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| **Foundation Year** | **Titrations** | **Semester 1** |

**Titrations**

i) Determining the concentration of a sodium hydroxide solution

ii) Determining the concentration of sodium carbonate solution

**Aim**

To determine the concentration of two solutions using a standard solution of hydrochloric acid.

**Introduction**

In this experiment a titration will be performed in order to work out the concentration of a solution of sodium hydroxide. A titration will also be carried out to determine the concentration of a standard solution of sodium carbonate prepared by another group of students. The standard solution in this titration will be 0.100 M hydrochloric acid. More guidance on titrations, if required, can be found within some excellent videos online:

Titration: <http://www.rsc.org/learn-chemistry/resource/res00002258/titration?cmpid=CMP00007814>

**Skills associated with this practical**

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| **Practical Skills**   * Correct use of a volumetric pipette * Filling a burette correctly * Performing a titration | **Scientific Skills**   * Performing mole calculations * Rearranging formulae |

**Signposts**

‘Chemistry’, Conoley and Hills sections 6.5 and 6.6 (pp. 130 – 133).

**Understanding Hazard and Minimising Risk**

You must stand up throughout the practical, and safety glasses must be worn at ALL times in the lab. You must wear a labcoat whilst you are carrying out ALL practical work. Long hair must be tied back, and trousers (jeans are OK) must be worn. Open-toed shoes and clothing revealing bare skin are not permitted.

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| Substance | Amount | Hazards | Minimising Hazards | Disposal / Spillage |
| Dilute sodium hydroxide solution | 200 cm3 | May be harmful if inhaled, swallowed and absorbed through skin. May cause respiratory, skin and eye irritation. | Gloves as needed. | Pour down sink with lots of water. |
| Dilute hydrochloric acid | 100 cm3 | Causes skin irritation.  Causes serious eye irritation. | Gloves as needed. | Pour down sink with lots of water. |
| Methyl orange | A few drops | Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation (toxic). Severe over-exposure can result in death. | Wear gloves. | Pour down sink with lots of water. |
| Phenolphthalein | A few drops | Classified as low hazard, but avoid contact with skin and eyes (skin and eye irritation). | Wear gloves. | Pour down sink with lots of water. |

**Procedure**

Apparatus

PER PAIR: 50 cm3 burette 100 cm3 conical flask

1. cm3 volumetric pipette + bulb Retort stand and clamp
2. **Determination of the concentration of a sodium hydroxide solution**

Method

1. Fill a burette with 50 cm3 of 0.100 M hydrochloric acid solution (make sure you place a funnel in the neck of the burette for the filling process). Ask your partner to take a photo of you filling the burette for your *Skills Portfolio*.
2. Pipette 25.0 cm3 of the sodium hydroxide of unknown concentration into a 100 cm3 conical flask. Ask your partner to take a photo of you filling the pipette for your *Skills Portfolio*.
3. Add 2 drops of Phenolphthaleinindicator to the sodium hydroxide solution in the flask.
4. Titrate the hydrochloric acid against the sodium hydroxide until the solution turns colourless. Record the titre needed to neutralise the sodium hydroxide. Ask your partner to take a photo of you running solution from the burette for your *Skills Portfolio*. **This should show you using the correct hand to control the tap, and your other hand to swirl the conical flask.**
5. Repeat steps 1-4 until concordant results are obtained.

**Analysis and questions – you will be required to enter some of your answers into your lab notebook and/or Labdog**

1. Write down the balanced equation for the reaction between sodium hydroxide and hydrochloric acid
2. Calculate the concentration of the sodium hydroxide solution supplied using the average titre of your concordant results.

**ii) Determination of the the concentration of a sodium carbonate solution**

Method

1. Fill a burette with 0.100 M hydrochloric acid solution.
2. Pipette 25 cm3 of the sodium carbonate solution of unknown concentration of into a 100 cm3 conical flask. Add a few drops of Methyl orangeindicator.
3. Titrate the hydrochloric acid against the sodium carbonate solution until there is a distinct colour change for the solution from orange to red. Record the titre needed to neutralise the sodium carbonate solution.
4. Repeat steps 1-4 until concordant results are obtained.

**Analysis and questions – you will be required to enter your answers into your lab notebook and/or Labdog**

1. Write down the balanced equation for the reaction between sodium carbonate and hydrochloric acid.
2. Calculate the concentration of sodium carbonate using the average titre of your concordant results.
3. Compare your result with the concentration calculated by your partner group. If there is a discrepancy between the values, try to suggest why this might be the case.

**Deadlines, Assessment and Feedback on Performance**

You are required to complete the Skills Portfolio document associated with this practical (both parts a and b). This should be completed electronically with all photos inserted in the appropriate places and accompanying text typed in. The submission deadline for *Skills Portfolios* will normally be midnight on the Sunday following the practical, although you will be given specific guidance during the practical session. Submission is via the e-submission system Turnitin which you will be able to access in the appropriate folder in the Laboratories and Coursework Blackboard course.