1. How many moles of NH₃ are there in 77.5 g of NH₃?
   A) 0.220 mol
   B) 4.55 mol
   C) 14.0 mol
   D) $1.31 \times 10^3$ mol
   E) None of the above.

2. The SI prefixes *kilo* and *centi* represent, respectively:
   A) $10^3$ and $10^{-2}$.
   B) $10^6$ and $10^{-1}$.
   C) $10^{-3}$ and $10^{-2}$.
   D) $10^{-6}$ and $10^2$.
   E) $10^2$ and $10^{-3}$.

3. How many molecules are there in 8.0 g of ozone, O₃?
   A) 3 molecules
   B) $3.6 \times 10^{24}$ molecules
   C) $1.0 \times 10^{23}$ molecules
   D) $3.0 \times 10^{23}$ molecules
   E) $6.0 \times 10^{23}$ molecules

4. When 50.0 mL of a 0.3000 M AgNO₃ solution is added to 50.0 mL of a solution of MgCl₂, an AgCl precipitate forms immediately. The precipitate is then filtered from the solution, dried, and weighed. If the recovered AgCl is found to have a mass of 0.1183 g, what is the concentration of magnesium ions in the original MgCl₂ solution?
   A) 0.300 M
   B) $8.25 \times 10^{-3}$ M
   C) $1.65 \times 10^{-2}$ M
   D) $2.06 \times 10^{-3}$ M
   E) $4.13 \times 10^{-3}$ M

5. Give the formula for cobalt(II) chlorate dihydrate
   A) CoCl₂·2H₂O
   B) CoClO₃(H₂O)₂
   C) Co(ClO₃)₂(H₂O)₂
   D) Co(ClO₃)₂·2H₂O
   E) Co₂(ClO₃)₅·2H₂O
6. How many significant figures are there in 1.3070 g?
   A) 6
   B) 5
   C) 4
   D) 3
   E) 2

7. One method of determining the concentration of hydrogen peroxide (H₂O₂) in a solution is through titration with iodide ion. The net ionic equation for this reaction is
   \[ \text{H}_2\text{O}_2 + 2\text{I}^- + 2\text{H}^+ \rightarrow \text{I}_2 + 2\text{H}_2\text{O} \]
   A 50.00 mL sample of a hydrogen peroxide solution is found to react completely with 37.12 mL of a 0.1500 M KI solution. What is the concentration of hydrogen peroxide in the sample?
   A) 5.568 \times 10^{-2} \text{ M}
   B) 0.2227 \text{ M}
   C) 0.1010 \text{ M}
   D) 0.4041 \text{ M}
   E) 0.1114 \text{ M}

8. Calculate the density of CO₂(g) at 100°C and 10.0 atm pressure.
   A) 1.44 \text{ g/L}
   B) 134 \text{ g/L}
   C) 44.0 \text{ g/L}
   D) 53.6 \text{ g/L}
   E) 14.4 \text{ g/L}

9. 34.62 mL of 0.1510 M NaOH was needed to neutralize 50.0 mL of an H₂SO₄ solution. What is the concentration of the original sulfuric acid solution?
   A) 0.0229 \text{ M}
   B) 0.218 \text{ M}
   C) 0.0523 \text{ M}
   D) 0.209 \text{ M}
   E) 0.105 \text{ M}

10. How many O atoms are there in 51.4 g CaSO₄?
    A) 4
    B) 2.40 \times 10^{24}
    C) 1.13
    D) 9.09 \times 10^{23}
    E) 2.28 \times 10^{23}
11. What is the molar mass of Freon-11 gas if its density is 6.13 g/L at STP?
   A) 0.274 g/mol
   B) 3.64 g/mol
   C) 78.2 g/mol
   D) 137 g/mol
   E) 365 g/mol

12. A sample of hydrogen gas was collected over water at 21°C and 685 mmHg. The volume of the container was 7.80 L. Calculate the mass of H₂(g) collected. (Vapor pressure of water = 18.6 mmHg at 21°C.)
   A) 0.283 g
   B) 0.572 g
   C) 0.589 g
   D) 7.14 g
   E) 435 g

13. Zinc dissolves in hydrochloric acid to yield hydrogen gas:
   \[ \text{Zn(s)} + 2\text{HCl(aq)} \rightarrow \text{ZnCl}_2(\text{aq}) + \text{H}_2(\text{g}) \]
   What mass of hydrogen gas is produced when a 7.35 g chunk of zinc dissolves in 500 mL of 1.200M HCl?
   A) 0.605 g
   B) 0.113 g
   C) 0.302 g
   D) 0.453 g
   E) 0.227 g

14. A 1.07 g sample of a Noble gas occupies a volume of 363 mL at 35°C and 678 mmHg. Identify the Noble gas in this sample? (R = 0.08206 L·atm/K·mol)
   A) He
   B) Ne
   C) Ar
   D) Kr
   E) Xe

15. Two moles of chlorine gas at 20.0°C are heated to 350°C while the volume is kept constant. The density of the gas
   A) increases.
   B) decreases.
   C) remains the same.
   D) Not enough information is given to correctly answer the question.
16. What is the formula for the ionic compound formed by calcium and selenium?
   A) CaSe
   B) Ca₂Se
   C) CaSe₂
   D) Ca₃Se
   E) CaSe₃

17. At what temperature will a fixed amount of gas with a volume of 175 L at 15°C and 760 mmHg occupy a volume of 198 L at a pressure of 640 mm Hg?
   A) 274°C
   B) 214°C
   C) 114°C
   D) 1°C
   E) −59°C

18. Iron has a density of 7.87 g/cm³. What mass of iron would be required to cover a football playing surface of 120 yds × 60 yds to a depth of 1.0 mm? (1 inch = 2.54 cm; 1 lb = 453.6 g)
   A) 6.4 × 10³ lb
   B) 6.4 × 10⁴ lb
   C) 1.0 × 10⁵ lb
   D) 4.7 × 10⁷ lb
   E) 4.7 × 10⁸ lb

19. Which is the correct formula for copper(II) phosphate?
   A) Cu₂PO₄
   B) Cu₃(PO₄)₂
   C) Cu₂PO₃
   D) Cu(PO₄)₂
   E) Cu(PO₃)₂

20. Calculate the number of moles of gas contained in a 10.0 L tank at 22°C and 105 atm. (R = 0.08206 L·atm/K·mol)
   A) 1.71 × 10⁻³ mol
   B) 0.0231 mol
   C) 1.03 mol
   D) 43.4 mol
   E) 582 mol
21. The percent composition by mass of a compound is 76.0% C, 12.8% H, and 11.2% O. The molar mass of this compound is 284.5 g/mol. What is the molecular formula of the compound?
   A) C_{10}H_{3}O
   B) C_{5}H_{18}O
   C) C_{16}H_{28}O_{4}
   D) C_{20}H_{12}O_{2}
   E) C_{18}H_{36}O_{2}

22. A sample of a gas occupies $1.40 \times 10^3$ mL at 25°C and 760 mmHg. What volume will it occupy at the same temperature and 380 mmHg?
   A) 2,800 mL
   B) 2,100 mL
   C) 1,400 mL
   D) 1,050 mL
   E) 700 mL
Answer Key

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