1. A 1.6-mol sample of KClO₃ was decomposed according to the equation

\[ 2\text{KClO}_3(s) \rightarrow 2\text{KCl}(s) + 3\text{O}_2(g) \]

How many moles of O₂ are formed assuming 100% yield?
A) 1.1 mol  
B) 1.3 mol  
C) 1.6 mol  
D) 0.8 mol  
E) 2.4 mol

2. A 1.6-mol sample of KClO₃ was decomposed according to the equation

\[ 2\text{KClO}_3(s) \rightarrow 2\text{KCl}(s) + 3\text{O}_2(g) \]

How many moles of KCl are formed assuming 100% yield?
A) 1.1 mol  
B) 1.3 mol  
C) 1.6 mol  
D) 0.8 mol  
E) 2.4 mol

3. 4.5 mol of Al and an excess of Br₂ are reacted according to the equation

\[ 2\text{Al} + 3\text{Br}_2 \rightarrow 2\text{AlBr}_3 \]

How many moles of AlBr₃ will be formed assuming 100% yield?
A) 1.5 mol  
B) 2.3 mol  
C) 3.0 mol  
D) 4.5 mol  
E) 6.8 mol

4. The rusting of iron is represented by the equation \[ 4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3 \]. If you have a 1.64-mol sample of iron, how many moles of O₂ will be needed to completely react the iron?
A) 1.23 mol  
B) 2.19 mol  
C) 3.28 mol  
D) 1.64 mol
5. The balanced equation \( \text{P}_4(s) + 6\text{H}_2(g) \rightarrow 4\text{PH}_3(g) \) tells us that 2.0 mol \( \text{H}_2 \)
A) reacts with 1.0 mol \( \text{P}_4 \)
B) produces 4.0 mol \( \text{PH}_3 \)
C) cannot react with phosphorus
D) produces 1.3 mol \( \text{PH}_3 \)
E) reacts with 2.0 mol \( \text{P}_4 \)

6. When a precipitation reaction occurs, the ions that do not form the precipitate
A) evaporate
B) are cations only
C) form a second insoluble compound in the solution
D) are left as ions in the solution
E) none of these

7. Refer to the following equation:

\[ 4\text{NH}_3(g) + 7\text{O}_2(g) \rightarrow 4\text{NO}_2(g) + 6\text{H}_2\text{O}(g) \]

How many moles of ammonia (\( \text{NH}_3 \)) will be required to produce 11.6 mol of water?
A) 4.64 mol
B) 11.6 mol
C) 7.73 mol
D) 5.80 mol
E) none of these

8. What type of reaction is \( 2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2 \)
A) Combustion
B) Precipitation
C) Double replacement
D) Neutralization
E) Decomposition

9. What type of reaction is \( \text{NaCl}_{(aq)} + \text{AgNO}_3_{(ag)} \rightarrow \text{NaNO}_3_{(aq)} + \text{AgCl}_{(s)} \)
A) Combustion
B) Precipitation
C) Double replacement
D) Neutralization
E) Decomposition
10. An aqueous solution of sodium carbonate is reacted with an aqueous solution of calcium chloride.

Identify the solid in the balanced equation.
A) Na$_2$CO$_3$
B) CaCl$_2$
C) NaCl
D) CaCO$_3$
E) There is no solid formed when the two solutions are mixed.

11. An aqueous solution of sodium carbonate is reacted with an aqueous solution of calcium chloride.

What is the coefficient of the solid in the balanced equation (in standard form)?
A) 5
B) 4
C) 3
D) 2
E) 1

12. An aqueous solution of sodium carbonate is reacted with an aqueous solution of calcium chloride.

The net ionic equation contains which of the following species (when balanced in standard form)?
A) CO$_3^{2-}$ (aq)
B) 2Na$^+$ (aq)
C) 2Cl$^-$ (aq)
D) Cl$^-$ (aq)
E) 2Ca$^{2+}$ (aq)
13. An aqueous solution of potassium chloride is mixed with an aqueous solution of sodium nitrate.

The net ionic equation contains which of the following species (when balanced in standard form)?

A) $2K^+(aq)$
B) $3NO_3^-(aq)$
C) $2KNO_3(aq)$
D) $2Na^+(aq)$
E) No net ionic equation exists for this reaction.

14. This question is blank

15. An aqueous solution of sodium carbonate is reacted with an aqueous solution of calcium chloride. The complete ionic equation contains which of the following species (when balanced in standard form)?

A) $Na^+(aq)$
B) $2CO_3^{2-}(aq)$
C) $2Na^+(aq)$
D) $Cl^-(aq)$
E) $3Ca^{2+}(aq)$

16. This question is blank

17. Considering the activity series Ca, Mg, Zn, Fe, Cu where Ca is the most reactive metal and Cu is the least reactive metal would the following reaction take place?

$Cu(s) + ZnSO_4(aq) \rightarrow Zn(s) + CuSO_4(aq)$

A) yes
B) no

18. Considering the activity series Ca, Mg, Zn, Fe, Cu where Ca is the most reactive metal and Cu is the least reactive metal would the following reaction take place?

