

Contents

1	Explaining Modern Technology.....	1
	What Socrates Would Ask Me.....	2
	Omitting Irrelevant Subjects Is an Art.....	5
	No One should Be Afraid of Formulas.....	7
 Part I: Fundamentals of Mathematics and Logic		
2	Mathematicians Are Humans Like You and Me – They Count and Arrange	13
	What a Number “Sees” When It Looks into a Mirror.....	14
	Sets Are Everywhere	25
	Functions Tell Us How to Get Results	31
	“Come Closer!” Is What Limits Want.....	40
	An Eye for an Eye and a Tooth for a Tooth – That’s the Principle of Equations	44
3	Mathematicians Are Nothing Special – They Draw and Compare	53
	How Mr. Euclid’s Ideas Have Grown Up.....	53
	How the Fraction “Zero Divided by Zero” and the Product “Infinity Times Zero” Are Related.....	64
	Relations Which We Can Deduce, but Not Really Understand.....	74
4	When It Helps to Ignore Any Meaning	81
	Where Discretionary Powers Are Not Allowed.....	81
	Games Which Can Be Played without Thinking	83
	How Logical Thinking Can Be Replaced by Pattern Recognition.....	87
	Detours Which Are Shorter Than the Direct Route.....	98
	How We Can Enter into Four- or Higher-Dimensional Spaces Using Simple Steps	100
5	About the Methods for Computing the Future.....	109
	Attempts to Reduce Expectations to Numbers	110
	How We Can Calculate the Number of Possible Cases.....	112
	What You Can Do If You Don’t Want to Know All the Details	118
	How to Handle the Situation When the Cases Are No Longer Countable.....	125
	Statistics Are More Than Just Listing the Results of Counts.....	129

6	What Talking and Writing Have in Common	131
	How Speech and Writing Are Interrelated.....	132
	What Grammar Has to Do with the Meaning of Texts	133
	How to Control Conversations in Order to Make Sure All Participants	
	Get a Fair Chance to Say Something	141

Part II: Fundamentals of Natural Sciences

7	What the Moon Has to Do with Mechanical Engineering.....	147
	What Galileo Galilei Could Teach Us without Upsetting the Pope.....	148
	What Sir Isaac Newton Found Out about Forces and Moving Bodies	
	on Earth and in the Sky.....	153
8	How Albert Einstein Disregarded Common Sense.....	173
	How Meters and Clocks Were “Relativized” and the Speed of Light	
	Was Made the Standard Reference	173
	How the Beautiful World of Mr. Newton Got Bended.....	189
9	How a Few Frog Legs Triggered the Origin of Electrical	
	Engineering.....	207
	The Tremendous Consequences of Accidental and Simple	
	Observations	208
	How Mr. Maxwell Transferred His Ideas from the Bath Tub to Free	
	Space.....	216
	How the Feasibility of High Voltage and Radio Waves Became	
	Evident without Experimenting	227
	What We Get by Multiplying or Dividing Volts, Amperes and Similar	
	Things.....	233
10	Small, Smaller, Smallest – How the Components of Matter Were	
	Found.....	241
	How the Age-Old Assumption That Matter Is Composed of Atoms	
	became Experimentally Relevant	242
	What Can Be Deduced from the Assumption That Gases	
	Are Small Balls Flying Around	248
	How Particles Which Had Been Called “Indivisible” Broke Apart.....	258
11	How the Difference between Particles and Waves Disappeared.....	267
	How Waves Can Be Forced to Show Us That They Really Are	
	Waves	267
	How It became Necessary to Consider Rays of Light and Heat as	
	Flying Packets of Energy.....	271
	A Theory Which Could Be Confirmed, but Stayed Inconceivable.....	281
	Phenomena Which Even Einstein Thought to Be Impossible	302

12 How “Recipes” in the Cells of Living Organisms Were Found and Can Be Rewritten309
How Organization and Life Are Connected309
How the Living became “Technological Matter”316
Like the Mother, Like the Father - How Inheritance Works.....317
How New Recipes Can Be Smuggled into Living Cells.....338
How to Provide Evidence Confirming “Who It Was”341

Part III: Fundamentals of Engineering

13 Why Engineers Are “Playing with Models”347
What Engineers Are Needed for347
A Look into the Toy Box of Engineers.....352
How the Sine Function Makes the Jobs of Engineers Easier377

14 Everything becomes Digital – Really Everything?.....389
What Zeros and Ones Have to Do with Digital Systems389
Why Engineers Want to Digitize as much as Possible398
Computer Hardware: How Digital Systems Which Execute Programs Are Built411
Computer Software: How Programmers Can Tell Their Computers What They Expect Them to Do421
An Engineering Job Which Is Not Yet Adequately Done434

Concluding Remarks.....437

Acknowledgments.....439

References.....441

Name Index.....443

Subject Index.....445