



**T-LEVELS**  
*THE NEXT LEVEL QUALIFICATION*

# **T Level resource improvement project**

**T Level in Science – developmental activities**

**[et-foundation.co.uk](https://et-foundation.co.uk)**

### T Level A10.3

This developmental task links to AO2 formative assessment materials. Match the laboratory equipment to its use or application.

| Equipment                                                        | Use/application                                                                                                        |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Autoclaves                                                       | to separate suspensions                                                                                                |
| Data loggers                                                     | to decontaminate/sterilise equipment and some consumables                                                              |
| Glassware                                                        | to produce exceptionally low temperatures                                                                              |
| Centrifuges                                                      | to accurately measure and transfer solutions                                                                           |
| Digital (eg mechanical) and non-digital (eg volumetric) pipettes | as a safety measure to capture and remove airborne hazards                                                             |
| Multimeters                                                      | to measure pH (eg how acidic or alkaline a substance is)                                                               |
| Cryogenic equipment                                              | for collecting, storing and recording data over a period of time                                                       |
| Incubators                                                       | to provide a contained and controlled environment (sealed atmosphere) for manipulating samples, substances and objects |
| Microbiological equipment                                        | to measure voltage, current and, therefore, resistance in a circuit                                                    |
| Fume cupboards                                                   | to provide a controlled and accurately maintained environment (eg in terms of temperature or humidity)                 |
| Refrigerators and freezers                                       | to perform a range of microbiological techniques while maintaining an aseptic environment                              |
| Glove boxes                                                      | to store, measure, transfer and collect reagents and samples                                                           |
| pH meters                                                        | to provide a controlled and accurately maintained temperature                                                          |
| Scientific balances                                              | to monitor temperature or temperature changes                                                                          |
| Thermometers                                                     | to accurately determine the mass of a sample, including small ones                                                     |

### **T Level A10.4**

Research the following techniques that are used to appropriately handle different types of substances. Specify how and when each technique would be used.

| <b>Technique</b>                       | <b>How and when it would be used?</b> |
|----------------------------------------|---------------------------------------|
| Material data sheets                   |                                       |
| Personal protective equipment          |                                       |
| Safe handling equipment                |                                       |
| Containment controls                   |                                       |
| Procedures for handling compressed gas |                                       |

## T Level A10.5

Research the most appropriate equipment to use to measure accurate results for each of the following scales.

| Scale | Equipment needed to measure quantities at that scale |
|-------|------------------------------------------------------|
| Kilo  |                                                      |
| Milli |                                                      |
| Micro |                                                      |
| Nano  |                                                      |

### A2.6: individual responsibilities in relation to the wider team

This activity is linked to AO3 formative assessment materials.

Click on [download.cfm \(uhdb.nhs.uk\)](https://uhdb.nhs.uk/download.cfm) to view the staffing structure at the University Hospitals of Derby and Burton.

This is one of the UK's largest hospitals, employing over 12,000 staff. Use this staffing structure to help illustrate how an individual's role in such a large

organisation is related to the much larger team. Select three different job roles from the organisational structure chart and add the responsibilities of each role to the table below. You may need to carry out additional research into your chosen three job roles.

|                           |  |
|---------------------------|--|
| <b>1. Job role:</b>       |  |
| Health and safety         |  |
| Security                  |  |
| Policies and procedures   |  |
| Deadlines                 |  |
| Departmental dependencies |  |
| <b>2. Job role:</b>       |  |
| Health and safety         |  |
| Security                  |  |
| Policies and procedures   |  |
| deadlines                 |  |
| Departmental dependencies |  |
| <b>3. Job role:</b>       |  |
| Health and safety         |  |
| Security                  |  |
| Policies and procedures   |  |
| Deadlines                 |  |
| Departmental dependencies |  |

After looking at this example of organisational structure in the health and science sector what conclusions can you draw about an individual's responsibilities in relation to the wider team?

---



---

---

---

---

---

---

---

---

---

---

---

---

## **A2: laboratory comparison project**

### **Project brief**

This activity is related to AO2 and AO3 formative assessment materials.

