T-LEVELS | Institute for Apprenticeships & Technical Education

# T Level Technical Qualification in Science



Employer set project (ESP)

# Laboratory Sciences

Project brief

V1.0
P002415
13 November 2023 - 24 November 2023
603/6989/9

NCFE CACHE

**T Level Technical Qualification in Science**
**Employer set project (ESP)**

# Laboratory Sciences
**Project brief**

## Contents

# Guidance for students

## Student instructions

- read the project brief and the task guidance carefully before starting your work
- you **must** work independently and make your own decisions on how to approach the tasks within the employer set project (ESP) – your work should:
    - be in an Arial font 12pt, within standard border sizes, however you may choose to hand write your work – if you choose to hand write your work, this should be in black ink
    - clearly show where sources have been used to support your own ideas and opinions
    - clearly reference all sources used to support your own ideas and opinions
    - reference any quotations from websites
- you **must** clearly name and date all of the work that you produce during each supervised session
- you **must** hand over all of your work to your tutor at the end of each supervised session
- you **must** not work on the assessment in between supervised sessions

## Student information

This ESP will assess your knowledge, understanding and skills from across the core content of the qualification.

In order to achieve a grade for the core component, you **must** attempt both of the external examinations and the employer set project. The combined marks from these assessments will be aggregated to form the overall core component grade (A* to E and U). If you do not attempt 1 of the assessments or fail to reach the minimum standard across all assessments, you will receive a U grade.

Your tutor will explain how the assessment time is broken down per task and will confirm with you if individual tasks need to be completed across multiple sessions.

At the end of each supervised session, your tutor will collect all assessment materials before you leave the room. Yo**u must not** take any assessment material outside of the room (such as via a physical memory device). You **must not** upload any work produced to any platform that will allow you to access materials outside of the supervised sessions (including email).

You can fail to achieve marks if you do not fully meet the requirements of the task, or equally if you are not able to efficiently meet the requirements of the task.

## Plagiarism

Plagiarism may result in the external assessment task being awarded a U grade. For further guidance refer to the plagiarism guidance, and maladministration and malpractice policy located on the NCFE website.

# Presentation of work

- any work not produced electronically must be agreed with your tutor, and the evidence you produce should be scanned and submitted as an electronic piece of evidence, for example a digital photograph; your tutor will arrange for any digital photographs to be taken
- all your work should be clearly labelled with the relevant task number and your student details and be legible (for example front page and headers)
- electronic files should be given a clear file name for identification purposes (see tasks for any relevant naming conventions)
- all pages of your work should be numbered in the format page X of Y, where X is the page number and Y is the total number of pages
- you must complete and sign the external assessment cover sheet (EACS) – declaration of authenticity form and include it at the front of your assessment task evidence
- you must submit your evidence to the tutor at the end of each session

# Scenario: treatment of type 1 diabetes using insulin from different sources

## Introduction

Type 1 diabetes is thought to be an autoimmune condition; the cells that produce insulin are mistakenly destroyed by the immune system. This leaves an individual unable to produce their own insulin and results in an inability to control the level of glucose in the blood. As a result, type 1 diabetics must take insulin injections to provide their bodies with the insulin needed to regulate their blood glucose levels.

Insulin for this purpose has traditionally been extracted and isolated from pig pancreases, and while this insulin works effectively in the majority of diabetics, this method has numerous drawbacks, including risk of allergic reaction. As a result, modern production methods for making insulin tend to be via genetic engineering, allowing for a 'human' synthetic version of the insulin to be made in cultures of bacterial or yeast cells in laboratories.

One way to produce synthetic human insulin is by genetically engineering bacterial plasmids. The gene for human insulin is inserted into bacterial plasmids, which are inserted into bacterial cells. The bacterial cells multiply and replicate the plasmid, allowing for large quantities of bacteria with the human insulin gene encoded to be cultured. These bacterial cells are able to produce and secrete large quantities of synthetic human insulin which can then be extracted and purified. The purified synthetic human insulin can be used to treat type 1 diabetics.