$Ca(s) + FeSO_4(aq) \rightarrow Fe(s) + CaSO_4(aq)$

A) yes
B) no
19. True or false? The equation $\text{O}_2(g) + 2\text{Mg}(s) \rightarrow 2\text{MgO}(s)$ can be interpreted by saying that 1 mol of O$_2$ reacts with 2 mol of Mg to form 2 mol of MgO.
   A) True
   B) False

20. True or false? Spectator ions are not included in a net ionic equation.
   A) True
   B) False

   A) True
   B) False

22. An aqueous solution of potassium chloride is mixed with an aqueous solution of sodium nitrate.

   The complete ionic equation contains which of the following species (when balanced in standard form)?
   A) $2\text{K}^+(aq)$
   B) $3\text{NO}_3^-(aq)$
   C) $\text{Cl}^-(aq)$
   D) $2\text{Na}^+(aq)$
   E) $2\text{KNO}_3(aq)$

23. Classify the following reaction:
   $2\text{Mg}(s) + \text{O}_2(g) \rightarrow 2\text{MgO}(s)$
   A) combination or synthesis
   B) precipitation
   C) acid-base
   D) single displacement
   E) double displacement
24. An aqueous solution of ammonium sulfate is allowed to react with an aqueous solution of lead(II) nitrate. The net ionic equation contains which of the following species (when balanced in standard form)?

A) $2\text{NH}_4^+(aq)$
B) $2\text{SO}_4^{2-}(aq)$
C) $2\text{NO}_3^-(aq)$
D) $\text{Pb}^{2+}(aq)$
E) $\text{NO}_3^-(aq)$

25. Based on the solubility rules BaSO$_4$ is

A) soluble
B) insoluble

26. Based on the solubility rules Mg(NO$_3$)$_2$ is

A) soluble
B) insoluble

27. \[\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(g)\]

A) acid-base
B) synthesis
C) decomposition
D) combustion
E) single replacement

28. Predict the identity of the precipitate that forms when an aqueous solution of sodium hydroxide reacts with an aqueous solution of iron(III) chloride.

A) No precipitate forms
B) NaCl
C) Na$_3$Fe
D) Fe$_3$OH
E) Fe(OH)$_3$

29. Which of the following is a single replacement reaction?

A) Pb + O \rightarrow PbO
B) PbSO$_4$ + ZnCl$_2$ \rightarrow ZnSO$_4$ + PbCl$_2$
C) CH$_4$ + 2O$_2$ \rightarrow CO$_2$ + 2H$_2$O
D) 2NiN \rightarrow 2Ni + N$_2$
E) CuSO$_4$ + Zn \rightarrow ZnSO$_4$ + Cu
Chem 101 Useful Information

<table>
<thead>
<tr>
<th>1 Kg = 1000 g</th>
<th>1 cal = 4.184 J</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 L = 1000 mL</td>
<td>T(°C) + 273 = T(K)</td>
</tr>
<tr>
<td>T(°F) = 1.80(T°C) + 32</td>
<td>0°C = 273 K</td>
</tr>
</tbody>
</table>

Specific heat of water = 1 cal/g/°C

1 atm = 14.70 psi

1 cal = 4.184 J

1 L = 1000 mL

T(K) = T°C + 273

T(°F) = 1.80(T°C) + 32

1 atm = 760 mm Hg

1 mol of gas at STP = 22.4 liters

R = 0.08206 L atm/mol K

Ideal Gas Law: PV = nRT

\[
\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}
\]

\[
P_1 = \frac{P_2 V_2}{V_1}
\]

\[
V_1 = \frac{V_2 T_1}{T_2}
\]

\[
T = \frac{C}{\lambda v}
\]

C = 3.00 x 10^8 m/s

Avogadro's number = 6.022 x 10^{23}

Activity Series for Metals

Li, K, Ba, Ca, Na, Mg, Al, Mn, Zn, Cr, Fe, Co, Ni, Sn, Pb, H, Cu, Ag, Hg, Pt, Au

Most Active

Least Active

**LANTHANOIDS**

Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu

**ACTINOIDS**

Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr

XI
**Chem 101 Useful Information**

**Nomenclature Flow Chart**

**Nonmetal name with –ide ending**
- + 1 nonmetal
  - Name the metal
  - Single-Charge Metal

**Name the polyatomic ion**
- + 2 nonmetals
  - Indicate metal charge by (Roman #) or Latin name (-ous or -ic)
  - Multiple-Charge Metal

**2 Nonmetals**
- *Metal + Nonmetal*
  - Chemical Formula
  - H + Nonmetal(s)
  - Name as acids
  - *Treat NH₄⁺ as a metal when naming compounds

**Table 7.1 General Rules for Solubility of Ionic Compounds (Salts) in Water at 25 °C**

1. Most nitrate ($\text{NO}_3^-$) salts are soluble.
2. Most salts of Na⁺, K⁺, and NH₄⁺ are soluble.
3. Most chloride salts are soluble. Notable exceptions are AgCl, PbCl₂, and Hg₂Cl₂.
4. Most sulfate salts are soluble. Notable exceptions are BaSO₄, PbSO₄, and CaSO₄.
5. Most hydroxide compounds are only slightly soluble.* The important exceptions are NaOH and KOH. Ba(OH)₂ and Ca(OH)₂ are only moderately soluble.
6. Most sulfide ($\text{S}^{2-}$), carbonate ($\text{CO}_3^{2-}$), and phosphate ($\text{PO}_4^{3-}$) salts are only slightly soluble.*

*The terms *insoluble* and *slightly soluble* really mean the same thing: such a tiny amount dissolves that it is not possible to detect it with the naked eye.
Answer Key Chem 101 Practice Exam 3 Fall 2012

1. E
2. C
3. D
4. A
5. D
6. D
7. C
8. E
9. B or C
10. D
11. E
12. A
13. E
14. This question is blank
15. C
16. This question is blank
17. B
18. A
19. A
20. A
21. A
22. C
23. A
24. D
25. B
26. A
27. D
28. E
29. E