

# Contents

Using This Book .....	v
Using BIOZONE'S Resource Hub .....	viii
Physical Sciences: Concepts and Connections ...x	

## Skills for Physical Sciences

<i>Key Skills and Knowledge</i> .....	1
<input type="checkbox"/> 1 The Nature of Science .....	2
<input type="checkbox"/> 2 Systems and Models .....	4
<input type="checkbox"/> 3 Observations and Assumptions .....	5
<input type="checkbox"/> 4 Measurement and Units .....	6
<input type="checkbox"/> 5 Useful Concepts in Physical Sciences .....	9
<input type="checkbox"/> 6 Accuracy and Precision .....	12
<input type="checkbox"/> 7 Working With Numbers .....	14
<input type="checkbox"/> 8 Graphical Analysis .....	17
<input type="checkbox"/> 9 Describing the Data .....	19
<input type="checkbox"/> 10 Investigations in Physics .....	20
<input type="checkbox"/> 11 Ratio and Proportion in Chemistry .....	22
<input type="checkbox"/> 12 Safety in the Lab .....	24
<input type="checkbox"/> 13 Standard Equipment in Chemistry .....	26
<input type="checkbox"/> 14 Investigations in Chemistry .....	27
<input type="checkbox"/> 15 Measurement and Quantitative Analysis .....	28
<input type="checkbox"/> 16 Periodic Table .....	30

## MATTER AND ITS INTERACTIONS ..... 31

### PS1.A

#### Structure and Properties of Matter

<i>Key Skills and Knowledge</i> .....	32
<input type="checkbox"/> 17 Salt on Those? .....	33
<input type="checkbox"/> 18 What is Matter? .....	34
<input type="checkbox"/> 19 Introduction to the Atom .....	35
<input type="checkbox"/> 20 Atomic Theory and Rutherford's Experiment ....	36
<input type="checkbox"/> 21 Atomic Structure .....	39
<input type="checkbox"/> 22 Atomic Models and Valence Electrons .....	41
<input type="checkbox"/> 23 Exploring the Periodic Table .....	43
<input type="checkbox"/> 24 Trends in the Periodic Table .....	46
<input type="checkbox"/> 25 Valence Electrons and Reactivity .....	50
<input type="checkbox"/> 26 Bonding .....	51
<input type="checkbox"/> 27 Ionic Bonding .....	52
<input type="checkbox"/> 28 Covalent Bonding .....	55
<input type="checkbox"/> 29 Molecular Shape .....	57
<input type="checkbox"/> 30 Intra- and Intermolecular Forces .....	60
<input type="checkbox"/> 31 Comparing Substances .....	63
<input type="checkbox"/> 32 Review Your Understanding .....	66
<input type="checkbox"/> 33 Summative Assessment .....	67

### PS1.B

#### Chemical Reactions

<i>Key Skills and Knowledge</i> .....	69
<input type="checkbox"/> 34 Antacid Chemistry .....	70
<input type="checkbox"/> 35 Using Mass to Determine Quantity .....	71
<input type="checkbox"/> 36 The Mole .....	72
<input type="checkbox"/> 37 Using Molar Mass .....	75
<input type="checkbox"/> 38 Empirical Formulas .....	78
<input type="checkbox"/> 39 Percentage Composition .....	79
<input type="checkbox"/> 40 Balancing Equations .....	80
<input type="checkbox"/> 41 Stoichiometry .....	83
<input type="checkbox"/> 42 Solutions and Concentration .....	84
<input type="checkbox"/> 43 Creating Standard Solutions .....	85
<input type="checkbox"/> 44 Verifying a Claim .....	87
<input type="checkbox"/> 45 Reaction Rates .....	89
<input type="checkbox"/> 46 Energy in Chemical Reactions .....	91
<input type="checkbox"/> 47 Enthalpy and Chemical Reactions .....	93
<input type="checkbox"/> 48 Bond Energies .....	97
<input type="checkbox"/> 49 Reversible Reactions .....	98
<input type="checkbox"/> 50 Equilibrium Reactions .....	100
<input type="checkbox"/> 51 Le Châtelier's Principle .....	102
<input type="checkbox"/> 52 Industrial Equilibria .....	104
<input type="checkbox"/> 53 Acids and Bases .....	107
<input type="checkbox"/> 54 Review Your Understanding .....	110
<input type="checkbox"/> 55 Summative Assessment .....	111

