Basic Education - Grade Eight

Chemistry

National Textbook
Center for Educational Research and Development
New Curricula

Republic of Lebanon

Ministry of Education and Higher Education

CHEMISTRY

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Together We Build Through Education!

The Center for Educational Research and Development (CERD) has embarked on an extensive workshop for assessing and developing the educational framework and curricula which have been placed into effect more than three years ago. With full realization of the fact that the educational cycle must continue normally through its components, and until the development process attains its aspired objectives, we are placing in the hands of students, teachers and directors of public schools, this corrected version of textbooks issued by CERD as part of the National Textbook Series.

This version is an interim stage incorporating the corrected typographical and linguistic errors discovered by CERD specialists as well as teachers and students through their daily dealings with the books. The process of assessment and development of the framework and curricula will take into consideration all the comments that have been made, or will be made, in this regard.

It is expected that once the curricula are developed and aligned with the general and specific objectives set for them, the textbooks will be realigned with the new curricular and framework requirements, including tying the content of a course to the number of teaching hours set for it during the school year, taking into consideration vertical alignment within the same course as well as the horizontal alignment with the rest of the courses.

I take this opportunity to invite all school administrators, teachers and students and all officials concerned in public and private schools alike, to promptly send their comments on these curricula and books as their contribution to enrichment of this momentous national process.

This workshop, which was launched under the kind sponsorship of His Excellency the Minister of Education and Higher Education in implementation of Decree No. 10227 embodying the educational curricula and their objectives, fits in with CERD's proclaimed new motto "Together We Build Through Education".

It is our earnest desire to see this national, all-inclusive workshop attracting the greatest amount of interest and participation to define the safest and soundest educational options that directly affect our children, as we vow to continually modernize education and develop its ways and means to keep abreast of modern developments and progress in science and technology.

Dr. Leila MALEEHA
President CERD

Introduction

In conformity with the objectives of the new curricula, this eigth 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 (resources, tips on where to find information and how to use 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.

Features of this book

This book is divided into four units. The first unit includes two chapters, while the three other units include three chapters each.
Each unit starts with an overview of the subject matter to be covered.

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 Review provides the key concepts and main ideas of the chapter.

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

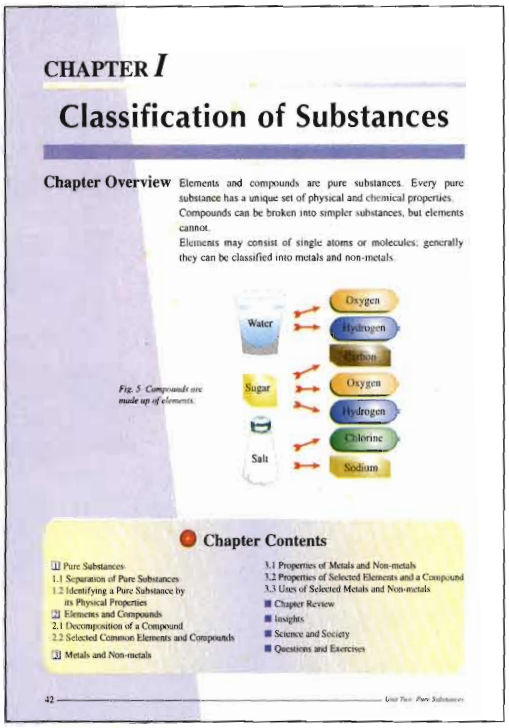
Science and Society includes real-life applications, help students relate the chemistry concepts to their everyday-life.

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.

All comments and suggestions are welcome.

The Authors

The eleven chapters of this book are all organized in the same format. In each chapter, distinguishing symbols are assigned to the different parts: Activity (materials, procedure, analysis and conclusion), Glossary, Remark, Safety, Chapter Review, Insights, Science and Society, Questions and Exercises.



