Chemistry English in Context
Course Book II

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Bucureşti

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FOREWORD

Alina Gălbează (Buzarna-Tihenea) is Lecturer with the Department of Modern Languages for Specific Purposes within the Faculty of Letters, "Ovidius" University of Constanta. Aside from her teaching activity, she also carries out research in linguistics, literary studies and teaching methodology, with a focus on English for specific purposes (ESP).

Chemistry English in Context. Course Book II is part of her research in the field of ESP. It is the second volume of a course material designed for first- and second-year chemistry students who have an intermediate or upper-intermediate level of knowledge of English. The book comes as the logical sequel of the first volume, adding more topics and more grammatical complexity. It can also be used independently, by professionals in the chemical field who use English in their research and work.

The course book was conceived as a tool to acquire, develop and test the learner's knowledge of some of the more common terms and grammatical structures encountered by students and specialists in the chemical field. It combines authentic materials with a wide array of exercises, in view of stimulating the creativity, fluency, grammar and lexical precision of the learners.

Chemistry English in Context. Course Book II consists of eight units. The first seven deal with different aspects of chemistry, while the eighth is a revision unit. Within the units, the exercises are increasingly specific, starting with the introduction of the topic, through brainstorming, then

developing the terminology and grammar, fixing this knowledge and then challenging the learners to use it in the form of structured discussions and essays.

The typology of the exercises is diverse, adapted to the degree of richness of the topic and to the type of grammar taught. The exercises start with a high degree of abstraction, dealing with the theoretical side of the topic, after which they become more specific, dealing with the concrete, applied aspect of the topic. Each unit is followed by a Grammar Snapshot, consisting in a synthesis of the grammatical aspects encountered in that unit.

The course book is a practical guide to the world of chemistry, which it explores in a learner-friendly way.

Assistant Professor Lavinia Istratie-Macarov

UNIT 1

THE PERIODIC TABLE OF ELEMENTS

1. What do you know about the Periodic Table? Write as many ideas as you can in 2 minutes. Work in groups.

2. Read the following text and answer the questions:

The periodic table

"The periodic table is a tabular arrangement of the chemical elements, ordered by their atomic number (number of protons in the nucleus), electron configurations, and recurring chemical properties. In general, within one row (period) the elements are metals on the left-hand side, and non-metals on the right-hand side.

The rows of the table are called periods; the columns are called groups. Six groups (columns) have names as well as numbers: for example, group 17 elements are the halogens; and group 18, the noble gases. The periodic table can be used to derive relationships between the properties of the elements, and predict the properties of new elements yet to be discovered or synthesized. The periodic table provides a useful framework for analyzing chemical behavior, and is widely used in chemistry and other sciences.

Dmitri Mendeleev published in 1869 the first widely recognized periodic table. He developed his table to illustrate periodic trends in the properties of the then-known elements. Mendeleev also predicted some properties of then-unknown elements that would be expected to fill gaps in this table. Most of his predictions were proved correct when the elements in question were subsequently discovered. Mendeleev's periodic table has since been expanded and refined with the discovery or synthesis of further new elements and the development of new theoretical models to explain chemical behavior.

The first 94 elements exist naturally, although some are found only in trace amounts and were synthesized in laboratories before being found in nature. Elements with atomic numbers from 95 to 118 have only been synthesized in laboratories. It has been shown that elements 95 to 100 once occurred in nature but currently do not. Synthesis of elements having higher atomic numbers is being pursued".

(Source: "Periodic Table" (24th July 2021). *Wikipedia, the free encyclopedia*. [Online] https://en.wikipedia.org/wiki/Periodic_table [Accessed 25th July 2021])

A. Which are the words whose meaning you do not know?

B. What is the meaning of the words/ expressions underlined in the text? Explain them in English and use them in sentences of your own.

C. What are the synonyms of the following words: *ingenious, location, recurring, to refine, to emphasize, unique?*

D. Match the following synonyms:

1. chemical element	a. period
2. row	b. group
3. column	c. element

E. Who published the first widely recognized periodic table? When?

F. Chemical elements are arranged in the Periodic Table according to:

a. atomic number;
b. proton configuration;
c. number of protons in the nucleus;
d. number of electrons in the nucleus;
e. electron configurations;
f. recurring chemical properties.

