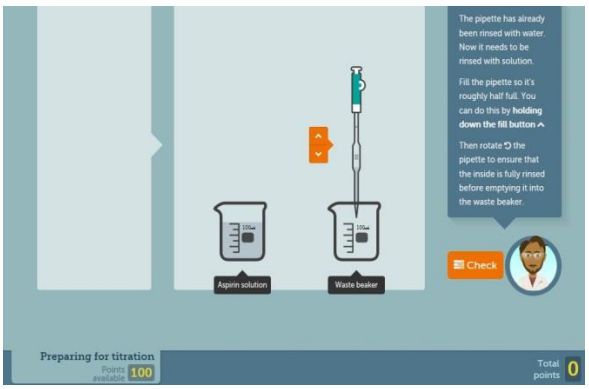
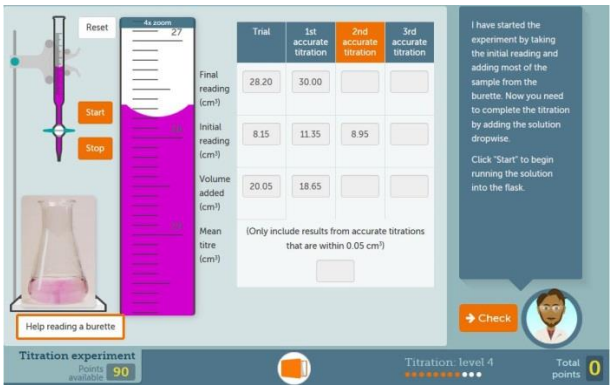
Titration screen experiment teacher notes

The Royal Society of Chemistry's titration screen experiment is a freely available digital resource. It is designed to enhance student understanding of volumetric analysis and improve practical skills relating to titrations in the laboratory. The interactive screen experiments enable students to undertake acid/base and redox titrations within unique and engaging contexts.





Important technical information

This resource has been developed using the latest HTML5 technology. The advantage is that this will work without any plug-ins or installations. However you will need to ensure you are using a modern browser like Internet Explorer 10+, Chrome or Firefox. The product will also work on touch screen devices like Android tablets using a Chrome browser and iPads using the Safari browser.

This product will not work on old browsers such as Internet Explorer 8 and 9 and the screen size is not responsive meaning it is not optimised for use on smartphones.

All the core titration skills at your finger tips

Target pupil level:

- Key Stage 4 or Scottish Credit and Qualifications Framework level 5 (Screen experiment Level 1)
- Key Stage 5 or Scottish Credit and Qualifications Framework level 7 (Screen experiment levels 2-4)

The resource is divided into 4 levels, each of which are estimated to take approximately 30 minutes to complete either as homework activity or in class. They may be used as a pre-lab task to familiarise students with the techniques and concepts or as a post-lab extension exercise.

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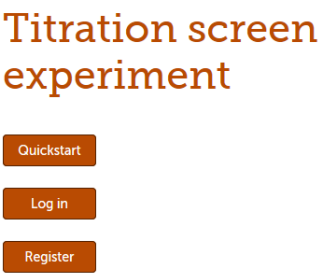
Points are scored as the student progresses through the activity and these are stored within the lab book. In addition, there is a section at the end of each level for students to reflect on their progress.

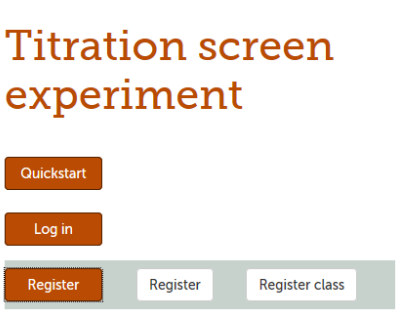
Register for free to save your progress

One of the real advantages of this resource is the option to register and log in. Once logged in the user will see their scores, personal badges and can download their unique lab book anytime. Please note only one lab book is saved per level so if a user decides to repeat to improve their skills the existing lab book is overwritten. If you want to keep all your lab books it is recommended that you download or print them.



You can also register after using quickstart as the register button remains at the top right of the header bar during the activities.

Registration numbers are 10 digit numerical codes. We recommend students keep these safe and private although no personal information is linked to the accounts.



Teachers can quickly register classes by using the register class button. From there teachers can print multiple copies of the class registration numbers and cut these into strips for each student. If teachers keep a record of the registration numbers they can check completed homework themselves online. Alternatively students can print/save electronic lab books as a revision aid.

At the end of each level there is a review section for students to reflect on their progress and draw conclusions. It is expected that these reviews will be shown to a teacher so that more specific learning and understanding can be discussed. The lab books can be downloaded as pdf files or printed so there are many ways in which these can be shared with teachers.

