1. A weather balloon filled with helium has a diameter of 3.50 ft. What is the mass in grams of the helium in the balloon? The density of the helium is 0.166 g/L. The volume can be calculated as \((\frac{4}{3})\pi r^3\). [1 ft = 12 in; 1 in = 2.54 cm]
   
   A) 106 g  
   B) 271 g  
   C) 21.3 g  
   D) 79.9 g  
   E) 63.6 g

2. A temperature of _______ K is the same as 63 °F.
   
   A) 290  
   B) 276  
   C) 29  
   D) 336  
   E) 17

3. Select the correct statement.
   
   A) Chemical changes always produce substances different from the starting materials.  
   B) Chemical changes provide the only valid basis for identification of a substance.  
   C) Chemical changes are easily reversed by altering the temperature of the system.  
   D) Chemical changes are always associated with extensive properties.  
   E) Chemical changes are accompanied by changes in the total mass of the substances involved.

4. Which one of the following numbers has the greatest number of significant figures?
   
   A) 0.5070  
   B) 0.00201  
   C) \(4.18 \times 10^{-3}\)  
   D) \(6.02 \times 10^{24}\)  
   E) \(4.02 \times 10^{2}\)
5. Express the following calculation in the correct number of significant figures:

\[
\frac{54.575 + 71.3}{3.120}
\]

A) 40.34
B) 40.345
C) 40.35
D) 40.4
E) 40.3

6. Alpha (α) rays are:
   A) positively charged particles and deflected away from the positively charged plate.
   B) positively charged particles and deflected towards the positively charged plate.
   C) negatively charged particles and deflected away from the negatively charged plate.
   D) negatively charged particles and deflected towards the negatively charged plate.
   E) not charged and are unaffected by external electric or magnetic fields.

7. Magnesium (Mg) has three isotopes: \(^{24}\text{Mg}\) (23.985 amu), \(^{25}\text{Mg}\) (24.986 amu), \(^{26}\text{Mg}\) (25.983 amu). If the average atomic mass of magnesium is 24.31 amu and the combined percent abundance of the heaviest two isotopes (\(^{25}\text{Mg}\) and \(^{26}\text{Mg}\)) is 21.30%, what is the % abundance of isotope \(^{26}\text{Mg}\)?
   A) 11.21%
   B) 10.09%
   C) 9.052%
   D) 12.25%
   E) 78.70%

8. What is the mass percent of oxygen in barium perchlorate?
   A) 38.1%
   B) 8.50%
   C) 23.4%
   D) 4.70%
   E) 19.0%
9. Combustion of a 0.9827 g sample of a compound containing only carbon, hydrogen, and oxygen produced 1.900 g of CO\(_2\) and 1.070 g of H\(_2\)O. What is the empirical formula of the compound?
A) C\(_4\)H\(_{11}\)O\(_2\)
B) C\(_2\)H\(_3\)O
C) C\(_4\)H\(_9\)O\(_2\)
D) C\(_4\)H\(_{10}\)O\(_3\)
E) C\(_2\)H\(_5\)O\(_2\)

10. Which one of the following statements regarding nitric acid is false?
A) It slightly ionizes in aqueous solution.
B) Its aqueous solutions conduct electricity.
C) It is soluble in water.
D) It is a strong electrolyte.
E) It produces H\(^+\) and NO\(_3\)\(^-\) in aqueous solution.

11. What is the coefficient of H\(_2\)O when the following equation is properly balanced with the smallest set of whole numbers?
\[ \text{Al}_4\text{C}_3 + \text{H}_2\text{O} \rightarrow \text{Al(OH)}_3 + \text{CH}_4 \]
A) 12
B) 6
C) 3
D) 4
E) 5

12. A sample of gallium(III) sulfite, contains 1.95 mol of sulfite ions. The number of moles of gallium(III) ions in the sample is
A) 1.30 mol
B) 2.92 mol
C) 1.95 mol
D) 5.84 mol
E) 3.90 mol
13. Vanadium (V) and oxygen (O) can combine to form several different compounds. The composition of two of them are:

- **Compound I**: 1.112 g of O for every 3.541 g of V
- **Compound II**: 3.326 g of O for every 4.236 g of V

If compound I is VO, then compound II is:

A) V₂O₅  
B) V₂O₃  
C) V₂O₂  
D) VO₃  
E) VO₂  

14. Which of the following compound(s) is/are not named correctly?

I. Hg₂Cl₂, Mercury chloride
II. CoCl₂·6H₂O, Cobalt(II) chloride hexahydrate
III. Pb(NO₃)₂, Lead nitrate
IV. NH₄ClO₂, Ammonium chlorite

A) I and III only  
B) I, II and III only  
C) I and IV only  
D) II and III only  
E) I and II only

15. What is the oxidation number of molybdenum (Mo) in Ag₂MoO₄?

A) +6  
B) +4  
C) +5  
D) +2  
E) +3

16. Which one of the following statements about the reaction is false?  

3Ni(s) + 8HNO₃(aq) → 3Ni(NO₃)₂(aq) + 4H₂O(l) + 2NO(g).  

A) HNO₃ is acting as a reducing agent.  
B) The oxidation state of Ni in Ni(NO₃)₂ is +2.  
C) Oxidation and reduction occur in this reaction.  
D) The oxidation state of Ni(s) is zero.  
E) Ni(s) is oxidized in the reaction.
17. What products result from mixing aqueous solutions of Ni(NO₃)₂ and NaOH?
   A) Ni(OH)₂(s), Na⁺(aq), and NO₃⁻(aq)
   B) Ni(OH)₂(s) and NaNO₃(s)
   C) Ni₂(OH)₂(aq) and NaNO₃(aq)
   D) Ni(OH)₂(aq) and NaNO₃(s)
   E) Ni(OH)₂(s), N₂(g), and H₂O(l)

18. Which one of the following is a diprotic acid?
   A) sulfurous acid
   B) hydrofluoric acid
   C) phosphoric acid
   D) chloric acid
   E) nitrous acid

19. All of the following reactions
   \[2\text{Al}(s) + 3\text{Br}_2(l) \rightarrow 2\text{AlBr}_3(s)\]
   \[2\text{Ag}_2\text{O}(s) \rightarrow 4\text{Ag}(s) + \text{O}_2(g)\]
   \[\text{CH}_4(l) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(g)\]
   can be classified as
   A) oxidation-reduction reactions
   B) combustion reactions
   C) precipitation reactions
   D) displacement reactions
   E) acid-base reactions

20. Zinc metal can be obtained from zinc oxide, ZnO, by treating with carbon monoxide, CO.

   \[\text{ZnO} + \text{CO} \rightarrow \text{Zn} + \text{CO}_2\]

   The carbon monoxide is obtained from carbon.

   \[2\text{C} + \text{O}_2 \rightarrow 2\text{CO}\]

   What is the maximum amount of zinc that can be obtained from 75.0 g of zinc oxide and 50.0 g of carbon.
   A) 60.3 g
   B) 11.1 g
   C) 81.4 g
   D) 58.6 g
   E) 272 g
Answer Key

1. A
2. A
3. A
4. A
5. A
6. A
7. A
8. A
9. A
10. A
11. A
12. A
13. A
14. A
15. A
16. A
17. A
18. A
19. A
20. A