3U Review – Unit 3 (Solutions and Solubility)

Intermolecular Forces (6.1, 6.2, note, crossword)
- Intermolecular forces: ionic (ΔEN>1.7), dipole-dipole (0.5<ΔEN <1.7), hydrogen bonding (H + N, O, or F), London forces (in all compounds).
- Other terms: alloy, electrolyte, dissociation, homogeneous, heterogenous, instantaneous and induced dipoles, lone pair, mixtures, non-polar, polar, solute, solution, solvent.

Concentration (= solute ÷ solution) (6.3, note)
- Percentages: V/V, W/W, W/V (W/V is for aqueous solutions only: 1 mL = 1 g, 1 L = 1 kg).
- Parts per million (ppm). Unit on top is 1 million times greater (e.g. 1 mg/kg, 1μg/g, 1 mg/L).

Making Molar Solutions (6.5, two notes)
- How to read and use a pipette.
- Making a molar solution from a solid (M = n/L) or from a stock solution ($M_1V_1 = M_2V_2$).
- Mixing 2 solutions ([ ] = total # mol ÷ total # L).

Net ionic equations (7.3, note)
- Molecular, ionic and net ionic equations.
- Positive ions come first in formula; charge is equal to valence (see periodic table or ions list).
- Material and electrical balance must exist.

Solubility rules and solubility curves (7.1, two labs)
- Using solubility rules to predict solubility.
- Calculations using solubility curves to compare g solute / g water at different temperatures.
- Define saturated, unsaturated, supersaturated.

Drinking Water (6.4, crossword)
- Water treatment: 1) collection, 2) coagulation, flocculation, sedimentation, 3) filtration, 4) dis-infection, 5) aeration, 6) softening, 7) fluorida-tion, 8) post-chlorination, 9) ammoniation.

Solutions Stoichiometry (7.6, note)
- Using mol/L & mole ratio as conversion factors: volume(x) ↔ moles(x) ↔ moles(y) ↔ volume(y)

Conductivity of acids, bases, and salts (8.1, lab)
- Electrical conductivity increases with an increasing concentration of ions.
- Strong acids (HCl, HBr, H_2SO_4, HNO_3) have a greater percentage ionization than weak acids.
- Acids: start with H in formula, Bases: ionic hydroxides, Salts: ionic (metal + nonmetal).

Acids and bases (8.1, 8.2, 8.4, note)
- Taste, feel, pH, and reactions with baking soda, metals (e.g. Mg), and pH indicators.
- pH = 7 is neutral, < 7 is acidic, > 7 is basic.
- $[H^+(aq)] = 10^{-pH}$, $pH = -\log[H^+(aq)]$.
- Arrhenius definition of acids (ionize in H_2O to form H_3O^+), bases (dissociate to produce OH^-)
- Bronsted-Lowry acids (proton donors) & bases (proton acceptors). Conjugate acid-base pairs.

Neutralization and Titration (8.5, note, lab)
- Acid + Base → salt + water, reading a burette.
- Titration formula: #H x M_A x V_A = #OH x M_B x V_B

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1. Based on ΔEN, what types of intermolecular forces exist in these compounds: HCl, H_2O, NaCl, CH_4?
2. Use ideas about intermolecular forces to explain why a) oil and water don't mix, but water and HCl do, b) solids are more soluble at high temperatures, but gases are less soluble.
3. Wine contains alcohol as a 12% V/V solution. What volume of pure alcohol is in 250 mL of wine?
4. A 300 mL glass of water contains 8.0 ppm of oxygen. What is the mass of oxygen in the glass?
5. What is the molar concentration of KCl if 15 g are dissolved in H_2O to a total volume of 800 mL?
6. How many grams of NaOH is needed to make 100 mL of a 3.00 mol/L NaOH solution?
7. How many mL of 18.0 mol/L H_2SO_4 would be required to make 1.00 L of a 3.00 mol/L H_2SO_4 solution?
8. What concentration results when 3.0 L of 0.30 M NaCl is mixed with 1.0 L of 1.5 M NaCl?
9. Write molecular, ionic, and net ionic equations: a) $NaNO_3(aq) + CuCl_2(aq)$, b) $K_2CO_3(aq) + Al(NO_3)_3(aq)$.
10. Which of these compounds are soluble? a) AgCl, b) $Ca_3(PO_4)_2$, c) $Zn(C_2H_3O_2)_2$, d) LiOH
11. Using pg. 316, determine how much solid forms: a) 100 g of water saturated with $KClO_3$ at 100°C is cooled to 90°C, b) 38 g of water saturated with KNO_3 at 50°C is cooled to 38°C.
12. List the 9 steps involved in water treatment. Summarize the purpose of each step in one sentence.
13. What volume of 1.50 M NaCl would be needed to react completely with 50.0 mL of 0.350 M $Pb(NO_3)_2$?
14. If 1.40 L of 0.500 mol/L KOH is mixed with excess $Al_2(SO_4)_3$ what mass of precipitate will form?
15. Which will be the weakest conductor of electricity: 1 M NaCl, 1 M $HC_2H_3O_2$, 1 M NaOH, 1 M HCl?
16. How can acids be distinguished from bases (list reactions of indicators used in class, taste, feel, etc.)?
17. Calculate the pH when $[H^+(aq)] = 3.9 \times 10^{-5}$. Calculate $[H^+(aq)]$ when pH = 9.57.
18. Distinguish between the Arrhenius and Bronsted-Lowry definitions of acids and bases.
19. Identify the acid, base, and conjugate acid-base pairs: $NH_3(aq) + H_2O \rightarrow NH_4^+(aq) + OH^-(aq)$.
20. What volume of 3.1 M H_3PO_4 will neutralize 250 mL of 0.30 M $Ca(OH)_2$? Write the neutralization equation.