

# The **States-Of-Matter Approach** to Introductory Chemistry (**SOMA**)

This is an introductory chemistry course for upper secondary chemistry (grade 10) (chemistry for general education). The course introduces chemistry in a logical and at the same time pedagogically sound way, by means of the three states of matter. The course consists of three major units and is intended for 3 periods per week course. The units are:

- A. **Air, Gases, and the Gaseous State**
- B. **Salt, Salts, and the Solid State**
- C. **Water, Liquids, and the Liquid State**

In gases, the molecules are small, only a few non-metals (O, H, N, C, S, F, Cl, and inert gases) are studied. Covalent bonding only enters. No intermolecular interactions exist. The study of hydrocarbons provides for an integrated study of inorganic and organic chemistry. Atomic and molecular structure (but not the periodic table) is introduced here. Chemical reactions, stoichiometry, reaction energetics, and gas laws provide the physical chemistry part of the unit.

- In salts, ionic bonding and crystal structure are studied. The periodic table and oxidation number are introduced here. Covalent solids and metals are also part of the unit.
- In liquids, intermolecular bonds are treated. Organic chemistry is part of the unit. Solution chemistry and acids and bases (including organic acids) are studied here. The unit concludes with chemical reactions in aqueous solutions.
- Each major unit includes a corresponding major social and environmental issue. Air pollution, the greenhouse effect, and the depletion of ozone layer are a major theme in air and gases. Waste disposal, and recycling of materials (especially of metals) are considered with solids. Water quality, water pollution, and acid rain are themes in water and liquids.

A relevant book has been written in Greek as part of the M.Sc. thesis in chemistry education by E. Pyrgas under the supervision of G. Tsapalis. From this book are the following pages that start Part B. Translation into English is by Georgios Tsapalis. The Appendix has the main sections of each unit. Detailed contents can be seen in the Reference.

## **Reference:**

Tsapalis, G. (2000). The **States-Of-Matter Approach** to Introductory Chemistry (SOMA). *Chemistry Education Research and Practice*, 1, 161-168. [<http://www.rsc.org/Education/CERP>]

## **Appendix: Outline of the contents of the book**

### **Unit A. Air, Gases, and the Gaseous State**

- A 1 The atmospheric air**
- A 2 Atoms and atomic structure**
- A 3 Molecules and molecular structure**
- A 4 The chemical reaction**
- A 5 Oxygen and inert gases**
- A 6 The ideal gas and its state equation**
- A 7 Hydrocarbons**
- A 8 Air pollution**

### **Unit B. Salt, Salts, and the Solid State**

- B1 Salt and the crystal structure**
- B2 Salts, metal oxides, and  
metal hydroxides**
- B3 Molecular solids**
- B4 Metals**
- B5 Solid waste and  
its management**

### **Unit C. Liquids, and the Liquid State**

- C1 The role of the liquid state for life**
- C2 Range of temperatures and pressures for the liquid state**
- C3 Intermolecular forces (Van der Waals forces)**
- C4 Water**
- C5 Mercury and bromine: the only liquid chemical elements**
- C6 Organic chemistry: liquid organic compounds**
- C7 Solutions**
- C8 Colligative properties of solutions**
- C9 Acids and bases**
- C10 Drinking water and water pollution**

<b>U N I T  A</b>	<b>air, gases, and the gaseous state</b>
---------------------------------------	--

- A 1** the atmospheric air
- A 2** atoms and atomic structure
- A 3** molecules and molecular structure
- A 4** the chemical reaction
- A 5** oxygen and inert gases
- A 6** the ideal gas and its state equation
- A 7** hydrocarbons
- A 8** air pollution



## A 1 THE ATMOSPHERIC AIR

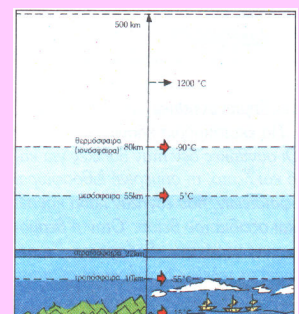
### A 1.1 Physical and chemical identity of air

### A 1.2 Air as a mixture of gases

### A.1.3. Classification of matter - Substances, mixtures, compounds

Pure substances and mixtures of substances

Chemical compounds and chemical elements



The various parts of the atmosphere with the temperature conditions prevailing in them, as well as their relative extension, and the activities in them.