G. What is the Periodic Table used for?

H. Has the Periodic Table changed since its publication? Explain.

I. How many elements exist naturally?

J. The following elements have been synthesized in laboratories:

a. elements with atomic numbers 95 and 118;
b. elements with atomic numbers between 95 and 118;
c. elements with atomic numbers from 95 to 100.

K. The following elements once occurred in nature but currently do not:

a. elements with atomic numbers 95 and 100;
b. elements with atomic numbers between 95 and 118;
c. elements with atomic numbers from 95 to 100.

L. What is the difference between the following words: *devise, develop, invent, discover***? Are they synonyms? Make sentences using these words**

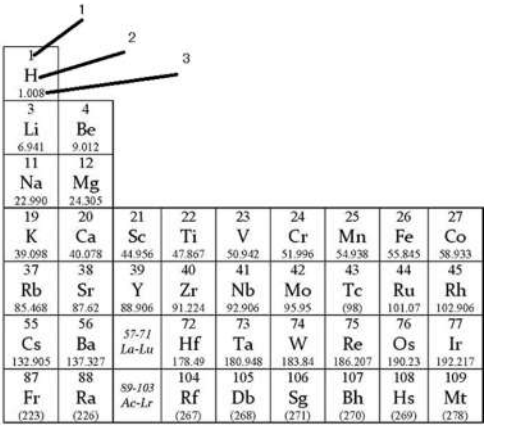
3. Fill in the blanks with the following words: *row, isotopes, chemical properties, atomic number, electrons, protons, columns, element.*

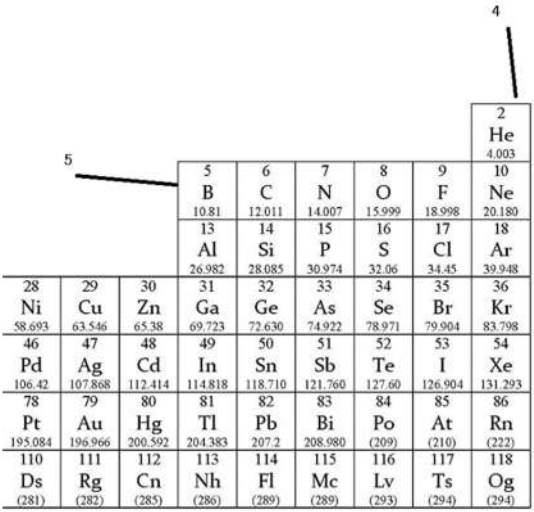
"Each chemical element has a unique (1)..... representing the number of protons in its nucleus. Most elements have differing numbers of neutrons among different atoms, with these variants being referred to as (2)..... . For example, carbon has three naturally occurring isotopes: all of its atoms have six (3)..... and most have six neutrons as well, but about one per cent have seven neutrons, and a very small fraction have eight neutrons. Isotopes are never separated in the periodic table; they are always grouped together under a single (4).....

In the standard periodic table, the elements are listed in order of increasing atomic number. A new (5)..... (*period*) is started when a new electron shell has its first electron. (6)..... (*groups*) are determined by the electron configuration of the atom; elements with the same number of (7)..... in a particular subshell fall into the same columns. Elements with similar (8)..... generally fall into the same group in the periodic table. Thus, it is relatively easy to predict the chemical properties of an element if one knows the properties of the elements around it. As of 2016, the periodic table has 118 confirmed elements, comprising elements 1 (hydrogen) to 118 (ununoctium)".

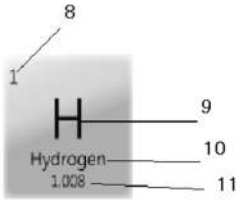
(Source: "Periodic Table" (24th July 2021). *Wikipedia, the free encyclopedia*. [Online] https://en.wikipedia.org/wiki/Periodic_table [Accessed 25th July 2021])

