Investigating Oxidation- reduction Reactions

Chemistry 101*: General Chemistry*

Post-Lab & Lab Report #7

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January 29, 2020

Investigating Oxidation- Reduction Reactions

Purposes: To investigate the chemical reaction (Redox) for reactants which is oxidize and Reduced for looking chemical forming such precipitation, gases ,and color changes. This is type of things we are looking for to define what happen that cause the reactants become oxidize and reduced. That means the electron has lost and gained in the chemical reaction. For part IV and V to find the amount of chemical element in the in the reaction which is reacted.

Procedure:

Part I: calculate the mass of $KMnO_4$ to make an .02 M solution of $KMnO_4$ dilute with the water. The solution require a mass of .94824 gram of potassium permanganate then dissolve in boiling water about 300 mL of the solution we should get for the experiment in the next part. Then save it in the container of 1000 mL

Part III:

Calculate the mass require of oxalic acid to react with $KMnO_4$ in process of titration to find the concentration. Put in the flask and add the 50 mL then and add the sulfuric acid to the solution about 13-14 mL. heat with hot plate till it reach 80-90 Celsius then titrate with $KMnO_4$ the solution you make for the experiment. Wait for the color change to light pinkish then you stop titrate then you measure the quantity of $KMnO_4$ you added then calculate the morality of solution. Repeat for two other flasks.

Part IV:

Instead of oxalic acid we put some unknown sample for the instructor. We can use the same process as above weight out sample and divide in four parts then repeat Step from Part III

Part V:

Instead of oxalic acid we put some unknown sample for the instructor. We can use the same process as above weight out sample and divide in four parts then repeat Step from Part III to find out the ferrous ion in the solution and percentage of by mass used in the experiment and how much are there. Steps are same in part III but it is just a new unknown which we got from the professor.

Data charts:

Procedures	Observations	Conclusions
Test for sulfate **1.** Dissolve small Na_2SO_4 in 2 mL deionized water in the test tube. Then put 20 drop of 6M HCl . No more than 4-6 drop of $BaCl_2$	There is precipitate formed in test tube like gelatinous white matter on the top of solution	SO_4^{2-} is present because there is precipitate in the solution.
Behavior of HSO_3^- **1.** 2 ml $NaHSO_3$ then test for sulfate but add 2 ml distilled water to bisulfite solution watch out the precipitate in test tube	No precipitate in the solution color is transparent. No color	There is no chemical reaction occur because there redox of SO_4^{2-} and no precipitate in the test tube
A Effect of HSO_3^- on MnO_4^- 1. 2 ml $NaHSO_3$ then put the dilute HCl then add a $KMnO_4$ one at a time and mixing every drop and see color changes then test for sulfate	The purple color changed to clear solution Cloudy are form when we add BaCl2	There is Mn^{2+} pink and it is too dilute to see and redox and SO_4^{2-} is present because of precipitate in solution
B: 1. 2 ml $NaHSO_3$ then put 1% 2-3 of Hydrogen peroxide then test for sulfate.	Cloudy less ,little precipitate	Little reaction , less reactant , little precipitate or none. Little chemical reaction
C: 1. 2 ml $NaHSO_3$ then put Br2 14-15 drop see color changes then test for Sulfate	Tiny cloudy and little precipitate the color Br2 is yellow	Little reaction , less reactant , little precipitate or none. Little chemical reaction
D: 1. 2 ml $NaHSO_3$ then put dilute HCL then add $K_2Cr_2O_7$ solution one drop at a time mixed after each drop then test for sulfate	No color changed when we add $K_2Cr_2O_7$ in solution Nothing seem to happen. No color change when test with sulfate	No chemical reaction occur because there is no precipitate are formed when we test with SO_4^2

Procedures	**Observations**	**Conclusions**
3a: **1.** to first tube add 5 drop dilute H_2SO_4 then put Hydrogen peroxide 8-10 drop see the bubble are formed	Don't see any gas, by condition we have	There is decomposition chemical reation because it form a gas
3B: **1.** to first tube add 5 drop dilute H_2SO_4 then add ammonium sulfate. See color change.	Color become clear from the purple color.	There is ion transform because its color change.
3C: **1.** to first tube add 5 drop dilute H_2SO_4..add small amount of KI then see color change. Then do add sodium thiosulfate until color disappear. See what color has changed	When add KI the color become yellow dark similar to test tube I2 The color change when we add the starch on it to brownish then we add Na2S2O4 the test tube become clear again	I2 which make the test tube look yellow. The chemical reaction occur it color change. Then acid change it color to restate of phase.
2B: **1.** 2 ml $NaHSO_3$ then put 5-6 drop dilute NaOH and 2 drop of KMnO4 solution see color change	Light yellow formed when we put KMnO4 to the solution Look like more yellow.	There ion which change the color to yellow
2C: **1.** 2 ml $NaHSO_3$ then put Na_2CO_3 stir gently till it dissolved then add 2 drop of KMnO4	For a second we can see yellow brown color we add KMnO4	Little chemical reacton occur because we don't see big amount of changes .

