Practice Problems
Chapter 1 - 4

1. How many grams of Li₃N can be formed from 1.75 moles of Li? Assume an excess of nitrogen.

   \[ 6 \text{ Li}(s) + \text{N}_2(g) \rightarrow 2 \text{Li}_3\text{N}(s) \]

2. Consider the following balanced reaction. What mass (in g) of CO₂ can be formed from 288 mg of O₂? Assume that there is excess C₃H₇SH present.

   \[ \text{C}_3\text{H}_7\text{SH}(l) + 6 \text{O}_2(g) \rightarrow 3 \text{CO}_2(g) + \text{SO}_2(g) + 4 \text{H}_2\text{O} \text{ (g)} \]

3. Determine the theoretical yield of HCl if 60.0 g of BCl₃ and 37.5 g of H₂O are reacted according to the following balanced reaction. The molar mass of BCl₃ = 117.16 g/mol.

   \[ \text{BCl}_3(g) + 3 \text{H}_2\text{O}(l) \rightarrow \text{H}_3\text{BO}_3(s) + 3 \text{HCl}(g) \]

4. An ionic bond is best described as:
   a. the sharing of electrons.
   b. the transfer of electrons from one atom to another.
   c. the attraction that holds the atoms together in a polyatomic ion.
   d. the attraction between 2 nonmetal atoms.
   e. the attraction between 2 metal atoms.

5. The empirical formula was determined to be C₄H₄O, if you know that the molecule has a mass between 130 and 140 g/mol, what is the molecular formula?

6. Which of the following is an atomic element?
   a. Br
   b. H
   c. N
   d. O
   e. Mg

7. Give the name for SnO.

8. Give the structure for sodium chlorate.
   a. NaClO
   b. NaClO₂
   c. NaClO₃
   d. NaClO₄
9. Calculate the molar mass of Al(C₂H₃O₂)₃.

10. How many N₂O₄ molecules are contained in 76.3 g N₂O₄? The molar mass of N₂O₄ is 92.02 g/mol.

11. Give the mass percent of carbon in C₁₄H₁₉NO₂.
   a. 38.89%
   b. 72.07%
   c. 5.17%
   d. 2.78%

12. Determine the empirical formula for a compound that contains C, H and O. It contains 52.14% C and 34.73% O by mass.
   a. C₂H₆O
   b. CHO
   c. C₄H₁₃O₂
   d. CH₄O₃
   e. CH₃O

13. The statement, "In a chemical reaction, matter is neither created nor destroyed." is called
   a. The Law of Conservation of Mass
   b. Dalton's Atomic Theory
   c. The Scientific Method
   d. The Law of Multiple Proportions
   e. The Law of Definite Proportions

14. Choose the pure substance from the list below.
   a. sea water
   b. sugar
   c. air
   d. lemonade
   e. milk

15. A substance composed of 2 or more elements in a fixed, definite proportion is considered
   a. a homogeneous mixture.
   b. a heterogeneous mixture.
   c. a compound.
   d. a solution.
   e. an alloy.
16. Which of the following are examples of physical change?
   a. dew forms on a blade of grass
   b. a halloween light stick glows after shaking
   c. an egg solidifies during cooking
   d. a hydrogen balloon explodes when contacted with a flame
   e. None of the above are physical changes.

17. Determine the mass of an object that has a volume of 88.6 mL and a density of 9.77 g/mL.

18. Determine the number of protons, neutrons and electrons in the following:
   \[ \frac{65}{29} X \]

19. What species is represented by the following information?
   \[ p^+ = 12 \quad n^\circ = 14 \quad e^- = 10 \]
   a. Si\(^{4+}\)
   b. Mg
   c. Ne
   d. Si
   e. Mg\(^{2+}\)

20. Predict the charge that a calcium ion would have.

21. Silver has an atomic mass of 107.868 amu. The Ag-109 isotope (108.905 amu) is 48.16%. What is the amu of the other isotope?

22. How many Li atoms are contained in 97.9 g of Li?

23. How many significant figures are in \(3.408 \times 10^4\) m?
Answers

1. 20.3 g Li$_3$N
2. 0.198 g CO$_2$
3. 56.0 g HCl
4. B
5. C$_8$H$_8$O$_2$
6. E
7. tin (II) oxide
8. C
9. 204.13 g/mol
10. $4.99 \times 10^{23}$ N$_2$O$_4$ molecules
11. B
12. A
13. A
14. B
15. C
16. A
17. 866 g
18. $p^+ = 29$ $n^o = 36e^- = 29$
19. E
20. 2$^+$
21. 106.905 amu
22. $8.49 \times 10^{24}$ Li atoms
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