

2

MATTER AND CHANGE

PRACTICE PROBLEMS

In your notebook, solve the following problems.

SECTION 2.1 MATTER

- Which of the following is *not* a physical change?
 - dissolving sugar in water
 - burning gasoline in an engine
 - evaporating sea water to obtain salt
 - slicing a piece of bread
- Which of the following is *not* a property of a gas?
 - has a definite shape
 - has no definite volume
 - assumes the shape of its container
 - easily compressible
- Which of the following is *not* a physical property of sucrose? (sugar)
 - solid at room temperature
 - decomposes when heated
 - dissolves in water
 - tastes sweet
- Which of the following is typically in a different physical state than the other three at room temperature?
 - salt
 - sugar
 - flour
 - water
- Complete the following table.

| physical state | definite shape? | definite volume? | readily compressible? |
|----------------|-----------------|------------------|-----------------------|
| gas | no | no | yes |
| liquid | no | yes | no |
| solid | yes | yes | no |

Use Table 2.1 to answer the following questions. p 35

- Which substance is a colored gas?
- Which liquids boil at a lower temperature than water?
- For which substances would 2 cm^3 have a mass greater than 6 g? OMIT

SECTION 2.2 MIXTURES

- How might one separate a mixture of water and salt? distillation
- What is a homogeneous mixture? even throughout
- Which of the following mixtures are homogeneous? Which are heterogeneous?
 - gasoline homogeneous
 - chunky peanut butter heterogeneous
 - oil and vinegar salad dressing heterogeneous
 - orange soda homogeneous

4. Which of the following are pure substances? Which are mixtures?

- a. ethanol b. vinegar c. motor oil d. helium

5. Use the system types from Table 2.3 to describe each of the following solutions.

OMIT X

- a. ethanol in water b. sucrose in ethanol c. carbon in iron d. oxygen in water

SECTION 2.3 ELEMENTS AND COMPOUNDS

1. What elements make up chloroform, chemical formula CHCl_3 ?

carbon hydrogen chlorine

2. Name the elements represented by the following chemical symbols.

- a. Pb lead b. K potassium c. Au gold d. Fe iron

3. Classify the following as elements, compounds, or mixtures.

- a. salt compound b. water compound c. iron element d. sterling silver mixture

4. Write the chemical symbol for each of the following elements.

- a. chlorine Cl b. sodium Na c. silver Ag d. carbon C

5. A liquid is allowed to evaporate and leaves no residue. Can you determine whether it was an element, a compound, or a mixture?

Not really

6. Which of the following is not an element?

- a. copper b. sulfur c. ammonia d. helium

SECTION 2.4 CHEMICAL REACTIONS

1. Which one of the following is a chemical change?

- a. gasoline boils b. lead is added to gasoline c. gasoline burns d. gasoline is poured into a tank

2. Classify each of the following changes as physical or chemical.

- a. dew is dried by the sun physical b. a dark cloth is faded by the sunlight chemical c. grape juice is converted to wine chemical d. soap is dissolved in water physical

3. In the chemical reaction carbon dioxide plus water \rightarrow carbonic acid, what does the arrow stand for?

"yields", "produces", etc

4. Name the product(s) in problem 3.

carbonic acid

5. Name the reactant(s) in problem 3.

carbon dioxide and water

6. If 44 grams of carbon dioxide react completely with 18 grams of water, what is the mass of carbonic acid formed?

62g

7. In an engine, octane combines with oxygen to form carbon dioxide and water. If 22.8 grams of octane combine completely with 80 grams of oxygen to form 70.4 grams of carbon dioxide, what mass of water is formed?

32.4g

8. What is the name of the chemical law on which problems 6 and 7 are based?

Conservation of mass

4

Atomic Structure

Reviewsheet

A. Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this chapter. Each blank can be completed with a term, short phrase, or number.

Atoms of each element are 1 from the atoms of all other elements. Dalton theorized that atoms are indivisible, but the discovery of 2 particles changed this theory. We now know that atoms are made up of electrons, which have a 3 charge; 4, which have a positive charge; and 5, which are neutral. The latter two particles are found in the 6 of the atom.

It was 7 who discovered the nucleus of the atom. The nucleus has a 8 charge and it occupies a very small volume of the atom. In contrast, the negatively charged 9 occupy most of the volume of the atom.