### **Introduction/scenario**

You are working as part of a government team of health and safety inspectors. Your team leader has asked you to visit a range of different science organisations and report on their health and safety practices. As part of this you will carry out a virtual inspection of the digital engineering company ProLabs. You will view their engineering, testing and programming labs. You will also inspect the college/school prep room and teaching labs.

You must produce a report that provides information on how two organisations are following relevant health and safety legislation as well as describing the hazards present and how health and safety is managed. You must end your report with a comparison of the two organisations and provide recommendations on how they could improve their health and safety provision.

### **Task**

You must produce a report that:

- describes the main activities of the organisations
- describes the potential hazards in each organisation and links them to the health and safety measures used
- explains why each of the two organisation's specific health and safety management system improves health and safety standards and enables that they comply with legislation (e.g. in regard to the control of hazardous substances and personal protective equipment) and health and safety policies
- compares the health and safety measures taken by the two organisations in relation to the legislation
- evaluates the measures taken by each organisation to ensure high standards of health and safety that comply with legislation
- includes the benefits and constraints of following the health and safety management system for the employees and for the company

You may wish to include pictures of each organisation's labs to help illustrate your report findings.

This is an extended piece of writing and, as such, you will also be marked on the quality of your written communication.

## Resources

The following sources of information will help you with your report. You will also be given a tour of the college/school's prep room.

[360° virtual lab tour – Prolabs](#)

[Health and Safety Executive](#)

[CLEAPSS](#)

[Pfizer – prioritising health and safety](#)

## A3.2 and B1.44: analysis of vinegar by titration

This activity is related to AO2 and AO3 formative assessment materials.

By carrying out this activity learners will develop skills in assessing risk in the context of carrying out a titration.

A risk assessment must be carried out for this activity.

## Scenario

For this activity learners will calculate the concentration of different samples of vinegar. They will achieve this by carrying out a titration against a known-concentration solution of sodium hydroxide. The method for this practical is available from the CLEAPPS website (CLEAPPS Login-in will be required): [PP020 – analysis of vinegar by titration](#)

## Procedure

*Method summarised from CLEAPSS practical procedure PP020*

Wear eye protection.

Use samples of shop-bought vinegar diluted by a factor of four.

1. Use a small beaker and filter funnel to fill a burette with 0.2 M sodium hydroxide solution. Check that there are no air bubbles in the jet and note the initial burette reading.
2. Use a pipette and pipette filler to transfer a known volume of diluted vinegar into a conical flask.
3. Add two to three drops of phenolphthalein indicator to the vinegar solution in the flask. Swirl to mix. Stand the flask on a white tile under the burette.

4. Using the correct technique, run sodium hydroxide solution from the burette into the vinegar solution (continually swirling the flask) until a “permanent” pink–purple colour is obtained. Note the new burette reading. This is the “rough” titration. The pale pink–purple (mauve) colour will fade quite quickly as the very dilute sodium hydroxide solution absorbs carbon dioxide from the atmosphere. If the mauve colour is stable for approximately 10 seconds, take this as the end point of the titration.
5. Rinse out the flask and repeat the titration with a fresh solution of diluted vinegar. However, this time quickly add the alkali solution from the burette to within  $1\text{cm}^3$  of the rough titration volume. Now add the sodium hydroxide solution one drop at a time (gently swirling the flask) until the addition of one drop produces a “permanent” mauve colour.
6. Repeat the titration with fresh samples of diluted vinegar to obtain consistent results.

### **Running the activity**

This activity could begin by sharing examples of industries where titration is used as an analytical method, for example, in wastewater analysis or the food manufacturing industry. Following this introduction, the teacher/lecturer could demonstrate the method while learners identify hazards and the control methods used to manage the risks through discussion/observation. Learners should consider the personnel who may be present in the industrial lab and how visitors/contractors and other groups present may be at risk in this setting.

Following the demonstration of the method learners are given blank copies of the risk assessment matrix to complete for this experiment. To assist them in this task, they should also be given a copy of the method. Learners should complete the hazards and control methods and use the grid to calculate total and resultant risk.

Once the risk assessment is complete it can be signed off by a member of staff and the learners can then carry out the practical task themselves, following the control measures identified in their risk assessment.

