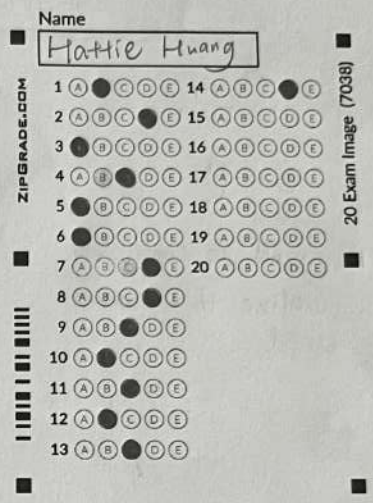
SCH3U1 **Solutions Unit Test** **Level:** 3 **Name & I:** Hattie Huang **{F23}**

You may use a solubility table and periodic table for this test.

Expectations Assessed
• Understand qualitative and quantitative properties of solutions • Communicate qualitative and quantitative properties of solutions

Multiple Choice **[Level 1 2 3]**
DO NOT WRITE ON OR OVER THE MULTIPLE CHOICE AREA or BORDER BOXES EXCEPT FOR THE NAME BOX & FILLED IN CIRCLES



Short Answer:
- Read all parts of the question before beginning your answer.
- **Show all work, formulas and units as appropriate!!**
- Use point form and do NOT waste time rewording the question in your answer.
- DESCRIBE: Give detailed points showing you understand the pattern or process.
- EXPLAIN: Give detailed points further supported by reasons/relevance/effects/causes

1. Explain each of the following observations, **in 1-3 lines each,** regarding dissolving [Level 1 2 ~~3~~ 4]

a) a pile of fine sugar dissolves faster than a sugar cube of equal mass

Because the molecules of a pile of fine sugar have more loose arrangement than the molecules of a sugar cube, so the water molecules can combination ↑SA/V with the molecules of a pile of fine sugar easily, so a pile of fine sugar dissolves faster than a sugar cube of equal mass. GS ✓

b) **[Taking it Further]** while the molecular compound sugar and ionic compound magnesium chloride both dissolve well in water, only the $MgCl_2$ solution conducts electricity well.

Because molecular compond is formed by molecular, not by electrons, when them dissolve well in water, the molecular will combination with water molecules. For ionic compound, they are formed by electrons, when they dissolve well in water, their electrons not longer attract others, instead of move free in the water molecular, such as Mg^{2+} and Cl^-, so it can conducts electricity well. SA ✓

2. For a chemical analysis, 750 mL of a 0.480 mol/L potassium permanganate ($KMnO_4$) solution is to be prepared. Calculate the **mass** of potassium permanganate crystals that will need to be dissolved to make this solution. [Level 1 2 3]

$V = 750\,mL = 7.5\,L$

$c = \frac{n}{V}$

$c = 0.480\,mol/L$

$n = \frac{m}{mm}$

$n = cV$
$= 0.480\,mol/L \times 0.75\,L$
$= 0.36\,mol$

$m = n\,mm$
$= 0.36\,mol \times (39.1 + 54.94 + (16.00 \times 4))$
$= 56\,g$ (2sf). ↑L ✓

∴ The mass of $KMnO_4$ crystals that will need to be dissolved to make this solution is 56g

3. One brand of mineral water contains 1.55 ppm of dissolved nitrate. Calculate the mass of nitrate in an 11.0-L container of this bottled water (recall 1g of water = 1ml). [Level 1 2 3]

11 L = 1.1×10⁴ mL = 1.1×10⁴ g

M = 1.55ppm × 1.1×10⁴ g
= 1.7×10⁴ g ÷10⁶

∴ the mass of nitrate in an 11.0L container of this bottled water is 1.7×10⁴ g

4. **[Taking it Further]** A waste drum containing 85.0 L of 6.0 mol/L hydrofluoric acid (HF) needs to be neutralized so that it isn't hazardous. Calculate the mass of potassium hydroxide (KOH) pellets that would be required to completely neutralize this amount of acid. Show the neutralization reaction and all other work. You may use the stoichiometry map or any method where I can easily follow your work. [Level 1 2 3 4]

$n = \frac{m}{mm}$

$c = \frac{n}{V}$

∵ Required to completely neutralize this amount of acid.

∴ $HF_{(aq)} + KOH_{(aq)} \rightarrow H_2O_{(l)} + KF_{(l)}$

$n_{(HF)} = CV$
$= 6.0 mol/L \times 85L$
$= 510 mol$

$n_{KOH} = n_{HF} \times \frac{1 mol\ KOH}{1 mol\ HF}$
$= 510 mol$

oops over here

$m_{KOH} = n_{KOH} \times mm_{KOH}$
$= 510 mol \times (39.1 + 16 + 1.01)$
$= 3 \times 10^4 g$

SF

∴ The mass of KOH pellets that would be required to completely neutralize this moment of acid is $3 \times 10^4 g$.

5. Consider the following balanced reaction: Barium chloride ($BaCl_2$) solution is mixed with potassium (K_2SO_4) sulphate solution to produce a solid precipitate barium sulphate and a solution of potassium chloride in the following balanced equation: [Level 1 2 3]

$$BaCl_{2(aq)} + K_2SO_{4(aq)} \rightarrow BaSO_{4(s)} + 2KCl_{(aq)}$$

For this reaction, write

(a) a total ionic equation, showing spectator ions crossed out.

$Ba^{2+}_{(aq)} + 2Cl^-_{(aq)} + 2K^+_{(aq)} + SO_{4(aq)}^{2-} \rightarrow BaSO_{4(s)} + 2K^+_{(aq)} + 2Cl^-_{(aq)}$

(b) a net ionic equation

$Ba^{2+}_{(aq)} + SO^{2-}_{4(aq)} \rightarrow BaSO_{4(s)}$

6. **[Taking it Further]** The hydrogen ion concentration in beer is 3.12×10^{-5} mol/L. Calculate the pH of beer. [Level 2 3 4]

$pH = -\log H^+$

$pH = -\log(3.2 \times 10^{-5} mol/L)$
$= 4.49$

∴ The pH of beer is 4.49.

onus: Write two questions you still have (related to topics in unit) that **were not** answered during this unit.