

INSTRUCTION SHEET 1

The competition is designed to encourage those students who enjoy Chemistry, particularly its practical side, to develop theory skills and to reward those who attain a high level of proficiency. Every secondary school in the ACT area has been invited to enter two teams consisting of three members each. If more than six students from a particular school are interested, it is suggested that a local competition be held to select the best team members.

The basis of the present competition is that each team member is to standardize a sodium hydroxide solution against supplied hydrochloric acid solution and then to standardize one acetic acid solution with the sodium hydroxide solution. Judging will be on the basis of the values each team member reports for the titres and concentrations of the sodium hydroxide and acetic acid solutions.

Each team member will be allocated to a laboratory bench and each team member will have access to a complete set of glassware.

A supervisor in each laboratory will allocate on request:

Up to 120 mL of standard HCl solution (to be collected in a 250 mL beaker)
Up to 400 mL of sodium hydroxide solution (to be collected in a 600 mL beaker)
Up to 120 mL of acetic acid solution A
Up to 120 mL of acetic acid solution B
Up to 120 mL of acetic acid solution C

Methyl red indicator for the hydrochloric acid/sodium hydroxide titration and phenolphthalein indicator for the sodium hydroxide/acetic acid titration.

In summary:

Each member of the team will have a full set of equipment.

Each member of the team will standardize the NaOH against the HCl

Each member of the team will standardize ONE (either A, B or C) of the three CH_3COOH

Solutions.

Each team member will have either one of A, B or C

INSTRUCTION SHEET 2

Students should check-in at the foyer of the Science Teaching Building (136) where they will be directed to their laboratory. Once inside the laboratory, check with the supervisor who will allocate your group to a bench and check the names on his/her list. You may then set up your glassware which must consist comprise for each student:

4 x 250 mL beakers	1 x 100 mL beaker	1 x 600 mL beaker
3 x 250 mL conical flasks	1 x 50 mL burette	1 x 25 mL pipette
Burette stand	Plastic funnel	Retort stand

Pipette filler

Your supervisors will then dispense to you, using a beaker, your allocated solutions. Solutions must not be removed from the beakers until commencement time which is 5.00pm.

Each team will have one and a half hours to complete all titrations, carry out all calculations and hand in results sheets. Students are invited to light refreshments and snacks while the results are being checked. Results of the competition will be announce shortly after the submission of results sheets. There will also be a printout of team performances and certificates will be forwarded to schools. Winners of the competition will be invited to participate in a national competition to be held later in the year in the Research School of Chemistry.

Students within a team may discuss methods and results freely. Individual duties within a team are entirely at the discretion of the team. As many titrations may be carried out as time and solution volume allows. Allowance for breakages and spillages will be at the discretion of the Adjudicator.

Judging will be primarily on the basis of the calculated molarity of the acetic acid solutions. This should cause errors due to uncalibrated glassware, traces of carbonate, etc. to cancel out. **Correct titration volumes but incorrect molarities through arithmetic error will cause the team to lose.** Calculated molarities of the 'apparent' winning team will be checked against titration volumes to ensure against the slight possibility that poor arithmetic has compensated for poor titration.

The team with the lowest sum of variances (calculated value-true value)² for the three acetic acids concentrations will be declared the winner. If there is a tie, the team with the best sum of variances for sodium hydroxide concentrations (of the tied teams) will win.

INSTRUCTION SHEET 3

Phenolphthalein indicator solutions and methyl red indicator solution (2-3 bottles each) will be available in each laboratory.

There will be a wash-bottle filled with distilled water.

Safety glasses must be brought to the competition.

Bring the instruction and result sheets, pens, calculators and paper for rough calculations.

Solutions must not be pipetted by mouth. Use a pipette filler.

Before the competition begins you may rinse your burette with distilled water. Check that the tap turns freely, and that it does not leak, or is not blocked. Report any problems to a supervisor. Do not touch the solution bottles until advised to do so.

When you are told to start, you have one and a half hours to complete all titrations and calculations, and complete the results sheets. There should be plenty of time, so don't hurry. The technique you use is at your own discretion but the following method is a guide to normal practice:

Pipette 25 mL of HCl solution into a conical flask. Add a few drops of methyl red indicator. Add NaOH from the burette to the end point. Note the volume on your result sheet.

Repeat as often as time and solution volumes allow.

Do the same with the CH₃COOH solutions using phenolphthalein indicator.

Calculate concentrations of NaOH and CH₃COOH solutions.

You may wish to provide your own wiping towels and white cards to facilitate reading of burettes and white backgrounds to enhance detection of end point colour changes

If there any breakages, serious spillages, etc. report them to a supervisor. In some circumstances, solutions or apparatus may be replaced. First aid kits are available.

You may discuss your results with your team, but not with members of other teams, until after the competition.

When you have finished all your titrations and calculations, check your calculations. Write your calculated concentrations on the results sheets (four significant figures). Only these final results will be used in judging.

Hand your result sheet to a supervisor. Rinse all your apparatus with water.

Presentation of prizes is expected to be made at about 7.30 pm.