						
Perchlorate	ClO <sub>4</sub> <sup>-</sup>						
Permanganate	MnO <sub>4</sub> <sup>-</sup>						
Acetate	CH <sub>3</sub> COO <sup>-</sup>						

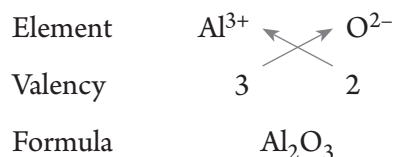
**Step 3** Interchange the valencies of the symbol and shift it to the lower right corner of the symbol. The valency numbers become subscripts of the corresponding symbols.

**Step 4** Reduce the valency numbers to a simple ratio by dividing with a common factor, if required.

The procedure is now illustrated by the following examples.

**EXAMPLE 1** Let us consider the compound aluminium oxide.

**SOLUTION**



**EXAMPLE 2** Write the formula of calcium phosphate.**SOLUTION**

Element	Ca <sup>2+</sup>	↔	PO <sub>4</sub> <sup>3-</sup>
Valency	2	↔	3
Formula	Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>		

**EXAMPLE 3** Write the formula of sodium sulphate.**SOLUTION**

Element	Na <sup>+</sup>	↔	SO <sub>4</sub> <sup>2-</sup>
Valency	1	↔	2
Formula	Na <sub>2</sub> SO <sub>4</sub>		

**CHECK YOUR PROGRESS**

Write the molecular formula for

- |                       |                         |                     |                       |
|-----------------------|-------------------------|---------------------|-----------------------|
| 1. Calcium chloride   | 2. Ammonium nitrate     | 3. Zinc sulphate    | 4. Copper(II) nitrate |
| 5. Lead dioxide       | 6. Potassium dichromate | 7. Sodium phosphate | 8. Barium chloride    |
| 9. Iron(III) sulphate | 10. Aluminium sulphite  |                     |                       |

**WRITING THE NAME OF A COMPOUND****1. Compounds formed by the combination**

**between metals and non-metals:** In writing the formula of such compounds, the metal element is written on the left hand side and the non-metal element is written on the right hand side.

In naming the compound, the metal element is named as such and the name of the non-metal element is changed to have its ending **-ide**.

For example:

NaCl	Sodium chloride
KI	Potassium iodide
CaBr <sub>2</sub>	Calcium bromide
Ca <sub>3</sub> N <sub>2</sub>	Calcium nitride
MgS	Magnesium sulphide
Ca <sub>3</sub> P <sub>2</sub>	Calcium phosphide

**2. Compounds formed by the combination**

**between two different non-metal elements:** The less electronegative non-metal is written on the left hand side and the more electronegative non-metal is written on the right hand side. In naming such compounds, the less electronegative non-metal is written as such but the name of the more electronegative non-metal is changed to have its ending as **-ide**.

For example:

HCl	Hydrogen chloride
H <sub>2</sub> S	Hydrogen sulphide

Compounds containing more than one atoms of

a non-metallic element are named by using Greek prefixes **mono-**, **di-**, **tetra-** and **penta-**. These prefixes indicate the number of atoms present in the compound.

For example:

CO	Carbon monoxide
SO <sub>3</sub>	Sulphur trioxide
CO <sub>2</sub>	Carbon dioxide
PCl <sub>3</sub>	Phosphorus trichloride
CCl <sub>4</sub>	Carbon tetrachloride
PCl <sub>5</sub>	Phosphorus pentachloride

When the same two non-metal elements form a number of different compounds, then Greek prefixes are used.

For example:

NO	Nitrogen monoxide
NO <sub>2</sub>	Nitrogen dioxide
N <sub>2</sub> O	Dinitrogen monoxide
N <sub>2</sub> O <sub>3</sub>	Dinitrogen trioxide
N <sub>2</sub> O <sub>4</sub>	Dinitrogen tetroxide
N <sub>2</sub> O <sub>5</sub>	Dinitrogen pentoxide

When hydrogen is first element in a formula, then no prefix like di, tri, etc. is used before the name hydrogen. For example:

H <sub>2</sub> S	Hydrogen sulphide
------------------	-------------------

**3. Compounds containing three elements one of which is oxygen:**

- Compounds containing three elements one of which is oxygen are named with **-ate** ending, if there is only one such compound.

