Volume 4: Nature of Matter, Instructor Materials

Table of Contents

Contents  

I. Introduction  
   A. Overview of the Unit  1  
   B. Acknowledgments and Origins of Ideas  2  
   C. General Safety Considerations  2  

II. Students’ Notions about Nature of Matter  
   A. Students’ Prior Beliefs as Described in the Research on Student Conceptions  3-4  
   B. Conceptions that Students Should Develop  5, 7  

III. Cognitive Rationale  8-9  

IV. Instructor Notes  
   A. Equipment List  13-38  
   B. List of Student Investigations/Activities  39-42  
   C. Student Activities with Embedded Instructor Notes  
   Investigation M1: Measuring Mass and Volume and Calculating Density  43-44  
   Activity M1.1: Will it sink or float?  45-46  
   Activity M1.2: How is the mass of a liquid related to its volume?  47  
   Activity M1.3: How can density be found from a graph of mass and volume?  48-50  
   Activity M1.4: How is density related to floating and sinking?  51-52  
   Activity M1.5: Does the beverage sink or float?  53-54  
   Activity M1.6: Does the empty can sink or float?  55-56  
   Activity M1.7: How are size and shape related to floating and sinking?  57-58  
   Activity M1.8: When is it appropriate to average densities?  59-60  

   Investigation M2: Thinking about Densities of Solids, Liquids, and Gases  65-66  
   Activity M2.1: Which liquids are thicker?  67-68  
   Activity M2.2: Are thicker liquids denser?  69  
   Activity M2.3: Do various gases have different densities?  70  
   Activity M2.4: Which egg is cooked?  71  

   Investigation M3: Separating Mixtures into Component Parts  75-76  
   Activity M3.1: How can heterogeneous mixtures be separated?  77-78  
   Activity M3.2: Is margarine a substance or a mixture?  79  

Page No.
Activity M7.3: Which fruits and flowers act as acid/base indicators? 159-160
Activity M7.4: How can acids, bases, and indicators be used in art? 161-162

D. Focus on Science
- Focus on Science M1.1: Fundamental Qualities: A Starting Point 163-164
- Focus on Science M1.2: Measuring Mass and Volume and Calculating Density 165
- Focus on Science M2.1: Thinking about Densities of Gases, Liquids, and Solids 166-167
- Focus on Science M3.1: Separating Mixtures into Component Parts 168-169
- Focus on Science M4.1: Observing and Explaining Physical Changes 170
- Focus on Science M5.1: Observing Chemical Changes 171-172
- Focus on Science M6.1: Compounds and Elements 173
- Focus on Science M7.1: Classification of Compounds 174-175

E. Homework
- Homework M1.1: Density 181-182
- Homework M2.1: Matter 183
- Homework M3.1: Change of State 184-185
- Homework M4.1: Solutions and Mixtures 186-187
- Homework M5.1: Chemical Change 188-189
- Homework M6.1: Elements and Compounds 190-191
- Homework M7.1: Compounds in Chemical Reactions 192

F. Sample Assessment 193-198
G. List of References for Nature of Matter 199-200
H. Nature of Matter, Transparency Masters 201