During the practical task learners should record the titre for each repeat until the results are concordant (within  $0.1\text{cm}^3$  of each other).

| Titration                           | Rough | 1 | 2 | 3 |
|-------------------------------------|-------|---|---|---|
| Burette start<br>(cm <sup>3</sup> ) |       |   |   |   |
| Burette end<br>(cm <sup>3</sup> )   |       |   |   |   |
| Titre<br>(cm <sup>3</sup> )         |       |   |   |   |
| Concordant?                         |       |   |   |   |

Once concordant titres have been achieved learners can use results to calculate the concentration of the vinegar. If they have been using different brands/types of vinegar they could compare results at this stage.

Following these calculations learners should revisit their risk assessment and carry out the following:

- ascertain whether all hazards were identified
- evaluate whether the control measures were appropriate for the risks involved in this experiment
- discuss reasons for reviewing and updating risk assessments used in industrial laboratories

Risk assessment resources also available as templates from the NCFE exam board:  
[NCFE QualHub](#)

| Risk matrix – evaluation of risks |   |         |              |                              |                         |        | Action level     |
|-----------------------------------|---|---------|--------------|------------------------------|-------------------------|--------|------------------|
| Almost certain                    | 5 | 5       | 10           | 15                           | 20                      | 25     | 20–25<br>Stop    |
| Highly likely                     | 4 | 4       | 8            | 12                           | 16                      | 20     |                  |
| Likely                            | 3 | 3       | 6            | 9                            | 12                      | 15     | 12–16<br>Urgent  |
| Unlikely                          | 2 | 2       | 4            | 6                            | 8                       | 10     | 8–10<br>Action   |
| Extremely improbable              | 1 | 1       | 2            | 3                            | 4                       | 5      | 4–6<br>Monitor   |
|                                   | X | 1       | 2            | 3                            | 4                       | 5      | 1–3<br>No action |
|                                   |   | Minimal | Minor injury | 7 day absence plus an injury | Serious or major injury | Severe |                  |
|                                   |   |         | Consequence  |                              |                         |        |                  |

|                                             |            |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
|---------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------|-----------|-----|-------------|-----|------------|-----|----------|-----|--------|-----|-------------|-----|--------------------|-----|
| <b>Person carrying out risk assessment:</b> |            | <table border="1"> <tr> <td><b>Those at risk</b></td> <td><b>Key</b></td> </tr> <tr> <td>Own staff</td> <td>OWN</td> </tr> <tr> <td>Venue staff</td> <td>VEN</td> </tr> <tr> <td>Organisers</td> <td>ORG</td> </tr> <tr> <td>Visitors</td> <td>VIS</td> </tr> <tr> <td>Public</td> <td>PUB</td> </tr> <tr> <td>Contractors</td> <td>CON</td> </tr> <tr> <td>All persons onsite</td> <td>AOS</td> </tr> </table> | <b>Those at risk</b> | <b>Key</b> | Own staff | OWN | Venue staff | VEN | Organisers | ORG | Visitors | VIS | Public | PUB | Contractors | CON | All persons onsite | AOS |
| <b>Those at risk</b>                        | <b>Key</b> |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Own staff                                   | OWN        |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Venue staff                                 | VEN        |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Organisers                                  | ORG        |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Visitors                                    | VIS        |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Public                                      | PUB        |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Contractors                                 | CON        |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| All persons onsite                          | AOS        |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Person(s) responsible on site:              |            |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Venue:                                      |            |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Work activity:                              |            |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |
| Date of assessment:                         |            |                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |            |           |     |             |     |            |     |          |     |        |     |             |     |                    |     |

Please read the guidelines before completing your risk assessment.

| Hazard | Who might be harmed?<br>(see those at risk above) | Likelihood | Severity | Total risk level | Control measures<br>(add any control measures you will use) | Likelihood | Severity | Residual risk level |
|--------|---------------------------------------------------|------------|----------|------------------|-------------------------------------------------------------|------------|----------|---------------------|
|        |                                                   |            |          |                  |                                                             |            |          |                     |
|        |                                                   |            |          |                  |                                                             |            |          |                     |
|        |                                                   |            |          |                  |                                                             |            |          |                     |

## **B1.42: food additives and analysis**

This activity is related to AO2 and AO3 formative assessment materials. It helps learners to develop the evaluative skills needed to answer AO3 quality of written communication questions.