### PS1.C

#### Nuclear Processes

<i>Key Skills and Knowledge</i> .....	114
<input type="checkbox"/> 56 Nuclear Power .....	115
<input type="checkbox"/> 57 Inside the Nucleus .....	116
<input type="checkbox"/> 58 Isotopes .....	118
<input type="checkbox"/> 59 Radioactive Decay .....	119
<input type="checkbox"/> 60 Fission and Chain Reactions .....	121
<input type="checkbox"/> 61 Fission vs Fusion .....	124
<input type="checkbox"/> 62 Review Your Understanding .....	126
<input type="checkbox"/> 63 Summative Assessment .....	127

## MOTION AND STABILITY: FORCES AND INTERACTIONS ..... 128

### PS2.A

#### Forces and Motion

<i>Key Skills and Knowledge</i> .....	129
<input type="checkbox"/> 64 Breaking Bricks .....	130
<input type="checkbox"/> 65 Distance and Displacement .....	131
<input type="checkbox"/> 66 Speed and Velocity .....	134
<input type="checkbox"/> 67 Acceleration .....	141
<input type="checkbox"/> 68 Introduction to Forces .....	145
<input type="checkbox"/> 69 Newton's Second Law .....	148
<input type="checkbox"/> 70 Newton's Third Law .....	158
<input type="checkbox"/> 71 Introduction to Momentum .....	160

# Contents

<input type="checkbox"/>	<b>72</b>	Investigating Collisions.....	162
<input type="checkbox"/>	<b>73</b>	Law of Conservation of Momentum .....	164
<input type="checkbox"/>	<b>74</b>	Impulse.....	165
<input type="checkbox"/>	<b>75</b>	Crumple Zones and Crash Helmets.....	167
<input type="checkbox"/>	<b>76</b>	Review Your Understanding .....	171
<input type="checkbox"/>	<b>77</b>	Summative Assessment.....	172

PS2.B, PS3.C

## Types of Interactions

		<i>Key Skills and Knowledge</i> .....	175
<input type="checkbox"/>	<b>78</b>	Force Field .....	176
<input type="checkbox"/>	<b>79</b>	Gravity.....	177
<input type="checkbox"/>	<b>80</b>	Newton's Law of Gravitation.....	179
<input type="checkbox"/>	<b>81</b>	Objects of Attraction.....	184
<input type="checkbox"/>	<b>82</b>	Coulomb's law .....	187
<input type="checkbox"/>	<b>83</b>	Electric Fields.....	190
<input type="checkbox"/>	<b>84</b>	Magnetism.....	193
<input type="checkbox"/>	<b>85</b>	Understanding Magnetism .....	196
<input type="checkbox"/>	<b>86</b>	Electricity and Magnetism .....	199
<input type="checkbox"/>	<b>87</b>	Magnetic Fields.....	202
<input type="checkbox"/>	<b>88</b>	Generators and Motors .....	204
<input type="checkbox"/>	<b>89</b>	Forces in Materials.....	208
<input type="checkbox"/>	<b>90</b>	Review Your Understanding .....	214
<input type="checkbox"/>	<b>91</b>	Summative Assessment.....	215

