

Contents

<i>Foreword Wynne Davies</i>	<i>page</i> xiii
<i>Preface</i>	xv
<i>Acknowledgements</i>	xvii

SECTION 1 – PHYSICS

Part 1a Gases

1. Boyle’s law	1
2. Charles’ law	3
3. Gay-Lussac’s law (third gas law)	5
4. Avogadro’s equation	7
5. Universal gas equation	9
6. Dalton’s law of partial pressures	11
7. Henry’s law	13
8. Graham’s law of diffusion	15

Part 1b Pressure and flow

1. Pressure and force	17
2. Hagen–Poiseuille equation (and laminar flow)	19
3. Reynold’s number (and turbulent flow)	21
4. Laplace’s law and tension	24
5. Bernoulli equation and Venturi effect	26

Part 1c Electricity

1. Ohm's law, voltage, current and resistance	28
2. Capacitance and capacitors	31
3. Inductance and inductors	33
4. Work and power	35
5. Transformers	37
6. Electrical charge	39

Part 1d Other

1. Doppler equation and effect	41
2. Beer–Lambert law	43
3. Relative humidity	45
4. Natural frequency	46
5. Wave equation and ultrasound	48

SECTION 2 – PHARMACOLOGY

Part 2a Pharmacokinetics

1. Bioavailability	50
2. Volume of distribution	53
3. Clearance	55
4. Hepatic clearance	57
5. Concentration and elimination	59
6. Plasma concentration and compartment models	61
7. Loading dose and maintenance dose	63
8. Exponential function and rate constant	65
9. Half-life and context-sensitive half-life	68
10. Time constant	71

11. Rates of reaction	73
12. Michaelis–Menten equation	75

Part 2b Pharmacodynamics

1. Drug–receptor dissociation constant and affinity	77
2. Therapeutic index	79

SECTION 3 – PHYSIOLOGY

Part 3a Cardiovascular

1. Cardiac output and cardiac index	81
2. Stroke volume	83
3. Ventricular stroke work and index	85
4. Ejection fraction and fractional area change	87
5. Coronary perfusion pressure and coronary blood flow	89
6. Bazett’s formula – QT interval corrected	91
7. The Fick principle – cardiac output measurement	92
8. The Fick equation – oxygen uptake measurement	94
9. Mean arterial pressure	96
10. Venous return	98
11. Total blood volume	100
12. Systemic vascular resistance	102
13. Uterine blood flow	104
14. Stewart–Hamilton equation	106
15. Oxygen delivery	108
16. Oxygen extraction ratio	110
17. Oxygen content equation	112
18. The dilution principle – measurement of fluid compartment volume	114

Part 3b Respiratory

1. Diffusing capacity	115
2. Compliance	117
3. Bohr equation	119
4. Alveolar ventilation equation	121
5. Alveolar gas equation	123
6. Helium dilution technique	125
7. Spirometry: forced expiration	127
8. Lung volumes and capacities	128
9. Respiratory quotient and respiratory exchange ratio	130
10. Shunt equation	132
11. Pulmonary vascular resistance	134

Part 3c Renal

1. Renal filtration fraction	136
2. Renal clearance and Cockcroft–Gault formula	137
3. Starling's equation – rate of filtration	139
4. Fick's law of diffusion	141

Part 3d Cellular, biochemical and acid-base

1. Osmolality/osmolarity and the osmolar gap	143
2. Morse equation and osmotic pressure	145
3. Anion gap	147
4. Goldman equation	149
5. Gibbs–Donnan effect	151
6. Nernst equation	153
7. pH	155

8. pKa	157
9. Acid–base compensation simplified	159
10. Henderson–Hasselbalch equation	161

Part 3e Neurological

1. Cerebral perfusion pressure and intracranial pressure	163
2. Intraocular pressure	165

SECTION 4 – STATISTICS

1. Binary classification tests and 2×2 tables	167
2. Negative predictive value	168
3. Positive predictive value	170
4. Specificity	172
5. Sensitivity	174
6. Relative risk	176
7. Relative risk reduction	178
8. Absolute risk reduction	180
9. Accuracy of test	182
10. Chi-squared test	184
11. Likelihood ratio	186
12. Standard error of mean	188
13. Standard deviation and variance	189
14. Power	191
15. Odds ratio	192

Appendix

1. <i>The International System of Units</i>	194
2. <i>Units of measurement</i>	196

Index	197
--------------	-----