

Chem2/FS95
Final Exam/Tues

Name _____ Section _____

StdntNo. _____ TA _____

Clearly show all work, equations, units, for partial credit Use extra paper.

1. A 0.254 gm sample of pure oxalic acid ($\text{H}_2\text{C}_2\text{O}_4$, $\text{MWt}=90.035$), required 37.23 ml of a KOH solution to reach an endpoint. Calculate the concentration of the KOH.

The neutralization reaction is: $\text{H}_2\text{C}_2\text{O}_4 + 2\text{KOH} \rightarrow \text{K}_2\text{C}_2\text{O}_4 + 2\text{H}_2\text{O}$

Ans: 0.152 M

2. A 10.00 ml sample of acetic acid, $\text{HC}_2\text{H}_3\text{O}_2$, was diluted to 100.00 ml. A 25.00 ml aliquot of the diluted acid required 34.27 ml of 0.1234 M NaOH to reach an endpoint.

Calculate the concentration of the original acid sample.

The neutralization reaction is: $\text{HC}_2\text{H}_3\text{O}_2 + \text{NaOH} \rightarrow \text{NaC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O}$

Ans: 1.692 M

3. A 4.123 gm sample containing a KClO_3/KCl mixture was heated to produce oxygen gas. After heating, the sample lost 0.594 gm. Calculate the weight percent of KClO_3 in the sample. (MWt of $\text{O}_2 = 32.00$, MWt of $\text{KClO}_3 = 122.55$)

The decomposition reaction is: $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$ Ans: 36.8 % KClO_3

4. The oxygen from the above experiment was collected by water displacement at 22.0 oC. The volume of water displaced was 496 ml. Calculate the molar volume of oxygen at STP from the experimental data. Barometric Pressure = 747.3 Torr, Vapor pressure of $\text{H}_2\text{O} = 19.8$ Torr at 22.0 oC, $R = 0.08206$ L atm/mole K, MWt of $\text{O}_2 = 32.00$ gm/mole, 1.000 atm = 760.0 Torr.

Ans: 23.7 L

5. A standard blue dye solution containing 7.63 ppm of dye gave an absorbance reading of 0.843 in a spectrophotometer. Another solution of the same dye of unknown concentration showed an absorbance of 0.579 at the same wavelength. Calculate the concentration of the blue dye unknown.

Ans: 5.24 ppm

6. What is the percent transmittance of a solution with an absorbance of 0.579?

26.4% T

7. If 35 drops of a solution measuring 25.0 %T is mixed with 45 drops of water, what is the percent transmittance of the diluted solution?

54.5% T

Methanol can be prepared via the following exothermic reaction: $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightleftharpoons \text{CH}_3\text{OH}(\text{g})$

What would be the effect of the following changes on the equilibrium:

8. A decrease in temperature:

a) shift right b) shift left c) no change d) not enough info

Ans: A

9. An increase in overall pressure:

a) shift right b) shift left c) no change d) not enough info

Ans: A

10. Removal of some $\text{CH}_3\text{OH}(\text{g})$:

a) shift right b) shift left c) no change d) not enough info

Ans: A

11. The number of theoretical plates, N , is a measure of efficiency of a GC column. Calculate the peak widths, w_B , for a substance run on two different columns, one with $N=70.0$, the other with $N=7000.$, assuming the retention time, t_R , is 100.0 sec for both columns. $N=16(t_R/w_B)^2$

Ans: $w=47.8$ sec for $N=70$ and $w=4.78$ sec for $N=7000$

12. Calculate how the increase in N will affect the peak height, H , for the substance above if identical amounts (Areas) are injected into the two different columns? $A=1/2 w_B(H)$

Ans: 10x taller for narrower peak

13. The K_{sp} of Ag_2CO_3 is 8.1×10^{-12} . What is the solubility in grams per liter? (MWt of $\text{Ag}_2\text{CO}_3 = 275.75$) (Hint: start by writing out the equilibrium involved)

Ans: 3.5×10^{-2} gm/L

14. The solubility of $\text{Co}(\text{OH})_3$ (MWt = 109.96) is 3.2×10^{-3} gm/L. What is the K_{sp} ?

Ans: $K_{sp}=1.9 \times 10^{-17}$

Extra credit: (1-2 pt. ea. depending on quality of answer)

What were your most favorite and least favorite labs of the second half of the semester and why?

NaOH std

Molar Volume of O_2

Colorimetry

LeChatelier's Principle

GC

K_{sp}