## Brief

You are working as a research assistant in an academic lab, researching treatment options for diabetes. Although some type 2 diabetics require insulin, the study is focused on type 1 only. As part of a research project, you have been tasked with comparing how quickly both pig insulin and synthetic human insulin begin to act in type 1 diabetics, and for how long the effect is maintained.

You must complete the following steps:

- researching
- producing a plan for investigation
- analysing and evaluating the effectiveness of the investigation
- reporting on your findings to the wider team
- participating in a group discussion
- reflecting on the process

Complete the tasks below to guide you through these steps.

# Task 1: research a strategy

(22 marks)

## What you have to do

You have been provided with a database containing a range of potentially relevant sources for your project, all the resources are linked to the use of insulin in type 1 diabetics. You have been tasked by your supervisor with carrying out a literature review on the use of pig insulin and synthetic human insulin in patients with type 1 diabetes. Your supervisor has asked for an overview of the advantages and disadvantages of treatment with each type of insulin and has asked for how a patient's response to insulin is measured. Some sources will be more relevant or reliable than others.

The sources are shown in appendix 1 of this assignment brief document. You will need to:

- carry out a literature review of the use of both pig insulin and synthetic human insulin, with a focus on the advantages and disadvantages of each type of insulin and how a patient's response to insulin is measured
- justify why you have chosen specific sources and rejected others – your justification should be based on:
  - how reliable you think the source is and why
  - how relevant you think the source is and why
- use an academic referencing technique when citing or referencing literature

Add any notes about your work in your project diary. These notes will not be marked. They are to help you to complete task 6 which is a reflective evaluation.



## Resources

- project brief
- computer access
- NCFE provided literature database (appendix 1)
- guidance on capturing browsing history
- research a strategy template pro forma
- project diary

## Assessment objectives

AO2: Apply core knowledge and skills to the development of a scientific project (18 marks)

AO4: Use English, mathematics, and digital skills as appropriate (4 marks)

## Core Skills

CS2: Researching

CS7: Reflective evaluation

## The evidence I have to submit for this task

A literature review.

Internet browsing history.

## Submission

The following filename convention should be used for all materials produced:

(Provider_number)_(Student registration number)_(Surname)_(First name)_Task1_Research_Strategy

Note: please request your provider and student number from your tutor.

## How the evidence will be assessed

This will be externally marked by examiners.

## Time for completion of task 1

3 hours. Plus 30 minutes for completion of project diary.

# Task 2: plan a project

(36 marks)

## What you have to do

Use the sources that you selected in your literature review to complete a project plan.

The project plan must:

- outline a method for comparing the start of action of both pig insulin and synthetic human insulin in type 1 diabetics, as well as determining how long the effects are maintained
- include all appropriate risk assessments relevant to the investigation
- identify the data or information you need to collect prior to the investigation in order to be able to conduct it
- identify the data you would expect to collect throughout the investigation in order to confirm that each step has been successful
- describe how you will collect the required data and who you will report these findings to

Add any notes about your work in your project diary. These notes will not be marked. They are to help you to complete task 6 which is a reflective evaluation.

## Resources

- project brief
- NCFE provided literature database (appendix 1)
- literature review (from task 1)
- project diary
- risk assessment form template
- risk matrix

## Assessment objectives

AO1: Plan their approach to meeting the project brief (12 marks)

AO2: Apply core knowledge and skills to the development of a scientific project (12 marks)

AO4: Use English, mathematics, and digital skills as appropriate (4 marks)

AO5: Realise a project outcome and review how well the outcome meets the brief (8 marks)

## Core Skills

CS1: Project management

CS2: Researching

CS3: Working with others (risk assessment)

CS4: Creativity and innovation

CS6: Communication (written)

CS7: Reflective evaluation

## The evidence I have to submit for this task

Your project plan.

## Submission

The following filename convention should be used for all materials produced:

(Provider_number)_(Student registration number)_(Surname)_(First name)_Task2_Plan_Project

Note: please request your provider and student number from your tutor.

