T-LEVELS | Institute for Apprenticeships & Technical Education

Employer set project student pack

T Level Technical Qualification in Science

Version 1.0 September 2022 603/6989/9
Internal reference: TQ-ESP-StudentPack-Science

NCFE CACHE

Contents

Introduction

If you are a student studying the T Level in Health and Science (Science pathway) and preparing for the employer set project (ESP), this support pack is for you.

We know that the ESP can seem daunting and there are so many points to consider and skills to develop, but we are here to help. This support pack contains guides and activities on various aspects to help with your ESP preparation as a supplement to your classes and is to support your independent learning. The support ranges from English writing, reflection, key terms, applying the core skills and more. In addition to guides, this pack contains some activities in each section.

We do not recommend doing it all at once; it can be a lot to digest. The first section is a self-assessment, this is a good place to start to identify areas where you would benefit from more support. Start with these key areas and then work through the others step by step.

Self-assessment

In each of the areas, give yourself a RAG rating (red – R, amber – A or green – G). Rate yourself 'red' if you are not confident, 'amber' if you have some confidence and 'green' if you are very confident. Once you have completed a section of this pack, come back and rate yourself again, saying why you have given yourself that rating. If you are still on red or amber, what are your next steps to turn this to a green?

Area	Rating before		Rating after		Next steps
	RAG	Why	RAG	Why	
Key terminology					
Core skills					
English, maths and digital (EMD) skills in your employer set project (ESP)					
Maths: foundations for your ESP					
English: foundation for your ESP					
The importance of evaluation in your ESP					
The importance of justification in your ESP					

Area	Rating before		Rating after		Next steps
	RAG	Why	RAG	Why	
Creating effective conclusions in your ESP					
Reflection					
Referencing					
Completing effective risk assessments					
Statistics: from question to outcome					
Top tips for peer discussions					
Top tips for presentations					
Making links through effective project management					

Key terminology

Here are some of the key terms from the T level Technical Qualification in Science specification. Once you have covered these areas, or for revision, write their definition in the space provided. There is space at the end for you to add any other terminology you feel would be useful.

Term	Definition
Core component section A: the health and science sector	
Accuracy	
Biohazard (biological agent)	
Controlled variables	
Dependent variable	
Good laboratory practice (GLP)	
Good manufacturing practice (GMP)	
Hypothesis	
Independent variable	
Job description	
Laboratory information management systems (LIMs)	
Negative control	

Term	Definition
Personal protective equipment (PPE)	
Person specification	
Positive control	
Precision	
Primary information source	
Qualitative data	
Quality assurance	
Quality control	
Quantitative data	
Random errors	
Range	
Reliability	
Risk assessment	

Term	Definition
Secondary information source	
Standard deviation	
Standard operating procedure (SOP)	
Systematic errors	
Core component section B: science concepts	
Activation energy	
Aerobic respiration	
Alternating current	
Antibody	
Antigen	
Adenosine Triphosphate (ATP)	
Carbohydrates	
Catalyst	

Term	Definition
Coefficient of viscosity	
Collision theory	
Count-rate	
Density	
Diploid	
Direct current	
Direct transmission	
Deoxyribonucleic acid (DNA)	
Electrical charge	
Electrical current	
Empirical formula	
Enzyme	
Eukaryotic cells	

Term	Definition
Excitation	
Fluid	
Genetics	
Genomics	
Half-life	
Haploid	
Indirect transmission	
Ionisation	
Isotope	
Lipids	
Longitudinal wave	
Mass flow rate	
Meiosis	

Term	Definition
Mitosis	
Mole	
Molecular formula	
Monomer	
Newtonian fluid	
Non-Newtonian fluid	
Pathogen	
Polymer	
Potential difference	
Pressure	
Prokaryotic cells	
Proteins	
Relative isotopic mass	

Term	Definition
Resistance	
Ribonucleic acid (RNA)	
Semi-conservative replication	
Steady flow	
Titration	
Transverse wave	
Turbulent flow	
Viscosity	
Volumetric flow rate	
Wave	
Other terminology	

Term	Definition

Core skills

The employer set project (ESP) brief requires that students apply and contextualise core knowledge through the demonstration of the core skills, and these are demonstrated through the completion of a number of tasks:

CS1: Project management
CS2: Researching
CS3: Working with others
CS4: Creativity and innovation
CS5: Problem solving
CS6: Communication
CS7: Reflective evaluation

Task 1: research a strategy
Task 2: plan a project
Task 3: analysis of data
Task 4: presentation of outcomes and conclusions
Task 5: group discussion
Task 6: reflective evaluation

Key core skills terminology

Core skill	Describe this skill in your own words, and how you could demonstrate it
Project management	
Researching	
Working with others	

Core skill	Describe this skill in your own words, and how you could demonstrate it
Creativity and innovation	
Problem solving	
Communication	
Reflective evaluation	

How the core skills are demonstrated in each task

Task 1: research a strategy

In the first task, students are required to carry out a literature review of various resources related to that project brief.

This task links to Researching (CS2) and Reflective evaluation (CS7). To maximise success in this type of assessment, you should consider the following tips:

Use the pro-formas that are provided

The pro-formas include a table that allows you to identify which sources you have selected to inform your planning and also those which you have not selected.

Consistently referenced

Select which style of academic referencing will be used and stick to it. See referencing section of this report to refresh your knowledge in this area.

Justify source selection/rejection

When justifying which sources have been selected and which have not, it is important to:

- discuss the amount of data present in the sources; for example, is there enough quantitative data to support the conclusions made within the source?
- identify any bias that may affect any conclusions made by the sources
- use quotes from the sources to further justify the selection decision
- as with all tasks, use a professional tone within your writing

Reflect

Include notes in your project diary so that you can complete the reflective evaluation task (task 6).

Task 2: plan a project

In the second task students are required to use the sources selected in their literature review from Task 1 to then complete a project plan.

This task links to Project management (CS1), Researching (CS2), Working with others (CS3 – via the risk assessment), Creativity and innovation (CS4), Communication (CS6) and Reflective evaluation (CS7).

To maximise success in this type of assessment you should consider the following tips:

Link to the previous task

Refer to the research selected in task 1 to justify your planning and explain how it informed the planning of your project.

Consider timescales

Ensure that you include appropriate timescales for your projects and refer to any economic constraints of the project.

Take care completing the risk assessment

When carrying out a risk assessment, make sure that risks are correctly prioritised using any guidance given. Also ensure any pro-formas provided for risk assessments are used to achieve the maximum number of marks. For more guidance on completing your risk assessment, see the completing effective risk assessments section of this support pack.

Be specific

When referring to data collection ensure that a specific method is included on how that data is to be collected.

Reflect

Include notes in your project diary so that you can complete the reflective evaluation task (task 6).

Task: using 2 highlighters, identify which of the above tips link to the core skills: CS1, CS2, CS3, CS4, CS6 and CS7.

Task 3: analysis of data

In this task, students are provided with a raw data pack in the form of a laboratory information management systems (LIMs). This data then requires appropriate analysis and subsequent reporting. This task links to Creativity and innovation (CS4), Problem solving (CS5), Communication (CS6) and Reflective evaluation (CS7).

To maximise success in this type of assessment you should consider the following tips:

Conduct statistical analysis

Use suitable statistical analyses by selecting the appropriate statistical techniques. You should ensure the outcomes of the statistical analysis feature within the report when discussing the relevant conclusions (see statistics: from question to outcome section of this support pack). There may be multiple data sets within the LIMs (for example, on several tabs of a spreadsheet) and therefore it is important to apply the statistical analysis across the various data sets provided.

Be critical

Consider any anomalies in the data and any limitations of the data when writing the report.

Justify conclusions

Make sure you include a detailed justification of any conclusions in the report based on the statistical analysis. Check out the importance of justification in your employer set project (ESP) section of this support pack.

Reflect

Include notes in your project diary so that you can complete the reflective evaluation task (task 6).

Task: using 4 highlighters, identify which of the above links to each of the core skills: CS4, CS5, CS6, and CS7.

Task 4: presentation of outcomes and conclusions

In this task, students produce an A2 scientific poster which they subsequently present to their tutor.

This task links to Creativity and innovation (CS4), Communication (CS6) and Reflective evaluation (CS7).

To maximise success in this type of assessment you should consider the following tips:

Consider what makes an effective scientific poster

- include data analysis from task 3 and any subsequent conclusions
- include infographics that present that data from task 3 (for example, any relevant graphs or tables)
- ensure the poster is professional, it should not include any irrelevant or decorative content
- information should be written using a professional tone

Be prepared for the presentation

- be clear and confident on the content within your scientific poster as you will receive questions from your tutor after your presentation
- try to give your presentation flow, you should use your poster as a prompt when presenting rather than reading directly from it or reading directly from a script
- check out the top tips for presentations section of this support pack

Reflect

Include notes in your project diary so that you can complete the reflective evaluation task (task 6).

Task: identify 4 factors you will need to consider when communicating in a presentation and explain how to demonstrate this for effective communication. There is one to get you started.

1: Posture

How to demonstrate this for effective communication:

2:

How to demonstrate this for effective communication:

3:

How to demonstrate this for effective communication:

4:

How to demonstrate this for effective communication:

Task 5: group discussion

In this task, students respond to concerns and queries around the methods used in their projects. To do this, students must take part in a group discussion with peers where they formulate an appropriate individual response.

This task links to Working with others (CS3), Creativity and innovation (CS4), Problem solving (CS5), Communication (CS6) and Reflective evaluation (CS7).

To maximise success in this type of assessment you should consider the following tips:

Be prepared

Refamiliarise yourself with your research, data, and presentation from the previous tasks so that you are confident when contributing to the group discussion.

Engage

You should listen and respond to your peers, rather than making generic statements. Ensure to engage verbally and not just use your body language (for example, nodding in agreement).

Check out the top tips for peer discussion section of this support pack.

Incorporate all aspects

Finally, when writing the response to the query and or concern, you should ensure that you use the outcomes from your research, data and presentation and not just the outcome from the group discussion.

Reflect

Include notes in your project diary so that you can complete the reflective evaluation task (task 6).

Task: what verbal cues could you use when engaging with others in a group discussion? How could you show that you understand? How do you ensure everyone gets a chance to speak?

Include example phrases you could use in the space below.

Task 6: reflective account

In this task, students write a reflective evaluation of their performance on their previous 5 tasks. This task links to Communication (CS6) and Reflective evaluation (CS7).

To maximise success in this type of assessment you should consider the following tips:

Consider both positives and areas for improvement

Ensure you refer to what worked well, remember that you will have demonstrated your strengths in this task and it is important that you recognise those. In a reflection, it is also important to refer to what improvements and changes need to be made if the tasks were to be done again.