Procedures	Observations	Conclusions
5: **1.** Dissolve oxalic acid and then add 20 drop dilute of H_2SO_4 . Separate in two test tube one with hot burner and at room temperature. After 5 minute then add 3-4 drop KMnO4 to each test tube which goes faster in reaction.	With heat dissolve faster than no heat applied. The become transparent we put the KMnO4 but the color of cold one is still purple on the of it.	Temperature cause chemical reaction to change phase faster and go back in the same stage(Shift)

Part III: Standardization of $KMnO_4$

	Trial 1	**Trial 1**	**Trial 3**
Mass of vial	6.1928g	6.2471g	6.1834g
Mass of vial with acid	6.2871g	6.3420g	6.2778g
Mass after transfer	6.1928g	6.2475g	6.1840g
Mass of oxalic acid	.0943g	.0945g	.0938g
$KMnO_4$ Initial buret reading	0.0	12.0	24.1
$KMnO_4$ final buret reading	12.0	24.0	36.1
Total Volume added	12.0	12.0	12.0
Mole of Oxalic acid	7.479*10^-4 mol	7.4952*10^-4 mol	7.4397*10^-4 mol
Mole of $KMnO_4$	2.992*10^-4 mol	2.9998*10^-4 mol	2.975*10^-4 mol
$KMnO_4$ concentration	.024933 mol/ L	0.024998 mol/ L	0.0247916 mol/ L
Average concentration	.024907 mol/ L	.024907 mol/ L	.024907 mol/ L
Sig Average concentration	0.0249 mol / L	0.0249 mol / L	0.0249 mol / L
Deviation from average	0.000026	0.000091	0.000115
Relative Deviation	1.04	3.65	4.63
Average relative deviations	3.11	3.11	3.11

From the beginning , we measure masses accurately and precision of titration is also accurate but the dilute solution significant is high from the reference number that we can refer to. Relative deviation and the different relative deviations from average are less than 10 ppt. so we measure and repeat the experiment accurately and there is might be something wrong with concentration of the **$KMnO_4$** dilute solution. If I get around 15 mL of **$KMnO_4$** the concentration would be accurate for what we expected from the experiment.

Part IV: Percent Oxalate Ion

	Trial 1	**Trial 1**	**Trial 3**
Mass of vial	6.1860g	6.2510g	6.1849g
Mass of vial with unknown	6.4480g	6.5128g	6.4455g
Mass after transfer	6.1860g	6.2524g	6.1849g
Mass unknown used	.2620g	.2618g	.2606g
$KMnO_4$ Initial buret reading	0.0	0.0	0.0
$KMnO_4$ final buret reading	28.7	28.5	28.5
Total Volume added	28.7	28.5	28.5
Mole of Oxalate Ion	1.7871*10^-3 mol	1.7745*10^-3 mol	1.7745*10^-3 mol
Mole of $KMnO_4$	7.1483*10^-4 mol	7.098*10^-4 mol	7.098*10^-4 mol
Mass of Oxalate Ion	.15729g	.15619g	.15619g
% Percent Oxalate Ion	60.03	59.66	59.94
Average % Percent Oxalate Ion	59.87763%	59.87763%	59.87763%
Sig Average % Percent Oxalate Ion	59.9%	59.9%	59.9%
Deviation from Average	.1523	.2176	.05236
Relative Deviation	2.543	3.634	1.040
Average Relative Deviations	2.405	2.405	2.405
Sig Average Relative Deviations	2.41	2.41	2.41

I would not round much of for significant because the Relative deviation will get larger if I round up the number. So I put the sig Avg for the percent oxalate in the solution of the experiment. So we make it better that way. And accuracy and precision are in the right spot. PPT is less than 10, so precision is precise and accurate. So there will be only three sig fig in experiment, that the end of part IV by find the mass of oxalate but we have to find the mole ratio of **$KMnO_4$ and Oxalate is 2:5** so we time 5 divide by two, so we will the number of mole of oxalate then convert gram of oxalate. Then find the percent ratio in trials we got and weigh it.

Part V: Percent Ferrous Ion in Redox Experiment

	Trial 1	**Trial 1**	**Trial 3**
Mass of vial	6.1859g	6.1859g	6.1859g
Mass unknown used	1.0048g	1.0053g	1.0059g
$KMnO_4$ Initial buret reading	0.0	15.9	22.6
$KMnO_4$ final buret reading	15.9	31.8	38.5
Total Volume added	15.9	15.9	15.9
Mole of unknown Ion	1.59*10^-3 mol	1.59*10^-3 mol	1.59*10^-3 mol
Mole of $KMnO_4$	3.18*10^-4 mol	3.18*10^-4 mol	3.18*10^-4 mol
Mass of Unknown	0.0888015g	0.0888015g	0.0888015g
% Percent ferrous Ion	8.838%	8.833%	8.828%
Average % Percent Ferrous Ion	8.833%	8.833%	8.833%
Sig Average % Percent Ferrous Ion	8.83%	8.83%	8.83%
Deviation from Average	.005	.0	.005
Relative Deviation	.5661	0	.5661
Average Relative Deviations	.3773	.3773	.3773
Sig Average Relative Deviations	3.77*10^-1	3.77*10^-1	3.77*10^-1

We divide a mass of 4.0130 with a vial four parts then we got the volume added then covert to mole using the morality of Solution we got from part III then time by mole ratio of ferrous ion 5:2 of **$KMnO_4$** so we time 5 divide 2 then we get moles of unknown then using molar mass of Fe :55.85 g/ mol to convert to gram of Ferrous ion then we compare the percentage of what we have from calculation to the what we used in the solution of mass unknown per trial.

Conclusion:

	Average value	**Average relative deviation**
Part III: Average molarity of $KMnO_4$	.0249 mol/ L	3.11
Part IV: unknown number	1039R (unsure)	
Sig Average % Percent Oxalate Ion	59.9%	2.41
Part V:unknown number	760R (unsure)	
Sig Average % Percent Ferrous Ion	8.83%	3.77*10^-1