CHAPTER *I*

Classification of Substances

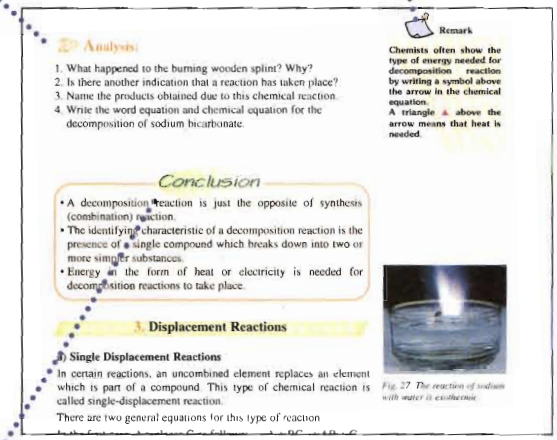
Chapter Overview Elements and compounds are pure substances. Every pure substance has a unique set of physical and chemical properties. Compounds can be broken into simpler substances, but elements cannot.
Elements may consist of single atoms or molecules; generally they can be classified into metals and non-metals.

Fig. 5 Compounds are made up of elements.

Chapter Contents

- Information correlated with the activity or text material.

- Questions leading to the attainment of the objectives.



Analysis:

1. What happened to the burning wooden splint? Why?
2. Is there another indication that a reaction has taken place?
3. Name the products obtained due to this chemical reaction.
4. Write the word equation and chemical equation for the decomposition of sodium bicarbonate.

Remark

Chemists often show the type of energy needed for decomposition reaction by writing a symbol above the arrow in the chemical equation.
A triangle ▲ above the arrow means that heat is needed.

Conclusion

- A decomposition reaction is just the opposite of synthesis (combination) reaction.
- The identifying characteristic of a decomposition reaction is the presence of a single compound which breaks down into two or more simpler substances.
- Energy in the form of heat or electricity is needed for decomposition reactions to take place.

3. Displacement Reactions

a) Single Displacement Reactions

In certain reactions, an uncombined element replaces an element which is part of a compound. This type of chemical reaction is called single-displacement reaction.
There are two general equations for this type of reaction

Fig. 27 The reaction of sodium with water is exothermic.

Conclusion

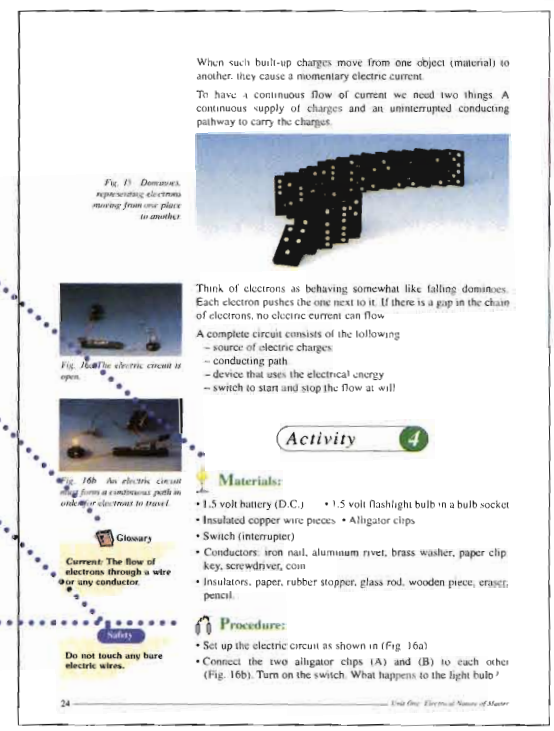
- Provides the concepts and factual knowledge to be mastered for that section.

- 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.



When such built-up charges move from one object (material) to another, they cause a momentary electric current.

To have a continuous flow of current we need two things. A continuous supply of charges and an uninterrupted conducting pathway to carry the charges.

Fig. 15 Dominoes representing electrons moving from one place to another.

Think of electrons as behaving somewhat like falling dominoes. Each electron pushes the one next to it. If there is a gap in the chain of electrons, no electric current can flow.

