

NSW Schools Titration Competition

Competitors Booklet

(amended 2018)



Competition Rules

1. A school may choose to enter teams at only one venue and may enter up to eight teams.
2. A team is only eligible to compete if confirmation of entry has been received by the school before the date of competition. If payment has not been made teams forfeit their place.
3. Only students currently enrolled in years eleven or twelve may form part of a team. A student may compete only if they can present an Indemnity Form signed by their parent or guardian.
4. Only complete teams of three are eligible to compete for places, prizes and plaques. Teams of one or two (due to any misadventure) may participate on the competition day but their results will not be counted as a team result.
5. The competition lasts for one and one-half hours. The competition is deemed to begin when the venue coordinator announces the start of the competition. No extra time will be permitted to any team for any reason.
6. During the competition a member of any team may not communicate with another person outside their own team, unless
 - ✓ an issue of safety is involved or
 - ✓ the communication is with a venue supervisor or venue coordinator.

Within a team, members may freely give guidance to each other.

7. Safety glasses must be worn at all times during the competition. A competitor behaving in an unsafe manner, contrary to the laboratory safety rules of the venue, will be asked to leave the competition venue and their team will be deemed to be incomplete (Refer to rule 4).
8. Teams may bring into the competition
 - ✓ A non-programmable calculator and writing tools.
 - ✓ Apparatus which may assist them in practical titration including, white cards, magnifying glasses and cotton wool.
 - ✓ Their own glassware and pipette fillers.

Teams may not bring into the competition

- ✗ Food, notes, hint sheets, programmable calculators, laptops and mobile phones.
- ✗ Electronic assistive devices, such as autopipettes and pH probes.

9. Calculation penalties apply in this competition.

To avoid a penalty you must

- ✓ Include at least two sodium hydroxide titres written down in each column of the results sheet. Do not reverse the titration - base in burette only.
- ✓ Write down your concentrations to four significant figures.
- ✓ Cross out or erase values that you want to be ignored.
- ✓ Put all values in the spaces provided.

10. The decision of the Venue Coordinator is final.



Important Hints and Preparation Ideas

1. Train teams to make correct numerical calculations. About 30% of all mistakes in the competition are calculation errors. Heavy penalties apply if students do not:
 - Give all their results to four significant figures.
 - Include at least two sodium hydroxide titres for each acid titration.
 - Write their results in the spaces provided.Crossed out or semi-erased data will not be counted.
2. Thoroughly discuss the competition rules and safety advice with students well in advance of the competition date. Teachers must apply these rules in school practice sessions.
3. Explain the meaning of the term 'concordant data' to students.
4. Ensure solution containers used by teams are closed after each use.
5. There is no substitute for training. Some schools have six two-hour training sessions to prepare for the competition.
6. Do not attempt to average results between team members. The highest chance of success lies in each team member using their own calculated concentrations. In a titration such as this the technique and equipment vary between each team member. The averaging of results between students will therefore tend to increase the percentage error of the calculated value.
7. Do not reverse the titration. Base must be used in the burette and acid in the conical flask.
8. Teachers may wish to download the 8 team edition of the calculation spreadsheet from the hints page of the competition website to enter practice data and check student performance.

Important Safety Advice

- Pipette fillers must be used. Care should be taken by teachers to instruct students in the proper use of pipette fillers including the safe insertion of pipette into filler. Students must never force the pipette into the rubber mouth of the filler.
- The practice of filling burettes by standing on stools is dangerous. A student should bring the burette down to his/her level to fill whenever possible.
- For safety reasons, there are minimum dress standards expected in laboratories:
 1. Safety goggles must be worn at all times in the laboratory. Some venues will require laboratory coats to be worn
 2. Minimum dress regulations include:
 - (a) Shoes - fully enclosed
 - (b) Blouses/Shirts - must cover the entire torso. Mid-riffs & cut-offs are not permitted unless a laboratory coat is worn over clothing.
- The chemicals used in the competition are classified as Non-hazardous and Non-dangerous by the DET Chemical Safety in Schools package. However, this should never be used as a reason for relaxing safety guidelines for the safe handling and use of chemicals used in the NSW Schools Titration Competition.