Be sure to check out the reflection section of this support pack for more guidance on completing reflective evaluations.

Think broadly

To achieve the higher marks, you must explain what the impact of the proposed changes would have been on the project overall, or on specific tasks. For example, if you had selected a different piece of research, how would this have then changed the project plan and your approach to your poster and group discussion?

Task: using Gibbs Reflective Model as an example – think of something that occurred on placement, or in a recent skills session you had in class (role play, presentation) and complete a reflective evaluation.

1. Describe what happened:

2. What were you thinking? What were your feelings and reactions?

3. Evaluate, was it good or bad? Also include why and how.

4. Analyse it, what sense do make of it?

5. Conclusion, what else could you have done?

6. Action planning, what would you do if it happened again?

English, maths and digital (EMD) skills in your employer set project (ESP)

The table below can be used to guide your focus when it comes to considering how you would demonstrate the general English competencies (GEC), general mathematical competencies (GMC) and general digital competencies (GDC). For each competency, the core skill is linked. You would be expected to demonstrate these during your employer set project (ESP), therefore included in the table are the tasks you could demonstrated the general competency in.

It is an important component of your assessment outcomes (AOs): **AO4 Use English, maths, and digital skills as appropriate.**

General competency	Linked core skills in science	Linked ESP tasks
GEC1. Convey technical information to different audiences	CS1.1: Independently produce a high-level project plan, written in a clear, unambiguous way and taking into account the document's purpose	Task 2
	CS6.1: Provide results and recommendations (written and verbal) to customers/clients	Task 2 Task 3 Task 4 Task 5 Task 6
GEC2. Present information and ideas	CS2.1: Conduct a review of independently selected scientific literature and other appropriate primary/secondary sources	Task 1 Task 2
	CS6.1: Provide results and recommendations (written and verbal) to customers/clients	Task 2 Task 3 Task 4 Task 5 Task 6
GEC3. Create texts for different purposes and audiences	CS1.1: Independently produce a high-level project plan, written in a clear, unambiguous way and taking into account the document's purpose	Task 2
	CS6.1: Provide results and recommendations (written and verbal) to customers/clients	Task 2 Task 3 Task 4 Task 5

General competency	Linked core skills in science	Linked ESP tasks
		Task 6
GEC4. Summarise information/ideas	CS1.1: Independently produce a high-level project plan, written in a clear, unambiguous way and taking into account the document's purpose	Task 2
	CS7.1: Evaluate the project's processes and outcomes	All tasks
GEC5. Synthesise information	CS2.1: Conduct a review of independently selected scientific literature and other appropriate primary/secondary sources	Task 1 Task 2
GEC6. Take part in/lead discussions	CS6.1: Provide results and recommendations (written and verbal) to customers/clients	Task 2 Task 3 Task 4 Task 5 Task 6
GMC2. Estimating, calculating and error spotting	CS4.1: Make creative, innovative improvements to scientific practice, processes and outcomes by following an evaluation cycle	Task 2 Task 3 Task 4 Task 5
GMC5. Processing data		
GMC6. Understanding data and risk	CS7.1: Evaluate the project's processes and outcomes	All tasks
GMC8. Communicating using maths	CS1.1: Independently produce a high-level project plan, written in a clear, unambiguous way and taking into account the document's purpose	Task 2
	CS6.1: Provide results and recommendations (written and verbal) to customers/clients	Task 2 Task 3 Task 4 Task 5 Task 6

General competency	Linked core skills in science	Linked ESP tasks
GMC10. Optimising work processes	CS5.1: Solve a problem within a science context	Task 3 Task 5
GDC2. Design, create and edit documents and digital media	CS6.1: Provide results and recommendations (written and verbal) to customers/clients	Task 2 Task 3 Task 4 Task 5 Task 6
GDC3. Communicate and collaborate	CS3.1: Identify their own role in relation to the wider team	Task 2

Maths: foundations for your employer set project (ESP)

Maths is an important part of all T levels and indeed, any health and science role. We use maths when calculating doses, to communicate information such as disease statistics and to determine if treatments are working effectively, amongst others. This section includes guides and questions on a selection of mathematical areas. Give these a go to develop your skills. Please note that the mathematical examples and questions are not exhaustive. If you identify areas you would like to work further on, be sure to speak to your teacher or a maths specialist.

Rearranging formulae

A formula is a relationship between different variables that is expressed algebraically. Often the formula will have application in everyday life, such as the formula for speed or the formula for converting Degrees Celsius to Degrees Fahrenheit.

There may be cases where we wish to rearrange a formula to find a different variable from that formula.

Example 1

Rearrange

$$v = f\lambda$$

to make f the subject.

We can divide both sides by λ which will remove λ from the right-hand side of the equation leaving just f.

$$\frac{v}{\lambda} = f$$

There is our answer!

Rearranging can become more complex when we have more values and with the introduction of algebraic fractions, but it is just a step-by-step process.

Example 2

Rearrange

$$y = \frac{4 + x}{7} - 2$$

to make ***X*** the subject.

The first term we need to remove is '-2', this is because it is the only variable on our right-hand side that is not part of the fraction. We can move the -2 by adding 2 to both sides:

$$y + 2 = \frac{4 + x}{7}$$

The second term we need to remove is the denominator, and we can do this by multiplying both sides by 7.

$$7(y + 2) = 4 + x$$

Notice the use of brackets as the 7 is multiplied by both **y** and 2.

The third term to remove is '4', and we can do this by subtracting this from both sides.

$$7(y + 2) - 4 = x$$

And there we have it! Have a go yourself using the practice questions below.

Practise rearranging formulae

1.Rearrange the following formula to make x the subject:

$$9(x - 4) + 3 = y$$

2.Rearrange the following formula to make x the subject:

$$4y = \frac{t + x}{m}$$

3.The formula to convert degrees Fahrenheit to degrees Celsius is:

$$C = \frac{5}{9}(F - 32)$$

You record a temperature of 36.2 C, use the formula above to convert this into Fahrenheit

4. How much current flows through a 9 V battery that has a resistance of 6.4 Ω? (Hint: You will need to remember Ohm's law)

Using units: dimensional analysis

In the health and science sectors, you may find yourself either performing calculations with no formula or calculating units for an unfamiliar calculation. Both these tasks can be solved with the understanding of one principle: dimensional analysis. The name may sound complicated, but it is essentially using units to your advantage.

First, some background. Whenever you put numbers through a calculation or formula, you are also putting their units through the calculation.

For example, when calculating the speed of a car travelling 200 km in 4 hours using the formula:

$$speed = \frac{distance}{time}$$

We input our values from the question into the formula:

$$\frac{200\ km}{4\ h} = 50\ km/h$$

If we look just at the units, we can see we are treating them algebraically – that is, like an x or y:

$$\frac{km}{h} = km/h$$

Tip: whenever you say 'per' in units, that means divide.

For example, 'km/h' means km divided by hour.

Therefore, if you do not have the formula for calculating speed, or you have forgotten it, you can work it out from the units:

- km/h

  → kilometres divided by hour

  → distance divided by time

By the same principle, if you do not know the units, but have the formula, you can calculate the units by putting them into the formula.

Using this principle of dimensional analysis can mean less memorising and can help you out when you are given an unfamiliar equation.

Try the following practice questions using the key points from above (the answers are at the end of this section).

Working out units from formulae/calculations

1. You are preparing a dose of ibuprofen for a patient. You calculate the concentration using the following formula:

$$concentration = \frac{mass}{volume}$$

You dissolve 100 mg in 5 mL, what are the units?

2. Researchers are looking into the effect of dietary acid on the breakdown of tooth enamel. From their experiments, they calculate the rate of decay as mg of enamel broken down per hour. What are the units?

3. When analysing blood samples for haemoglobin concentration to diagnose anaemia, a technician will perform a count for the mass of haemoglobin (measured in g) per litre of blood. What are the units for this?

Working out formula from units

1. Resting heart rate is given in beats per minute (bpm). Therefore, what is the formula to calculate heart rate?

2. The density of copper at room temperature is 8.96 g/cm^3. Therefore, how would you calculate the density of a 200 cm^3 piece of aluminium with a mass of 540 g?

3. The units for moments are Newton-metres (Nm). If you were to calculate the moment experienced by a prosthetic arm holding a weight, what formula would you use? The weight exerts a force of 10 N and the distance of the weight from the elbow of the arm is 0.3 m.

Calculating rate

Rate is a measure we need to calculate in various areas of health and science.

Remember:

$$rate = \frac{change}{time}$$

And the units? The rules of dimensional analysis apply here too!

Have a go at these questions.

1. A newborn baby has an increase in mass of 2 kg in the 6 weeks from birth. Calculate the rate of increase, giving your answer to 2 significant figures. State the units.

2. A clinical researcher is looking at the effect of a new pharmaceutical drug on breathing rate. In a 5-minute period, one subject has 90 breaths. Calculate their respiratory rate in breaths/minute.

3. A chemical reaction produces 500 g of product in 16 minutes. Calculate the rate of reaction and state the units.

Percentages

Calculating percentages, is incredibly useful, both in health and science and in everyday life. In the T level qualification, it falls under GMC2: estimating, calculating and error spotting. In this section, we have step-by-step guides to help you gain confidence with percentages.

Percentage increase

To work out what the new amount will be after a percentage increase:

1. Work out the percentage of the original amount
2. Add that amount onto the original amount

Example

The diameter of a bacterial colony was 1.2 mm after a 2% increase in size, what will the new diameter be?

Work out 2% of 1.2:

1.2 ÷ 100 x 2 **or** 1.2 x 0.02 = 0.024

Add the percentage increase to the original amount:

1.2 + 0.024 = 1.224 mm

(A shortcut would be to simply calculate 1.2 x 1.02 = 1.224)

Percentage decrease

To work out a percentage decrease:

1. Work out the percentage of the original price
2. Take that amount away from the original price

Example

You order personal protective equipment (PPE) that costs £850; however, you have 10% discount code, how much do you now pay?

Work out 10% of £850:

850 ÷ 100 x 10 **or** 850 ÷ 10 **or** 850 x 0.1 = 85

Take the percentage decrease from the original amount:

850 – 85 = £765

(A shortcut would be to calculate 90% of the original 0.9 x £850 = £765)

Calculating percentage change

To work out percentage change between an original value and a final value:

1. Find the difference between the 2 values
2. Divide the difference by the original value
3. Multiply by 100 to change that number to a percentage

Example

The laboratory energy bill in 2020 was £1277, in 2022 the bill is £1971. What is the percentage increase in the cost of energy?

