NATIONAL

SCIENCE EDUCATION

STANDARDS



Contents

Call to Action vii

National Science Education Standards: An Overview 1

Organization of the Standards, 3
Science Teaching Standards, 4
Professional Development Standards, 4
Assessment Standards, 5
Science Content Standards, 6
Science Education Program Standards, 7
Science Education System Standards, 8
Toward the Future, 9

1 Introduction 11

Why National Science Education Standards?, 12
Goals for School Science, 13
History of the National Science Education Standards, 13
Organization, 15
Guidance for Readers, 17
References for Further Reading, 17

2 Principles and Definitions 19

Perspectives and Terms in the National Science Education Standards, 22 References for Further Reading, 24

3 Science Teaching Standards 27

STANDARD A, 30
STANDARD B, 32
STANDARD C, 37
STANDARD D, 43
STANDARD E, 45
STANDARD F, 51

Changing Emphases for Teaching, 52 References for Further Reading, 53

4 Standards for Professional Development for Teachers of Science 55

THE STANDARDS, 58 STANDARD A, 59 STANDARD B, 62 STANDARD C, 68 STANDARD D, 70

Changing Emphases for Professional Development, 72 References for Further Reading, 73

5 Assessment in Science Education 75

THE STANDARDS, 78

STANDARD A, 78

STANDARD B, 79

STANDARD C, 83

STANDARD D, 85

STANDARD E, 86

Assessments Conducted by Classroom Teachers, 87

Improving Classroom Practice, 87

Planning Curricula, 87

Developing Self-directed Learners, 88

Reporting Student Progress, 88

Researching Teaching Practices, 89

Assessments Conducted at the District, State, and National Levels, 89

Data Analysis, 90

Teacher Involvement, 90

Sample Size, 90

Representative Sample, 90

Sample Assessments of Student Science Achievement, 91

Assessing Understanding of the Natural World, 91

Assessing the Ability to Inquire, 98

Changing Emphases for Assessment, 100

References for Further Reading, 101

6 Science Content Standards 103

Rationale, 104

Unifying Concepts and Processes Standard, 104

Science as Inquiry Standards, 105

Physical Science, Life Science, and Earth and Space Science Standards, 106

Science and Technology Standards, 106

Science in Personal and Social Perspectives Standards, 107

History and Nature of Science Standards, 107

Form of the Content Standards, 108

Criteria for the Content Standards, 109

Use of the Content Standards, 111

Changing Emphases for Contents, 113

Content Standard: K-12, 115

Content Standards: K-4, 121

Science as Inquiry, 121

Physical Science, 123

Life Science, 127

Earth and Space Science, 130

Science and Technology, 135

Science in Personal and Social Perspectives, 138

History and Nature of Science, 141

```
Content Standards: 5-8, 143
        Science as Inquiry, 143
        Physical Science, 149
        Life Science, 155
        Earth and Space Science, 158
        Science and Technology, 161
        Science in Personal and Social Perspectives, 166
        History and Nature of Science, 170
   Content Standards: 9–12, 173
        Science as Inquiry, 173
        Physical Science, 176
        Life Science, 181
        Earth and Space Science, 187
        Science and Technology, 190
        Science in Personal and Social Perspectives, 193
        History and Nature of Science, 200
      References for Further Reading, 204
7 Science Education Program Standards 209
      THE STANDARDS, 210
          STANDARD A, 210
          STANDARD B, 212
          STANDARD C, 214
          STANDARD D, 218
          STANDARD E, 221
          STANDARD F, 222
      Changing Emphases for Programs, 224
      References for Further Reading, 225
8 Science Education System Standards 227
      THE STANDARDS, 230
          STANDARD A, 230
          STANDARD B, 231
          STANDARD C, 231
          STANDARD D, 232
          STANDARD E, 232
           STANDARD F, 233
           STANDARD G, 233
      Changing Emphases for Systems, 239
      References for Further Reading, 240
Epilogue 243
Appendix 246
Index 254
Credits 261
```