A complete circuit consists of the following
– source of electric charges
– conducting path
– device that uses the electrical energy
– switch to start and stop the flow at will

Fig. 16a The electric circuit is open.

Fig. 16b An electric circuit must form a continuous path in order for electrons to travel.

Activity 4

Materials:

- 1.5 volt battery (D.C.)
- 1.5 volt flashlight bulb in a bulb socket
- Insulated copper wire pieces
- Alligator clips
- Switch (interrupter)
- Conductors: iron nail, aluminum rivet, brass washer, paper clip key, screwdriver, coin
- Insulators: paper, rubber stopper, glass rod, wooden piece, eraser, pencil

Glossary

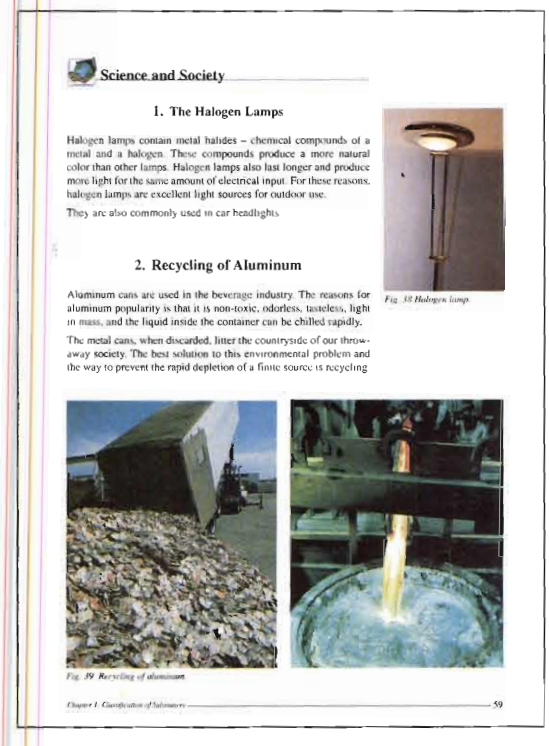
Current: The flow of electrons through a wire or any conductor.

Safety

Do not touch any bare electric wires.

Procedure:

- Set up the electric circuit as shown in (Fig. 16a).
- Connect the two alligator clips (A) and (B) to each other (Fig. 16b). Turn on the switch. What happens to the light bulb?



Science and Society

1. The Halogen Lamps

Halogen lamps contain metal halides – chemical compounds of a metal and a halogen. These compounds produce a more natural color than other lamps. Halogen lamps also last longer and produce more light for the same amount of electrical input. For these reasons, halogen lamps are excellent light sources for outdoor use.

They are also commonly used in car headlights.

Fig. 18 Halogen lamp.

2. Recycling of Aluminum

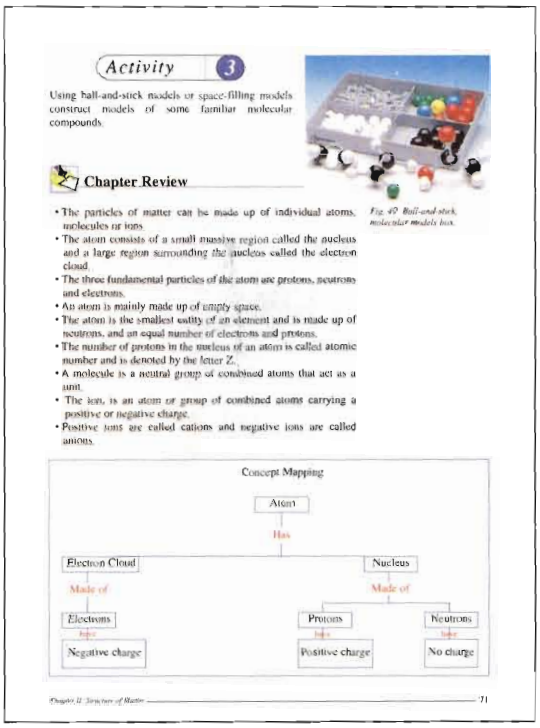
Aluminum cans are used in the beverage industry. The reasons for aluminum popularity is that it is non-toxic, odorless, tasteless, light in mass, and the liquid inside the container can be chilled rapidly.