NSW Schools Titration Competition - Instructions & Method for Candidates

Check that you have the following equipment at your work space.

<u>Per Team of Three</u>	Standard solution of hydrochloric acid, 450 mL Solution of sodium hydroxide, 1000 mL Pipette filler, 1 bottle of phenolphthalein indicator 1 x Result Form, funnel to fill burette
<u>Per Team Member</u>	Solution of acetic acid (labeled A, B or C), 150 mL 1 x 400 mL beaker, 1 x 250 mL beaker 1 x 150 mL or 250 mL conical flask Wash bottle containing demineralised water 1 x 25 mL bulb pipette, 1 x 50 mL burette Bosshead and clamp, white tile, safety goggles Note that candidates may bring their own pipettes, pipette fillers or burettes if they wish.

- ✓ Before the competition begins, only if time permits and if your venue supervisor allows, may you rinse your burette with water. Check that it does not leak and is not blocked. Report any problems to a supervisor. Practise opening and closing the taps on the burettes, keeping in mind that this is fragile glassware. **Do not touch the solutions until you are advised to do so.**
- ✓ At the start of the competition make a note of the time. You have 1.5 hours to complete all the titrations, the calculations and the results form. Plan your time carefully. **You must wear your safety goggles. You must wear lab coats if required by venues.**
- ✓ Properly rinse your burette with sodium hydroxide solution and then fill the burette with sodium hydroxide solution.
- ✓ Pipette 25 mL standard hydrochloric acid solution into the conical flask. Add a few drops of indicator to the flask. Run in sodium hydroxide from the burette to the end-point and note the burette volume. Repeat as often as time and solution quantities allow. Record all concordant data in the result form. Record at least two titre values or a penalty will apply.
- ✓ Now pipette 25 mL unknown acetic acid (A, B or C) into the conical flask, add indicator and repeat the titration process until you have a concordant set of results for acetic acid. You must record at least two titre values or a penalty will apply. Calculate the concentration of your sodium hydroxide solution and then your concentration of acetic acid solution.
- ✓ If there is any breakage or serious spillage, report it to a supervisor. Note that replacement of solutions or apparatus cannot be guaranteed and is at the discretion of the supervisors.
- ✓ **Discuss your results within your team only.** Recheck your calculations. Write the titration volumes and the concentration of your acetic acid on the result form to **four significant figures**.
- ✓ When your team is satisfied with its result, submit your result form to a supervisor. Rinse all apparatus and return equipment to its correct place.
- ✓ Remain at the venue until the results are announced.

Competition Modifications to Assist Students with Disabilities

Firstly, it is important to remember that this is a team competition. Students **within a team** are allowed to communicate with one another and they are encouraged to routinely assist each other. They need to be mindful that this assistance does not adversely affect the results of the team, some examples of which are given below.

It is also important that any modifications made to the competition attempt as far as practicable to maintain the integrity of a student's ability to demonstrate good analytical technique. In particular, any participant in the competition should be able to:

- **Fill a pipette and manually judge the liquid meniscus.** Non-electronic, one-handed pipette fillers are available and may be used by any student.
- **Accurately read a burette and control the flow of liquid from it.** Assistance may be given from other team members with regards to filling & positioning the burette, but control of the stopcock should be made by an individual participant.
- **Accurately determine the endpoint by indicator colour change.** Because control of the burette and concurrent swirling of conical flask may not be possible, a modification allowing the use of a magnetic stirrer may be appropriate. The stirrer would need to be supplied by the participating team.

Appropriate laboratory access and workspace modifications for students with a disability are available, and details can be provided from the venue via the competition coordinator on request.

Some assistance within a Team likely to Reduce Performance

- Averaging out titres between team members when determining the concentration of sodium hydroxide solution.
- Having another team member occasionally read the burette meniscus on your behalf.
- Relying on one team member to perform all calculations.
- Asking one team member to judge another team member's endpoint.

Amended: 6 December 2018