

Bo Nilsson

# Exercises with Solutions in Radiation Physics

---

Managing Editor: Paulina Leśna-Szreter

Language Editor: Andrew Laister



DE GRUYTER  
OPEN

# Contents

Preface — VII

<b>1</b>	<b>Radiation Sources and Radioactive Decay — 1</b>
1.1	Definitions and Equations — 1
1.1.1	Radioactivity and Decay Equations — 1
1.1.2	Disintegration Schematics — 3
1.2	Exercises in Radiation Sources and Radioactive Decay — 7
1.3	Solutions in Radiation Sources and Radioactive Decay — 11
<b>2</b>	<b>Interaction of Ionizing Radiation with Matter — 28</b>
2.1	Definitions and Relations — 28
2.1.1	Radiometric Quantities — 28
2.1.2	Definition of Interaction Coefficients — 29
2.1.3	Interaction Processes — 35
2.2	Exercises in Interaction of Ionizing Radiation — 41
2.2.1	Charged Particles — 41
2.2.2	Photons — 44
2.3	Solutions in Interaction of Ionizing Radiation — 51
2.3.1	Charged Particles — 51
2.3.2	Photons — 60
<b>3</b>	<b>Detectors and Measurements — 91</b>
3.1	Definitions and Relations — 91
3.1.1	Counting Statistics — 91
3.1.2	Detector Properties — 93
3.2	Exercises in Detectors and Measurements — 98
3.2.1	Counting Statistics — 98
3.2.2	Detector Properties — 101
3.3	Solutions in Detectors and Measurements — 105
3.3.1	Counting Statistics — 105
3.3.2	Detector Properties — 118
<b>4</b>	<b>Radiation Dosimetry — 137</b>
4.1	Definitions and Relations — 137
4.1.1	Definitions of Important Dosimetric Quantities — 137
4.1.2	Radiation Equilibria — 142
4.1.3	Cavity Theories — 145
4.1.4	Ionization Chamber Dosimetry — 148
4.1.5	Calorimetric and Chemical Dosimeters — 150
4.2	Exercises in Dosimetry — 152

4.2.1	Definitions and Important Quantities	152
4.2.2	Radiation Equilibra	152
4.2.3	Cavity Theories	155
4.2.4	Ionization Chamber Dosimetry	157
4.2.5	Calorimetric and Chemical Dosimeters	158
4.3	Solutions in Dosimetry	159
4.3.1	Definitions and Important Quantities	159
4.3.2	Radiation Equilibra	161
4.3.3	Cavity Theories	168
4.3.4	Ionization Chamber Dosimetry	181
4.3.5	Calorimetric and Chemical Dosimeters	186
<b>5</b>	<b>Radiation Biology</b>	<b>190</b>
5.1	Definitions and Relations	190
5.2	Exercises in Radiation Biology	195
5.3	Solutions in Radiation Biology	197
<b>6</b>	<b>Radiation Protection and Health Physics</b>	<b>208</b>
6.1	Definitions and Equations	208
6.1.1	Dose concepts	208
6.1.2	Transport of radionuclides in the body	210
6.1.3	Radiation shielding calculations	211
6.2	Exercises in Radiation Protection	220
6.2.1	Radioecology	220
6.2.2	Point Radioactive Sources	223
6.2.3	Extended Radioactive Sources	225
6.3	Solutions in Radiation Protection	228
6.3.1	Radioecology	228
6.3.2	Point Radioactive Sources	242
6.3.3	Extended Radioactive Sources	250

**Bibliography** — 268

**Index** — 269