1. Find the difference between £1971 and £1277:
   £1971 – £1277 = £694
2. Divide the difference by the original value:
   694 ÷ 1277 = 0.5435
3. Multiply by 100 to change the decimal into a percentage:
   0.5435 x 100 = 54.35%

Calculating one number as a percentage of another number

1. Divide the number you want to find as a percentage by the other number
2. Multiply the decimal by 100 to convert it to a percentage

Example

A bill for department resources comes to £5600. The PPE equipment ordered was £850. What was the cost of the PPE equipment expressed as a percentage of the total bill?

Divide the cost of PPE by the total cost:

850 ÷ 5600 = 0.1518

Multiply by 100 to convert to a percentage:

0.1518 x 100 = 15.18%

Practise calculating percentages

1. You measure a virus cell that is 48 nm in diameter. Another virus cell is measured to be 124 nm in diameter. How much larger is the second cell given as a percentage?

2. During one week of a disease outbreak, 25,000 people were found to be infected. If the total population is 740,000. What percentage of the population were infected?

3. A group one metal is added to water, and the time taken for a reaction is measured. The group one metal takes 25 s to react. When the water temperature is increased the reaction time goes down to 19 s.

What is the percentage decrease in time taken to react?

4. A cell with a diameter of 0.045 mm is viewed through a microscope, the cell appears to have a size of 18 mm when viewed through the lens.

What is the magnification of the microscope given as a percentage?

General mathematical competencies (GMC)

All T level students (regardless of subject) must develop 10 general mathematical competencies. These are:

- GMC1. Measuring with precision
- GMC2. Estimating, calculating and error spotting
- GMC3. Working with proportion
- GMC4. Using rules and formulae
- GMC5. Processing data
- GMC6. Understanding data and risk
- GMC7. Interpreting and representing with mathematical diagrams
- GMC8. Communicating using maths
- GMC9. Costing a project
- GMC10. Optimising work processes

You will find that there are specific questions within the external assessments that assess against these competencies; however, it is important to consider how maths is assessed within your employer set project (ESP).

The table below can be used to guide your focus when it comes to considering how you would demonstrate the general mathematical competencies:

General mathematical competency	Examples of how GMC is applied to the health and science T Level
GMC1. Measuring with precision	Measuring with precision can include: • choosing the correct equipment for the task • the units and scale of the measurement needed • taking account of any errors, such as zero errors and equipment that is 'off' a set amount • how this zero and systematic error could be affected with further calculations, the error could get compounded • reading calculator screens and choosing the appropriate number of significant figures/decimal places
GMC2. Estimating, calculating and error spotting	The estimation, calculating and error spotting competency can require: • understanding and knowledge of the context in order to find appropriate solutions to calculations • using rules of thumbs when making estimations. For example, an extra inch of height adds 5 pounds of weight • getting a sense check of any calculations performed, so you can be reassured your answer is in line with the expected solution

General mathematical competency	Examples of how GMC is applied to the health and science T Level
GMC3. Working with proportion	Working with proportions can include: • using numbers, ratios and percentages, for example, but also graphical representations, determining trends/pattens • an understanding of direct proportion and inverse proportion – such as in graphs, numbers or qualitative descriptions • applying proportionality to make predictions and draw conclusions, for example
GMC4. Using rules and formulae	Using rules and formulae includes: • knowledge and understanding of how to use rules and formulae given in the specification • general rules as well, such as area and volume calculations, hierarchy of operators for multiplication, division, brackets, addition (BIDMAS) • being able to use formula to find different quantities by rearranging equations • taking account of units and dimensions, and the effect when performing calculations, for example
GMC5. Processing data	Processing data can include: • how the data is collected to begin with • what technology, such as spreadsheets, is used to process the data • how the data is represented and processed such as tables or chart/graph form • being able to interpret already processed data, such as drawing conclusions from provided graphs
GMC6. Understanding data and risk	Understating data and risk can include: • knowledge and understanding of how data is sourced, for example primary, or secondary sources • being able to critically evaluate data • making predictions and drawing conclusions from data • considering how data was generated, for example sample sizes, data source in terms of possible bias
GMC7. Interpreting and representing with mathematical diagrams	Interpreting and representing with mathematical diagrams include: • the creation of suitable diagrams, charts, infographics, for example • being able to interpret diagrams and charts

General mathematical competency	Examples of how GMC is applied to the health and science T Level
	• using technology in their production and setting suitable scales, trend lines, for example
GMC8. Communicating using maths	Communicating with maths includes: • the use of calculations and diagrams to represent your findings and support your conclusions/judgements • using different methods for different audiences – such as information for the general public versus information for professionals/specialists
GMC9. Costing a project	Costing of a project can include: • financial planning, considering the various costs involved, such as equipment, space, time, resources, labour • being able to justify a budget for a certain project • taking into account risks that could potentially impact on any plans
GMC10. Optimising work processes	Optimising work processes can include: • identifying problems from data gathered, such as time requirements, efficiency, financials • suggestions for improvements and any resulting calculations, such as the amount of time saved, how it would affect resources/equipment costs • gather data to analyse the impact that the changes have and evaluate said impact

Answers to questions

Practise rearranging formulae

1. $x = \frac{y-3}{9} + 4$

2. $4ym - t = x$

3. Rearranging gives $\frac{9}{5}\,C + 32 = F$ so, 36.2 C = 97.16 F

4. 1.41 A (Using V = IR, rearrange to give I = V/R (3.s.f.))

Working out units from formulae/calculations

1. mg/mL
2. mg/h

    *Tip: remember, ‘per’ means divide!

3. g/L

Working out formula from units

1. beats divided by minutes
2. mass divided by volume (giving an answer of 2.7 g/cm^3)
3. force x distance (giving an answer of 300 Nm)

    *Tip: remember your rules of algebra! ab = a x b

Calculating rate

1. 0.33 kg/week
2. 18 breaths/min
3. 31.25 kg/min

Practise calculating percentages

1. 258% larger
2. 3.37%
3. 24%
4. 40000%

English: foundations for your employer set project (ESP)

Why spelling, punctuation and grammar (SPaG)?

Spelling, punctuation and grammar (SPaG) enables us, as writers, to convey our thoughts in a way that our reader will find easy to understand.

SPaG that is clear and accurate can make you appear more professional and get your message heard.

Employers are more likely to employ people who have good written communication skills.

Apostrophes

There are 2 types of apostrophes:

- **possession** –ownership/belonging (for example, the dog's toy)
- **omission** – where you leave out a letter (for example, I'm a student (Instead of I am))

In formal writing such as reports and articles, apostrophes for omission should be avoided to help keep the formal tone and register.

Apostrophes for possession often cause some confusion.

1. **The *dog's* tail was fluffy.**

Dog is a singular noun, so you need to add an apostrophe and 's' to show that the tail belongs to the dog.

2. ***James's* dog was naughty.**

James is a singular noun so, even though it ends in an 's' already, you need to add an apostrophe and another 's' to show that the dog belongs to James.

3. **The *brothers'* feet were muddy.**

Brothers is a plural noun that ends in an 's', so you don't add another 's' after your apostrophe. You can just add an apostrophe to show the feet belong to the brothers.

4. **The *children's* toys were broken**

Children is a plural noun, but it does not end with an 's', so you need to add an apostrophe and an 's' to show that the toys belong to the children.

The following activity is for you to try to recap apostrophes for omission and possession, as well as identifying if they are singular or plural.

Apostrophe activity

Add the apostrophe	Possession/omission	Singular or plural?
My dads name is Amir.		
Pauls dog is very cute.		
I read the research its apparently Harmans Theory of aging.		
Antonios grandma speaks English, Italian and Arabic.		
My sisters friend is coming to visit in an hour.		
Im not sure but I think the physiotherapists are meeting next week.		
The hospitals strategy.		
The Childrens Hospital		
Hes the friend I spend the most time with.		
Thats Davids pen, he must have forgotten it.		
The swimmers families cheered them on.		

Using the correct word

Sometimes words can be confusing as they sound the same but have different spellings and meanings. Below are some words that are often confused, with an activity to help secure understanding of the meanings.

It's or its?
The dog had eaten all _____dinner.
____ been a fantastic day, she exclaimed.
The dog licked _____paw.
Let me know when _____ready.

I or me?
Who else will be coming to the cinema with John and ____?
The children and ____were sitting on the settee.

Whose or who's?
_____ shoes are these?
_____ left their shoes in the doorway again?
I do not know ____number this is.
Do you know _____singing this song?

Accept or except?
I _____your apology.
No dogs allowed _____guide dogs.
Everyone ___the nurses need to attend.
They do not _____credit cards in the shop.

Practice or practise?
I am going to visit the new medical _____.
I must _____my breathing techniques.
On a Friday, the children _____handwriting.
The injection is given at your doctor's _____.

Affect or effect?
Does the medication _____the symptoms of the patient?
The new medication has no _____on glucose.

Advise or advice?
My _____would be to visit your GP.
I _____that you stop smoking.
I asked the doctor for some _____.
Scientists _____that you wear a mask.

Allowed or aloud?
You are not _____in the restricted area.
The process of learning clinical reasoning may be assisted by using think _____.
The patient was _____to go home.
She read the instructions _____.

Activity

Create a sentence for each of the following words.

Word	Meaning	Sentence example
Past	Gone in time/no longer	
Passed	To indicate movement	
Advice	A noun that means a suggestion about what you should do (a guide to action)	
Advise	A verb that means to suggest what should be done – to recommend/give info to someone (verb)	
Lose	To fail to win or hold on to something	
Loose	Adjective: not tight, not attached or Verb: to free something or someone.	
Affect	To influence something	
Effect	The result – it represents the end and a good way to remember is both start with an ‘e’.	
Infer	Come to a conclusion, make an educated guess.	
Imply	To suggest, hint at.	

Formality and tone

What makes a text formal or informal?

- purpose – what is it trying to achieve?
- audience – who is it for?
- tone – the attitude of the text
- punctuation
- language and grammar

Activity

The following activity is to identify the formality of the text. Select from the following the formality of each of the descriptions:

- highly formal
- quite formal
- quite informal
- highly informal

Description	Formality
An article for your company's newsletter about you and your job role.	
An email to a customer reminding them of an appointment	
An email to friend to invite them to your birthday night out.	
A letter to customer with regards to receiving an incorrect product.	

Activity

Which of the following would be the most formal?

1(a). An email to the council about the decline of leisure activities in the local area.

1(b). An email to the council regarding a stall at the local summer fayre.

2(a). A review of a recent film.

2(b). A review of local transport.

