

Oxidation numbers and balancing redox equations

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Lab

Name: _____ Date: _____ Class: _____

How strong is the hydrogen peroxide sold for bleaching hair or cleaning wounds? You titrate a diluted sample against purple potassium manganate(VII) in acid, find the end point from the first permanent pink, and then convert the titre into a concentration and a percentage strength.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** IB R3.2

Aim

To find the concentration of a hydrogen peroxide solution by titration with acidified potassium manganate(VII).

Equipment

- 0.0200 mol/dm³ potassium manganate(VII) in a burette
- Hydrogen peroxide solution diluted by the teacher (5.00 cm³ made up to 250 cm³)
- 1.0 mol/dm³ sulfuric acid, 25.0 cm³ pipette, conical flasks, white tile, funnel

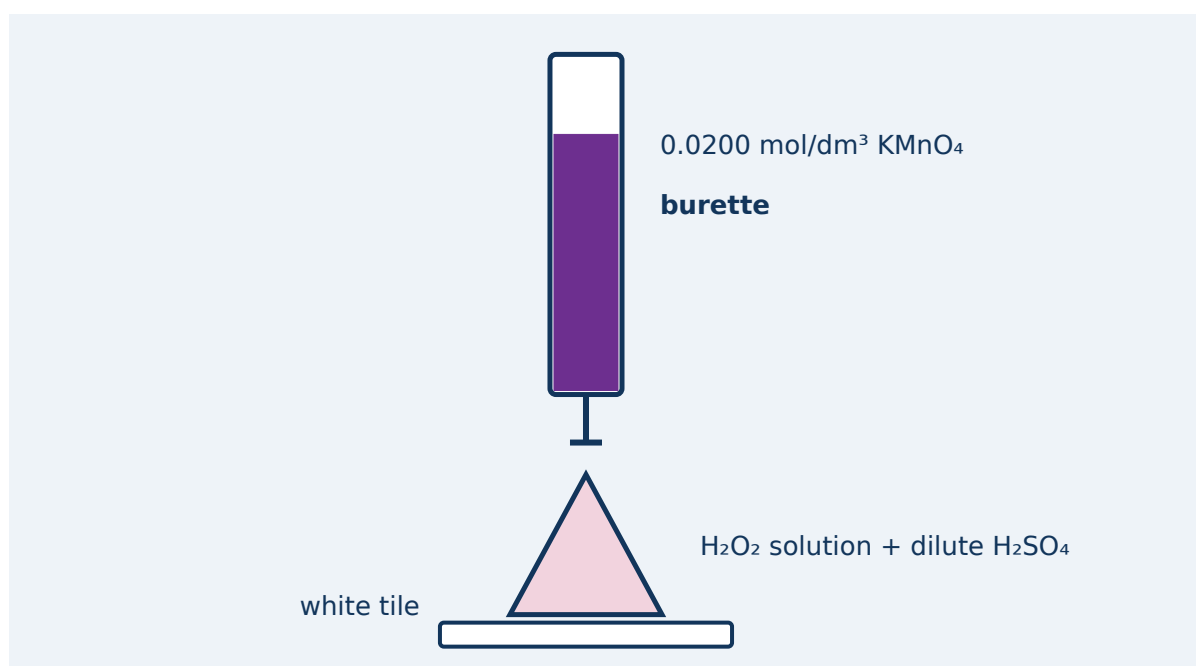
Safety

Safety

Wear eye protection and gloves. Hydrogen peroxide of the original strength bleaches skin. Sulfuric acid of 1 mol/dm³ is an irritant. Manganate(VII) stains clothes and skin brown. Wipe spills at once.

Method

1. Rinse the burette with the manganate(VII) solution, fill it and record the initial reading.
2. Pipette 25.0 cm³ of the diluted peroxide into a conical flask and add about 20 cm³ of sulfuric acid.
3. Run in the manganate(VII) while swirling. The purple fades slowly at first, then faster.
4. Stop when one drop gives a pale pink that stays for 30 seconds. Record the final reading.
5. Do one rough titration, then repeat until you have three results within 0.10 cm³.



Set-up for the permanganate titration of hydrogen peroxide.

Results

Sample burette readings:

Titration	Initial (cm ³)	Final (cm ³)	Titre (cm ³)
Rough	0.00	18.10	18.10
1	0.50	18.15	17.65
2	18.15	35.85	17.70
3	0.20	17.80	17.60

Analysis questions

Question 1 Mean titre

Identify the concordant results and calculate the mean titre.

Question 2 Why no indicator

Explain why no indicator is added and how the end point is recognised.

Question 3 Choice of acid

Explain why sulfuric acid is used and not hydrochloric acid or nitric acid.

Question 4 Moles of manganate(VII)

The equation is $2\text{MnO}_4^- + 5\text{H}_2\text{O}_2 + 6\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 5\text{O}_2 + 8\text{H}_2\text{O}$. Calculate the moles of MnO_4^- in the mean titre.

Question 5 Hydrogen peroxide concentration

Calculate the moles of H_2O_2 in 25.0 cm^3 of diluted solution and the concentration of the original solution in mol/dm^3 and as a percentage (g per 100 cm^3 , $M_r\text{ H}_2\text{O}_2 = 34.0$).

Question 6 Uncertainty

Each of the two readings that make up a titre carries $\pm 0.05\text{ cm}^3$. Work out the percentage uncertainty of a titre of 17.65 cm^3 .

Question 7 Improving the method

Describe one way to improve accuracy and one observation that suggests a catalyst is at work at the start.