## How the evidence will be assessed

This will be externally marked by examiners.

## Time allowed for completion of task 2

3 hours. Plus 30 minutes for completion of project diary.

# Task 3: analyse data

(34 marks)

## What you have to do

Due to the limitations of time and resources, you are not required to carry out the investigation you have planned.

Therefore, you have been provided with a raw data pack, obtained from an organisation that developed and plan to investigate the use of pig insulin compared to synthetic human insulin in type 1 diabetics. The raw data pack is in the form of a laboratory information management system (LIMS) spreadsheet. You may also find the statistical techniques booklet useful in deciding which statistical tests are appropriate – you are **not** required to use them all.

In this experiment the researcher recruited a single patient with type 1 diabetes and carried out the following method over six days:

- the patient was given a standardised meal to eat
- immediately following the meal they were injected with pig insulin
- their blood glucose levels were recorded every 15 minutes over the course of 6 hours
- after 4 hours the patient was given 50g of chocolate to eat to measure the effects on blood glucose levels
- this was repeated 3 times, once per day, for pig insulin
- the researcher then carried out the same method over a further 3 days, they replaced pig insulin with synthetic insulin

You will need to determine how long it takes on average for the patient's blood glucose level to fall within healthy range (4-9mmol/L in type 1 diabetics), and how well it controls the increase in blood glucose level following consumption of the chocolate. You will need to carry out statistical analysis of the data to determine whether there is a significant difference between the onset of action between the two types of insulin, and whether the action of each type of insulin tested is effective enough to control blood glucose levels after 4 hours.

You must:

- analyse the data provided to measure the effectiveness of the researchers' plan, identifying which type of insulin is most likely to be beneficial to type 1 diabetics
- produce a report of your analysis, to include:
  - presentation of data to enable peer review
  - selection of appropriate statistical techniques
  - application of appropriate statistical techniques
  - justification for your conclusions

Add any notes about your work in your project diary. These notes will not be marked. They are to help you to complete task 6 which is a reflective evaluation.

## Resources

- project brief
- computer access
- access to NCFE provided LIMS spreadsheet
- project diary
- statistical techniques guidance document

## Assessment objectives

AO2: Apply core knowledge and skills to the development of a scientific project (16 marks)

AO3: Select relevant techniques and resources to meet the brief (6 marks)

AO4: Use English, mathematics, and digital skills as appropriate (6 marks)

AO5: Realise a project outcome and review how well the outcome meets the brief (6 marks)

## Core Skills

CS4: Creativity and innovation

CS5: Problem solving

CS6: Communication (written)

CS7: Reflective evaluation

## The evidence I have to submit for this task

Your analysis report including any charts and graphs.

## Submission

The following filename convention should be used for all materials produced:

(Provider_number)_(Student registration number)_(Surname)_(First name)_Task3_Analyse_Data

Note: please request your provider and student number from your tutor.

## How the evidence will be assessed

This will be externally marked by examiners.

## Time allowed for completion of task 3

3 hours. Plus 30 minutes for completion of project diary.

# Task 4: present outcomes and conclusions

(28 marks)

## What you have to do

4(a) Use your project plan from task 2 and your report from task 3 to produce an A2 scientific poster to describe and explain your findings. The poster may be produced and displayed electronically rather than printed.

Your poster must show:

- the problem being addressed/investigated
- the results of your analysis, including any graphs and charts
- your conclusion

4(b) Produce a presentation to summarise the main points from your poster to your tutor. Your tutor will make observations on your presentation and ask questions if further detail is needed. The presentation will be recorded by video.

Add any notes about your work in your project diary. These notes will not be marked. They are to help you to complete task 6 which is a reflective evaluation.



