$\overline{}$ = %
31

Name:________________

Titration Test

1. What is the difference between an endpoint and an equivalence point. Which one does the experimenter observe? Which one will help with stoichiometry?

- end point → observed change in indicator
- equivalence point → stoichiometric neutralization

/2

2. Define the term "protism" for the point of view of both acids and bases.

- number of protons an acid can donate or a base can accept

/2

What is the protism of each of the following(i.e. mono, di tri protic):

Formula	Protism
HBr	mono
H_3PO_4	tri
NaOH	mono
$Al(OH)_3$	tri
Na_2CO_3	di
CH_3COOH	mono

/6

3. Determine the concentration of 450 mL of HCl solution if neutralization can be achieved by 255 mL of 0.01 M KOH

$$HCl + KOH \rightarrow KCl + H_2O$$

$$n_A = n_B$$

$$C_A V_A = C_B V_B$$

$$C_A = \frac{C_B V_B}{V_A}$$

$$C_A = \frac{0.01\,M \times 255\,mL}{450\,mL}$$

$$C_A = 0.0056\dot{6}\,M$$

/4

/14

4. Determine the concentration of 25 mL of H_3PO_4 solution if neutralization can be achieved by the addition of 0.852 g of Na_2CO_3 (s).

$$2H_3PO_4 + 3Na_2CO_3 \rightarrow 2Na_3PO_4 + 3H_2O + 3CO_2$$

$$3n_A = 2n_B$$

$$3C_AV_A = 2n_B$$

$$C_A = \frac{2n_B}{3V_A}$$

$$C_A = \frac{2 \times 0.00804\ mol}{3 \times 0.025\ L}$$

$$0.852g \times \frac{1\ mol}{105.99g} = 0.00804\ mol$$

$$C_A = 0.214\ M$$

note change in unit to make units agree!!

5 / 5

5. 2.50 g of a diprotic base is carefully neutralized by hydrochloric acid (HCl). 361.7 mL of 0.1 M HCl is required to achieve neutralization. Use this information to determine the molar mass of the base (Hint, find amount in moles first and then use the mass (2.50 g) to determine the mass for one mole. Now given your answer, which of the following bases could be the base in this question: Na_2SO_4, K_2CO_3, $Na_2C_2O_4$, $Ba(OH)_2$, $Al(OH_3)$, NaOH

$$n_A = 2n_B$$

$$C_AV_A = 2n_B$$

$$n_B = \frac{C_AV_A}{2}$$

$$n_B = \frac{0.1\ mol/L \times 0.3617L}{2}$$

$$n_B = 0.01809\ mol$$

$$\frac{2.50g}{0.01809\ mol} = 138.24\ g/mol$$

$\therefore K_2CO_3 \Rightarrow 138.21\ g/mol$

alternate

$$2.50g = 0.01809\ mol$$

$$1\ mol \times \frac{2.50g}{0.01809\ mol} = 138.24g$$

$\therefore 138.24\ g/mol$

6 / 6

11 / 11

6. Jessica and Brittini are messing about in the lab one day and accidentally brake a full bottle (2.00 L) of 12.1 M concentrated hydrochloric acid (HCl). Not quite sure what to do, Jessica quickly stirs in a 3.00 kg bag of sodium hydroxide (NaOH) in the hopes of neutralizing this mess. According to Brittini's calculations, this is to much base, so she quickly adds 3.0 L of concentrated 18.0 M H_2SO_4. After the fire department and the ambulance have left, you are now faced with the job of neutralization. What mass in kg of $NaHCO_3$ (a monoprotic base) must be added to achieve true neutralization.

6

$$n_A^{HCl} + 2n_A^{H_2SO_4} = n_B^{NaOH} + n_B^{NaHCO_3}$$

$$C_A^{HCl}V_A^{HCl} + 2C_A^{H_2SO_4}V_A^{H_2SO_4} = n_B^{NaOH} + n_B^{NaHCO_3}$$

$$n_B^{NaHCO_3} = C_A^{HCl}V_A^{HCl} + 2C_A^{H_2SO_4}V_A^{H_2SO_4} - n_B^{NaOH}$$

$$n_B^{NaHCO_3} = 12.1\ \text{mol}/\text{L} \times 2.00\ \text{L} + 2 \times 18.00\ \text{mol}/\text{L} \times 3.0\ \text{L} - 3000\ \text{g} \times \frac{1\ \text{mol}}{40.00\ \text{g}}$$

$$n_B^{NaHCO_3} = 57.2\ \text{mol}$$

$$57.2\ \text{mol} \times \frac{84.01\ \text{g}}{1\ \text{mol}} \times \frac{1\ \text{kg}}{1000\ \text{g}} = 4.81\ \text{kg}\ NaHCO_3$$

6