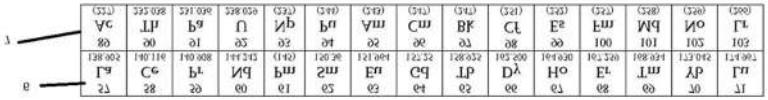
1		**5**	
2		**6**	
3		**7**	
4		**8**	


1
2
3
1
H
1.008
3
Li
6.941
4
Be
9.012
11
Na
22.990
12
Mg
24.305
19 K 39.098
20 Ca 40.078
21 Sc 44.956
22 Ti 47.867
23 V 50.942
24 Cr 51.996
25 Mn 54.938
26 Fe 55.845
27 Co 58.933
37 Rb 85.468
38 Sr 87.62
39 Y 88.906
40 Zr 91.224
41 Nb 92.906
42 Mo 95.95
43 Tc (98)
44 Ru 101.07
45 Rh 102.906
55 Cs 132.905
56 Ba 137.327
57-71 La-Lu
72 Hf 178.49
73 Ta 180.948
74 W 183.84
75 Re 186.207
76 Os 190.23
77 Ir 192.217
87 Fr (223)
88 Ra (226)
89-103 Ac-Lr
104 Rf (267)
105 Db (268)
106 Sg (271)
107 Bh (270)
108 Hs (269)
109 Mt (278)


4
2
He
4.003
5
5
B
10.81
6
C
12.011
7
N
14.007
8
O
15.999
9
F
18.998
10
Ne
20.180
13
Al
26.982
14
Si
28.085
15
P
30.974
16
S
32.06
17
Cl
34.45
18
Ar
39.948
28 Ni 58.693
29 Cu 63.546
30 Zn 65.38
31 Ga 69.723
32 Ge 72.630
33 As 74.922
34 Se 78.971
35 Br 79.904
36 Kr 83.798
46 Pd 106.42
47 Ag 107.868
48 Cd 112.414
49 In 114.818
50 Sn 118.710
51 Sb 121.760
52 Te 127.60
53 I 126.904
54 Xe 131.293
78 Pt 195.084
79 Au 196.966
80 Hg 200.592
81 Tl 204.383
82 Pb 207.2
83 Bi 208.980
84 Po (209)
85 At (210)
86 Rn (222)
110 Ds (281)
111 Rg (282)
112 Cn (285)
113 Nh (286)
114 Fl (289)
115 Mc (289)
116 Lv (293)
117 Ts (294)
118 Og (294)

4. Look at the following pictures and fill in with the following words: *symbol, group, mass, column, atomic number, row, period, lanthanides, name, actinides*. **Some of the words can be used twice.**





1		**7**	
2		**8**	
3		**9**	
4		**10**	
5		**11**	
6			

Give examples of: *noble gas, alkali metal, (alkaline) earth metal, transition metal, semimetal, nonmetal.*

5. Read the following text and decide whether the following statements are TRUE, FALSE or NOT MENTIONED in the text.

Metals, metalloids and nonmetals

"According to their shared physical and chemical properties, the elements can be classified into the major categories of metals, metalloids and nonmetals. Metals are generally shiny, highly conducting solids that form alloys with one another and salt-like ionic compounds with nonmetals (other than the noble gases). The majority of nonmetals are colored or colorless insulating gases. In between metals and nonmetals are metalloids, which have intermediate or mixed properties.

Metal and nonmetals can be further classified into subcategories that show a gradation from metallic to non-metallic properties, when going left to right in the rows. The metals are subdivided into the highly reactive alkali metals, through the less reactive alkaline earth metals, lanthanides and actinides, via the archetypal transition metals, and ending in the physically and chemically weak post-transition metals. The nonmetals are simply subdivided into the polyatomic nonmetals, which, being nearest to the metalloids, show some incipient metallic character; the diatomic nonmetals, which are essentially nonmetallic; and the monatomic noble gases, which are nonmetallic and almost completely inert. Specialized groupings such as the refractory metals and the noble metals are also known and occasionally denoted.

Placing the elements into categories and subcategories based on shared properties is imperfect. There is a spectrum of properties within each category and it is not hard to find overlaps at the boundaries, as is the case with most classification schemes. Beryllium, for example, is classified as an alkaline earth metal although its amphoteric chemistry

and tendency to mostly form covalent compounds are both attributes of a chemically weak or post transition metal. Other classification schemes are possible such as the division of the elements into mineralogical occurrence categories, or crystalline structures".

