TITLE: Redox titration

ASSESSMENT CRITERION: C

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| 7-8 | The student is able to:  i. **correctly collect, organize, transform and present** data in numerical and/or visual forms  ii. **accurately interpret** data and **explain** results **using correct scientific reasoning**  iv. **evaluate** the validity of the method based on the outcome of a scientific  investigation  v. **explain** improvements or extensions to the method that would benefit the  scientific investigation. | The student registers in a well formatted table (title, labeled columns including magnitudes and units) the raw and/or processed data obtained in the lab.  * The calculations are right and an example of them is shown. * The student gets a main conclusion from a right interpretation of the results. * The conclusion is argued with comments on precision and accuracy of the results, and, when applicable, of the percentage difference between the obtained value and the awaited one. * The student establishes the validity of the method, discussing its implications and limitations (precision, accuracy, etc.) based on the right interpretation of the results. * The student explains in detail two or more non trivial sources of error or weaknesses of the method. * The student explains in detail realistic improvements for each mentioned weaknesses and/or extensions of the method that would benefit the investigation. |

OBJECTIVES: Investigate the amount of hydrogen peroxide in commercial oxygenated water.

THEORETICAL BACKGROUND:

Commercial oxygenated water is a solution of hydrogen peroxide in distilled water with a variable concentration between 3 and 30 %. This concentration is often indicated in term of “volumes”, what means the volume of oxygen released by one volume of solution, i.e., if we have 10 vol. oxygenated water, then 1 L of it will release 10 L of oxygen in normal conditions according to the reaction: 2 H2O2 → 2 H2O + O2, where 2 mol of hydrogen peroxide (34 grams) release 1 mol of gaseous oxygen, i.e., 22.4 L in normal conditions.

Reaction between hydrogen peroxide and permanganate in acidic media is as follows:

2 MnO4- + 5 H2O2  +  6 H+  →  2 Mn2+ + 5 O2 + 8 H2O

MATERIALS:

* Stand and clamp
* Funnel
* 2 x 100mL Beaker
* Burette
* 250 mL Erlenmeyer
* Pipette and filler
* 100 mL volumetric flask
* Potassium permanganate 0.05 M
* Commercial oxygenated water
* Sulfuric acid 2 M

SECURITY:

* Use goggles and gloves.
* All the substances are toxic. If they get in contact with your skin, rinse it with water thoroughly.

PROCEDURE:

1. Arrange the burette in the stand with the clamp. Using a funnerl, fill it with permanganate solution, assuring that no bubbles remain anywhere, and adjust the level to 0.Always place a beaker underneath!
2. Make a solution of commercial oxygenated water taking 10 mL of the one provided and diluting it to 100 mL in a volumetric flask with distilled water.
3. Take 25 mL of this solution with the pipette and pour it in the erlenmeyer. Add 25 mL of 2 M sulfuric acid and 25 mL of distilled water.
4. Titrate the mix with the permanganate solution until a slight violet color remains in the erlenmeyer (that means you have put just one drop more than needed).
5. Record the volume needed and repeat the whole procedure to verify the result.

TASKS:

1. Write a lab report including at the beginning the objective, balanced equation, background information (redox reaction and titration,...) as well as your risk assessment.
2. Make a table with your data. Be careful with the units and significant figures.
3. Calculate the hydrogen peroxide concentration of the commercial oxygenated water remembering the dilution performed at the beginning.
4. Write your conclusion and compare your result with the one on the commercial bottle.
5. Evaluate the procedure in respect to precision and accuracy of the results. Indicate weaknesses and sources of error and improvements for them.