-ide	hypo- + -ite	-ite	-ate	per- + -ate
F <sup>-</sup> , fluoride	FO <sup>-</sup> , hypofluorite	FO <sub>2</sub> <sup>-</sup> , fluorite	FO <sub>3</sub> <sup>-</sup> , fluorate	FO <sub>4</sub> <sup>-</sup> , perfluorate
Cl <sup>-</sup> , chloride	ClO <sup>-</sup> , hypochlorite	ClO <sub>2</sub> <sup>-</sup> , chlorite	ClO <sub>3</sub> <sup>-</sup> , chlorate	ClO <sub>4</sub> <sup>-</sup> , perchlorate
Br <sup>-</sup> , bromide	BrO <sup>-</sup> , hypobromite	BrO <sub>2</sub> <sup>-</sup> , bromite	BrO <sub>3</sub> <sup>-</sup> , bromate	BrO <sub>4</sub> <sup>-</sup> , perbromate
I <sup>-</sup> , iodide	IO <sup>-</sup> , hypoiodite	IO <sub>2</sub> <sup>-</sup> , iodite	IO <sub>3</sub> <sup>-</sup> , iodate	IO <sub>4</sub> <sup>-</sup> , periodate

- If there are two compounds, the one with more oxygen is named with **-ate** ending and the one with less oxygen is named with **-ite** ending.

For example:

NaNO <sub>3</sub>	Sodium nitrate
NaNO <sub>2</sub>	Sodium nitrite
CaSO <sub>4</sub>	Calcium sulphate
CaSO <sub>3</sub>	Calcium sulphite
Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>	Calcium phosphate
Na <sub>2</sub> CO <sub>3</sub>	Sodium carbonate

- In situations where more than two possibilities exist, the **-ite** and **-ate** endings are extended. This is basically limited to halogens with oxygen in which there are four possibilities. In addition to **-ite** and **-ate**, there are hypo- + -ite and per- + -ate.

For example:

KClO	Potassium hypochlorite	<i>The number of oxygen atoms is less than 2.</i>
KClO <sub>2</sub>	Potassium chlorite	<i>The number of oxygen atoms is 2.</i>
KClO <sub>3</sub>	Potassium chlorate	<i>The number of oxygen atoms is 3.</i>
KClO <sub>4</sub>	Potassium perchlorate	<i>The number of oxygen atoms is 4.</i>

#### 4. Naming of compounds with variable valencies:

If a metal forms two series of compounds, these are differentiated by endings. The ending **-ic** is given to the name of the compound in which the metal shows the higher valency. The ending **-ous** is given to the name of the compound in which the metal is

