In the following list of compounds, circle those that are insoluble in water:

Pb(NO₃)₂  K₂S  Ba₃(PO₄)₂  Mg(OH)₂

Classify as strong acid, weak acid, strong base, weak base, or salt:

HF  CH₃NH₂  Ca(OH)₂  HNO₃

Complete the following precipitation reactions with balanced molecular, total ionic, and net ionic equations. Be sure to indicate precipitates with (s).

A.  Hg₂(NO₃)₂(aq)  +  KI(aq)  →

Balanced molecular:

Total ionic:

Net ionic:

B.  FeSO₄(aq)  +  Ba(OH)₂(aq)  →

Balanced molecular:

Total ionic:

Net ionic:
(6) 4. Give the oxidation number of the indicated element in each of the following compounds or ions:

C in CO₂_____

Br in BrO₄⁻_____  
P in HPO₃²⁻_____  

(10) 5. Given the following oxidation-reduction reaction:

S₂O₄²⁻ + CrO₄²⁻ → SO₃²⁻ + Cr³⁺

(a) Identify:  The reagent being oxidized  _________  
The reagent being reduced  _________  
The oxidizing agent  _________  
The reducing agent  _________  
(This refers to the complete ion, not just the element changing oxidation number)

(b) Balance the equation in acidic solution. (Show your work, including the beginning and ending oxidation numbers of the elements that undergo a change).

(8) 6. Three 5-L flasks each contain 4 g of gas at 273 K. Flask A contains H₂, flask B contains He, and flask C contains CH₄. Rank the contents of each flask in terms of the following properties by circling the correct relationship:

Pressure:  A>B>C  
Density:  A>B>C  
Average Molecular Kinetic Energy:  A>B>C  
Average Molecular Velocity:  A>B>C
7. Oxygen gas can be produced by the decomposition of potassium chlorate in the presence of a catalyst, according to the following reaction:

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

(a) A sample of KClO\(_3\) was decomposed in this fashion, and the oxygen was collected over water by displacing the water from an upended container. The volume of the oxygen collected was 1.56 L at a temperature of 20 \(^\circ\)C. The atmospheric pressure was 755 torr, and the vapor pressure of water at 20 \(^\circ\)C is 17.5 torr. Calculate the moles of KClO\(_3\) and the grams of KClO\(_3\) in the sample. (Show your work). \( R = 0.08206 \text{ L-atm-mol}^{-1}\text{-K}^{-1} \).

(b) \( \Delta H_f^\circ \) for KClO\(_3\) \(_{(s)}\) = -397.7 kJ/mol; \( \Delta H_f^\circ \) for KCl \(_{(s)}\) = -436.7 kJ/mol. Calculate \( \Delta H \) for the decomposition of one mole of KClO\(_3\). Is the reaction exothermic, or endothermic?

(c) Calculate \( \Delta H \) for the decomposition of the quantity of KClO\(_3\) specified in part a.
(10) 8. A tank of gas with a volume of 3.6 L is under a pressure of 75 atmospheres at 30 °C. If the gas were completely released into plastic bag at 0.95 atmospheres pressure and 5 °C, what volume would the gas occupy in the bag?

(12) 9. An unknown metal weighing 44.7 g is heated to a temperature of 87.2 °C and placed in an insulated cup containing 105.6 g of water at a temperature of 20.5 °C. After the metal cools, the final temperature of the metal and the water is 23.4 °C. (Specific heat of water = 4.184 J/g·°C)

(a) How much heat has the metal lost?

(b) What is the specific heat of the metal?

(12) 10. Heats of reaction can often be calculated using Hess’s Law and data from combustion experiments in a calorimeter. An example is the reaction of ethylene (C\(_2\)H\(_4\) (g)) with water to form ethyl alcohol (C\(_2\)H\(_5\)OH (l)):

\[
\text{C}_2\text{H}_4(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{l})
\]

Write and balance the combustion equations for C\(_2\)H\(_4\) (g) and C\(_2\)H\(_5\)OH (l), and use their heats of combustion to calculate \(\Delta H\) for the above reaction.

\(\Delta H_{\text{comb}} \text{C}_2\text{H}_4(\text{g}) = -1411\ \text{kJ/mol};\ \Delta H_{\text{comb}} \text{C}_2\text{H}_5\text{OH}(\text{l}) = -1367\ \text{kJ/mol}\)