**Investigating Oxidation- reduction Reactions**

**Chemistry 101***: General Chemistry*

Post-Lab & Lab Report #7



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**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 KMnO4 to make an .02 M solution of KMnO4 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 KMnO4 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 KMnO4 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 KMnO4 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:**

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| --- | --- | --- |
| **Procedures** | **Observations** | **Conclusions** |
| **Test for sulfate**   1. Dissolve small Na2SO4 in 2 mL deionized water in the test tube. Then put 20 drop of 6M HCl . No more than 4-6 drop of BaCl2 | There is precipitate formed in test tube like gelatinous white matter on the top of solution | SO42- is present because there is precipitate in the solution. |
| **Behavior of HSO3-**   1. 2 ml NaHSO3 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 SO42- and no precipitate in the test tube |
| **A Effect of HSO3- on MnO4-**   1. 2 ml NaHSO3 then put the dilute HCl then add a KMnO4 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 Mn2+ pink and it is too dilute to see and redox and SO42-  is present because of precipitate in solution |
| B:   1. 2 ml NaHSO3 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 NaHSO3 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 NaHSO3 then put dilute HCL then add K2Cr2O7 solution one drop at a time mixed after each drop then test for sulfate | No color changed when we add K2Cr2O7 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 SO42 |
| **Procedures** | **Observations** | **Conclusions** |
| **3a:**   1. to first tube add 5 drop dilute H2SO4 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 H2SO4 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 H2SO4..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 NaHSO3 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 NaHSO3 then put Na2CO3 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 . |

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| **Procedures** | **Observations** | **Conclusions** |
| **5:**   1. Dissolve oxalic acid and then add 20 drop dilute of H2SO4 . 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 KMnO4**

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| --- | --- | --- | --- |
|  | **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 |
| **KMnO4 Initial buret reading** | 0.0 | 12.0 | 24.1 |
| **KMnO4 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 KMnO4** | 2.992\*10^-4 mol | 2.9998\*10^-4 mol | 2.975\*10^-4 mol |
| **KMnO4 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 **KMnO4** dilute solution. If I get around 15 mL of **KMnO4** 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 |
| **KMnO4 Initial buret reading** | 0.0 | 0.0 | 0.0 |
| **KMnO4 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 KMnO4** | 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 **KMnO4 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**

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| --- | --- | --- | --- |
|  | **Trial 1** | **Trial 1** | **Trial 3** |
| **Mass of vial** | 6.1859g | 6.1859g | 6.1859g |
| **Mass unknown used** | 1.0048g | 1.0053g | 1.0059g |
| **KMnO4 Initial buret reading** | 0.0 | 15.9 | 22.6 |
| **KMnO4 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 KMnO4** | 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 **KMnO4** 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:**

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|  | **Average value** | **Average relative deviation** |
| **Part III: Average molarity of KMnO4** | .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 |