

Jarosław CHOJNACKI  
Anna DOŁĘGA  
Bogusław DRĘCZEWSKI

# **SELECTED TOPICS IN GENERAL AND INORGANIC CHEMISTRY**

(A textbook for chemistry 3.E12)

GDAŃSK 2012



PRZEWODNICZĄCY KOMITETU REDAKCYJNEGO  
WYDAWNICTWA POLITECHNIKI GDAŃSKIEJ  
*Janusz T. Cieśliński*

RECENZENT

*Jan F. Biernat*

PROJEKT OKŁADKI  
*Katarzyna Olszonowicz*

Wydanie II – 2005

Wydano za zgodą  
Rektora Politechniki Gdańskiej

Oferta wydawnicza Politechniki Gdańskiej jest dostępna pod adresem  
<http://www.pg.gda.pl/wydawnictwo/oferta>

© Copyright by Wydawnictwo Politechniki Gdańskiej  
Gdańsk 2012

Utwór nie może być powielany i rozpowszechniany, w jakiejkolwiek formie  
i w jakikolwiek sposób, bez pisemnej zgody wydawcy

ISBN 978-83-7348-458-0

## CONTENTS

Introduction .....	5
<b>PART A. BASIC CHEMICAL PRINCIPLES (<i>Anna Dołęga</i>) .....</b>	<b>7</b>
<b>1. CHEMICAL EQUATIONS .....</b>	<b>7</b>
Problems .....	13
Supplementary problems .....	14
<b>2. STOICHIOMETRY .....</b>	<b>16</b>
2.1. Atomic and molar masses. The mole .....	16
2.2. Calculations based on chemical formulas .....	17
2.3. Calculations based on chemical equations .....	21
2.4. Theoretical and actual yield of a chemical reaction .....	24
2.5. The limiting reactant .....	26
Problems .....	27
Supplementary problems .....	28
<b>3. SOLUTIONS .....</b>	<b>29</b>
3.1. Expressing concentrations .....	29
3.1.1. Mass percentage, ppm and ppb .....	29
3.1.2. Molar concentration (molarity of solution) .....	31
3.2. Converting concentrations. Dilution .....	32
3.3. Stoichiometry of reactions in solution .....	35
Problems .....	37
Supplementary problems .....	38
<b>PART B. ACID-BASE EQUILIBRIA (<i>Jarosław Chojnacki</i>) .....</b>	<b>39</b>
<b>4. ELECTROLYTES .....</b>	<b>39</b>
4.1. Introduction .....	39
4.2. Arrhenius theory of acids and bases .....	40
4.3. Brønsted theory of acidity .....	40
4.4. Self-ionization of water .....	41
4.5. Solutions of weak acids .....	44
4.6. Solutions of weak bases .....	45
4.7. Solutions containing weak and strong acids .....	46
4.8. Solutions containing weak and strong bases .....	47
Problems .....	48
Supplementary problems .....	49
<b>5. BUFFERS AND HYDROLYSIS .....</b>	<b>50</b>
5.1. Buffers .....	50
5.1.1. Buffers composed of a weak acid and its salt with a strong base .....	50
5.1.2. Buffers composed of a weak base and its salt with a strong acid .....	51
5.2. Hydrolysis .....	51
Problems .....	53
Additional Reading .....	54

PART C. QUALITATIVE ANALYSIS OF CATIONS ( <i>Bogusław Dręczewski</i> ) .....	55
6. INTRODUCTION. GENERAL DESCRIPTION OF ANALYTICAL GROUPS .....	55
7. SEPARATION AND IDENTIFICATION OF CATIONS IN MIXTURES .....	56
7.1. Testing for ammonium ions .....	56
7.2. Separation of cations into groups .....	56
7.3. Separation and identification of Group I cations – “silver” group .....	59
7.4. Separation and identification of Group II A cations – “copper” group .....	61
7.5. Separation and identification of Group III cations – “aluminum–nickel” group .....	65
7.6. Separation and identification of Group IV cations – “barium” group .....	70
7.7. Identification of Group V cations – “magnesium” group .....	72
Solutions of Problems .....	73
PRONUNCIATION GUIDE .....	77