The following activity is to identify the formality of the text by saying if it is formal or informal and also to suggest the tone of the text. Tone of the text is the mood such as humorous, sarcastic, sad, fun.

Text	Formal/informal	Tone
Temperatures are rising. This is caused by human emissions of greenhouse gases and a change in weather patterns		
The joys of camping in the UK – wonderful wet weather, soggy socks, and toppling tents! A great way to spend your well-deserved holiday		
Dial-a-dog! Ever wondered if a dog is for you? This is a great way to find out! You could soon be finding your own fantastic furry friend.		

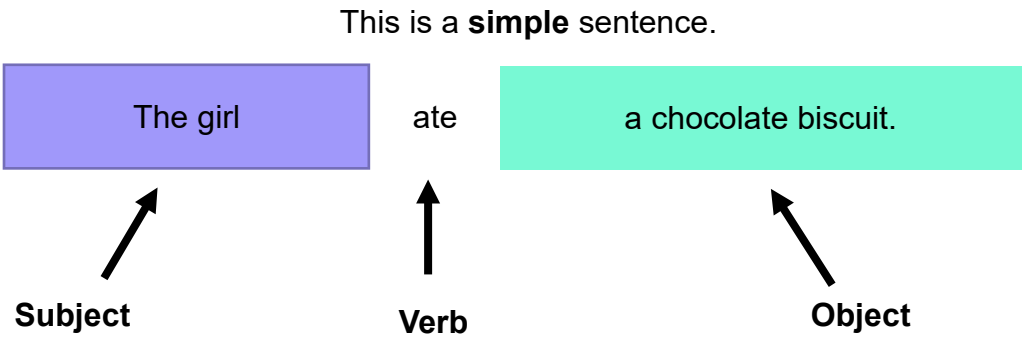
Tenses activity

Identify the tense of the sentence.

Sentence	Tense: past/present/future
We will go to the cinema on Saturday.	
Rashid is eating his lunch.	
Mario is walking to the shops.	
Viktoria slept all day yesterday.	
Mr and Mrs Perez are speaking Spanish.	
My parents flew from Gatwick airport.	
I am going to read a book.	
Elena is writing a story.	

Sentences

This is an example of a **main** clause. It is a complete sentence and makes sense by itself.



A compound sentence **connects 2 independent clauses, usually with a coordinating conjunction like, and, or, but**. They combine 2 or more self-sufficient and related sentences into a unified single sentence.

This is a **compound** sentence:

I like coffee. Helen likes tea.

I like coffee ***and*** Helen likes tea.

Conjunction

This is a **complex** sentence:

My sister, who is younger than me, is a doctor.

Complex sentences are formed by adding a **subordinate clause** to a main clause.

Subordinate clauses add information to the main clause.

For example: 'who is younger than me' is a subordinate clause as it adds more information to the sentence but **does not make sense on its own.**

A subordinate clause must be separated from the main clause using punctuation (usually a comma).

Sentence activity

What is the sentence type: simple, compound, or complex?

Sentence	Type
Molly, 2 years younger than me, was not allowed to go.	
It was a very sunny day.	
They did not like the food, so they left the restaurant.	
The boy was crying because he had fallen.	
Ahmed, managed to find a chair, while others had to stand.	
I have a dog called Toby.	

Answers for spelling, punctuation and grammar (SPaG) activities

Apostrophes

Add the apostrophe	Possession/omission	Singular or plural?
My dad's name is Amir.	Possession	Singular
Paul's dog is very cute.	Possession	Singular
I read the research its apparently Harman's Theory of aging.	Omission and possession	Singular
Antonio's grandma speaks English, Italian and Arabic.	Possession	Singular
My sister's friend is coming to visit in an hour.	Possession	Singular
I'm not sure but I think the physiotherapists are meeting next week.	Omission	Plural
The hospital's strategy.	Possession	Singular
The Children's Hospital	Possession	Plural
He's the friend I spend the most time with.	Omission	Singular
That's David's pen, he must have forgotten it.	Omission and possession	Singular
The swimmer's families cheered them on.	Possession	Plural

It's or Its?

- The dog had eaten all its dinner.
- It's been a fantastic day, she exclaimed.
- The dog licked its paw.
- Let me know when it's ready

I or me?

- Who else will be coming to the cinema with John and me?
- The children and I were sitting on the settee.

Whose or who's?

- Whose shoes are these?
- Who's left their shoes in the doorway again?
- I do not know whose number this is.
- Do you know who's singing this song?

Accept or except?

- I accept your apology.
- No dogs allowed except guide dogs.
- Everyone except the nurses need to attend.
- They do not accept credit cards in the shop.

Practice or practise?

- I am going to visit the new medical practice.
- I must practise my breathing techniques.
- On a Friday, the children practise handwriting.
- The injection is given at your doctors practice.

Affect or effect?

- Does the medication affect the symptoms of the patient?
- The new medication has no effect on his glucose.

Advise or advice?

- My advice would be to visit your GP.
- I advise that you stop smoking.
- I asked the doctor for some advice.
- Scientists advise that you wear a mask.

Allowed or aloud?

- You are not allowed in the restricted area.
- The process of learning clinical reasoning may be assisted by using think aloud.
- The patient was allowed to go home.
- She read the instructions aloud.

Word meaning

Word	Meaning	Possible example
Past	Gone in time/no longer	I often think of past holidays.
Passed	To indicate movement	Anita passed the ball to Umar.
Advice	A noun that means a suggestion about what you should do (a guide to action)	I need to get some advice about my car.
Advise	A verb that means to suggest what should be done – to recommend/give info to someone (verb)	I advise you to stay at home as the weather is poor.
Lose	Fail to win or holding on to something	I aim to lose weight.
Loose	Adjective: not tight, not attached or Verb: to free something or someone.	My dog is running loose as it escaped.
Affect	To influence something	Poverty can affect anyone.
Effect	The result – it represents the end and a good way to remember is both start with an ‘e’.	The experience has had a good effect on him.
Infer	Come to a conclusion, make an educated guess.	‘I don’t know how much you can infer from his data’.
Imply	To suggest, hint at.	She did not mean to imply that he was lying.

Formality and tone:

- article for your company's newsletter about you and your job role — quite formal
- email to a customer reminding them of an appointment — quite formal
- email to friend to invite them to your birthday night out — highly informal
- letter to customer with regards to receiving an incorrect product — highly formal

Which would be the most formal? 1(a) and 2(b)

Formality and tone:

- formal serious
- informal sarcastic
- informal fun

Tenses

Future, present, present, past, present, past, future, present.

Sentences

Complex, simple, compound, compound, complex, simple.

The importance of evaluation in your employer set project (ESP)

This section covers a range of evaluation examples, use the most appropriate format based on the questions being asked/work being evaluated.

> ‘Evaluation is the collection of analysis and interpretation of information about any aspect of a programme of education or training as part of a recognised process of judging its effectiveness, its efficiency and any other outcomes it may have.’
>
> ELLINGTON, H. PERCIVAL, F. RACE, P. (1993): Handbook of Educational Technology. London: Kogan Page

What is evaluation?

The main types of evaluation are:

- Process
- Impact
- Outcome
- Summative evaluation

Assessing resources found

Consider the following:

- Currency → the timeliness of the information
- Relevance → the importance of the information for your needs
- Authority → the source of the information
- Accuracy → the reliability, truthfulness, and correctness of the information

How to evaluate your own work and others: who, what, where, why and how?

How to evaluate your own work
Where did you gather your research?
What was your topic?
What did the research tell you?
Who have you cited within your work?
Why was it successful/unsuccessful?
How has this informed your work and conclusions?
How can you implement this?
How to evaluate work of others/sources
Where have you gathered your findings?
What facts/information have you found?
How did you cite the information?
What was the impact?
What is the key takeaway from the source?
How will it inform/conclude about your work?
Why was it successful/unsuccessful?
What would you change/adapt, and why?

Evaluations in your employer set project (ESP)

Evaluation is an important element of the ESP in the T Level qualification. Below are some areas where evaluations are a key component of success.

Evaluation is a key component of both the 'plan a project' task and 'reflective evaluation' task.

In the 'plan a project' task you need to be able to:

- evaluate the types of data to be collected and the mechanisms of collection
- clearly address how the data and its collection mechanism will meet the needs of the targeted practical investigation, the constraints of the setting, and the timeframes

In the reflective evaluation task, you need to be able to:

- provide an evaluation of all the tasks, including a comprehensive and balanced explanation of what worked well and what could have gone better

- evaluate your performance in the different tasks and demonstrate how any proposed changes might impact on other tasks in the ESP

Example of a reflective evaluation

In the following example, one component is evaluated and then taken through each task. You would do this several times, evaluating different components and how that impacted each task. It is an example from health; however, this structure could apply to healthcare science and science T Levels also.

> ‘When researching how best to support the patient in task 1, my research focused on physical care for Jo. This seemed effective to me as I felt really prepared for the supportive discussion in the role play. I was able to ask the right questions around his physical needs and respond to his answers. I was able to inform my healthcare plan as I was able to write quite comprehensively around the support he needs., including reviewing of his hypertension medication by a cardiologist specialist.
>
> However, when having my professional discussion with my fellow colleagues, it was highlighted that I did not look enough into what support I could give him and what my role is in supporting Jo. Reviewing this in my presentation, I highlighted that my responsibilities as a nurse entail that I would check his blood pressure, take any blood tests to see if there were any other underlying conditions, before documenting his physiological measurements and forwarding his bloods for testing. The healthcare plan would be changed to highlight my role in this part of his care, and how other specialists would then take the next step to focus his support further.’

