Grossmont College Name: \_\_\_\_\_\_KEY\_\_\_\_\_\_\_\_\_\_\_

Chemistry 142

Spring 2015, Quiz 4 Date: \_\_\_\_\_\_\_\_\_\_\_\_

1. A 10.0-mL solution of 0.300 M NH3 is titrated with a 0.100 M HCl solution. Calculate the pH after the following additions of the HCl solution Kb= 1.8 x 10–5 for NH3

(a) 0.0 mL

 *NH3 + H2O 🡪 🡨 NH4+ + OH-*

*I(M) 0.30 M 0 ~0*

*C(M) -x +x +x*

*E(M) 0.30 M– x x x*

*Kb = 1.8 \* 10-5 = [NH4+][OH-]/[NH3] = x2/(0.30M – x)*

 *assume x is small… = x2/0.30M x = 2.3 \* 10-3 M = [OH-]*

 *(this is less than 1% of starting concentration – our assumption that x is small is valid)*

 *Then use this to calculate [H3O+] = Kw/[OH-] =*

 *1.0 \* 10-14M2/2.3 \* 10-3 M= 4.3 \* 10-12 M*

 *and pH – log (4.3 \* 10-12 M) = 11.37*

 (b) 30.0 mL

**Find the volume of HCl by stoichiometry at the equivalence point: M1V1= M2V2**

**10.0 mL NH3 x (0.300 M NH3)/ 0.100 M HCl) = 30.0 mL**

Since this volume is at the Equivalence point all that remains is conjugate base

 *NH4+ + H2O 🡪 🡨 NH3 + H3O+*

*I(M) 0.0750 M 0 ~0*

*C(M) -x +x +x*

*E(M) 0.0750 M – x x x*

(c) 40.0 mL

**from part b, mmoles NH3 = 3.00 mmoles NH4+**

**moles HCl = 4.00 mmoles HCl**

**moles excess acid = 4.00 mmoles - 3.00 mmoles = 1.00 mmoles HCl**

**M HCl =  0.02 M HCl**

**pH = -log 0.02 = 1.70**

1. A 100.0 mL buffer is 0.15 M K2HPO4(aq) and 0.10 M KH2PO4(aq).
2. Calculate the pH of the buffer

1. Calculate the new pH if 10.0 mL of 1.0 M HNO3 are added.

The added H+ will react with the stronger base HPO4−2. Take care of stoichiometry.

 H+ + HPO4−2 🡪 H2PO4−

Mmol

Before 10. 15 10

Change -x -x +x

Mmol

After 0 5 20