

# Chemistry

Basic Education

Grade Nine



**SPECIMEN**



# Republic of Lebanon

Ministry of Education and Higher Education

## CHEMISTRY

**Basic Education**

Grade Nine

Center for Educational Research and Development




National  
Textbook

New Curricula





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# CHEMISTRY

**Basic Education**

Grade Nine

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# The National Textbook Project

By issuing the textbooks for the third year of each educational cycle, the Educational Center for Research and Development will have completed the third and last installment of books called for by the New Curricula. We are placing these books in the hands of students with the great hope that we are moving, step by step, toward the goal of acquiring sound learning, using sophisticated educational means and up-to-date methodology that encourage and reinforce individual thinking and research, acquisition of skills, development of ethical and national attitudes, the feeling of national belonging as well as the feeling of belonging to humanity at large.

The on-going revolution in information, communication and educational-aids technology has undoubtedly limited the role of the textbook and lowered the rank it used so recently to occupy. However, in our society and in many other societies, the textbook remains the basic means of education, and it is our duty to exert our utmost effort and care to come up with the best product as to form and content. Yet we should not lose sight of the fact that the textbook is not sufficient by itself but should rather be used as a stepping stone to access other sources of information. What is important is to keep a clear vision and maintain the right course toward our objective. The means should not turn into the end and the student should always remain the focus of the learning/teaching process.

No one ignores or denies the fact that textbook writing requires very high academic and educational qualifications and very wide field experience. The authors committees undeniably possess such qualities. Yet the textbooks of the last two years contained some negative aspects. Such is the nature of human work, no matter how good the intentions or how great the effort extended. Here constructive criticism constitutes a real contribution to raising the standard of authorship, minimizing errors and filling gaps. We say that, with all due appreciation and respect to all those who have contributed to the success of this project.

The Educational Center for Research and Development is embarking this year on a process of evaluating the New Curricula and related textbooks, teacher training courses and student achievement. This is a natural and necessary step now that the new system has been put into effect. This process aims at identifying the curricular objectives that have been achieved as well as those that have not been achieved, with a view to proceeding with the positive aspects and correcting the negative ones.

As part of this correction process, we plan to review the versions that have been issued in order to secure good textbooks for our students, who always deserve the best.

**March 13, 2000**

**President, Educational Center for  
Research and Development**

**Nemer FRAYHA**



# Introduction

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In conformity with the objectives of the new curricula, this ninth grade chemistry book aims, through its content and methodology of teaching, to develop students into active learners.

- The teaching of notions and concepts is achieved through a set of activities, which help develop the students' ability to actively participate in the laboratory work and class discussions, as well as encourage them to communicate through reading, writing and listening.
- The simplicity of the language and the use of a variety of educational materials (transparencies, videos, films, molecular models...), in each lesson provide novelty and nourish intellectual growth.
- To enhance the effectiveness of the text material and improve clarity and understanding, a large number of full-colored figures are used.

In this book, we have tried to strike a balance between theory and application and to supply everyday examples whenever possible and to show that there is more to chemistry than numbers.



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## Features of this book

This book is divided into five units: the first unit includes two chapters, the second, third and fifth include one chapter each, while the fourth unit includes three chapters.

**Activities** develop manipulative skills, use inexpensive materials and include clear and explicit directions that are easy to follow. These activities are the starting point for developing concepts and generalizations that are related to everyday life experiences.

**Chapter Summary** provides the key concepts and main ideas of the chapter.

**Insights** motivate students by showing them just how important and interesting chemistry really is.

**Science and Society** includes real-life applications, help students relate the chemistry concepts to their everyday-life.

**Questions and Exercises** at the end of each chapter allow for a gradual and in-depth development of knowledge and skills to be attained. The questions and exercises are grouped into categories in terms of the cognitive level and types of skills they require. They help students to infer concepts, relate and examine illustrations and analyze them in the form of charts and graphs. Also, they help to reinforce and extend concepts, both scientific and social and enhance students' ability to write reports on science topics.

All comments and suggestions are welcome.

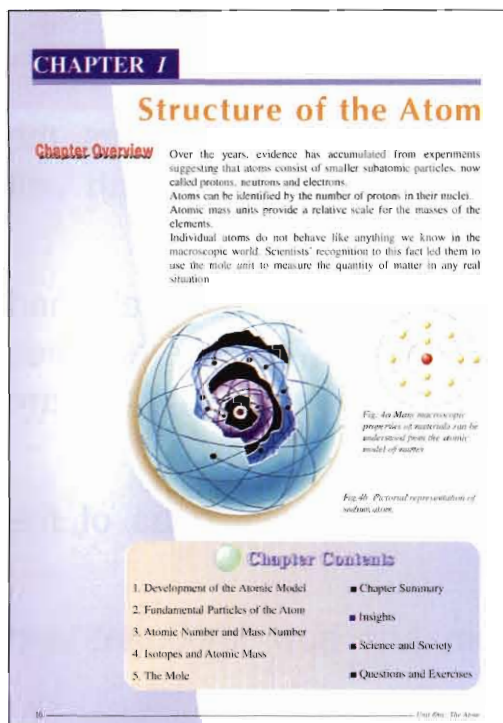
***The Authors***

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## Notes from the Authors:

The eight chapters of this book are all organized in the same format. In each chapter, distinguishing symbols are assigned to the different parts: Activity, Glossary, Remark, Safety, Chapter Summary, Insights, Science and Society, Questions and Society, Questions and Exercises.