The metal cans, when discarded, litter the countryside of our throw-away society. The best solution to this environmental problem and the way to prevent the rapid depletion of a finite source is recycling

Fig. 19 Recycling of aluminum.

Chapter 1: Classification of Substances 59

- Connecting the applications of chemistry to industry life.



Activity 3

Using ball-and-stick models or space-filling models construct models of some familiar molecular compounds.

Fig. 49 Ball-and-stick molecular models box.

Chapter Review

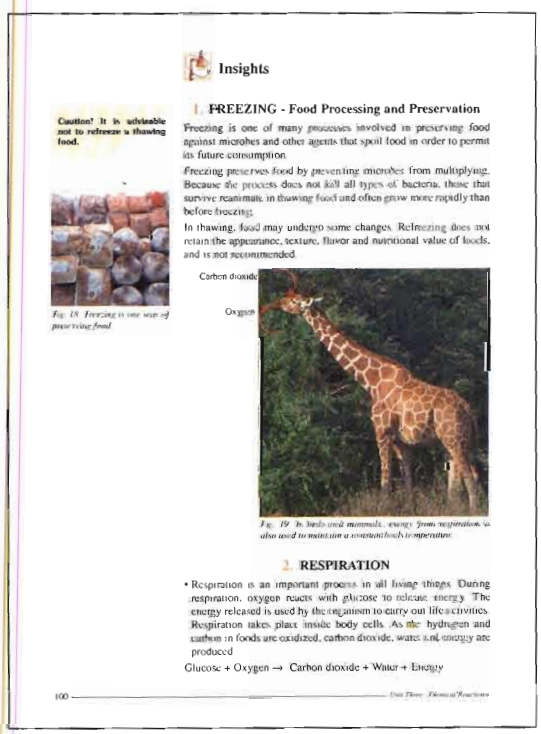
- The particles of matter can be made up of individual atoms, molecules or ions.
- The atom consists of a small massive region called the nucleus and a large region surrounding the nucleus called the electron cloud.
- The three fundamental particles of the atom are protons, neutrons and electrons.
- An atom is mainly made up of empty space.
- The atom is the smallest entity of an element and is made up of neutrons, and an equal number of electrons and protons.
- The number of protons in the nucleus of an atom is called atomic number and is denoted by the letter Z.
- A molecule is a neutral group of combined atoms that act as a unit.
- The ion, is an atom or group of combined atoms carrying a positive or negative charge.
- Positive ions are called cations and negative ions are called anions.

Concept Mapping

Atom
Has
Electron Cloud | Nucleus
Made of | Made of
Electrons | Protons | Neutrons
have | have | have
Negative charge | Positive charge | No charge

Chapter II: Structure of Matter 71

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



Insights

Caution! It is advisable not to refreeze a thawing food.

Fig. 18 Freezing is one way of preserving food.

1. FREEZING - Food Processing and Preservation

Freezing is one of many processes involved in preserving food against microbes and other agents that spoil food in order to permit its future consumption.

Freezing preserves food by preventing microbes from multiplying. Because the process does not kill all types of bacteria, those that survive reanimate in thawing food and often grow more rapidly than before freezing.

In thawing, food may undergo some changes. Refreezing does not retain the appearance, texture, flavor and nutritional value of foods, and is not recommended.

Carbon dioxide

Oxygen

Fig. 19 In birds and mammals, energy from respiration is also used to maintain a constant body temperature.