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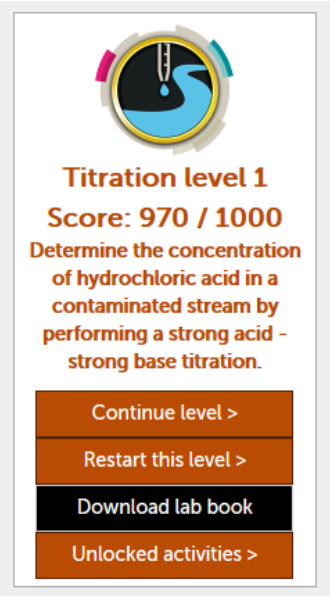
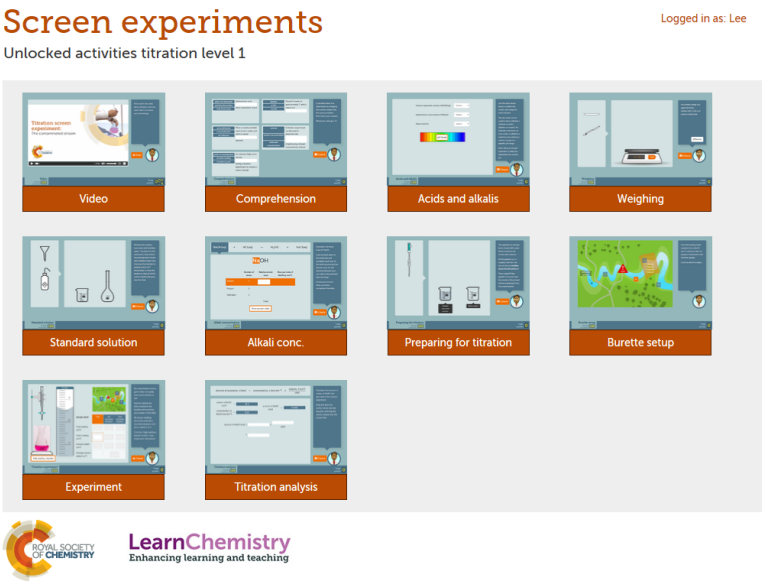
Unlock activities for classroom use

One of the newest features, as requested by you our teacher users, has been the 'unlock activities feature'. This provides easy access to the activities within the levels for a brief classroom demonstration.

To make use of this feature a teacher would need to:

- Create an account and make a note of it for the future
- Whilst logged in complete (or get a student to complete) any level of the screen experiment
- Done – that account will now have the extra 'unlocked activities button' which gives you access to all the activities from that level





All the accounts created by the screen experiment system are the same. We cannot provide the 'unlocked activities' upfront as this would prevent the use of the scoring and badging system as part of the design of the screen experiments, which is a student based pre-lab homework introduction to class practicals.

GCSE to A-Level, BTEC and National 5 to Advanced Highers curriculum coverage

Level 1 is particularly focused on GCSE level (National 5) study and provides opportunities for reinforcement of the following curriculum areas:

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- Volumetric analysis techniques *e.g.* preparing standard solutions, undertaking an acid/base titration;
- Amount of substance calculations *e.g.* converting mass to number of moles and determining concentration.

Levels 2 – 4 are focused at A-level (BTEC and Highers/Advanced Highers) and cover the following additional curriculum areas:

- pH curves, equivalence points and indicator selection;
- dilution calculations and units.
- redox titrations ($KMnO_4/Fe^{2+}$);
- determining ionic equations.

Level 1 – The contaminated stream (Strong acid / strong base titration)

This level is set within the context of a tanker spillage contaminating a stream with hydrochloric acid. The student is tasked with determining the concentration of the hydrochloric acid in the stream and if it is within acceptable limits.

Practical skills developed:

- Using a balance to weigh out solids;
- Preparing a standard solution;
- Using a graduated pipette to transfer solutions;
- Using a burette to perform a titration.

Key learning outcomes:

By the end of this activity a student should understand how to:

- make a standard solution;
- perform an acid/base titration;
- calculate the amount of substance, in moles, from mass;
- calculate the concentration of a solution;
- use the stoichiometry of an equation to determine the amount of substance;
- determine the concentration of an unknown solution.

Level 2 – Aspirin titration (weak acid / strong base titration)

This level enables the student to perform a weak acid / strong base titration to determine the amount of aspirin in a consignment of aspirin tablets.

Practical skills developed:

- use of a pestle and mortar;
- preparing a solution using a volumetric flask;
- use of a graduated pipette;
- use of a pH probe to monitor pH changes;
- use of a burette to perform an acid/base titration.

Key learning outcomes:

By the end of this activity a student should understand how to:

- identify a suitable indicator for an acid/base titration;
- calculate concentration of a solution;
- determine the concentration of a solution of unknown concentration.

Level 3 – Hair product (weak base / strong acid titration)

This level is a weak base / strong acid titration problem set within the context of analysing a consignment of hair product for the concentration of ammonia in order to determine if it is within safe limits.

Practical skills developed:

- use of a graduated pipette;
- use of a pH probe to measure pH changes;
- use of burette to perform an acid/base titration.

Key learning outcomes:

By the end of this activity a student should understand how to:

- identify a suitable indicator for an acid/base titration;
- calculate concentration of a solution;
- use the stoichiometry of an equation to determine the amount of substance;
- determine the concentration of a solution of unknown concentration.

Level 4 – Iron supplement tablets ($KMnO_4$ redox titration)

This level requires the student to undertake a redox titration to determine the Fe^{2+} (aq) concentration in iron supplementary tablets. The level concludes with an activity to summarise the techniques and steps common to volumetric analysis.

Practical skills developed:

- use of a pestle and mortar;
- making solutions using a volumetric flask;
- using a burette to perform a titration.

Key learning outcomes:

By the end of this activity a student should understand how to:

- to construct and balance ionic equations;
- perform a redox titration;
- use the stoichiometry of an equation to determine the amount of substance;
- determine the concentration of a solution of unknown concentration.

Further experiments

A microscale titration	http://www.rsc.org/learn-chemistry/resource/res00000536/a-microscale-acid-base-titration
Analysising indigestion tablets	http://www.rsc.org/learn-chemistry/resource/res00000698/using-indigestion-tablets-to-neutralise-an-acid
Analysis of bleach	http://www.rsc.org/learn-chemistry/resource/res00001205/which-bleach-is-the-best-buy

Guidance notes prepared by Simon Rees (Chemistry Teaching Fellow, The Foundation Centre, Durham University)

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