

Name: _____ Date _____ Section _____

Lab Partner: (ONLINE) _____

Data Sheet 1: Indirect (Back) Titration

Directions:

Use 1 tablet each for Tums & Equate. Measure out ~1.000g of Baking Soda. Record exact mass in mg.

Recorded Data: (All data should be recorded in pen.)

$$M_{\text{acid}} = M_{\text{HCl}} = \underline{1.057} \qquad M_{\text{base}} = M_{\text{NaOH}} = \underline{1.706}$$

Burette Readings (Record all measurements to the nearest 0.01 ml.)

		Baking Soda	Equate	TUMS
	Hydrochloric Acid, HCl	993 mg	(1 tablet)	(1 tablet)
1.	Initial Reading, V_i, ml	5.23	1.63	2.48
2.	Final Reading, V_f, ml	30.58	26.63	27.43
3.	Change in Volume, ml $\Delta V_{\text{HCl}} = V_f - V_i$			
4.*	millimoles of HCl, n_{HCl} $n_{\text{HCl}} = \Delta V_{\text{HCl}} \times M_{\text{HCl}}$			

Sodium Hydroxide, NaOH		Baking Soda	Equate	TUMS
5.	Initial Reading, V_i, ml	27.05	2.30	16.58
6.	Final Reading, V_f, ml	34.85	16.58	27.05
7.	Change in Volume, ml $\Delta V_{\text{NaOH}} = V_f - V_i$			
8.*	millimoles of NaOH, n_{NaOH} $n_{\text{NaOH}} = \Delta V_{\text{NaOH}} \times M_{\text{NaOH}}$			
9.*	millimoles of excess HCl, n_x $n_x = n_{\text{HCl}} - n_{\text{NaOH}}$			

On a separate sheet of paper, show calculations for the starred “” items.

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		Baking Soda	Equate		TUMS
10.	Antacid Chemical Formula	NaHCO_3	Al(OH)_3	MgCO_3	CaCO_3
11.*	Molar Mass				
12.	mass of active ingredient (mg)	993	160	105	500
13.*	millimoles of active ingredient				
14.	Equivalents				
15.*	HCl theoretical (mmoles)				
16.	HCl actual (mmoles)				
17.*	Percent Yield (%)				
18.*	Theoretical mass of HCl used. (mg)				
19.*	Actual mass of HCl used. (mg)				
20.	Cost of Antacid per dose (\$)				
21.*	Theoretical Cost Effectiveness (\$/mg)				
22.	Actual Cost Effectiveness (\$/mg)				

For row #12 use the actual measured mass in mg of Baking Soda. For Tums & Equate, record the mass of the active ingredients in mg listed on the bottle.

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Data Sheet 2: Direct (Forward) Titration

Directions: Use 1 tablet for Tums. Measure out ~1.000g of Baking Soda. Record exact mass in mg.

Recorded Data: (All data should be recorded in pen. Record all measurements to the nearest 0.01 ml.)

$$M_{\text{acid}} = M_{\text{HCl}} = \underline{\hspace{2cm}}$$

		Baking Soda	TUMS
	Hydrochloric Acid, HCl	980 mg	(1 tablet)
23.	Initial Reading, V_i, ml	38.20	30.58
24.	Final Reading, V_f, ml	49.95	38.20
25.	Change in Volume, ml $\Delta V_{\text{HCl}} = V_f - V_i$		
26.	millimoles of HCl, n_{HCl} $n_{\text{HCl}} = \Delta V_{\text{HCl}} \times M_{\text{HCl}}$		
<hr/>			
10.	Antacid Chemical Formula	NaHCO₃	CaCO₃
11.	Molar Mass		
12.	mass of active ingredient (mg)	980	500
13.	millimoles of active ingredient		
14.	Equivalents		
15.	HCl theoretical (mmoles)		
16.	HCl actual (mmoles)		
17.	Percent Yield (%)		

For row #12 use the actual measured mass in mg of Baking Soda. For Tums, record the mass of the active ingredients in mg listed on the bottle.

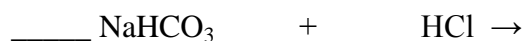
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		Baking Soda	TUMS
18.	Theoretical mass of HCl used. (mg)		
19.	Actual mass of HCl used. (mg)		
20.	Cost of Antacid per dose (\$) (*See website below.)		
21.	Theoretical Cost Effectiveness (\$/mg)		
22.	Actual Cost Effectiveness (\$/mg)		

Antacid Post Lab

- 1. Calculate Equivalents for Column 14:** Balance the equations below. The number of moles of HCl used are your mole equivalents.
(You may have already done this in the PreLab. If so, copy information here.)



- 2. Make 3 Column Graphs** that include all 5 Trials (3 Indirect & 2 Indirect)

Graph 1: Graph the Antacid Effectiveness (Percent Yield or Row #17).
[x-axis antacid name; y-axis percent yield]

Graph 2: Graph the Theoretical mg of HCl used vs. the Actual mg of HCl (Rows #18 & #19).
[x-axis antacid name; y-axis Series 1 = Theoretical mg, Series 2 = Actual mg]

Graph 3: Graph the Theoretical vs. Actual Cost Effectiveness. (Rows #21 & 22)
[x-axis antacid name; y-axis Series 1 Theoretical Cost, Series 2 Actual Cost]

* <http://web.mst.edu/~tbone/Subjects/TBone/antacidtable.html>

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Antacid Post Lab Questions

1. Based on the Percent Yields (Graph 1) rank the antacids from most effective to least effective.
2. Based on the Tums & Baking Soda values in Graph 2, were the direct titrations as effective as the indirect titrations? Explain.
3. Based on Graph #3, rank the antacids from least to most cost effective for the theoretical cost effectiveness.
4. Based on Graph #3, rank the antacids from least to most cost effective for the actual cost effectiveness.
5. Which one did you expect to be the most cost effective? Were you correct? Explain.
6. You are given a new antacid Mag-Neezi-Yum. It has the same price as the Equate and includes 160 mg of $\text{Mg}(\text{OH})_2$ and 105 mg of MgCO_3 , instead of 160 mg of $\text{Al}(\text{OH})_3$ and 105 mg of MgCO_3 . Explain how you could determine the theoretical effectiveness of the new antacid without having to do any titrations.
7. Aside from the cost of the antacid and the effectiveness, give at least one other reason someone might buy a given antacid over another one.