The importance of justification in your employer set project (ESP)

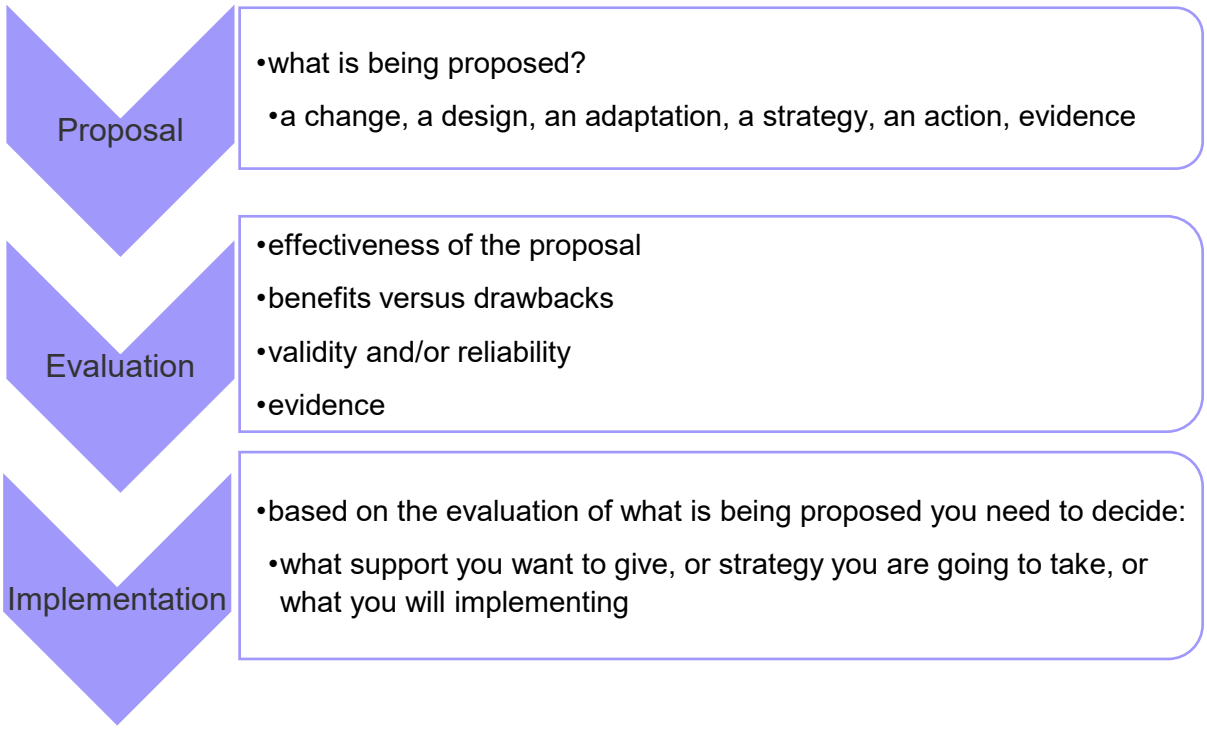
What is justification?

Justification is an important part of your assessment; however, it is also an important part of your professional life. You need to be able to say why you complete each action and your reasoning behind each action, which will then give you the justification of any proposed outcomes.

Justifications are an extension of evaluation. When you evaluate, you weigh up the good and bad, justification is evidencing *why* something is good or bad.

Justification is also about using evidence to defend what your next actions are, or sound reasoning behind why you are implementing a change.

Justification flow chart



Justification in your employer set project (ESP)

Justification is an important component of the employer set project (ESP) in the T Level qualification. Below are some areas where justifying is a key component of success.

In the research strategy task, you need to produce a literature review that includes a balanced and well-justified rationale for the selection, prioritisation, and rejection of wide range of sources.

In the analysis of data, you need to provide balanced and well-justified conclusions, including the results of your statistical tests.

Through your reflective evaluation task, you need to provide balanced and well-justified reasons for all the changes (or not) you would make if you were to do each task again.

Example of a justification

Let us now look at an example of a justification using the flow chart above.

Patient information

A patient, Jen, has diabetes, and she likes to eat high-sugar content food. She often feels tired, bloated and lacking in energy. She also has a problem with weight control, and really struggles to plan healthy meals around her busy life.

Proposal

Jen needs support in reducing her sugar levels; therefore, an intervention is needed that is focused mainly on managing her diet, specifically reducing her sugar levels. Firstly, I propose that Jen gets her bloods tested, including HbA1c, to make sure that there is no significant change in her blood glucose levels. This result will then be sent to her GP to see if any change in medication is needed. I would also recommend that Jen gets referred to DESMOND (Diabetes Education and Self-Management for Ongoing and Newly Diagnosed).

Evaluations

Research has shown that excessive sugar consumption can lead to spikes in blood sugar that can be life threatening, this has been replicated in several studies so is a reliable conclusion. Jen is currently showing physical symptoms of high blood glucose (bloating, tiredness), if this continues this could result in more serious complications, such as eyesight issues and circulatory problems. As Jen has a busy lifestyle, she may not have a full understanding of how to change her diet to best suit her schedule and meet her dietary requirements. If we set out an intervention that only meets Jen's physical requirements without taking into context her environmental and social needs, then we will not be best supporting Jen with her diabetes.

Implementation

HbA1c testing will check to see if Jen needs any changes to her medication, if her medication needs to be increased this could help reduce her blood glucose levels and reduce the symptoms. However, I think referring Jen to DESMOND will help educate her in how sugar levels impact her wellbeing and increase understanding of sugar in her day-to-day diet. DESMOND groups will allow for a sharing of ideas around how to manage a diet in a busy day-to-day life which should help to meet Jen's environmental and social needs.

Creating effective conclusions in your employer set project (ESP)

The last section of an academic writing is the ***conclusion***. The conclusion should reaffirm your answer to the question, and briefly summarise key arguments. It does not include any new points or new information.

- leave the reader thinking about your topic – leave an impression on them
- no new information in conclusion
- be sure to recap your ideas
- should follow logically from the body of the essay

This is the opposite of your introduction, it tells the reader what you have **assessed**, **justified**, **discussed** based on what you proposed in the introduction.

> 'A conclusion is the last part of something, its end or result. When you write a paper, you always end by summing up your arguments and drawing a conclusion about what you have been writing about.'
>
> www.vocabulary.com/dictionary/conclusion

What is a conclusion?

The main types of a conclusion are:

Scheme	Blame	Constitution	Ending

Consider the following:

Decision/ determination/ verdict	a position or opinion or judgment reached after consideration 'their conclusion took the evidence into account'
Close/ closing/ end	the last section of a communication

Typical words for a conclusion

Conclusion
Given the circumstances…
Now that one knows…
Overall…
The logical conclusion appears to be…
To summarise…
Ultimately…
Upon consideration of the facts discussed…
After the exploration of multiple professional viewpoints…
In summary…
Nevertheless…
When faced with the dilemma of…
Bearing in mind…
It seems clear that…
Given the evidence presented…
In general…
With all aspects considered…
In view of this information…

Structure of a conclusion

A conclusion has 3 sections:

- purpose – first, **repeat the purpose of your essay/report/literature review;** it will not use the exact same words as in your introduction, but it will repeat the point, the overall purpose to the question
- general conclusions – then set out your **general conclusions**, and a short explanation of why they are important
- draw it all together – finally, **draw together the question**, the evidence in the essay body and the conclusion; this way the reader knows that you have understood and answered the question, this part needs to be clear and concise

Example conclusion

In this health example, the conclusion is broken down into the steps mentioned above bringing them together into one paragraph:

Purpose: In summary, this report sets out clear proposals of how best to support Jo in his care and day-to-day living.
General conclusions: As highlighted earlier, Jo's independence is very important to him; however, this does cause a dilemma as Jo's emotional and physical needs are not being met. As Jo is a very proud man, it is important that what is proposed in this report is discussed with Jo and allows him to be part of the decision making. Subsequently, involving Jo will continue to encourage his independence, which is an important value for him, and allow for person-centred care. As discussed, research has shown hypertension can be linked to diagnosis of 'mild cognitive impairment or dementia' (Vest, 2021); therefore, a review of his medication may be needed to ensure that this is not having an impact on his memory loss.
Draw it all together: Having Jo involved in creating a healthcare plan, and following the actions previously mentioned regarding his physical and emotional needs, will allow for the best outcomes in a support plan, whilst ensuring Jo's values and beliefs are the foundation of our care.

Reflection

What is reflecting on your practice?

One definition is: *'The ability of a professional to critically, realistically and constructively review one's own performance in order to take necessary actions to improve abilities and/or maintain motivation toward teaching and learning goals'* (IGI Global, 2022).

IGI Global. 1988, *Publisher of Timely Knowledge*. (Online). Available at www.igi-global.com/dictionary/professional-self-reflection/33702 (September 2022)

The important terms here seem to be **reviewing practice with criticality and realism**, using a **practical approach** to inform the review. This then leads to some sort of action; making changes which improve practice or maintain motivation – and these would be towards specific goals.

Reflective practice requires you to be objective – to explore what you **do**, review all aspects of your work and how you can maintain or improve the standards required within your industry context.

Let us start by exploring how this could be structured. The first stage would be to **carry out a professional activity**. In T Levels, one example of this would be one of the tasks in the employer set project (ESP), where a reflection task is completed. Once you have completed the activities, you will use them as the basis of reflection, where you might ask yourself:

- what went well?
- what did not work so well?
- what were the factors which impacted on how well everything went?
- how did your approach impact on success?
- you could also consider the involvement of and/or feedback from others

When reflecting, it is important to be **objective**, take a 'step back' and look at what happens from the 'outside'. Imagine you are an onlooker, not involved personally, and evaluate **what** happened and **why** it happened. You might also ask for the input of others at this point, the professionals you work with to get the input from the perspective of others around you. You should think about who this might be and ensure you collect input and feedback from the most relevant people, even those who might be difficult to ask.

The next step or stage would be for you to **use** the findings of the reflections and evaluations to inform a plan of action. What **might, or will** you do to address any issues? Will you change something, or keep doing things the way you were? You should have personal justifications for what you choose to do here and if you are **not** going to change anything, focus on **why this is so**.

For areas where you **will** change things:

- what has informed the changes?
- why have you chosen the changes you have?

You need to think very carefully and objectively here to have the best and most positive impact. If you have received some ideas from others, again be objective, and make a professional judgement on whether you are going to try them out. It can be quite difficult to critically review your own work and take criticism from others but

using an objective, professional approach allows you to make informed choices which will help to maintain high standards or improve or develop any areas we need to.

Once you have reflected on your practice and made a plan, the next step or stage would be to put the plan into action. It is also important to review the changes you make and their impact, whilst also reviewing any areas which remain unchanged and how well they are going. Again, involving others might be useful here. Finally, it may be useful to review how well the whole process has gone, with some more long-term planning of action.

The stages or steps could be seen to overlap or even be more cyclical. It is important to acknowledge here that reflective practice is very much an ongoing process without always having start and end points and that the most successful professionals embed this into everything they do.

Models of reflection

Kolb's Experiential Learning Cycle (1984)

We will now explore some models of reflection, starting with **Kolb's Experiential Learning Cycle (1984):**

- concrete experience
- reflective observation
- abstract conceptualisation
- active experimentation

The first stage in this model is having the **concrete experience,** and generally, this could be planned or unplanned. We 'do' something or carry out a work activity, and we start off by describing what happened.

The second stage is **reflective observation**, where we reflect on what happened. We review the activity and carry out an objective review related to why we think the activity 'went' the way it did. What influenced what happened? What were the impacting factors related to how successful it was? Did anyone else have any impact or provide feedback to you?

