

# Contents

<b>Introduction</b>	11	<b>Lesson 2:</b>	
<b>Lesson 1:</b>		<b>Moving Matter</b>	30
Chemistry and Physics Matter	15	Moving Atoms	31
In the Beginning	16	Solid Sleep	31
Forming the World	16	Liquid Motion	31
Everything Matters	17	Going Gas	31
Matter Matters	18	Solid Matter	32
Turn Up the Volume	18	Liquid Matter	32
Mass Matters	19	Solid Liquids and Liquid Solids	33
Density Matters	20	Surface Tension	34
Buoyancy Basics	23	Viscosity Values	34
More on Matter	24	Heating Up	34
The Golden Rule	24	Gas Matter	35
Luster Matters	24	In the Air	36
Color May Matter	25	Atoms Together and Apart	36
The Shape of Matter	25	Voluminous Expanding Gas	37
Hardness Matters	26	Bubble Power	38
Smell Matters	27	Expanding and Escaping Air	38
More Properties Matter	27	Compressed Gas	38
Final Matters	28	Gas to Liquid to Solid to Liquid to Gas	39
What Do You Remember?	28	Final Matters	41
Notebooking Activities	28	What Do You Remember?	41
Project: Lava Lamps	29	Notebooking Activities	41
		Experiment: Earth's Water Cycle	42

### Lesson 3:

<b>Building Blocks of Creation</b>	<b>43</b>
Variety of Atoms .....	44
Attaching Atoms .....	45
Atom Anatomy .....	47
Charged Up .....	47
Pluses and Minuses .....	47
Primary Positives .....	48
Neutral News .....	49
Electric Electrons.....	49
Electron Energy.....	51
Clouds, Shells, and Orbitals .....	51
Valence Valor.....	52
The Periodic Table of Elements.....	53
The Key to Remember.....	54
Bonding Basics.....	55
Noble Gentlemen.....	55
Reactive Reactions.....	56
Experiment Explained .....	56
Busy Bonds .....	57
Valence Bonding .....	57
Ionic Bonding .....	57
Final Matters .....	59
What Do You Remember?.....	59
Notebooking Activities.....	60
Project: Sugar Cookie Periodic Table .....	61

### Lesson 4:

<b>Compound Chemistry</b>	<b>62</b>
Crystallized Creations.....	62
Common Crystals .....	63
Precious Gemstones.....	64
Diamonds .....	65
Pressure and Perseverance .....	65
Diamond Mines .....	65
The Four Cs .....	66
Putty, Plastics, and Pencil Erasers.....	67
Silly Surprise! .....	69
The Bad News .....	69
The Good News .....	70
Plastic Codes .....	71
Acidic Acid.....	72
Strong and Weak.....	73
Basic Bases .....	74
Neutral News .....	74
Potential pH.....	75
Chemical Chaos.....	76
Chemical or Physical Reactions .....	76

Reactants Releasing and Retaining .....	78
Final Matters.....	79
What Do You Remember?.....	79
Notebooking Activities.....	79
Experiment: Make a Smoke Bomb .....	80
Project: Grow Crystals.....	81

### Lesson 5:

<b>Multitude of Mixtures</b>	<b>82</b>
Heterogeneous Mixtures.....	83
Suspensions and Emulsions .....	84
Homogeneous Mixtures .....	85
Salute the Solute.....	85
Polar Bonds in Water.....	86
Soapy Solutions.....	87
Alloys .....	88
Colloids.....	90
Diluted Versus Concentrated.....	92
Separating Mixtures.....	92
Final Matters.....	93
What Do You Remember?.....	93
Notebooking Activities.....	94
Experiment: Filter Water .....	95

### Lesson 6:

<b>Mechanics in Motion</b>	<b>97</b>
Mechanical Mechanics .....	97
Always in Motion.....	98
Newton's First Law of Motion .....	98
Inertia in Motion .....	100
Roller Coaster .....	101
Newton's Second Law of Motion.....	102
Newton's Third Law of Motion .....	103
Newton's Third Law in Space .....	105
Sir Isaac Newton .....	106
Final Matters.....	106
What Do You Remember?.....	106
Notebooking Activities.....	107
Game: Ringers.....	108

## Lesson 7:

<b>Dynamics of Motion</b>	<b>109</b>
Feeling the Friction .....	109
Increasing Friction.....	111
Adhesion .....	112
Reducing Friction.....	113
Air and Water Friction .....	115
Grasping Gravity.....	116
Distance Dynamics .....	118
Accelerating Action .....	119
Free Falling.....	120
Diving from the Sky.....	120
Centripetal Force.....	121
David and Goliath .....	122
Final Matters .....	123
What Do You Remember?.....	123
Notebooking Activities.....	123
Project: Paper Airplane Design .....	124

## Lesson 8:

<b>Work in the World</b>	<b>126</b>
Finding Energy.....	127
Kinds of Energy .....	127
Connecting Kinetics.....	127
Potential Power .....	127
Conserving Energy.....	128
Creation Confirmation.....	129
Forms of Energy.....	131
Chemical Energy.....	131
Energy over Time .....	131
Fossil Fuels .....	132
Oceans of Oil.....	133
Countless Coal.....	135
Nature's Natural Gas .....	135
Creation Confirmation.....	136
Nuclear Energy .....	136
Renewable Energy .....	138
Hydropower.....	139
Wind Energy.....	140
Solar Energy.....	141
Biofuels .....	142
Geothermal Energy .....	143
Hydrogen.....	143
Final Matters.....	144
What Do You Remember?.....	144
Notebooking Activities.....	144
Experiment: Strike It Rich!.....	145

