1. Determine number of significant figures and proper units of: \((8.3801\text{g} - 2.576\text{g})/1.2\text{L}^{-1}\text{s}\)
   a. 2, gL/s
   b. 4, gL/s
   c. 2, L/s
   d. 4, L/s
   e. 5, gs/L

2. Which one of the following is most likely to be an ionic compound?
   a. HNF₂ because nitrogen and fluorine both have negative charges
   b. H₂CO because of the double ionic bond between carbon and oxygen
   c. N₂H₄ because hydrogen can bond ionically and covalently
   d. CaCl₂ because it contains a halogen and alkali earth metal
   e. CH₃Cl because the ionic element of chlorine creates a dipole moment

3. What is the percent mass of iron in Fe₄[Fe(CN)₆]₃? (Hint: Find molecular weight of molecule)

4. Assume that magnesium consists of three isotopes having the abundances and masses given below. According to the data, what is the average atomic mass of magnesium?

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Abundance</th>
<th>Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>²⁴Mg</td>
<td>78.70%</td>
<td>23.985 amu</td>
</tr>
<tr>
<td>²⁵Mg</td>
<td>10.13%</td>
<td>24.986 amu</td>
</tr>
<tr>
<td>²⁶Mg</td>
<td>11.17%</td>
<td>25.983 amu</td>
</tr>
</tbody>
</table>

   a. 25.00 amu
   b. 24.31 amu
   c. 24.97 amu
   d. 24.75 amu
5. Which of the following is an example of a physical property?
   a. Polymerization of DNA creates a double helix shape
   b. Proteins are synthesized by ribosomes in plants and transport macromolecules.
   c. Water corrodes an iron tank and changes color to orange
   d. Lithium battery explodes when punctured
   e. Heated water turns into steam at 100°C, but condenses again at high pressure

6. Zinc metal reacts with hydrochloric acid to produce zinc chloride and hydrogen gas. How many grams of hydrogen gas would be produced if 0.25 L of 1.0 M HCl solution were allowed to react with enough zinc such that all of the HCl reacted? If this amount of H₂ gas were at 0 oC and 1 atm, what would the volume be?

\[
\text{Zn} + 2\text{HCl} \rightarrow \text{H}_2 + \text{ZnCl}_2
\]

   a. 0.50 g, 2.8 L
   b. 0.25 g, 284 L
   c. 0.36 g, 0.36 L
   d. 0.25 g, 2.8 L
   e. 0.50 g, 5.6 L

7. A 20.0 mL sample of an element with a density of 3.0 g/mL contains \(4 \times 10^{23}\) atoms. What is the atomic weight (in g/mol) of this element?
   a. 300
   b. 40
   c. 60
   d. 90
   e. None of the above

8. After balancing the combustion reaction shown, what is the coefficient for O₂?

\[
\text{C}_7\text{H}_{14} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}
\]

   a. 42
   b. 21
   c. 11
   d. 10
9. Which set of elements below contains, respectively, an alkali metal, a halogen, a noble gas and a transition metal?
   a. Rb, Br, He, Ag
   b. H, F, Kr, V
   c. Li, S, La, Fe
   d. Ca, Kr, Tc, Mn

10. What is the correct chemical name of CoCl₃?
    a. cobaltous chloride
    b. cobalt trichloride
    c. cobalt(III) chloride
    d. cobalt(III) trichloride

11. How many protons and electrons are present in a Ca²⁺ ion?
    a. 20 protons and 18 electrons
    b. 18 protons and 20 electrons
    c. 20 protons and 21 electrons
    d. 20 protons and 19 electrons
    e. 22 protons and 20 electrons

12. What binary compound would be formed from barium ions and fluoride ion?
    a. Ba₂F₃
    b. BaF
    c. Ba₂F
    d. BaF₂
    e. BaF₃

13. A 9.4-g sample of titanium was added to a graduated cylinder originally containing 6.8 mL of water. After addition of the titanium, the water level in the graduated cylinder was 8.9 mL. What is the density of titanium?
    a. 1.4 g/cm³
    b. 4.5 g/cm³
    c. 1.1 g/cm³
    d. 0.22 g/cm³
14. Write out the correct net ionic equation for the reaction that occurs when solutions of Pb(ClO₃)₂ and Na₂SO₄ are mixed.

15. Which of the following compounds is most likely to dissolve in water?
   a. BaSO₄
   b. AgBr
   c. CaCO₃
   d. Na₂S
   e. None of the above.

16. What kind of reaction is the following? (FeCl₃ is also aqueous)
   a. Neutralization, because K is being neutralized by Cl
   b. Acid-base, because KOH is a strong base and Cl is the conjugate base to a strong acid
   c. Precipitation, because Fe(OH)₃ was precipitated
   d. Combustion, because OH ions can combine with H to form water

17. How many moles of oxygen gas will react with 12.4 mol aluminum?
   Equation: 4Al + 3O₂ → 2Al₂O₃
   a. 0.24 mol
   b. 0.42 mol
   c. 4.8 mol
   d. 9.3 mol
   e. 16.8 mol

18. What mass of copper (II) nitrate would be produced from the complete reaction of 45.6 g of copper, according to the chemical reaction shown below?
   Cu + 2AgNO₃ → Cu(NO₃)₂ + 2 Ag
19. The correct Stock system name for CuSO₄·5H₂O is
   a. cuprous sulfate pentahydrate
   b. copper (II) sulfate pentahydrate
   c. copper (II) sulfate hydrate
   d. copper (I) sulfate pentahydrate
   e. copper sulfate pentahydrate

20. C_{graphite} and C_{diamond} are examples of:
   a. isotopes of carbon because of the differences in atomic level
   b. allotropes of carbon because of the differences in physical structure
   c. the law of definite proportions because each will have the same fixed ratio
   d. different carbon ions because carbon is able to form different bond based on physical structure
   e. Tautomers because carbon can form double and triple bonds

21. Solid sulfur and oxygen gas react to produce sulfur trioxide as shown below. In a particular experiment, 5.0 g of O₂ are reacted with 6.0 g of S₈

   \[ S₈(s) + O₂(g) \rightarrow SO₃(g) \]

   a) Determine the limiting reagent and the mass of the product in grams
   b) What is the % yield of SO₃ if 7.9g SO₃ are isolated?

22. Which of the following is an example of a metal displacement reaction?
   a. 2 P(s) + 3 Cl₂(g) \rightarrow 2 PCl₃(g)
   b. CaBr₂(aq) + H₂SO₄(aq) \rightarrow CaSO₄(s) + 2 HBr(aq)
   c. 2 Na(s) + 2 H₂O(l) \rightarrow 2 NaOH(aq) + H₂(g)
   d. C₃H₈(g) + 5 O₂(g) \rightarrow 3 CO₂(g) + 4 H₂O(g)
   e. Fe₂O₃(s) + 2 Al(s) \rightarrow 2 Fe(s) + Al₂O₃(s)

23. Show work: In an experiment, 0.200 moles of Ba(OH)₂ are treated with 0.500 moles of HClO₃ according to the chemical reaction shown below:

   \[ Ba(OH)₂ + HClO₃ \rightarrow Ba(ClO₃)₂ + H₂O \]

   a) Balance the chemical reaction.
   b) Determine which species is the limiting reagent.
   c) Calculate the grams of H₂O formed.
   d) Determine which species is in excess and by how much (in grams).