This development activity consists of a series of tasks linked to food additives. Learners begin by carrying out a literature review using the suggested sources below and/or other sources of information. This task gives learners the opportunity to practise skills required for the employer set project. They will need to select which sources are suitable and extract the relevant information.

Suggested sources:

[Food colours and hyperactivity – NHS](#)

[Four advantages of food additives – Foods for Better Health](#)

[Food additives – World Health Organization](#)

[Food additives – Food Standards Agency](#)

[Looking at labels – British Nutrition Foundation](#)

[Potential use of nanomaterials as food additives or food ingredients in relation to consumer safety and regulatory controls – Food Standards Agency](#)

Once learners have an overview of the subject and have visited a range of sources they could create a strengths, weaknesses, opportunities and threats (SWOT) analysis table, as shown below. By reviewing strengths and weaknesses learners will consider the immediate advantages and disadvantages of using food additives. By evaluating opportunities and threats they will consider broader ideas and factors outside the organisation and make links to industry. Opportunities may include the development of new additives through simplified methods of manufacture while threats may include changes in government legislation or the sourcing of raw materials.

Learners evaluate the use of food additives to complete the table below, referring to a range of sources of information. They support evaluative comments with data from the literature review, where possible.

|               |            |
|---------------|------------|
| Strengths     | Weaknesses |
| Opportunities | Threats    |

## Suggested additional practical activities

### Activity one: scenario

In 2016 the soft drinks industry levy was announced. The levy directly targets the producers and importers of sugary soft drinks to encourage them to remove added sugar and promote diet drinks.

When new products are imported the additives need to be checked against approved E numbers. As some E numbers have been linked to hyperactivity in children it is also important to find out how much additive is present.

"Tropicalade" is a newly imported soft drink and your task is to identify which additives are present and in what quantities.

This practical task links to B1.42–B1.44: chemical analysis of substances.

### Part one: identify the E number

Learners carry out paper chromatography. They should be provided with a selection of known E-number samples (different food colourings) and one unknown sample. By carrying out the paper chromatography they identify the unknown E number. To confirm its identity learners could calculate  $R_f$  values for each sample and identify which ones have the same value.

Suggested method link: [Paper chromatography | practical videos | 14–16 students – Royal Society of Chemistry \(RSC\) Education](#)

### Part two: identify how much additive is present

Learners are provided with a stock solution (labelled "100 per cent") for the E number identified in part one and a sample of the "Tropicalade" drink. They carry out a serial dilution of the 100% stock solution, creating solutions at 80 per cent, 60 per cent, 40 per cent and 20 per cent. Additional dilutions could also be created.

Similar method link: [Colourimetric determination of copper ore | experiment – RSC Education](#)

Learners could consider the strengths and weaknesses of producing serial dilutions at smaller intervals.

Learners could predict the concentration of the “Tropicalade” sample by comparing it to the range of serial dilutions and identifying the closest colour match.

**Activity two: discuss the limitations of this method and suggest how it could be improved**

Learners calibrate a colorimeter using distilled water and select a suitable colour filter.

| Colour of solution | Colour of light to use in colorimeter |
|--------------------|---------------------------------------|
| Yellow             | Purple                                |
| Orange             | Blue                                  |
| Red                | Green                                 |
| Purple             | Yellow                                |
| Blue               | Orange                                |
| Green              | Red                                   |

Learners measure the absorbance of each solution made by serial dilution using the colorimeter. They use these values to plot a calibration curve of concentration (percentage) against absorbance. Finally, they measure the absorbance of the “Tropicalade” sample using the calorimeter and use the graph to match this absorbance to the concentration of the additive.

Learners can compare the values of concentration achieved through each method and write an evaluation of the method with reference to the data collected.

**PRODUCED  
BY**



Derby College Group has produced  
this resource on behalf of the  
Education and Training Foundation

**FUNDED  
BY**



**Department  
for Education**

This programme is funded by  
the Department for Education

Derby College Group is delivering this programme on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.