- List of chemicals and equipment needed to perform the activity.
- A quick reference for definitions of terms used in the chapter.
- Safety instructions are given to prevent accidents. Safety is of prime importance in every classroom.
- Describing the different steps of the procedure.

- Information correlated with the activity or text material.



- Questions leading to the attainment of the objectives.

**Analysis:**

1. Is the reaction between zinc and cupric sulfate solution exothermic? Why?
2. What evidence indicates that zinc has replaced the copper element in the compound cupric sulfate?
3. Write the equation of the reaction taking place.
4. Name the ions present in solution before and after reaction.
5. Is electron transfer involved in this reaction? If yes, name the oxidant and the reductant.

**Conclusion:**

When electrons are exchanged between the metal (Zn) which is in direct contact with the cation of  $\text{Cu}^{2+}$  in aqueous solution, energy is released in the form of heat.

**Remark:**

When these reactants are arranged so that they do not touch each other, energy is released in the form of electricity (direct current) rather than heat.

### Conclusion

- Provides the concepts and factual knowledge to be mastered for that section.



**Procedure:**

- Put 10 mL of hexane and 10 mL of benzene in two separate 150 mL beakers.
- Add 3 mL of the basic potassium permanganate solution to the hexane and 3 mL to the benzene.
- Stir both solutions thoroughly.

**Analysis:**

1. What do you observe in each beaker?
2. What do you conclude?

**Using bromine solution:**

When bromine solution is added to an alkane, no reaction occurs, the orange color of bromine solution does not change. Whereas, when added to an alkene, a rapid decoloration occurs, indicating that a reaction has occurred, due to the presence of a double bond.

**Using tincture of iodine solution:**

Molecules of unsaturated hydrocarbons are found in many compounds that occur in all parts of plants. They are called essential oils. For example, limonene (a polycyclic  $\alpha$ -terpene) is found in lemon and orange essential oils. These essential oils are of great commercial importance in the perfume and flavoring industries. Many foods such as vegetable oils may contain one or more double bonds. To detect the presence of double bonds, unsaturated iodine solution can be used.

**Activity 3:**

Compare the different amounts of unsaturation in vegetable oils (or same-solid fats).

**Materials:**

- 2 (100 mL) beakers
- Dropper
- Corn oil and sunflower oil (or margarine)
- Tincture of iodine solution
- Balance

**Glossary:**

Poly means many.



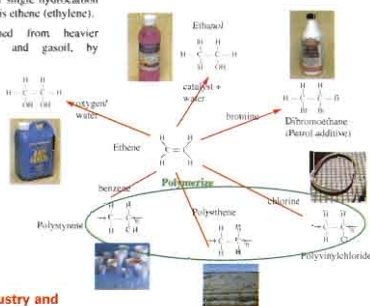
## ALKENES AS RAW MATERIALS

The petrochemical industry uses vast quantities of ethene and propene as units for building larger organic molecules.

## Plastics from Oil Fractions

The most important single hydrocarbon for making plastics is ethene (ethylene).

Ethene is obtained from heavier fractions, naphtha and gasoil, by cracking.



## Chemical Industry and Everyday Life

The chemical industry takes raw materials – petroleum, gas, coal, minerals, air, water – and makes a wide range of chemicals from them. These chemicals are used to make many products.

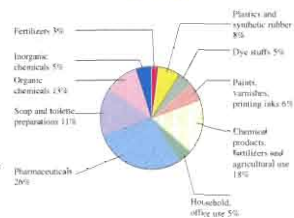


Fig. 58 The circle graph (pie chart) shows the range of products made by chemical industry and their relative % by value.

- Connecting the applications of chemistry to industry.

## Questions and Exercises

## I-Write the word(s) that best complete(s) each statement.

- Coal occurs in different ..... depending on the ..... process of the deposit.
- Although coal is used as a source of raw material, yet it is mainly used as .....
- The majority of molecules of which petroleum is composed are open ..... and ..... alkanes.
- During addition polymerization, individual ..... join together to form ..... polymer.
- Cracking uses catalysts of high ..... in the absence of ..... to break down ..... molecules into .....

## II- Answer True or False. If the statement is false change the underlined word(s) to make the statement true.

- A synthetic polymer is an inorganic large molecule composed of only one structural unit.
- Copolymers are polymers that are made up by repeating one monomer unit.
- Petroleum fractions are group of hydrocarbons that have different boiling points.
- Thermosetting polymers can be heated and molded many times.
- The temperature of fractionating tower in a refinery is controlled so that it is colder at the top and hotter at the base.

