1. The mass of $1.63 \times 10^{21}$ silicon atoms is
   A) $2.71 \times 10^{-23}$ g.
   B) $4.58 \times 10^{22}$ g.
   C) 28.08 g.
   D) $1.04 \times 10^4$ g.
   E) $7.60 \times 10^{-2}$ g.

2. All of the following are properties of sodium. Which one is a physical property of sodium?
   A) It is surface turns black when first exposed to air.
   B) It is a solid at 25°C and changes to a liquid when heated to 98°C.
   C) When placed in water it sizzles and a gas is formed.
   D) When placed in contact with chlorine it forms a compound that melts at 801°C.
   E) Sodium is never found as the pure metal in nature.

3. Consistent with vanadium being a transition metal, the name for VSO₄ should be
   A) vanadium sulfide.
   B) vanadium (I) sulfite.
   C) vanadium (I) sulfate.
   D) vanadium (II) sulfite.
   E) vanadium sulfur tetraoxide.

4. An organic thiol compound is 38.66% C, 9.73% H, and 51.61% S by mass. What is the empirical formula of this compound?
   A) C₂H₆S
   B) C₃H₄S
   C) C₄H₁₀S
   D) C₄H₁₂S
   E) C₅H₁₄S

5. Name the binary compound formed between barium and phosphorus.
   A) barium phosphorus
   B) barium phosphide
   C) barium phosphate
   D) barium diphosphate
   E) barium triphosphide
6. The Stock system name for CrO₃ is:
   A) chromium oxide
   B) chromium(II) oxide
   C) chromium(III) trioxide
   D) chromium(III) oxide
   E) chromium(VI) oxide

7. The Hope diamond weighs 44.0 carats. Determine the volume occupied by the diamond, given that its density is 3.5 g/cm³ at 20°C, and that 1 carat = 0.200 g.
   A) 2.5 cm³
   B) 0.40 cm³
   C) 0.016 cm³
   D) 63 cm³
   E) 150 cm³

8. How many moles of O atoms are in 25.7 g of CaSO₄?
   A) 0.189 mol
   B) 0.755 mol
   C) 4.00 mol
   D) 1.14 × 10⁻²³ mol
   E) 4.55 × 10⁻²³ mol

9. Calculate the number of moles of cesium in 50.0 g of cesium.
   A) 0.376 mol
   B) 0.357 mol
   C) 2.66 mol
   D) 2.80 mol
   E) 0.0200 mol

10. How many atoms are in 0.0728 g of PCl₃?
    A) 1.28 × 10²¹ atoms
    B) 4.38 × 10²² atoms
    C) 4.39 × 10²¹ atoms
    D) 3.19 × 10²⁰ atoms
    E) 6.02 × 10²⁴ atoms
11. Liquid heptane, \( \text{C}_7\text{H}_{16} \), burns in oxygen gas to yield carbon dioxide and water. What is the minimum mass of oxygen required for the complete reaction of 25.5 mL of heptane? (density of heptane = 0.6838 g/mL)
   A) 8.14 g
   B) 89.6 g
   C) 61.3 g
   D) 30.6 g
   E) 5.57 g

12. Ammonia reacts with diatomic oxygen to form nitric oxide and water vapor:
\[ 4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O} \]
When 40.0 g \( \text{NH}_3 \) and 50.0 g \( \text{O}_2 \) are allowed to react, which is the limiting reagent?
   A) \( \text{NH}_3 \)
   B) \( \text{O}_2 \)
   C) \( \text{NO} \)
   D) \( \text{H}_2\text{O} \)
   E) No reagent is limiting.

13. Calculate the mass of \( \text{FeS} \) formed when 9.42 g of iron reacts with 8.50 g of sulfur according to the following reaction.
\[ \text{Fe(s)} + \text{S(s)} \rightarrow \text{FeS(s)} \]
   A) 17.9 g
   B) 87.9 g
   C) 26.0 g
   D) 14.8 g
   E) \( 1.91 \times 10^{-3} \) g

14. If the price of gasoline is $2.99 per U.S. gallon, what is the cost per liter? (1 L = 1.06 qt)
   A) $0.30/L
   B) $0.79/L
   C) $1.27/L
   D) $2.99/L
   E) $12.66/L

15. A microliter corresponds to:
   A) \( 10^{-2} \) liters.
   B) \( 10^{-3} \) liters.
   C) \( 10^{-6} \) liters.
   D) \( 10^{-9} \) liters.
   E) \( 10^{-12} \) liters.
16. The SI prefixes *nano* and *deci* represent, respectively:
   A) $10^{-9}$ and $10^{-6}$.
   B) $10^6$ and $10^{-3}$.
   C) $10^2$ and $10^{-3}$.
   D) $10^9$ and $10^{-6}$.
   E) $10^{-9}$ and $10^{-1}$.

17. The element oxygen consists of three naturally occurring isotopes: $^{16}$O, $^{17}$O, and $^{18}$O. The atomic mass of oxygen is 16.0 amu. What can be implied about the relative abundances of these isotopes?
   A) More than 50% of all O atoms are $^{17}$O.
   B) Almost all O atoms are $^{18}$O.
   C) Almost all O atoms are $^{17}$O.
   D) The isotopes all have the same abundance, i.e. 33.3%.
   E) The abundances of $^{17}$O and $^{18}$O are very small.

18. Give the formula for cobalt(II) chlorate dihydrate
   A) CoCl$_2$·2H$_2$O
   B) CoClO$_3$·(H$_2$O)$_2$
   C) Co(ClO$_3$)$_2$·(H$_2$O)$_2$
   D) Co(ClO$_3$)$_2$·2H$_2$O
   E) Co$_2$(ClO$_3$)$_3$·2H$_2$O

19. What is the formula for the ionic compound formed by magnesium and iodine?
   A) MgI
   B) Mg$_2$I
   C) MgI$_2$
   D) MgI$_3$
   E) Mg$_3$I

20. Which is the correct formula for copper(II) phosphate?
   A) Cu$_3$PO$_4$
   B) Cu$_3$(PO$_4$)$_2$
   C) Cu$_2$PO$_3$
   D) Cu(PO$_4$)$_2$
   E) Cu(PO$_3$)$_2$
21. When balanced with smallest set of whole numbers, the coefficient of $O_2$ in the following equation is $\text{C}_2\text{H}_4 + \underline{3} \text{O}_2 \rightarrow 2 \text{CO}_2 + \underline{2} \text{H}_2\text{O}$

A) 1.
B) 2.
C) 3.
D) 4.
E) 6.

22. How many silicon atoms are there in 1.00 g of silicon?

A) 1 atom
B) 0.0356 atoms
C) $2.57 \times 10^{22}$ atoms
D) $2.14 \times 10^{22}$ atoms
E) $1.75 \times 10^{25}$ atoms
Answer Key

1. E
2. B
3. D
4. A
5. B
6. E
7. A
8. B
9. A
10. A
11. C
12. B
13. D
14. B
15. C
16. E
17. E
18. D
19. C
20. B
21. C
22. D