## Lesson 9:

<b>Sound of Energy</b>	<b>146</b>
Sound Essentials.....	146
3-D Dynamics .....	149
Directing Waves .....	150
Echoes.....	150
Conductor of Sound .....	150
Speedy Sound.....	152
Measuring Mach .....	154
Bullwhip Boom.....	155
Loud Waves.....	155
Frequent Frequency.....	156
Measuring Frequency .....	157
Low Frequency.....	157
High Frequency.....	157
Pitch .....	159
Sound Quality.....	159
Technology and Sound.....	160
Sonar.....	160
Ultrasound.....	160
Bioacoustics.....	161
If a Tree Falls .....	161
Sounds in Space .....	161
Final Matters.....	161
What Do You Remember?.....	162
Notebooking Activities.....	162
Project: Soundproof Box .....	163

## Lesson 10:

<b>Light of the World</b>	<b>164</b>
Let There Be Light!.....	164
Fire in the Sky .....	165
Hydrogen and Helium Explosion.....	165
Creation Confirmation.....	165
Radiating Race .....	165
Sources of Light .....	166
Electrifying Light .....	166
Just Passing Through .....	167
Shadows .....	168
Beams and Waves .....	168
Spectrum of Colors .....	169
Colorful White.....	170
Wavelength .....	171
Very Violet .....	171
You're Getting Warmer .....	171
Animal Vision .....	172
Eye See.....	173
Blue Skies.....	173

Primary Colors.....	174
Beams of Monochromatic Light.....	176
Bouncing Light.....	176
Bending Light.....	179
Final Matters.....	180
What Do You Remember?.....	181
Notebooking Activities.....	181
Experiment: Build a Periscope.....	182

### Lesson 11:

<b>Thermal Energy</b> .....	<b>183</b>
Thermodynamics.....	183
The Zeroth Law of Thermodynamics.....	184
The First Law of Thermodynamics.....	184
Creation Confirmation.....	184
The Second Law of Thermodynamics.....	185
The Third Law of Thermodynamics.....	186
The Heat of the Moment.....	187
Source or Sink.....	188
Traveling Heat.....	188
Radiation.....	189
Convection.....	189
Conduction.....	191
Heating Our World.....	192
Insulators.....	193
Set on Fire.....	193
Combustion.....	194
Triangle Truths.....	195
Measuring Heat.....	195
Fahrenheit.....	196
Celsius.....	196
Kelvin.....	196
Thermometer.....	197
Thermal Expansion.....	197
Ways of Wonderful Water.....	198
Final Matters.....	199
What Do You Remember?.....	199
Notebooking Activities.....	199
Experiment: Build a Solar Oven.....	200

### Lesson 12:

<b>Electrifying Our World</b> .....	<b>201</b>
All Charged Up.....	201
Attraction.....	202
Electron Electricity.....	202
Static Electricity.....	203
Current Events.....	205

It's Great to Insulate.....	205
Electrical Ions.....	206
Circling Power.....	207
Lines of Power.....	207
Electrical Grid.....	208
Planting Power.....	208
Generators.....	211
Loading the Circuit.....	211
Battery Power.....	211
Current Flowing.....	213
Circuit Central.....	213
Switching Things Around.....	214
Series Circuits.....	215
Parallel Circuits.....	216
Circuit Symbols.....	217
Final Matters.....	217
What Do You Remember?.....	217
Notebooking Activities.....	218
Experiment: Make a Flashlight.....	219

### Lesson 13:

<b>Mysterious Magnetism</b> .....	<b>220</b>
Magnetic History.....	220
Magnetite.....	221
Magnets Everywhere.....	221
North and South.....	222
My Magnetic Domain.....	223
Magnetic Materials.....	224
Magnetic Atoms.....	224
Compass Points.....	227
Northward Facing.....	228
Shielding Magnet.....	229
Upside-Down Poles.....	229
Pole Jumping.....	230
Off-Center Poles.....	230
Iron Earth.....	230
Electrifying Magnet.....	230
Motor Moments.....	232
Final Matters.....	234
What Do You Remember?.....	234
Notebooking Activities.....	234
Project: Magnetic Race Track.....	235

## Lesson 14:

Simple Machines	236
Archimedes .....	237
Six Simple Machines .....	238
Inclined Planes .....	239
Twisting Planes.....	241
Wedging In .....	242
Levers .....	243
First-Class Levers.....	244
Second-Class Levers .....	246
Third-Class Levers.....	247
Pulling Pulleys.....	247
Wheels and Axles .....	249
Belting Belts.....	250
Gears.....	251
Final Matters .....	252
What Do You Remember?.....	253
Notebooking Activities.....	253
Experiment: Build a Rube Goldberg Device..	254

<b>Supply List.....</b>	<b>255</b>
<b>Answer Key .....</b>	<b>261</b>
<b>Photo and Illustration Credits .....</b>	<b>269</b>
<b>Index .....</b>	<b>271</b>