SCH3U Solutions Unit Review

1. Definitions :

a)	miscible	b)	immiscible	(c)	solute	(d)	solvent
e)	solution	f)	unsaturated	(g)	saturated	(h)	supersaturated
i)	pH	j)	acid	(k)	base	(l)	neutral
m)	neutralization	n)	aqueous	(o)	electrolyte		

2. What is the universal solvent and why?

3. Make the following calculations and be sure to include the units in your answer:
a) What is the w/w % of brass where there is 27 g of aluminum dissolved in 123 g of copper?
b) What is the w/v % of a solution with 4.00g of sodium monoflourophosphate in 96.0 mL of water?
c) What is the v/v% of a solution with 4.00 mL of acetic acid in 96.0 mL of water?

4. What is the molar concentration of a solution that has 730 g of hydrogen chloride dissolved in 10.0 mL of water?

5. What mass of bromine gas can be found in 355 mL of a solution with a concentration of 2.54 M?

6. What is the volume of a solution that contains 15.0 mol of sodium acetate and has a concentration of 2.00 M?

7. What is the volume of concentrated sulfuric acid (18 M) that is required to make 7.00 L of 0.15 M H_2SO_4?

8. What is the concentration of a diluted base if you have made 10.0 L from only 10.0 mL of 15 M NaOH?

9. What makes an acid an acid and a base a base?

10. What are 5 characteristics of acids ?

11. What are 5 characteristics of bases?

12. What is the pH of a solution of 2.70×10^{-4} M hydrochloric acid?

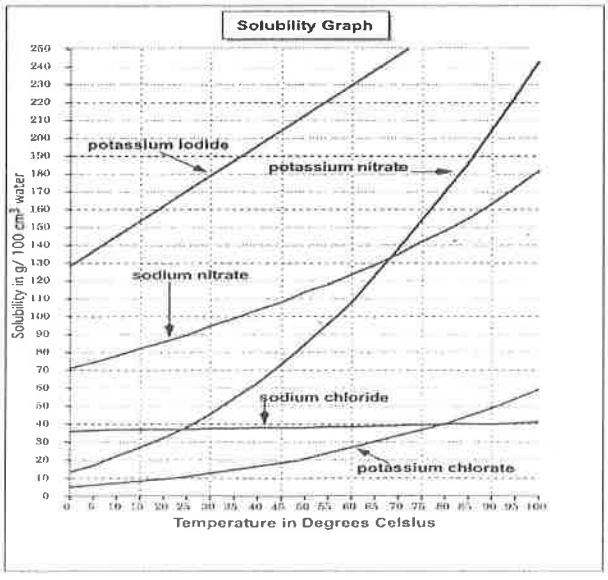
13. What is the hydronium ion (H_3O^+, same as H^+) concentration of a pH 2.50 acid?

14. What is a titration experiment and why is it important?

15. Titration reveals that 11.6 mL of 3.0 M sulfuric acid are required to neutralize the sodium hydroxide in 250.0mL of NaOH solution. What is the molarity of the NaOH solution?

16. If it takes 50 mL of 0.5 M KOH solution to completely neutralize 125 mL of sulfuric acid solution (H_2SO_4), what is the concentration of the H_2SO_4 solution?

17.



a) what is the solubility of $NaNO_3$ at 45 °C?
b) At what temperature are the two nitrates equally soluble?
c) At 30 °C what volume of water is required to dissolve 45.0 g of KI?
d) what solute shows an inverse relationship between solubility and temperature?
e) Shade the region of the graph where NaCl is unsaturated and $KClO_3$ is supersaturated.

Answers

1. consult text or notes
2. Water is the universal solvent. This is because it dissolves nearly any solute.
3. (a) w/w % = 27 g Al / 150 g solution x 100% = 18 %w/w %
   (b) w/v % = 4.00 g solute / 96 mL solvent = 4.17 % w/v%
   (c) v/v % = 4.00 mL solute / 100 mL solution = 4.00 % v/v %

Units for molar concentration include M (molarity) and mol / L

4. m = 730 g thus n = 730 g / 36.5 g.mol = 20.0 mol ; C = n/V = 20.0 mol/0.010 L= 2.0×10^3 M
5. n= 2.54 M * 0.355 L = 0.902 mol ; m = 0.902 mol * 159.8 g/mol = 144 g
6. v = n/C ; V = 15.0 mol / 2.00 mol/L = 7.5 L
7. $C_1V_1 = C_2V_2$; 18 M (V_1) = 0.15 M (7.00 L) ; V_1 = 0.0583 L = 58 mL
8. $C_1V_1 = C_2V_2$; 10.0 L (C_1) = 0.010 L(15M) ; C_1 = 0.015 M

9. Bronsted Lowry and Arrhenius definitions are required here.

10+11. Consult notes

12. pH = -log $[H_3O^+(aq)]$ = 3.569 $\Rightarrow$ $pH = -\log[2.70 \times 10^{-4}] = 3.569$
13. $[H_3O^+(aq)] = 10^{-pH} = 3.16 \times 10^{-3}$ M $\Rightarrow$ $10^{-2.50} = 3.16 \times 10^{-3}$ mol/L
14. See notes

15. 0.28M NaOH
16. 0.1 M

17a) 110 g/ 100 mL (b) 68 °C c) 25 mL of water
d) none, they all show a direct relationship (e) see discussion

3. a) $w/w\% = \frac{\text{solute (g)}}{\text{solution (g)}} \times 100\%$

$= \frac{27}{27+123} \times 100\%$

$= 18\%$

b) $w/v\% = \frac{\text{solute (g)}}{\text{solution (mL)}} \times 100\%$

$= \frac{4g}{96+4} \times 100$

$= 4\%$

c) $v/v\% = \frac{\text{solute (mL)}}{\text{solution (mL)}} \times 100\%$

$= \frac{4\,mL}{4+96} \times 100$

$= 4\%$

4. $C = \frac{n}{V}$

$= \frac{2}{0.01}$

$= 200\ mol/L$

$n = \frac{m}{M} = \frac{7.30g}{36.461}$

$= 2$

$\frac{10\,mL}{1000} = 0.01\ L$

5. $n = C \times V$

$= 2.54\ mol/L \times 0.355\ L$

$= 0.9017\ mol$

$m = n \times M$

$= 0.9017 \times 159.808$

$= 144.1\ g$

15. $H_2SO_4 + 2NaOH \rightarrow 2H_2O + Na_2SO_4$

$V = 11.6\,mL \div 1000 = 0.0116\,L$

$C = 3.0\,mol/L$

$n = C \times V$

$= 3 \times 0.0116$

$= 0.0348\,mol$

$\div 1 \times 2$

$V = 250\,mL = 0.250\,L$

$C = ?$

$n = 0.0696$

$C = \frac{n}{V} = \frac{0.0696\,mol}{0.250\,L} = \boxed{0.2784\,\frac{mol}{L}}$

16. $2KOH + H_2SO_4 \rightarrow 2H_2O + K_2SO_4$

$V = 50\,mL = 0.05\,L$

$C = 0.5\,\frac{mol}{L}$

$n = C \times V$

$= 0.025\,mol$

$\div 2 \times 1$

$V = 125\,mL = 0.125\,L$

$C = \frac{n}{V} = \frac{0.0125}{0.125} = \boxed{0.1\,mol/L}$

$n = 0.0125$