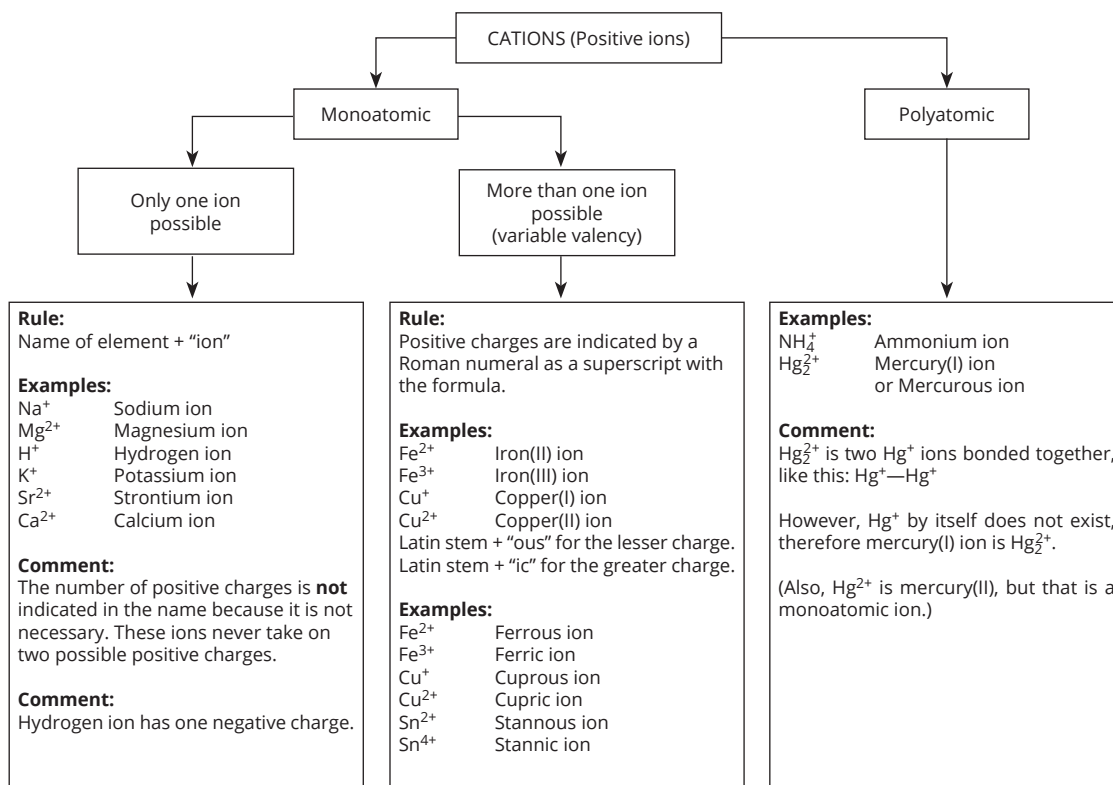


Fig. 1.1 Flowchart for naming of cations

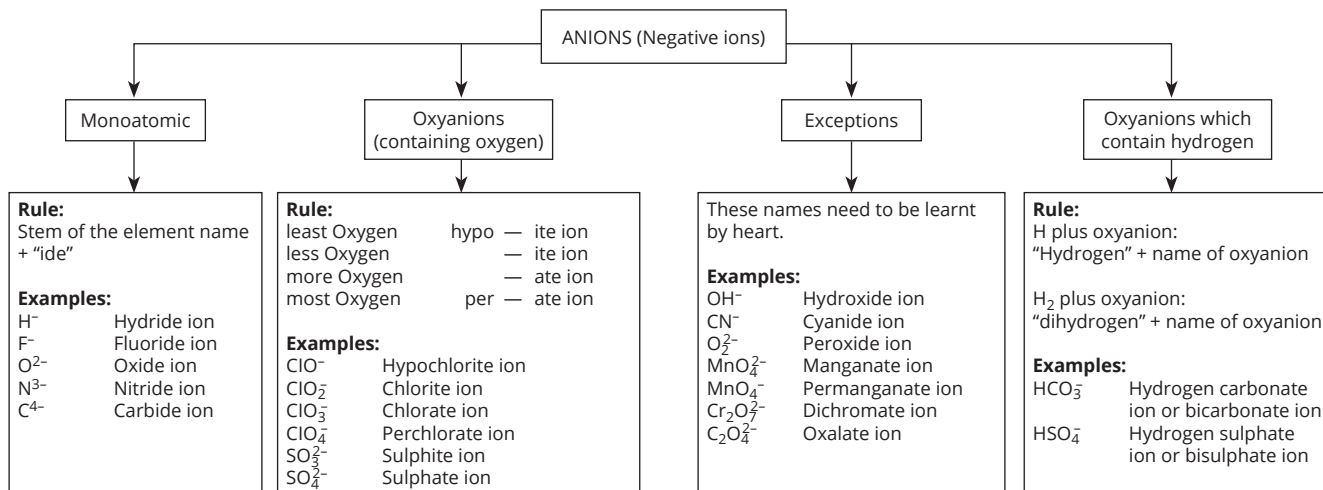


Fig. 1.2 Flowchart for naming of anions

having lower valency. A Roman numeral may also be used to indicate the valency of metal.