The third stage is **abstract conceptualisation.** For this, we make links to other facts, knowledge and understanding. We have to make sense of the experience; that is what Kolb means by 'abstract conceptualisation' and it is particularly important for something that is new. This learning involves using theories, logic and ideas, rather than feelings, to understand problems or situations.

The final stage is **active experimentation**, when we actively use any new knowledge, learning or understanding gained from the whole reflective process. Professionals can 'plan for the future' regarding what they have gained from applying this reflective cycle, and how it informs their future practice.

This is easy to relate to learning something new, but it can be just as beneficial to use with an existing activity or practice to review its effectiveness or success.

Try this model for yourself using the following template:

1. Concrete experience – doing/having an experience. Describe what happened.	
2. Reflective observation – reviewing and/or reflecting on the experience.	
3. Abstract conceptualisation – what did you learn from the experience? What sense can you make of it?	
4. Active experimentation – planning for the future and trying out what you have learned.	
Any other comments/notes?	

Gibbs' Reflective Cycle (1988)

The second model we will explore is **Gibbs' Reflective Cycle (1988**). There are 5 stages in this model:

1. Describe what happened
2. What were your feelings?
3. Evaluate why it happened and how you felt
4. Make conclusions
5. Plan a course of action

Similar to Kolb's model, we start this off in stage 1 by creating a description of what happened during completion of an activity or task.

For stage 2, the model then asks us to record our **feelings and reactions** related to the activity or task, and what we were thinking whilst completing it. It is also important to consider **how** these feelings, thoughts and reactions impacted on the activity, its success and completion.

The next stage is to evaluate the activity or task completed. This would include how good or bad it went, including an evaluation of the **why** it went the way it did, not simply focusing on the 'how' by producing a description, as this was completed in stage 1. To be successful, what is required at this stage is deep thought, evaluation, and objectivity, what were the factors which impacted on its success? Why did they impact on it, and what was the impact? What helped and contributed to its success, and what hindered or stopped its completion? What feedback or guidance was received, and how did it help, support, guide and impact what was done?

The fourth stage relates to making conclusions and this includes considering alternatives, what else could you have done? What could you have done differently, and how might this have impacted on the activity? Feedback from others could also help greatly with the completion of this stage. Focus again on taking a 'step back' and being objective, think professionally about what happened. It is not about blaming anyone for any problems or mistakes; we are all human and mistakes do happen sometimes. Therefore, it is about learning from what happened and making changes or adaptations to our practice, to ensure that activities and tasks are carried out efficiently in the future.

The final stage relates to planning a course of action based on the above steps. What would you do differently if you carried out the activity again? What have you learned from this activity that could help you to plan further professional activities and completion of tasks? How did your approach 'work', and what aspects of your practice can you develop and further improve as a result of reflecting on what you have done?

Gibbs also suggests that you should start the process again, the next time you carry out the same or similar activity.

Try this model for yourself using the following template:

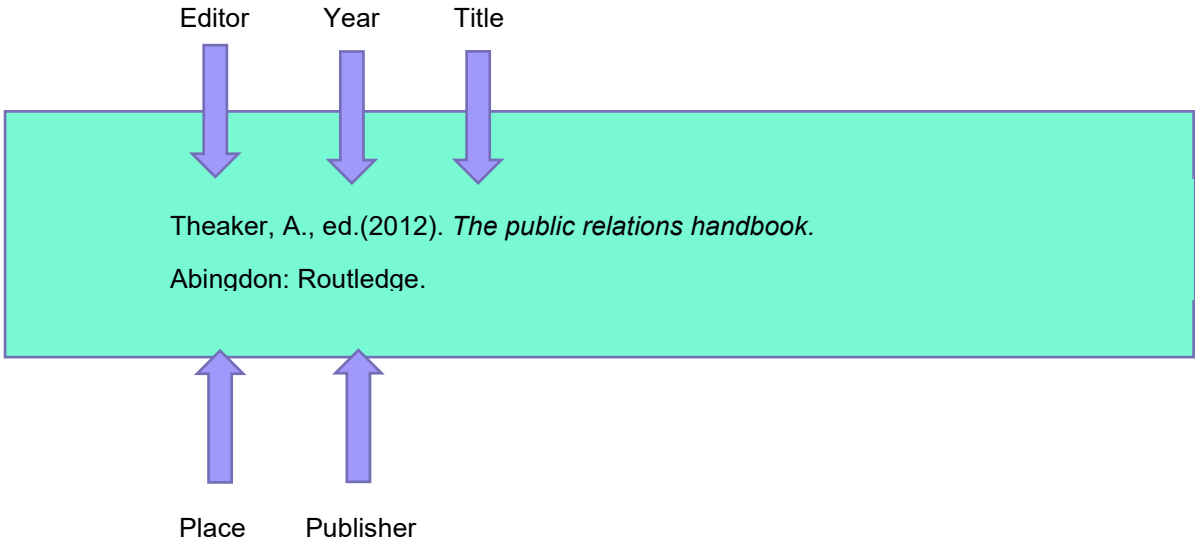
1. Describe what happened.	
2. What were you thinking? What were your feelings and reactions?	
3. Evaluate – was it good or bad? Also include why and how?	
4. Analyse it – what sense do you make of it?	
5. Conclusion – what else could you have done?	
6. Action planning – what would you do if it happened again?	
Any other comments/notes?	

Referencing

Style of referencing

Harvard referencing (often called the 'Author Date System') – worldwide and preference to use in study. When reading books or articles referenced using the Harvard system, the flow of the reading is less interrupted as the attention is not constantly diverted from the text to footnotes or endnotes. New students and the more general reader often find works written using the Harvard system more accessible, as pages dominated by large numbers of academic footnotes can be intimidating. Having a list of references at the end of the work to show the full reference that is cited within written work.

How to create a reference list



Harvard Referencing: Surname, Initial. (Year of publication) 'Title of article', *Title of newspaper*, followed by the place of the publisher with their name below day and month, page reference if available.

Further reference examples

Harvard reference list examples:

1. Referencing a book:

Tracey, D 2011. *Urban Architecture ideas and designs for the new food revolution*. Gabriola Island: New Society Publishers.

2. Referencing an academic journal:

Mackenzie, R. 1998. *Psychologist: to be or not to be? Journal of philosophical psychologists,* 34(2), 345-347.

3. Referencing newspaper articles:

Matomela, S 2010. *Crime rampant in Gauteng*. The Sun March:3.

4. Referencing websites:

Johnston. A. 2014,*The Fall of Neoliberal Politics*. [Online]. Available:

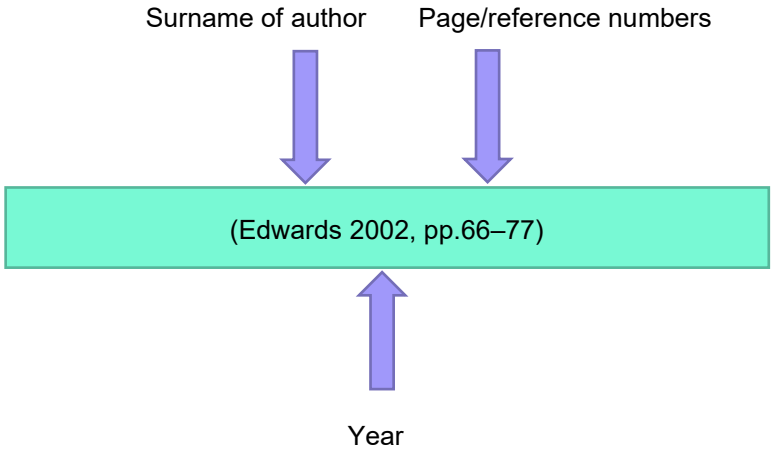
https://scholar.google.co.uk/scholar?q=Johnston.+A.+2014,The+Fall+of+Neoliberal+Politics.+%5BOnline%5D.+Available:&hl=en&as_sdt=0&as_vis=1&oi=scholart [28 August 2014]

How to cite reference within your work

Under the Harvard system, sources are cited in short notes in brackets within the text and a corresponding full reference is included in a list of references at the end of the work.

Every time the ideas, facts, or opinions of another are used in a piece of work it must be acknowledged with a full reference. Whether a source is quoted directly, indirectly, paraphrased, or summarised, it must be acknowledged. To do otherwise is plagiarism.

How to create a reference list



Completing effective risk assessments

Risk assessments are key for ensuring safety and minimising risk with scientific tasks. All tasks require a risk assessment, and this skill is assessed both in your employer set project (ESP) and in the second year synoptic assignments.

Different organisations have different templates and requirements for risk assessments. In your assignments, you will be supplied with a template to use, usually known as a pro-forma.

The easiest way to ensure you complete the required sections of risk assessment in your assignments, is to use the supplied pro-formas.

Health and Safety Executive's (HSE) 5 steps to risk assessment:

1. Identifying the hazards
2. Deciding who might be harmed and how
3. Evaluating the risks and deciding on precautions
4. Recording findings and implementing them, including completing risk assessment documentation
5. Reviewing your assessment and updating if necessary

Identifying hazards and deciding who might be harmed and how

It is important to consider all hazards, including those that may affect others. Those that need to be considered are everyone. The risk assessment pro-forma has the list of individuals who may be at risk:

Those at risk	Key
Own staff	OWN
Venue staff	VEN
Organisers	ORG
Visitors	VIS
Public	PUB
Contractors	CON
Anyone on-site	AOS

It is important to identify all risk which may be reasonably anticipated, even if the risk is low (this is recorded elsewhere in the risk assessment).

Evaluating risks and deciding on precautions

A key part of any risk assessment is determining risk level, also known as prioritisation. This is done using a risk matrix, again, the best option in your assessment is to use the one supplied with the pro-formas.

Risk matrix

Risk matrix – evaluation of risks							Action level
Almost certain	5	5	10	15	20	25	20-25 STOP
Highly likely	4	4	8	12	16	20	
Likely	3	3	6	9	12	15	12-16 URGENT
Unlikely	2	2	4	6	8	10	8-10 ACTION
Extremely improbable	1	1	2	3	4	5	4-6 MONITOR
	X	1	2	3	4	5	1-3 NO ACTION
		Minimal	Minor injury	7 day + injury	Serious or major injury	Severe	
			Consequence				

To use this matrix, you must first establish the likelihood (left side of above matrix) and consequence (bottom side of above matrix) of the hazard.

Likelihood	Consequence
Almost certain	Severe
Highly likely	Serious of major injury
Likely	7 day+ injury
Unlikely	Minor injury
Extremely improbable	Minimal

These levels are assigned numbers which are then multiplied together to give the risk level. You can use the table for this, and it will also give you the action level.

