

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

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

ch. 11 &amp; 3 IMF &amp; stochi test

70 points (4 ec)

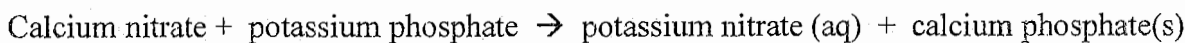
ap chemistry

**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.

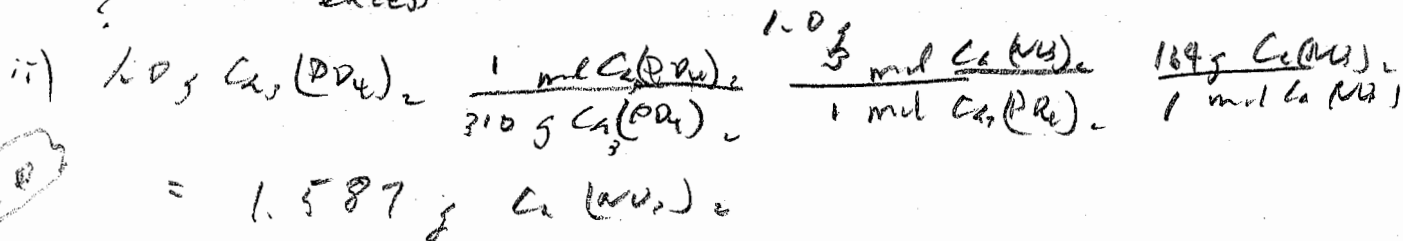
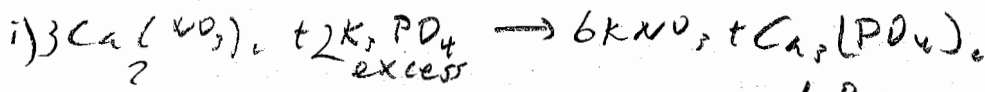
Signature: \_\_\_\_\_

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.

1. An aqueous solution has a 5.0 g mixture of calcium nitrate and sodium nitrate where the addition of excess potassium phosphate selectively reacts with the calcium nitrate and forms a precipitate, a solid.

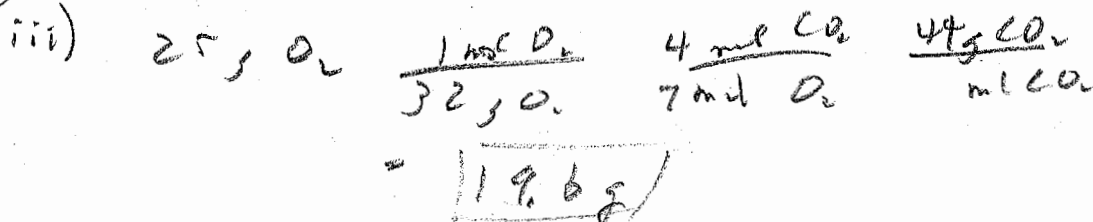
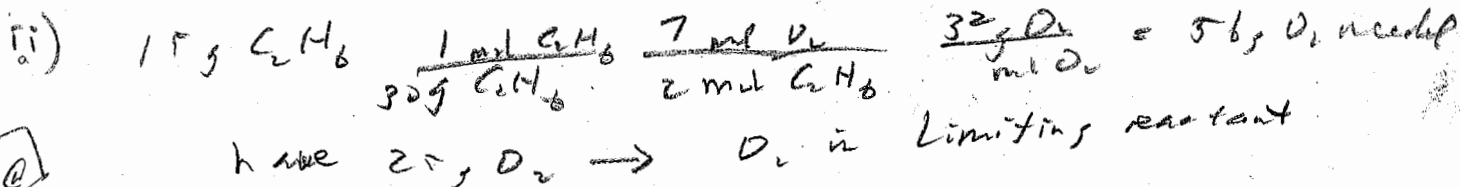
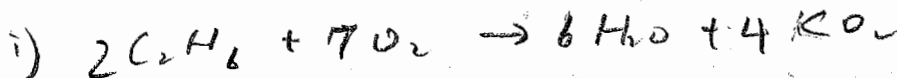


If 1.0 grams of a precipitate was formed, what is the % calcium nitrate in the mixture? [15 points]

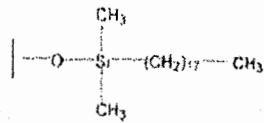


iii) %  $\text{Ca(NO}_3)_2$  in mixture =  $\frac{1.587 \text{ g Ca(NO}_3)_2 \text{ in mixture}}{5.0 \text{ g mixture}} = \frac{1.587}{5.0} = \boxed{32\%}$

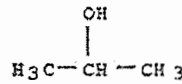
2. 15.0 g ethane + 25.0 g oxygen gas  $\rightarrow$  water + \_\_\_\_\_ g carbon dioxide. [15 points]



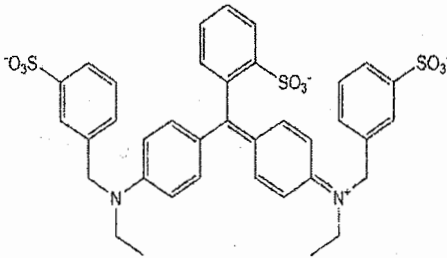
3. Based on the below information,



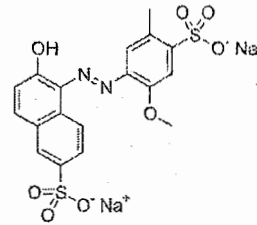
(source: stationary phase's surface)



(isopropyl alcohol - mobile phase)



(source: blue dye)

