100 POINTS—There are 5 pages to this exam (including the reference sheet). SHOW ALL YOUR WORK. YOUR ANSWERS MUST HAVE THE CORRECT NUMBER OF SIGNIFICANT FIGURES AND UNITS. CORRECT SPELLING MUST BE USED.

(7 pts.) 1. Given the solubility curve for compound B answer the following questions:

![Solubility curve for "B" graph]

What is the maximum number of grams of B that will dissolve in 5022 grams of water at 25°C?

\[
5022 \text{ g H}_2\text{O} \times \frac{23 \text{ g B}}{100 \text{ g H}_2\text{O}} = 1.2 \times 10^3 \text{ g B}
\]

**Answer:** \(1.2 \times 10^3 \text{ g B}\)
14.0 g NaCl \times \frac{1 \text{ mol NaCl}}{58.45 \text{ g NaCl}} \times \frac{1 \text{ L soln}}{0.250 \text{ mol NaCl}} = 958 \text{ L soln}

\text{ANSWER} \quad 958 \text{ L NaCl soln}

(9 pts.) 3. How many grams of Sulfate ions are there in 500.0 milliliters of a 0.350 M \text{Sn(SO}_4\text{)}_2\text{ solution}?

\[ 0.500 \text{ L soln} \times 0.350 \text{ mol} \text{Sn(SO}_4\text{)}_2\text{ L soln} \times 2 \text{ mol SO}_4^{2-} \times \frac{96.10 \text{ g}}{1 \text{ mol SO}_4^{2-}} = 33.6 \text{ g SO}_4^{2-} \]

\text{ANSWER} \quad 33.6 \text{ g SO}_4^{2-}

(8 pts.) 4. How many grams of acetone (C}_3\text{H}_6\text{O}) is present in 5000.0 ml of a 5.50% by weight-volume acetone solution?

\[ 5000.0 \text{ mL soln} \times \frac{5.50 \text{ g C}_3\text{H}_6\text{O}}{100 \text{ mL soln}} = 275.0 \text{ g C}_3\text{H}_6\text{O} \]

\text{ANSWER} \quad 275.0 \text{ g C}_3\text{H}_6\text{O}
dilute 0.870 L of a 3.000 M NaOH solution.

\[
\begin{align*}
M \cdot V_1 &= M \cdot V_2 \\
(3.000 \text{M})(0.870 \text{L}) &= M \cdot (0.870 \text{L} + 0.0400 \text{L}) \\
M &= 2.87 \text{M} \text{ NaOH}
\end{align*}
\]

**ANSWER**

2.87 M NaOH

(21 pts.) 6. For the following compounds:
   a. Write the solution inventory (the predominant species) in water
   b. Classify the following as a strong electrolyte, weak electrolyte, or nonelectrolyte.

<table>
<thead>
<tr>
<th>Solution Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Predominant Species)</td>
</tr>
<tr>
<td>a. Potassium sulfate</td>
</tr>
<tr>
<td>b. C(_2)H(_6)O (A polar compound)</td>
</tr>
<tr>
<td>c. Nitric Acid</td>
</tr>
<tr>
<td>d. Aqueous ammonia</td>
</tr>
<tr>
<td>e. Acetic acid</td>
</tr>
<tr>
<td>f. Hydrobromic Acid</td>
</tr>
<tr>
<td>g. Ferric sulfide</td>
</tr>
</tbody>
</table>

(7 pts.) 7. Short Answer

a. To increase the solubility of a gas, you would **decrease** the °T of the solution.

b. A dipole-dipole interaction is a **stronger** (stronger/weaker) intermolecular force than London forces.

c. To increase the rate of dissolving an ionic compound, you would: **Increase the temperature**, **stir/agitate**, and **make the ionic compound Smaller particles**.
8. How many grams of solvent must you add to 4.0 g of solute to make a 3.00 m ZnCl₂ solution?

\[
4.0 \text{g } \text{ZnCl}_2 \times \frac{1 \text{mol ZnCl}_2}{136.3 \text{g ZnCl}_2} \times \frac{1 \text{kg H}_2\text{O}}{3.00 \text{mol ZnCl}_2} = 0.09782 \text{g H}_2\text{O}
\]

\[
\text{Answer: } 9.8 \text{g H}_2\text{O}
\]

9. What type of intermolecular forces will the following have?

a. CH₃OH  H-bond

b. CH₄  London Dispersion Forces

c. F⁻ \(\text{Cl}^+\)  Dipole-Dipole

d. HF  Hydrogen bond

10. Write the correct chemical equations for the following:

Using: Correct chemical formulas

Physical states (aq), (s), (g)

And Balance the equation correctly

a. Aqueous potassium phosphate + aqueous iron (II) bromide → potassium bromide + ferrous phosphate

\[2 \text{K}_3\text{PO}_4(aq) + 3 \text{FeBr}_2(aq) \rightarrow 6 \text{KBr(aq)} + \text{Fe}_3(\text{PO}_4)_2(s)\]

b. Calcium metal + nitrogen → magnesium nitride

\[3 \text{Ca(s)} + \text{N}_2(g) \rightarrow \text{Mg}_3\text{N}_2(s)\]

c. Aqueous sodium carbonate + aqueous lead (II) nitrate → sodium nitrate + lead (II) carbonate

\[\text{Na}_2\text{CO}_3(aq) + \text{Pb(NO}_3)_2(aq) \rightarrow 2 \text{NaNO}_3(aq) + \text{PbCO}_3(s)\]