Example

If we have identified a hazard that is likely to cause a minor injury, we can use the matrix by looking at the cell that is in the ‘likely’ row and the ‘minor injury’ column:

Risk matrix

Risk matrix – evaluation of risks							Action level
Almost certain	5	5	10	15	20	25	20-25 STOP
Highly likely	4	4	8	12	16	20	
Likely	3	3	6	9	12	15	12-16 URGENT
Unlikely	2	2	4	6	8	10	8-10 ACTION
Extremely improbable	1	1	2	3	4	5	4-6 MONITOR
	X	1	2	3	4	5	1-3 NO ACTION
		Minimal	Minor injury	7 day + injury	Serious or major injury	Severe	
			Consequence				

For the total risk level, we get 6. We can input this into our risk assessment under the 'total risk level' column.

We can see that the action level for this risk falls under 'monitor' (a value of 4 – 6, colour light green).

Example

If we have identified a hazard that is highly likely to cause a serious or major injury, we can use the matrix by looking at the cell that is in the 'highly likely' row and the 'serious or major injury' column:

Risk matrix

Risk matrix – evaluation of risks							Action level
Almost certain	5	5	10	15	20	25	20-25 STOP
Highly likely	4	4	8	12	16	20	
Likely	3	3	6	9	12	15	12-16 URGENT
Unlikely	2	2	4	6	8	10	8-10 ACTION
Extremely improbable	1	1	2	3	4	5	4-6 MONITOR
	X	1	2	3	4	5	1-3 NO ACTION
		Minimal	Minor injury	7 day + injury	Serious or major injury	Severe	
			Consequence				

We can see that the total risk level is 16 which has an action level of 'urgent'.

Recording and implementing findings – including completing risk assessment documentation

Each stage of the 5 Steps to risk assessment should be documented. For your assessment, this is best done with the pro-forma provided to ensure that you include all the elements required by the mark scheme.

Here is an example of a completed one for determining total viable cell count, see the key underneath for more detail on what each heading requires.

1 2 3 4 5 6 7 8 9

Hazard	Who might be harmed? (see 'those at risk', above)	Likelihood	Severity	Total risk level	Control measures (add any other control measures you will use)	Likelihood	Severity	Res. risk level
Raw sample – samples contain bacteria that could potentially be harmful to those exposed	OWN	Unlikely	1	2	Clean any spillages up quickly and appropriately.	NA	NA	2
Bunsen burner – open flame that could either burn the operator or cause a fire	OWN	Unlikely	3	6	Remove gloves when using Bunsen burner. Ensure no flammable materials are kept near the Bunsen burner. Use safety flame when not actively flaming material. Wear appropriate personal protective equipment (PPE) (lab coat).	Unlikely	2	4
Spreading can induce the risk of aerosolization of the material if the operator is not properly trained in the flaming and cooling of spreaders	OWN	Likely	1	6	Ensure operator is fully trained in how to flame and then cool the spreader to ensure that a hot spreader is not used, which can increase the risk of aerosolization.	Unlikely	1	2

By signing the declaration below, you have agreed that you will put the appropriate control measures in place to ensure that hazards are reduced and that the risks applicable to your stand are controlled.

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Signed	**D. Student**
Print name	D. Student
Review date	07/10/2020

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1. **Hazard** – clearly describe the hazard and how it can be caused.
2. **Who might be harmed?** – using the table above, insert the 3-letter code for those who may be harmed by the hazard.
3. **Likelihood** – include 1 of the 5 likelihood descriptors from the risk matrix, based on your assessment of the uncontrolled risk
4. **Severity** – include 1 of the 5 consequence descriptors from the risk matrix, based on your assessment of the uncontrolled risk
5. **Total risk level** – using the matrix as described in the previous section, enter the total risk level for your chosen likelihood and consequence levels – this will be the number in the box of the matrix
6. **Control measures** – include all control measures that you will implement to reduce the risk – take some time to think here as not all are obvious – include things during the activity, such as safety steps taken by the person conducting the activity, but also consider other options such as personal protective equipment (PPE), training, signage, environment and time of day

7. **Likelihood** – now reassess the risk **after** your implemented control measures – include 1 of the 5 likelihood descriptors from the risk matrix
8. **Severity** – now reassess the risk **after** your implemented control measures – include 1 of the 5 consequence descriptors from the risk matrix
9. **Res. risk level** – recalculate the risk level for your post-control measures risk, using the likelihood and severity values from the previous columns and the risk matrix
10. **Signature and name** – this should be your own, you should **not** complete a risk assessment on behalf of somebody else
11. **Review date** – this is the date that the risk assessment will need to be reviewed – this will be in accordance with the policies of your organisation but is typically one year after the date the risk assessment was conducted

Reviewing your risk assessment

Risk assessments are not just done once and forgotten about. As regulations and hazards change, risk assessments must keep up to identify if new hazards or new control measured need to be considered. Therefore, risk assessments are reviewed regularly, this is in accordance with the policies of the organisation but is typically one year after the date the risk assessment was conducted (or reviewed).

Language in a risk assessment

A risk assessment is a formal piece of writing and should be written in a professional tone. You should ensure you are using spelling, punctuation and grammar (SPaG) correctly, as well as conveying meaning clearly and effectively throughout in a logical structure.

As it is a technical document, you can use technical language but must ensure that this is used correctly and without errors.

Ensure you have practised risk assessments prior to your assessment and have a go at the English exercises earlier in this pack.

Statistics: from question to outcome

Statistical techniques, ranging from simpler techniques such as calculating the median to more complex ones such as performing a T-test, are all incredibly useful. These techniques help tell us something about our data and can thus inform on our conclusions.

It is important we do not just conduct a statistical technique and then leave it there.

Statistical techniques inform our conclusions.

When we want to draw a conclusion, it is not enough to just look at the data or plot it and look at the graph, we need statistical analysis to be able to discern if there is a trend or difference in our data, and if that trend is significant enough to accept our hypothesis.

To do this, we must understand:

- what question are we trying to address with our statistical test?
- what does the outcome mean in relation to that question and the overall aim of the project?

Then we can produce reliable conclusions from our analysis that are relevant to the project aims.

Example

You are working as a laboratory scientist for a company testing a new drug to treat high blood pressure, called ‘DownBeatol’. You have 2 groups of patients with high blood pressure, you give 1 group DownBeatol and the other the current accepted medication. You are interested in determining if DownBeatol is better or worse than the existing drug at reducing high blood pressure. You measure the blood pressure of your participants after 2 weeks on the medication and conduct some statistical analysis.

You obtain the following results:

- average reduction in blood pressure – DownBeatol group: 7%
- average reduction in blood pressure – existing medication group: 5%
- paired student’s T-test returns a p value of 0.215

We will now use the output to inform our conclusions. Let us address the questions from above:

- what question are we trying to address with our statistical test?

We obtain this from the information given: to determine if the mean reduction in blood pressure is less or greater for patients given DownBeatol compared to patients given the existing medication.

- what does the outcome mean in relation to that question and the overall aim of the project?

The means are different: DownBeatol group has a 7% reduction in blood pressure and the existing medication group has only 5%.

However, our statistical test shows that this difference in not significant at 95% confidence – giving a p value of > 0.05; therefore, we cannot accept our hypothesis that there is a difference in drug effectiveness.

So, our conclusion is:

DownBeatol performs just as well as the existing medication for reducing blood pressure in patients with high blood pressure (two-tailed T-test, p = 0.215). Both medications reduce blood pressure by 5 to 7% on average. DownBeatol does not reduce blood pressure significantly more or less than the existing medication.

Key points to check in your conclusion:

- ✓ **have I interpreted the result of my statistical test/technique and used this to inform on my conclusion?**
- ✓ **have I included values from my test/technique output?**
- ✓ **have I related the conclusion to the scenario and project aims?**

Activity

Try these questions to practise creating conclusions. Example conclusions are included at the end.

1. You are a researcher looking into soil condition in ponds, you are interested in understanding the effect of agriculture of pond soil pH; you measure the acidity of 20 soil samples from 2 pond sites – one by a farm and one in a nature reserve – you analyse the data and obtain the following:

   - mean pH farm soils: 7.5
   - mean pH nature reserve soils: 6.2
   - standard deviation farm pH: 2.3
   - standard deviation nature reserve pH: 0.4
   - paired student's T-test returns a p value of 0.0413

Use the above information to write a conclusion on this analysis.

2. A veterinary laboratory scientist is looking into the effectiveness medications to treat urinary infections in dogs; she has been asked to determine if medicines have a different effectiveness in male and female dogs – she has collated data from hundreds of treated dogs on 5 different medications and has analysed the time to recovery (in days) – her null hypothesis is that there is no relationship between medication effectiveness and sex in treating urinary infection in dogs

The results of her analysis are:

- chi-square statistic (χ^2) = 3.2 with 4 degrees of freedom (critical value = 2.7) p = 0.016
- average recovery time (males) = 5.6
- average recovery time (females) = 6.1

Use the above information to write a conclusion on this analysis.

3. You are a food scientist working for a beverage company; you are creating a new fruit juice drink and are interested in how the concentration of papaya juice extract affects preference, you create several fruit juice drinks with varying papaya concentration between 2% and 10% – you give these to volunteers in your target group in a double-blind study – the participants rate the flavour of the drink on a scale of 1 (bad taste) to 5 (very good taste) and you obtain the following results:

Papaya concentration	Average rating
2%	3.9
4%	4.3
5%	4.2
6%	3.9
8%	3.5
9%	3.5
10%	2.7

Spearman's $\rho = -0.2$, $p = 0.00104$

Use the above information to write a conclusion on this analysis.

Answers

You do not need to have these word for word, but check your answers against the key points check box and compare to the answers here to see if you met those key points.

1. There is a significant difference in pond soil pH between natural areas (average pH = 6.2) and those on farmland (average pH = 7.5, T-test p = 0.0413) – additionally, there is greater dispersion in pH values in farmland (SD 2.3) compared to nature reserve (SD 0.4) – these results indicate that nature reserves have ponds with more stable and acidic pH whereas farmland ponds have more alkaline and variable soil pH
2. There is a significant association between medicine effectiveness (measured in time to recovery) and sex in treating urinary infections in dogs (Chi-squared, df = 4, p = 0.016) – on average, female dogs have a longer recovery time than male (6.1 days vs 5.6 days)
3. Papaya concentration significantly affects flavour in the fruit juice drink; there was a significant negative correlation between papaya concentration and participant preference (Spearman's ρ = -0.2, p = 0.00104) – the correlation was negative, with the best rated concentration being 4% (average score 4.3/5) and the worst rated being 10% (average score = 2.7) – however, the correlation is relatively weak (ρ = -0.2); therefore, there are other factors involved here

Top tips for peer discussions

Peer discussions are a very important part of science, we build on the knowledge and ideas of others, and it is through collaboration that we push the boundaries of innovation. You will also be assessed on your peer discussion in the employer set project (ESP). Therefore, this is a skill that is worth investing in.