## III- Answer the following questions:

- Why is crude oil fractionally distilled?
  - What is the main difference between cracking and fractional distillation?
  - The following list shows the uses to which plastics are put:
- |                                    |     |                        |     |
|------------------------------------|-----|------------------------|-----|
| Packaging                          | 36% | Transport industry     | 5%  |
| Building industry                  | 21% | Furniture industry     | 5%  |
| Electrical and electronic industry | 10% | Toys and leisure items | 4%  |
|                                    |     | Other uses             | 19% |
- Draw a circle graph (pie chart) to summarize these uses.

- Provides the fundamental points and key concepts by schematic synthesis.

## Insights

## Fuel Cells

Cells in which the reactants are continuously supplied to the cell are called fuel cells.

One type of fuel cell, called hydrogen-oxygen cell, uses hydrogen as the fuel and oxygen as the oxidizer and produces water as a product. Fuel cells are very efficient (about 90%) – at converting chemical energy into electric energy.

The reactions involved in this cell are:

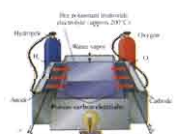
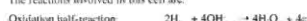


Fig. 26 The common hydrogen-oxygen fuel cell (used in the space shuttle). Multiple hydrogen-oxygen cells connected in series were used in Apollo and Gemini spacecrafts, where they provided both electricity and drinking water to the astronauts.

## Batteries and Toxic Metals

Batteries contain electrodes and electrolytes, which consist of different kinds of chemically active materials. These materials include compounds of toxic metals such as lead, cadmium, and mercury. Although these metals are useful, they pose environmental and health problems. If batteries are disposed of improperly, their toxic metals can leak into the environment. Once in the environment, these metals can contaminate the soil or the water. Toxic metals in the soil can be absorbed by plants and, when eaten, passed along to people and animals. Similarly, in water the toxic metals can be absorbed by fish and passed on to people and animals.

These toxic metals have the ability to disrupt the normal body chemicals such as enzymes. This is why these compounds pose a threat to the environment and to humans.



Fig. 25 Cells and batteries have many uses. If they are disposed of improperly, they cause environmental problem.

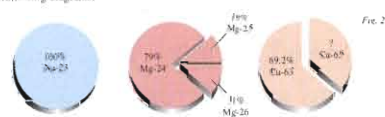
- Special science rubrics to show the role and importance of chemistry in everyday-life.

## Questions and Exercises

## I-Write the word(s) that best complete(s) each statement.

- Coal occurs in different ..... depending on the ..... process of the deposit.
- Although coal is used as a source of raw material, yet it is mainly used as .....
- The majority of molecules of which petroleum is composed are open ..... and ..... alkanes.
- During addition polymerization, individual ..... join together to form ..... polymer.
- Cracking uses catalysts of high ..... in the absence of ..... to break down ..... molecules into .....

- The composition of naturally occurring samples of the elements sodium, magnesium and copper, respectively are represented by the following diagrams.



What information can you draw from each circle graph (pie-chart)?

- Label the cathode and the anode in the diagram (Fig. 33) Identify the half-reaction taking place in each half-cell.

- Arrange the following in order of decreasing oxidation number of the nitrogen atom.

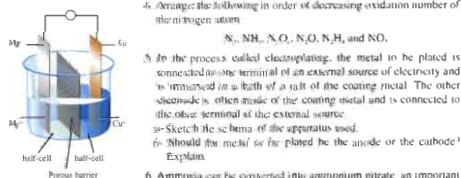


- In the process called electroplating, the metal to be plated is connected to one terminal of an external source of electricity and is immersed in a bath of a salt of the coating metal. The other electrode, is often made of the coating metal and is connected to the other terminal of the external source.

- Sketch the scheme of the apparatus used.

- Should the metal to be plated be the anode or the cathode? Explain.

- Ammonia can be converted into ammonium nitrate, an important

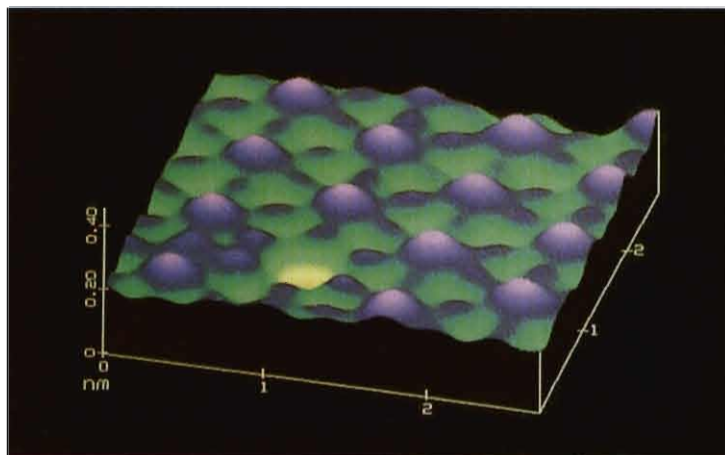


- Testing knowledge and evaluating the development of skills.



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