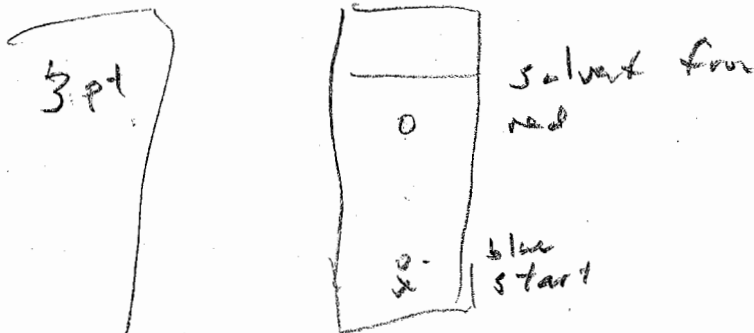


(source: red dye)

where thin layer chromatography, an adsorption chromatography technique, was used to separate the red and blue dyes using the same stationary phase as in your column chromatography lab and the composition of the mobile phase has isopropyl alcohol in the lab. [14 points]

a. alcohol concentration = the first phase of the psudeo-gradient elution

i. sketch expected results, where you label the starting point, solvent front, and location of the red and blue dyes.



ii. what is the relative Rf of the red and blue dyes? basis / rationale?

R<sub>f</sub> : red > blue ≈ 0

b<sub>f</sub> : polarizability : blue > red, so

strength / b<sub>f</sub> between dye & starting phase : blue > red, so

blue won't move much bc insufficient R<sub>OH</sub> to displace blue dye  
 while red move more

∴ separation of dye

1 pt

1

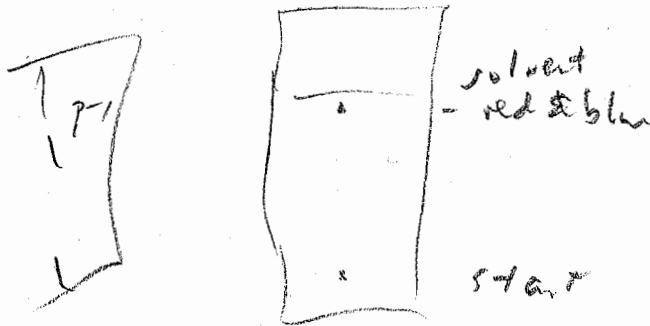
2

1

1

b. alcohol concentration = second phase of the psudeo-gradient elution

i. sketch expected results, where you label the starting point, solvent front, and location of the red and blue dyes.



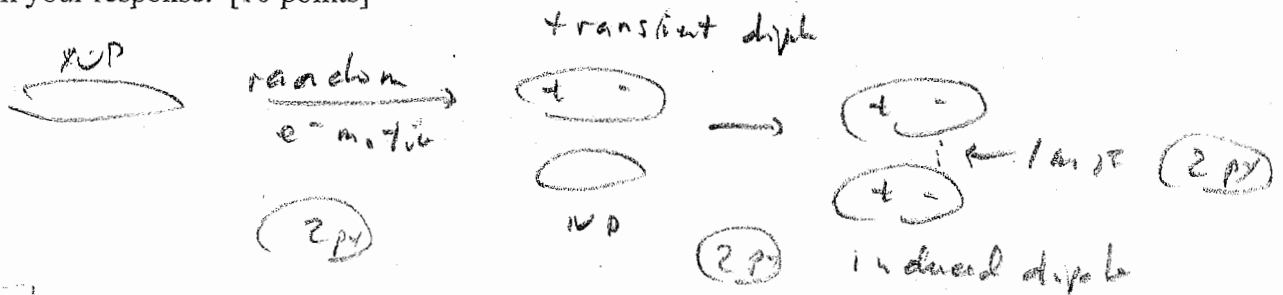
ii. what is the relative Rf of the red and blue dyes? basis / rationale?

1 p1  
 1  
 1  
 1

$R_f$ : red  $\approx$  blue  $\approx$  1

ble  $\equiv$  a lot of  $R_{OH}$ , which binds to the stationary phase, so both dyes remain in the mobile phase & moves with the solvent

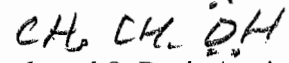
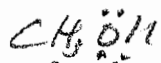
4. Describe London IMF in a nonpolar compound, where use and define the term, induced dipole and transient dipole in your response. [10 points]



2 p1 transient dipole: ...

2 induced dipole: ...

5. What is the relative vapor pressure of methanol versus ethanol? Basis / rationale? hint: methanol is an alcohol with a methyl group, while ethanol is an alcohol with an ethyl group. [10 points]



- 3 pt) i) both are have H-bond IMF b/c H bond to O & polar are b/c  $\Sigma$  bad by b/c O b/c shape of are
- 2 ii) London IMF: EtOH > MeOH b/c EtOH has more e<sup>-</sup>
- 2 iii) total IMF: EtOH > MeOH
- 3 iv) <sup>EtOH:</sup> ↑ IMF<sub>total</sub>: harder to separate liquid molecules → ↓ evaporation → ↓ gas → ↓ VP

6. The boiling point: HBr > HCl. Basis / rationale? Include all IMF in both compounds and the relative strength of the various IMF in your response. [10 points]

4 pt) as BP, HBr > HCl → IMF<sub>total</sub>: HBr > HCl

ii) HBr HCl



3 iii) London IMF: HBr > HCl  
b/c HBr has more e<sup>-</sup> / polarizability

3 iv) dipole-dipole IMF: HBr < HCl  
b/c ΔEN: HBr < HCl  
b/c ΔEN: HBr < HCl