(Source: "Periodic Table" (24th July 2021). *Wikipedia, the free encyclopedia*. [Online] https://en.wikipedia.org/wiki/Periodic_table [Accessed 25th July 2021])

a. The elements can be classified into the following main categories: metals, metalloids, and nonmetals, in terms of their different physical and chemical properties.

b. Metals are highly conducting solids and form alloys with one another.

c. Most nonmetals are colorless gases.

d. Metalloids are situated between metals and nonmetals, as they have intermediate or mixed properties.

e. Metal and nonmetals can be classified into subcategories, showing gradation from metallic to non-metallic properties, when going right to left in the rows.

f. Metals are subdivided into highly reactive alkali metals, lanthanides, and actinides.

g. Mass is different from weight.

h. Nonmetals are subdivided into polyatomic non-metals, diatomic nonmetals, and monatomic noble gases.

i. Polyatomic nonmetals are nearest to metalloids and have an incipient metallic nature.

j. Diatomic nonmetals are essentially nonmetallic and monatomic noble gases are nonmetallic and extremely dynamic.

k. Weight depends on gravitation, while mass remains the same, no matter the gravitation.

l. Placing the elements into categories and subcategories based on shared properties is imperfect because there are overlaps at the boundaries.

m. Beryllium is an alkaline earth metal although its amphoteric chemistry and tendency to mostly form covalent compounds are both attributes of a chemically weak or post transition metal.

n. Our weight on Earth is different from our weight on the Moon, but our mass remains the same.

o. The division of the elements into mineralogical occurrence categories or crystalline structures is another possible classification scheme of chemical elements.

a		**d**		**g**		**j**		**m**	
b		**e**		**h**		**k**		**n**	
c		**f**		**i**		**l**		**o**	

6. Match the words in column A with the words in column B and make sentences:

A	B
1. periodic	a. shells
2. electron	b. configuration
3. alkali	c. atoms
4. neutral	d. trends

5. quantum	e. metals
6. recurring	f. theory
7. electron	g. gases
8. atomic	h. radii
9. periodic	i. pattern
10. noble	j. law

7. Give synonyms for the following words make sentences: *increase, decrease, period, provide, important, evidence, effective.*

8. Give antonyms for the following words make sentences: *predictable, explained, increasing, remove, similar, attraction, complete.*

9. Read the following paragraph and fill it in with the appropriate missing sentences. There are two extra sentences.

A. Thus, his patterns could not be dismissed.

B. He also noticed that there were plenty of exceptions to the emerging patterns.

C. However, this was not always so obvious.

D. Therefore, the others rejected the patterns.

E. There were plenty of skeptics and it took years to gain international acceptance.

F. On the contrary, he tried altering the measured property values to better fit the patterns!

G. He did this while traveling by train.

H. On the other hand, nobody rejected the patterns.

Seeing chemical elements arranged in the modern periodic table is as familiar as seeing a map of the world. (1) ……

The creator of the periodic table, Dmitri Mendeleev, in 1869 began collecting and sorting known properties of elements. (2) …… It felt like he was playing a game. He noticed that there were groups of elements that exhibited similar properties. (3) ……

Incredibly, he didn't give up! (4) …… He also predicted that certain elements must exist which didn't at the time – again, to get the patterns in his "game" to work out.

(5) ..... Nevertheless, the newly-discovered elements matched the ones that Mendeleev predicted. (6)..... In addition, some of the properties that he "fudged" were later recalculated and found to be much closer to his predictions.

(adapted from "Periodic Table of Elements". *National Library of Medicine*. [Online] https://pubchem.ncbi.nlm.nih.gov/periodic-table/ [Accessed 22nd July 2021])

1	2	3	4	5	6

10. Read the following paragraphs and arrange them in the correct order:

A. “Moreover, atomic weights found within a periodic table one might think are constant. The truth is that atomic weights have changed as a function of time. Since 1899 the IUPAC Commission on Isotopic Abundances and Atomic Weights (CIAAW) has been evaluating atomic weights and abundances”.

B. “Finally, IUPAC assigns collective names (lanthanoids and actinoids) and group numbering (1 to 18) and has investigated the membership of the group 3 elements”.

C. “While much of what is in the periodic table is stable and unlikely to change, the IUPAC organization is responsible for deciding what needs to be changed. They have created criteria for what constitutes the discovery of a new element”.

D. “In addition, any new element must be assigned a temporary name and symbol, and if validated, given an official name. Such was the case when IUPAC recently reviewed elements 113, 115, 117 and 118, and decided to give them official names and symbols”.

E. “The periodic table as we know it today is managed by the International Union of Pure and Applied Chemistry, or IUPAC”.

F. “For example, Carbon had an atomic weight of 12.00 in 1902 but today it is [12.0096, 12.0116]! Times sure have changed as the source of the sample will determine the value”.

(adapted from “Periodic Table of Elements”. *National Library of Medicine*. [Online] https://pubchem.ncbi.nlm.nih.gov/periodic-table/ [Accessed 22nd July 2021])