Before you read the guidance in this section consider/reflect on the below questions.

What are **your** strengths when it comes to having professional discussions with your peers?

What characteristics and behaviours should you exhibit to have an effective peer discussion?

Below are some top tips to have effective peer discussions. Are there any you had not considered in your points above?

Prepare

A professional discussion requires professional knowledge. Before your discussions ensure you prepare: is there an article or technique you should be familiar with? If so, be sure to read up on it before the discussion. If the discussion is a sharing of ideas, preparation can include spending some time on your own drafting some ideas and collating your thoughts. This ensures you get the most out of the discussion and maximise your colleagues' time.

For the ESP, task 5 is a peer discussion, you should prepare for the discussion by:

- familiarising yourself with the material given
- re-familiarising yourself with your work from tasks 1 to 4 and considering how this relates to the client/stakeholder query
- collating your thoughts and preparing your discussion points:
    - what relevant knowledge do you have that relates to the query?

- what responses would you consider for the query?
- how does your previous work support and justify any responses?

Be clear and concise

When expressing your thoughts in a discussion, it is vital to articulate in clear language; the goal is not to show off but to bring everyone in the group to understanding, so that they can inform and build on the discussions. Use clear language and justifications to ensure your point comes across, you can ask your peers if they have understood or if they have any questions.

Make it an involved conversation

Build on the ideas of others. A peer discussion is not a space for everyone to just say their thoughts and ideas and move on, the purpose is to build and grow on the ideas of others. Consider what your peer has said, can you add anything? How does it link with your thoughts from your preparation? It can be intimidating for some people to contribute, so if you feel some may be nervous be sure to create a positive and open environment by inviting others to contribute and asking them questions. Be open and engaging in your answering of questions from others.

Do not forget manners

In a professional as well as a personal setting it is important to be respectful. Do not interrupt your peers whilst they are talking, even if you disagree with them. It is ok to disagree with what a peer has said but be sure to challenge this respectfully and raise well-informed points and arguments to counteract. Use your knowledge and information from preparation to justify, as opposed to just your personal opinion.

Listen fully

In group discussions, listening is just as important, if not more important, than speaking. Show you are listening by vocalising agreements or asking for elaboration/clarification: ‘That is an interesting idea, how would you apply it to this setting?’

Keep it relevant

It is easy to get lost in detail or find the conversation going off topic. Ensure you keep the brief/discussion purpose in mind and remember to bring the conversation back if it strays.

Activity

Summarise the tips for peer discussions below, you have been provided with 3 to start you off.

1. Be polite and allow others to speak.
2. Show you understand what others are saying by giving comments or asking questions.
3. Stick to the brief.
4.
5.
6.
7.
8.
9.
10.

Top tips for presentations

In the science sector, you are required to conduct presentations to various audiences on a variety of topics; therefore, it is important to hone the skill of presenting. Additionally, presenting is part of one of the core skills assessed in the science employer set project (ESP).

Do not worry if you are nervous! Presentations can seem daunting at first and this is the case for everyone, but with practise in a safe and supportive environment you will only improve.

We have collated some top tips for presentations. Use this in addition to the task 4: presentation of outcomes and conclusions included in this support pack.

Planning your presentation and digital aids

In your ESP, you will be presenting your scientific poster. You should plan what you are going to say separately to this poster; you should not just read off it.

A presentation is a story

Just like a story, it should have a beginning, middle and end. All characters should be introduced. Key points need to be backed up and cannot seem to appear from nowhere. The story needs to flow and make sense.

Remember, in your presentation you need to clearly articulate:

- **the aims of the project**
- **the results of the analysis**
- **your conclusions**

The presentation is **you** alongside your poster, the detail of the poster should be stimulus for the presentation with you expanding on each section, you should not just rely on the poster to present for you.

The presentation

Consider your audience

In the ESP, you are presenting to your tutor who has knowledge of terminology. Your tone should be formal and professional with this audience. You should always consider how technical your language should be, amending and tailoring your language appropriately to your audience.

Connect with your audience

Eye contact can be powerful when conveying information, you should not stare at your audience (particularly when there is only one person in it) but occasionally making eye contact can really help with communication. For key points on the slides, direct your audience's gaze by looking at the slides yourself, you can point and indicate aspects with your arms. Be sure to look back at your audience once you have finished highlighting these points on the slides.

Do not be afraid to ask questions if this is appropriate. Things such as 'how familiar are you with this technique?' can determine if you need to explain some background or if your audience is happy to move on. This technique also engages your audience.

Beware of distracting habits

We all have little things we do when we are nervous, either saying lots of 'ums' or shifting our body weight or fiddling with our hands or notes. These can be distracting for our audience; we should therefore minimise them as much as possible. Remember: the main goal of your presentation is to get your key points across, you do not want anything to interfere with this.

It is often hard for us to spot our own distracting habits, consider presenting in front of a friend and ask them to identify some that you may have.

Keep open and relaxed body language

Body language is a very important part of communication, and you need to be aware of your body language when undertaking presentations. When you are presenting, stand relaxed, maybe clasping your hands in front of you. Avoid crossing your arms as this can appear closed-off to your audience. Minimise fidgeting and unnecessary movement.

You can use your hands to make gestures but ensure these are deliberate movements that are not too fast or frequent, as this too can be distracting for your audience.

Be aware of your posture, ensure that you do not slouch. Your posture should be upright and open, which will make you look and feel more confident.

Use your voice

When you have taken time to prepare a presentation and show off our work, the last thing you want to let you down is how you deliver the information.

Keep pace. In presentations we almost always talk too fast, eager to get it over and done with. However, to ensure your message is not lost, practise talking slower, even to the point where it feels *painfully slow*, because once the adrenaline of presenting hits, this will speed up to normal pace.

When planning what you are going to say, add pauses and variation in volume. This not only helps emphasise points in your speech but also makes for more engaging and interesting watch for your audience. Each pause should last at least one breath. The breathing may also help you stay relaxed.

Tips to relax

- ensure you have practised – you will feel less nervous if you feel prepared
- before you go up to present, take several deep breaths and shake out your arms and legs – shallow breathing and tight muscles feed into our nervous system and make us feel even more anxious but counteracting this can help us feel calmer
- if you can, become familiar with the room and technology that you will be presenting with – even just 5 minutes walking around and taking it in can help ease the sense of unfamiliarity
- when you are up in front of your audience, before you say your first word, take a deep breath and smile

Practice

It is no secret that the best technique for good presentations is to practise. Every presentation makes you a better presenter. Ensure you have run through what you are going to say, how you will use your digital aids and maybe include some practice questions and answers.

Answering questions

The bit that many of us dread in a presentation is the question and answer section, but this is the opportunity for you to show off what you know. It is important to remember that you likely know more about your work than your audience do; you are the expert!

Be polite and respectful

Remember manners and etiquette – do not interrupt the person asking the question, even if you know the answer. Ensure your body language shows that you are listening – look at them and nod whilst they are asking the question.

Give yourself time

Even if you think you know the answer, take a pause to think before answering. Does the answer need some background to make sense? If so, you would need to start with that.

Do not be afraid to ask the person with a question a clarifying question of your own: ‘are you familiar with previous work in this area?’ and use their answer to inform on how much background you give.

Give reason and use your research and previous tasks to inform your answer.

If you do not immediately know the answer

- do not panic!
- take time to think, it is perfectly ok to say a holding phrase to give you time, for example:
  - ‘that is an interesting question’
  - ‘could I please have a moment to think about that?’
- take a breath and relax
- if you do not understand the question, ask the person to rephrase it
- repeat the question back to them to ensure you understand it; for example, ‘so from what I understand, you would like to know why I chose this method over others?’
- start with what you do know if it is relevant to the question (do not just waffle)

If, after following the above process, you still do not know the answer be honest! A simple ‘I am sorry I do not know the answer to that but it is a very interesting question and I will look into it later’ is perfectly respectable. Maybe you can include this in your reflection task and reflect on how this would impact your researching and presentation preparation in the future.

Activity

Film yourself conducting a presentation and watch it back to reflect. Include elements from the points above. Maybe you could use a reflective cycle to structure this? If you do not feel comfortable being filmed yet, consider presenting to a peer and obtaining feedback. It is still important to reflect on performance.

Making links through effective project management

It is important to remember, that although each task is submitted separately, this is a project, with each task linking to subsequent tasks. It is important to remember how each task links and informs on the following tasks and is an important part of the reflective journey throughout the project.

Task 1 	• this is the beginning of your project and foundation for all the tasks • focus your research around the brief; also think about what else you will need evidence for • the notes you make in your diary support your reflective evaluation in task 6 (as do any notes made after tasks 2 to 5) – ensure you include enough detail to be able to write your reflective evaluation – remember to make notes on how using information from a rejected source would impact the project
Task 2 	• this is the first opportunity to embed your research into an effective project plan, consider your literature review – also take information you learned into consideration for your risk assessment • your justification starts here, make sure you reference your research when justifying your methods of data collection
Task 3 	• you are creating an analysis report which includes limitations and interpretation of the data – the background for this will come from your literature review and research from task 1 • you must justify your conclusions, use the brief and your knowledge from tasks 1 and 2 to achieve this
Task 4 	• the scientific poster includes the aims and plan (tasks 1 and 2), the results and your analysis (from task 3) and conclusions of the investigation • you should use your analysis to justify your conclusions and use the knowledge from your literature review and project plan to express the limitations in the data • you can use your data analysis to inform on your graphs and tables, but your focus is a concise explanation, you may wish to consider creating new graphs and tables to represent this information
Task 5 	• the knowledge that forms the basis of your discussion comes from all preceding tasks – use this to inform the questions you ask from your peers and the answers you give to their questions • embed this in your client response • you will need to justify your points, both to your peers and in your client response – to do this effectively in your client response, remember to use information from previous tasks, as well as the points from the group discussion
Task 6 	• this reflective evaluation task relies on all preceeding tasks – your decisions for areas you would/would not change must be well justified • remember to reference the brief – speicifcally the aims of the project • it is important that you demonstrate how the performance on one task can impact the tasks that follow – consider constraints • for any improvements you suggest, remember to explain what impact they would have on the outcome of the various tasks and projects overall

Notes