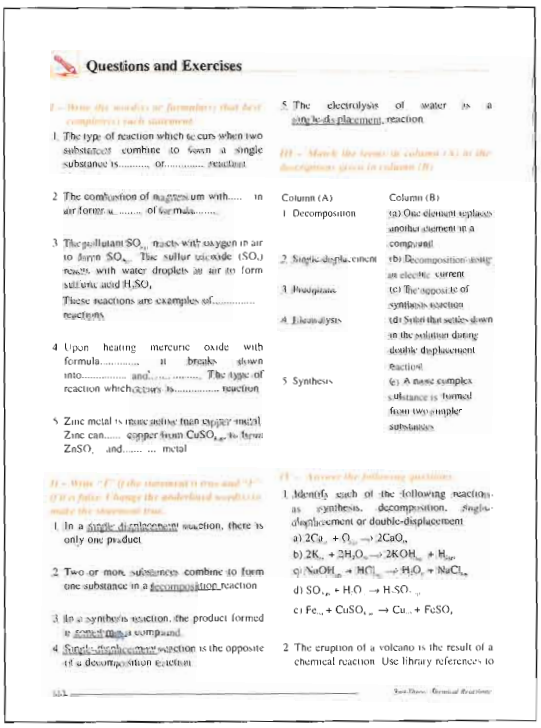
2. RESPIRATION

- Respiration is an important process in all living things. During respiration, oxygen reacts with glucose to release energy. The energy released is used by the organism to carry out life activities. Respiration takes place inside body cells. As the hydrogen and carbon in foods are oxidized, carbon dioxide, water and energy are produced.

Glucose + Oxygen → Carbon dioxide + Water + Energy

100 Unit Three: Chemical Reactions

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



Questions and Exercises

I – Write the word(s) or formula(s) that best completes(s) each statement.

1. The type of reaction which occurs when two substances combine to form a single substance is....., or..... reaction.

2. The combustion of magnesium with..... in air forms a..... of formula.....

3. The pollutant $SO_{2(g)}$ reacts with oxygen in air to form $SO_{3(g)}$. The sulfur trioxide (SO_3) reacts with water droplets in air to form sulfuric acid H_2SO_4. These reactions are examples of..... reactions.

4. Upon heating mercuric oxide with formula..... it breaks down into..... and..... The type of reaction which occurs is..... reaction.

5. Zinc metal is more active than copper metal. Zinc can..... copper from $CuSO_{4(aq)}$ to form $ZnSO_4$ and..... metal.

5. The electrolysis of water is a/an decomposition/displacement reaction.

III – Match the terms in column (A) to the descriptions given in column (B).

Column (A)	Column (B)
1. Decomposition	(a) One element replaces another element in a compound.
2. Single-displacement	(b) Decomposition using an electric current.
3. Precipitate	(c) The opposite of synthesis reaction.
4. Electrolysis	(d) Solid that settles down in the solution during double displacement reaction.
5. Synthesis	(e) A more complex substance is formed from two simpler substances.

II – Write "T" if the statement is true and "F" if it is false. Change the underlined word(s) to make the statement true.

1. In a single displacement reaction, there is only one product.

2. Two or more substances combine to form one substance in a decomposition reaction.

3. In a synthesis reaction, the product formed is called/as a compound.

4. Single-displacement reaction is the opposite of a decomposition reaction.

IV – Answer the following questions.

1. Identify each of the following reactions as synthesis, decomposition, single-displacement or double-displacement.
   a) $2Ca_{(s)} + O_{2(g)} \rightarrow 2CaO_{(s)}$
   b) $2K_{(s)} + 2H_2O_{(l)} \rightarrow 2KOH_{(aq)} + H_{2(g)}$
   c) $NaOH_{(aq)} + HCl_{(aq)} \rightarrow H_2O_{(l)} + NaCl_{(aq)}$
   d) $SO_{3(g)} + H_2O \rightarrow H_2SO_4$
   e) $Fe_{(s)} + CuSO_{4(aq)} \rightarrow Cu_{(s)} + FeSO_4$

2. The eruption of a volcano is the result of a chemical reaction. Use library references to

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- Testing knowledge and evaluating the development of skills.