The number of 10 in the nucleus of the atom is the atomic 11 of that element. Because atoms are electrically neutral, the number of protons and 12 in an atom are equal. The sum of the 13 and neutrons is the mass number. Atoms of the same element are identical in most respects, but they can differ in the number of 14 in the nucleus. Atoms that have the same number of protons but different mass numbers are called 15.

The 16 of an element is the weighted average of the masses of the isotopes of that element. Two isotopes of sulfur are $^{32}_{16}\text{S}$ and $^{34}_{16}\text{S}$. An atom of the sulfur-32 isotope contains 17 protons and 18 neutrons. The sulfur-34 isotope has 19 protons and 20 neutrons.

Each of the three known isotopes of hydrogen has 21 proton(s) in the nucleus. The most common hydrogen isotope has 22 neutrons.

It has an atomic mass of 23 ~~amu~~ and is called hydrogen-1.

mass number

1. different 4-1
2. subatomic 4-2
3. negative 4-2
4. protons 4-2
5. neutrons 4-2
6. nucleus 4-3
7. Rutherford 4-3
8. positive 4-3
9. electrons 4-3
10. protons 4-4
11. number 4-4
12. electrons 4-4
13. protons 4-5
14. neutrons 4-6
15. isotopes 4-6
16. (average) atomic mass 4-7
17. sixteen (16) 4-7
18. sixteen (16) 4-6
19. sixteen (16) 4-6
20. eighteen (18) 4-6
21. 1 one 4-7
22. 0 zero 4-7
23. 1 4-7

B. True-False

Classify each of the following statements as always true, AT; sometimes true, ST; or never true, NT.

- NT 24. According to Dalton's atomic theory, atoms are composed of protons, electrons, and neutrons. 4-1
- ST 25. Atoms of elements are electrically neutral. 4-2
- NT 26. The mass of an electron is equal to the mass of a neutron. 4-2
- AT 27. The charge on all protons is the same. 4-2
- NT 28. The atomic number of an element is the sum of the protons and electrons in the atom. 4-4
- NT 29. The atomic number of an element is the whole number that ~~decreases~~ *increases* as you read across each row of the periodic table from left to right. 4-4
- ST 30. An atom of nitrogen has 7 protons and 7 neutrons. 4-6
- AT 31. Relative atomic masses are measured in amus. 4-7
- AT 32. The number of neutrons in the nucleus can be calculated by subtracting the atomic number from the mass number. 4-5

C. Questions and Problems

Answer the following questions or solve the following problems in the space provided. Show your work.

33. Complete the following table. 4-5

| Element | Symbol | Atomic number | Mass number | Number of protons | Number of electrons | Number of neutrons |
|------------------|-----------|---------------|-------------|-------------------|---------------------|--------------------|
| carbon | <u>C</u> | <u>6</u> | 12 | <u>6</u> | 6 | <u>6</u> |
| <u>potassium</u> | K | 19 | <u>40</u> | <u>19</u> | <u>19</u> | 21 |
| <u>magnesium</u> | <u>Mg</u> | 12 | <u>24</u> | 12 | <u>12</u> | 12 |
| helium | <u>He</u> | 2 | 4 | 2 | <u>2</u> | <u>2</u> |
| <u>boron</u> | <u>B</u> | 5 | <u>11</u> | 5 | <u>5</u> | 6 |

34. Fill in the following table. 4-6

| Element | Symbol | Atomic number | Mass number | Number of neutrons |
|----------------|-------------------------------------|---------------|-------------|--------------------|
| nitrogen-15 | <u>¹⁵₇N</u> | <u>7</u> | <u>15</u> | 8 |
| <u>neon-22</u> | <u>²²₁₀Ne</u> | <u>10</u> | <u>22</u> | <u>12</u> |
| beryllium-9 | <u>⁹₄Be</u> | 4 | <u>9</u> | <u>5</u> |

35. Given the relative abundance of the following naturally occurring isotopes of oxygen, calculate the average atomic mass of oxygen: 4-7

| | |
|------------|--------|
| oxygen-16: | 99.76% |
| oxygen-17: | 0.037% |
| oxygen-18: | 0.204% |

See p116 for relative amu for each isotope

$$(0.9976)(15.995) + (0.00037)(16.995) + (0.00204)(17.999)$$

Final answer 15.999 or 16.0