For example:

CuCl is named as cuprous chloride because here the valency for copper is 1. It is also called copper(I) chloride.

Cu(NO<sub>3</sub>)<sub>2</sub> is named as cupric nitrate because here the valency for copper is 2. It is also called copper(II) nitrate.

FeO is named ferrous oxide because here the valency for iron is 2. It is also called iron(II) oxide.

Fe<sub>2</sub>O<sub>3</sub> is named as ferric oxide because here the valency for iron is 3. It is also called iron(III) oxide.

## Naming acids

Acids are generally named according to their anions.

- The names of binary acids or hydrides are given by adding the prefix **hydro-** and the suffix **-ic** to the name of the second element.

HCl	Hydrochloric acid
HBr	Hydrobromic acid
HF	Hydrofluoric acid

- The names of acids containing radicals of polyatomic groups are given on the basis of the second element

but the prefix **hydro-** is not used. These acids are called oxy acids.

H <sub>2</sub> SO <sub>4</sub>	Sulphuric acid
H <sub>2</sub> SO <sub>3</sub>	Sulphurous acid
HNO <sub>3</sub>	Nitric acid
H <sub>2</sub> CO <sub>3</sub>	Carbonic acid

## Naming bases

- Bases containing OH radical are named as **hydroxides**.

NaOH	Sodium hydroxide
Ca(OH) <sub>2</sub>	Calcium hydroxide
Ba(OH) <sub>2</sub>	Barium hydroxide

## Trivial names

- There are certain names of compounds which do not follow any systematic rule. These names have yet persisted and not been replaced because these names have become very common.

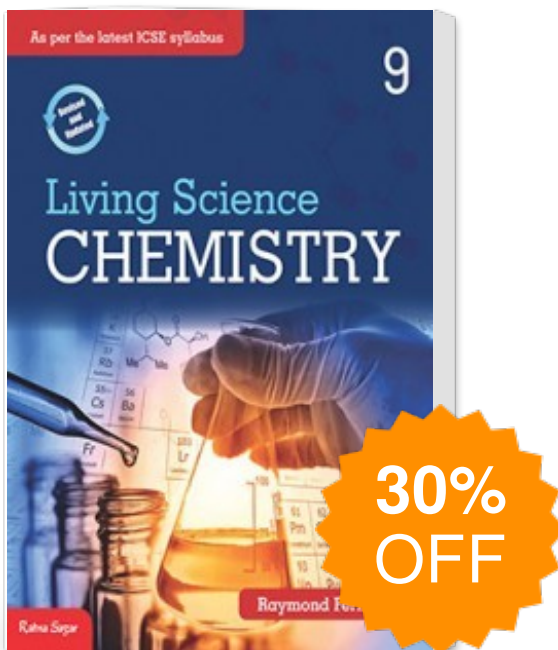
Ammonia	NH <sub>3</sub>
Sugar	C <sub>12</sub> H <sub>22</sub> O <sub>11</sub>
Borax	Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·10H <sub>2</sub> O
Washing soda	Na <sub>2</sub> CO <sub>3</sub> ·10H <sub>2</sub> O
Blue vitriol	CuSO <sub>4</sub> ·5H <sub>2</sub> O
Water	H <sub>2</sub> O

## CHECK YOUR PROGRESS

Write the names of the following compounds:

- |                      |                      |                      |                      |                                      |
|----------------------|----------------------|----------------------|----------------------|--------------------------------------|
| 1. FeSO <sub>4</sub> | 2. HgO               | 3. CuCl <sub>2</sub> | 4. KMnO <sub>4</sub> | 5. Pb(NO <sub>3</sub> ) <sub>2</sub> |
| 6. AgNO <sub>3</sub> | 7. ZnSO <sub>3</sub> | 8. BaCl <sub>2</sub> | 9. CaF <sub>2</sub>  | 10. MnSO <sub>4</sub>                |

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