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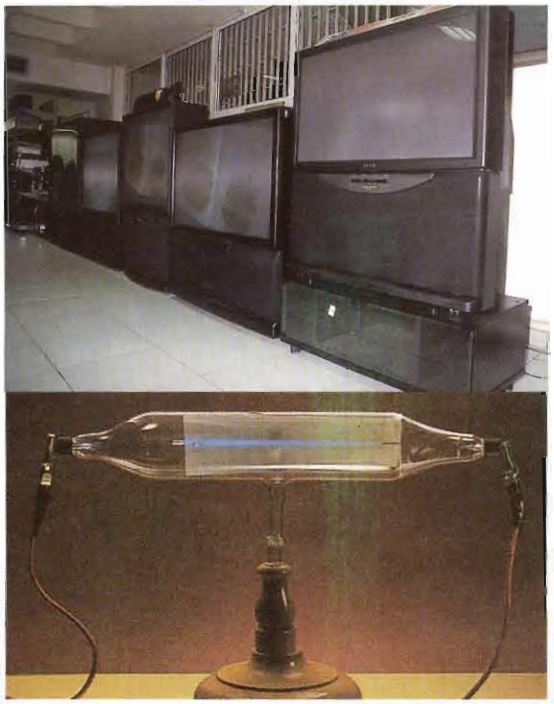
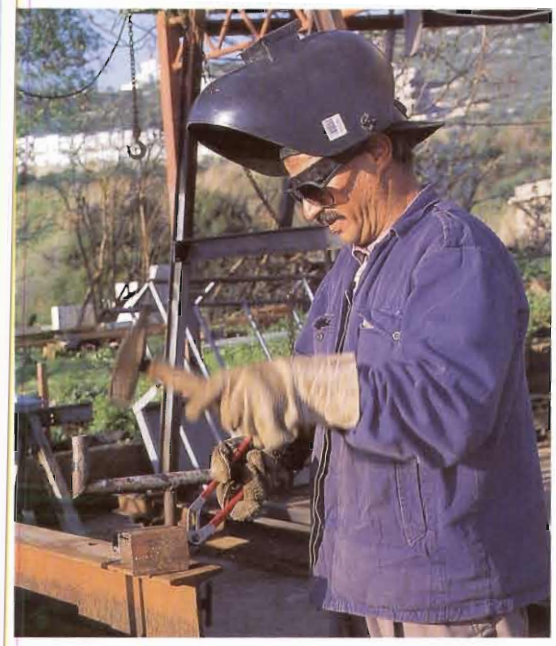
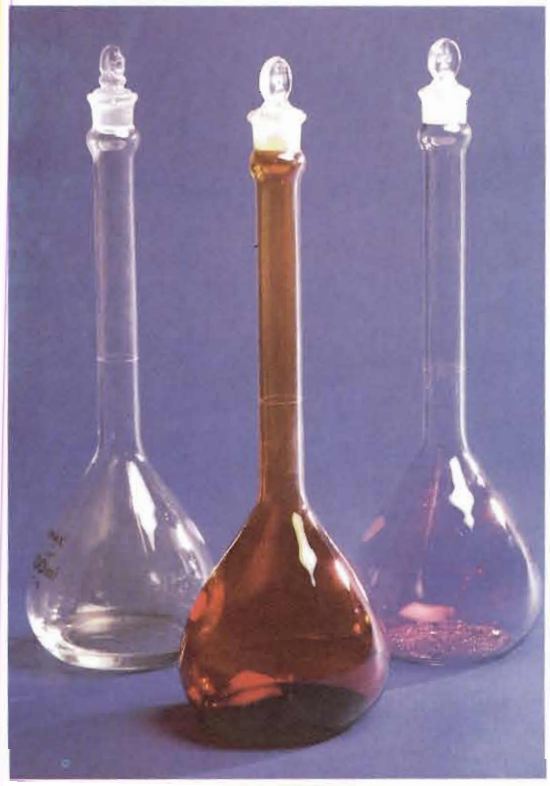


Unit Two: Pure Substances





Unit Three: Chemical Reactions

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