**Name: Block:**

**Group Members: Date: / / 2018**

**Due Date: Drop Date:**

The report is submitted in full, **on the due date**. If you are absent on the day, the report is expected to be submitted electronically. Late reports are penalized, and will *not accepted past the drop date*.

**Objective**

To determine the % concentration of H2O2 in a solution of hydrogen peroxide.

|  |  |  |
| --- | --- | --- |
| **Criteria** | **Student Self Evaluation** | **Teacher Assessment** |
| **Flow Chart:** a flow chart diagram of the procedure completed individually by each group member ***before the lab****! (for part 2 of the lab only)*  **Pre-Lab Questions:** displays a critical understanding of the background theory. | **/14** | **/14** |
| **Data, Results:** *(hand written, complete table)*  Provides results & detailed observations (and diagrams where appropriate) that are presented in **correctly labelled** tables with **descriptive, numbered titles**. | **/2** | **/2** |
| **Follow up Questions & Calculations:** *(hand written… all working out for calculations must be shown)*  Correctly identifies and explains the theory relating to the experiment and supports this with accurate observations & data. | **/6** | **/6** |
| **Presentation:**  Practical report is presented in the **correct format**, is written fluently and provides **appropriate section headings** and accurate referencing. ***Tables & graphs*** have numbered headings. Data & calculations may be hand written, however the remainder of the report is to be **word-processed.** | **/2** | **/2** |
| **Conclusion:** *(handwritten…****neatly!****)*  Identifies and defines important concepts and principles relevant to the experiment by relating back to the objective and hypothesis. Be sure to address the points listed in the lab handout when answering the conclusion. | **/3** | **/3** |
| **Practical:**  Is prepared on the day of the lab. Demonstrates an organized and safe approach to experimental work during the lab. Displays accurate & precise laboratory technique. Shows maturity, cooperation and leadership during laboratory work. **Titrated volumes** & **% [H2O2]** fall within an *acceptable range*. | **/5** | **/5** |
| **Results Summary** | **/32** | **/32** |

*We will be doing the lab on \_\_\_****Tuesday May 15****\_\_\_. In order to be ready to go, you need to complete the following sections of your lab report BEFORE arrive to class that day:*

* *Flow Chart*
* *Pre-Lab Questions*

Materials

Buret (50mL)

Retort stand

Extension clamp

Double c-clamp

Erlenmeyer flask (250mL)

Beaker (250mL)

Graduated cylinder (10mL)

Pipet (10mL)

Centigram balance

Medicine dropper

Standard solution of KMnO4 *(approx. 0.02M)*

3.0 M H2SO4

Hydrogen peroxide solution *(unknown %)*

Pre-Lab Questions: *(to be completed on a separate page & submitted with final report)*

1. What is meant by a standardized solution of KMnO4? ***(1 mark)***
2. What are the main reactants? *(H2SO4 is present only to acidify the solution.)* ***(1 mark)***
3. Write the reduction and oxidation half-cell equations ***(1 marks)***
4. Complete a balanced net ionic equation for the reaction. ***(1 mark)***
5. What is E0 cell.? What is the formula for calculating? ***(1 mark)***
6. E0 cell for a reaction used in a redox titration must ***always be positive***, why? ***(1 mark)***
7. Why is MnO4- especially useful in redox titrations *(two good reasons)*? ***(1 mark)***
8. What volume of H2O2 is suggested for the titration? How is this volume accurately determined? ***(1 mark)***
9. *Practice Calculation:* Use basic stoichiometry to find the molar concentration of the H2O2. Assume the density of the H2O2 solution is the same as water. ***(5 marks)***

**Table 1: Data Collected**

|  |  |
| --- | --- |
| **Mass of H2O2 solution** | **1.32 g** |
| **[MnO4-]** | **0.0268 M** |
| **Volume of MnO4- used** | **28.20 mL** |

*Steps – find the…*

* 1. balanced equation
  2. moles of MnO4-
  3. moles of H2O2
  4. mass of H2O2
  5. %H2O2 in solution by dividing the mass calculated in iv) by the mass from the table and multiply by 100

Safety:

Hydrogen peroxide is corrosive. It causes burns and is an irritant to skin. Wash any spills with plenty of soap and water.

Potassium permanganate is hazardous in case of skin contact *(irritant),* of eye contact *(irritant),* of ingestion, of inhalation. Corrosive to eyes and skin.

Procedure

1. Obtain a clean 250 mL Erlenmeyer flask, tare the balance, and, using a medicine dropper, add 20 drops of H2O2. Record the *exact mass* of H2O2 in table 1.

*\*NOTE: for subsequent trials measure H2O2 based on mass compared to trial #1, not drops. It is important that your masses are within 0.01g in order to have an accurate average.*

1. To the Erlenmeyer flask, add 30mL of water using a measuring cylinder. Then add 10 mL of H2SO4 using the volumetric pipette.
2. After cleaning and rinsing the buret, fill with KMnO4 solution. Record the initial volume in table 1.
3. Complete your titration with H2O2 until you obtain the lightest purple colour possible. Record your final volume in table 1.
4. Repeat procedure to complete 3-4 trials *(time permitting)* to ensure you have 3 volume measurements that are as close as possible to each other.
5. Clean up. **Unused KMnO4 must go in the waste container**. Solutions, after the titration, may be safely rinsed down the sink with lots of water.
6. Wash your lab bench and hands before leaving the lab.

Data and Observations:

**Table 1: Volume of KMnO4 to react with H2O2 Solution.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **[KMnO4] = .0250 M** | **Trial 1** | **Trial 2** | **Trial 3** | **Trial 4**  ***(if necessary)*** |
| **Mass of H2O2 (g)** |  |  |  |  |
| **Average Mass of H2O2 used (g)** | \*show calculation & indicate which trial was discounted as an outlier *(should be within 0.01g)* | | | |
| **Initial Volume of KMnO4 (mL)** |  |  |  |  |
| **Final Volume of KMnO4 (mL)** |  |  |  |  |
| **Volume of KMnO4 used (mL)** |  |  |  |  |
| **Average Volume of KMnO4 used (mL)** | \*show calculation & indicate which trial was discounted as an outlier | | | |

Follow-up Questions *(to be completed in this space provided)*

1. Write the ***balanced*** redox equation for MnO4- reacting with H2O2 in acid solution to give Mn2+ and O2.***(2 marks)***
2. Using the average volume, calculate the number of moles of MnO4- used. ***(1 mark)***
3. Using the molar ratio from your balanced equation, calculate the number of moles of H2O2 oxidized. ***(1 mark)***
4. Calculate mass of H2O2 oxidized. ***(1 mark)***
5. Calculate the percent concentration of H2O2 in the solution

*(HINT: use average mass & follow steps in your pre-lab questions)* ***(1 mark)***

Conclusion: ***(3 marks)***

* *Briefly summarize experiment*
* *State overall results of the experiment by addressing the objective(s)*
* *Discuss any sources of experimental error and suggest improvement for future experimentation*