This exam consists of 4 pages. Make sure you have one of each. Print your name at the top of each page now. A fifth page contains a periodic chart. You may tear it off and use it for scratch papers. Show your work on calculations, including unit conversions, and give answers in the correct units and appropriate number of significant figures.

In problems involving molecular and formula weights, you may use values rounded to the nearest 0.1 amu.

If anything confuses you or is not clear, raise your hand and ask!

Page Points

1 ______

2 ______

3 ______

4 ______

Total ______

(18) 1. For the potential reactants in water below:
   (a) Write the balanced potential metathesis equation in the molecular form showing the correct formula for the potential metathesis products.
   (b) Write a balanced net ionic equation, (or indicate no net ionic equation if there is none.)
   (c) If there is a net ionic equation, state whether the reaction should occur in the forward or reverse direction.
   (d) Be sure to indicate precipitates with (s), gases with (g), and weak electrolytes by writing the molecular formula rather than the ions

Examples:

Ex 1: NaCl + KI → NaI + KCl (potential metathesis reaction)
      No net ionic reaction
Ex 2 AgCl + LiNO₃ → AgNO₃ LiCl (potential metathesis reaction)
      AgCl(s) ← Ag⁺ + Cl⁻ (net ionic reaction, occurs in reverse)

A. Pb(NO₃)₂ + K₂SO₄ →

B. CaCO₃ + NaBr →

C. K₂S + FeCl₃ →
2. Classify as strong acid, weak acid, strong base, weak base, or salt:

- HCl
- NH₃
- MgCl₂
- H₂S
- HClO₄
- KOH

3. Circle the following compounds which are insoluble in water:

- NaNO₃
- Ca(C₂H₃O₂)₂
- PbCl₂
- BaCO₃
- Na₂SO₄
- Al₂S₃

4. Oxalic acid (H₂C₂O₄) was used as an acid standard to standardize a solution of sodium hydroxide. A sample of 1.55 g of oxalic acid dissolved in water required 45.2 mL of the sodium hydroxide solution to titrate it to the equivalence point.

(a) Write the balanced molecular equation for the reaction.

(b) Write the net ionic equation for the reaction.

(c) Calculate the molarity of the sodium hydroxide solution. (Show your work).

5. Give the oxidation number of the indicated element in each of the following compounds or ions:

- S in SO₃
- Br in BrO₂⁻
- Cu in CuCl
- P in H₂PO₄⁻
- C in C₆H₁₂O₆
- Cr in K₂Cr₂O₇
- S in HSO₃⁻
- C in CN⁻
- Fe in Fe₂O₃
6. Given the following oxidation-reduction reaction:

$$C_2O_4^{2-} + MnO_4^- \rightarrow CO_2 + Mn^{2+}$$

(a) Identify:
- The reagent being oxidized
- The reagent being reduced
- The oxidizing agent
- The reducing agent

(b) Balance the equation in basic solution.

7. State **Charles's Law** in its mathematical form.

8. A gas in a piston occupies a volume of 0.55 L at a temperature of 25 °C and 755 torr pressure. What will be the pressure of the gas if the volume is reduced to 0.11 L and the temperature is raised to 125 °C?
9. A tank contains 11.2 g of N\textsubscript{2} at 755 torr pressure. What will the pressure be if you then add 15.0 g of Argon to the tank?

10. Oxygen can be prepared by the heating mercuric oxide (HgO) according to the following reaction:

\[ 2 \text{HgO (s)} \rightarrow 2 \text{Hg (l)} + \text{O}_2 (g) \]

A sample of HgO 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 1.75 L at a temperature of 25 °C. The atmospheric pressure was 748 torr, and the vapor pressure of water at 25 °C is 23.8 torr. Calculate the \textbf{moles} of HgO and the \textbf{grams} of HgO in the sample. (Show your work) \( R = 0.08206 \text{ L-atm-mol}^{-1}.\text{K}^{-1} \).