

Name: \_\_\_\_\_

date: \_\_\_\_\_ period: \_\_\_\_\_

ch. 4 & 13 concentration & solution

test

75 points

ap chemistry

**Academic Honesty:** The answers on this test are my own and I am using only the allowed set of notes as described in the syllabus. I have not discussed the test questions with anyone before or during the test nor have I seen the test questions prior to the exam. If you violate any of the preceding items or do not sign, your semester grade is a F.

Signature: \_\_\_\_\_

In problems involving any calculation, show your work in an organized manner, include (i) any relevant equation (or formula), (ii) conversion factor(s), (iii) put the proper units in your calculations and answer, and (iv) proper number of significant figures in your answer.

$\text{Ca(NO}_3)_2$	Ca	1.40	=	40
	N	2.14	=	28
	O	6.16	=	96
				164
				0.021875 mol

1. How to prepare 175 mL of 125 mM calcium nitrate using \_\_\_\_\_. [10 points]

a. Solid calcium nitrate and water

2 p4  
 2  
 1

i)  $n = [C]V = 125 \frac{\text{mmol}}{\text{L}} \cdot 175 \text{ mL} \cdot \frac{\text{mol}}{10^3 \text{ mmol}} = \frac{21.875 \text{ mol}}{10^3 \text{ mL}} = 0.021875 \text{ mol}$

ii)  $0.021875 \text{ mol} \cdot \frac{164 \text{ g}}{\text{mol}} = 3.59 \text{ g}$

iii) mix 3.59 g  $\text{Ca(NO}_3)_2$  & enough  $\text{H}_2\text{O}$  to make 175 mL soln

b. 275 mM calcium nitrate and water

1 p4  
 3  
 1

i)  $[C_1]V_1 = [C_2]V_2$   
 $125 \text{ mM} \cdot 175 \text{ mL} = 275 \text{ mM} \cdot V$   
 $V = 79.5 \text{ mL}$

ii) mix 79.5 mL 275 mM  $\text{Ca(NO}_3)_2$  + 95.5 mL  $\text{H}_2\text{O}$   
 or 95.5 mL 175 mL

2. How many mL of 75 mM sodium hydroxide would neutralize 25.0 milligrams of <sup>Sulfuric</sup> carbonic acid, hydrogen carbonate in 35 mL aqueous solution of ~~carbonic~~ carbonic acid? [10 points]

3 p4  
 3  
 4

i)  $[NaOH] V_{NaOH} = 2 [H_2SO_4] V_{H_2SO_4}$   
 $= 2 n_{H_2SO_4}$

ii)  $25 \text{ mg } H_2SO_4 \cdot \frac{1 \text{ mol}}{10^3 \text{ mg}} \cdot \frac{\text{mol}}{98 \text{ g}} = 2.55 \cdot 10^{-4} \text{ mol}$

iii) subst  
 $75 \text{ mM } V = (2.55 \cdot 10^{-4} \text{ mol}) \cdot 2$   
 $V = \frac{2(2.55 \cdot 10^{-4} \text{ mol})}{75 \text{ mM}} = \frac{10^{-3} \text{ mol}}{75 \text{ M}} = 1.33 \cdot 10^{-3} \text{ L} = 1.33 \text{ mL}$

3. Write the net ionic equation of mixing aqueous solutions of \_\_\_\_; if there's no net ionic equation, then write "no reaction". [15 points]

a. Sulfuric acid + sodium hydroxide



b. Barium nitrate and lithium phosphate



c. Calcium chloride and potassium sulfate



d. Silver acetate and sodium nitrate

no rx

e. Sodium carbonate and hydrogen chloride



4. In regards to a separatory funnel, describe ... [10 points]

a. the basis / rationale of separating two chemicals

solids have differential solubilities in two immiscible solvent; thereby separation

b. how to use it

- mix immiscible solvents w/ solute into separatory funnel
- let stand for awhile
- open/close valve to collect different solvent

3 pt Q

5+15 pts

5. The density of 78.5% (by mass)  $\text{Na}_2\text{CO}_3$  <sup>aqueous solution</sup> is 1.33 g/mL. What is its concentration in molar? [10 points]

$$\frac{78.5 \text{ g Na}_2\text{CO}_3}{100 \text{ g soln}} \cdot \frac{1.33 \text{ g soln}}{\text{mL soln}} \cdot \frac{10^3 \text{ mL}}{\text{L}} \cdot \frac{1 \text{ mol Na}_2\text{CO}_3}{106 \text{ g Na}_2\text{CO}_3}$$

3 pt    3    2    2 pt

= 9.84 M

6. What is the basis / rationale that ethanol <sup>is</sup> soluble in water, while ethane is insoluble? [10 points]

separate solute	ethanol	ethane	same consume energy
solvent	high	low	high
	high	high	high
combine	high	intermediate	

5+4pt

as energy combine ethane + H<sub>2</sub>O < energy separate  
 energy separate < energy combine  
 unlikely to form sol

7. Old topic: what is the relative first ionization energy of \_\_\_; basis / rationale? [10 points]

a. Phosphorus versus sulfur

IE: S < P b/c

e<sup>-</sup> e<sup>-</sup> repulsion → easier to remove e<sup>-</sup>

1+4pt

S: [ ] 2s 2p 3s 3p 3d  
 P: [ ] 2s 2p 3s 3p 3d

↓ IE ← ↓ energy to remove e<sup>-</sup>

b. Nitrogen versus phosphorus

IE: P < N b/c

P has more shells of e<sup>-</sup> → ↑ r, ↑ Z → ↓ F<sub>eff</sub> → easier to remove e<sup>-</sup>

1+4pt

↓ IE ← ↓ energy to remove e<sup>-</sup>