**ENERGY** ..... 217

PS3.A

## Definitions of Energy

		<i>Key Skills and Knowledge</i> .....	218
<input type="checkbox"/>	<b>92</b>	The Physics of Amusement Parks .....	219
<input type="checkbox"/>	<b>93</b>	Types of Energy .....	220
<input type="checkbox"/>	<b>94</b>	The Physics of Work .....	221
<input type="checkbox"/>	<b>95</b>	The Work-Kinetic Energy Theorem .....	223
<input type="checkbox"/>	<b>96</b>	Stored Energy .....	225
<input type="checkbox"/>	<b>97</b>	Conservation of Energy.....	226
<input type="checkbox"/>	<b>98</b>	Pendulums .....	228
<input type="checkbox"/>	<b>99</b>	Efficiency.....	231
<input type="checkbox"/>	<b>100</b>	Review Your Understanding .....	232
<input type="checkbox"/>	<b>101</b>	Summative Assessment.....	233

PS3.B, PS3.D

## Conservation of Energy and Energy Transfer

		<i>Key Skills and Knowledge</i> .....	234
<input type="checkbox"/>	<b>102</b>	Winds of Change.....	235
<input type="checkbox"/>	<b>103</b>	The First Law of Thermodynamics .....	236
<input type="checkbox"/>	<b>104</b>	The Second law of Thermodynamics.....	240
<input type="checkbox"/>	<b>105</b>	Modeling Energy Flow.....	243
<input type="checkbox"/>	<b>106</b>	Work and Power.....	246
<input type="checkbox"/>	<b>107</b>	Energy and Power Plants .....	248

<input type="checkbox"/>	<b>108</b>	Energy Conversion Devices .....	251
<input type="checkbox"/>	<b>109</b>	Review Your Understanding .....	255
<input type="checkbox"/>	<b>110</b>	Summative Assessment.....	256

## WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER ..... 258

PS4.A

## Wave Properties

		<i>Key Skills and Knowledge</i> .....	259
<input type="checkbox"/>	<b>111</b>	Rogue Waves .....	260
<input type="checkbox"/>	<b>112</b>	Properties of Waves .....	261
<input type="checkbox"/>	<b>113</b>	The Speed of Sound .....	264
<input type="checkbox"/>	<b>114</b>	Sound and Hearing .....	267
<input type="checkbox"/>	<b>115</b>	The Doppler Effect .....	269
<input type="checkbox"/>	<b>116</b>	Wave Reflection and Interference .....	270
<input type="checkbox"/>	<b>117</b>	Diffraction and Interference.....	272
<input type="checkbox"/>	<b>118</b>	Digital Waves.....	274
<input type="checkbox"/>	<b>119</b>	Review Your Understanding .....	278
<input type="checkbox"/>	<b>120</b>	Summative Assessment.....	279

PS4.B, PS3.D

## Electromagnetic Radiation

		<i>Key Skills and Knowledge</i> .....	282
<input type="checkbox"/>	<b>121</b>	Photovoltaic cells.....	283
<input type="checkbox"/>	<b>122</b>	The Electromagnetic Spectrum.....	284
<input type="checkbox"/>	<b>123</b>	Evaluate a Claim .....	287
<input type="checkbox"/>	<b>124</b>	High Energy Waves and Health .....	289
<input type="checkbox"/>	<b>125</b>	Duality of Light .....	291
<input type="checkbox"/>	<b>126</b>	Review Your Understanding .....	295
<input type="checkbox"/>	<b>127</b>	Summative Assessment.....	296

PS4.C

## Information Technologies and Instrumentation

		<i>Key Skills and Knowledge</i> .....	298
<input type="checkbox"/>	<b>128</b>	Data and EM Waves.....	299
<input type="checkbox"/>	<b>129</b>	Waves and Technology .....	300
<input type="checkbox"/>	<b>130</b>	Transmitting Information Using Waves .....	302
<input type="checkbox"/>	<b>131</b>	Review Your Understanding .....	305
<input type="checkbox"/>	<b>132</b>	Summative Assessment .....	306

		Appendix: Equipment List.....	307
		Image Credits.....	308
		Index .....	309