## Resources

- project brief
- computer and printer access
- access to NCFE provided LIMS spreadsheet
- your analysis report from task 3
- A2 paper, various coloured markers, scissors and glue, and/or IT software/applications to create poster (or parts of) for printing, and printing facilities
- project diary

## Assessment objectives

AO2: Apply core knowledge and skills to the development of a scientific project (12 marks)

AO3: Select relevant techniques and resources to meet the brief (6 marks)

AO4: Use English, mathematics, and digital skills as appropriate (4 marks)

AO5: Realise a project outcome and review how well the outcome meets the brief (6 marks)

## Core skills

CS4: Creativity and Innovation

CS6: Communication (written and verbal)

CS7: Reflective evaluation

## The evidence I have to submit for this task

Your A2 scientific poster.

Video recording of presentation.

## Submission

The following filename convention should be used for all materials produced:

(Provider_number)_(Student registration number)_(Surname)_(First name)_Task4_Present_Outcomes

Note: please request your provider and student number from your tutor.

## How the evidence will be assessed

This will be externally marked by examiners using the video recording and tutor commentary.

## Time allowed for completion of task 4

4(a) 3 hours

4(b) 1 hour. Plus 30 minutes for completion of project diary

# Task 5: group discussion

(9 marks)

## What you have to do

You have been provided with an email from a concerned parent (see appendix 2); their child has recently been diagnosed with type 1 diabetes and they have queries about suggested treatments.

In your allocated group, discuss the questions the parent has raised and how it would be best to respond. You will need to refer to your research notes to contribute effectively to the discussion. It is suggested 10 minutes are given over to this at the start of the discussion.

Each group member will then take it in turns to make suggestions and to agree on an approach. It is suggested that groups consist of a maximum of 6 individuals to allow sufficient time for discussion in 40 minutes; this will allow ample time for individuals to give their opinion and respond to others. Your group discussion will be recorded.

Take notes during the team discussion. Write down any valid points and suggestions made.

Following the discussion, you will need to (individually) draft an email to the parent to respond to the queries raised. This email response can be handwritten or produced in suitable word processing software – it does **not** need to be written in an email client. Usual exam conditions apply during this part of the task (max 10 minutes).

There is an overall time limit of 1 hour for this task. In this time, you will:

- be asked to read the email from the parent in your groups (see appendix 2)
- be given 10 minutes to familiarise yourself with your literature review, your plan, your data analysis and scientific poster
- discuss your suggestions for responding to the parent
- be given 10 minutes to draft an email to the parent to respond to the queries raised

## Student resources required

- project brief
- your literature review (task 1)
- your project plan (task 2)
- your data analysis and report (task 3)
- your A2 scientific poster (task 4)
- email (appendix 2)

## Assessment objectives

AO2: Apply core knowledge and skills to the development of a scientific project (4 marks)

AO3: Select relevant techniques and resources to meet the brief (2 marks)

AO5: Realise a project outcome and review how well the outcome meets the brief (3 marks)

## Core skills

CS3: Working with others

CS4: Creativity and innovation

CS5: Problem solving

CS6: Communication (verbal)

CS7: Reflective evaluation

## The evidence I have to submit for this task

Your recorded discussion.

Your email reply to the parent.

## Submission

The following filename convention should be used for all materials produced:

(Provider_number)_(Student registration number)_(Surname)_(First name)_Task5_Group_Discussion

Note: please request your provider and student number from your tutor.

## How the evidence will be assessed

This will be externally marked by examiners.

## Time allowed for completion of task 5

1 hour.

# Task 6: reflective evaluation

(18 marks)

## What you have to do

Write a reflective evaluation of your work. This should be based on:

- your literature review (task 1)
- the experience of developing your project plan (task 2)
- your data analysis and report (task 3)
- your A2 scientific poster (task 4)

Your reflections should include:

- an evaluation of your approach to each task, including the methods and tools used in your analysis
- any changes you would make to your approach to each task

Your notebooks and previous work can be used to support your evaluation.



## Resources

- project brief
- your literature review
- your project plan
- your analysis and report
- your A2 scientific poster
- your project diary
- access to the NCFE provided literature database (appendix 1)
- access to the NCFE provided LIMS spreadsheet
- reflective evaluation template

## Assessment objectives

AO2: Apply core knowledge and skills to the development of a scientific project (7 marks)

AO3: Select relevant techniques and resources to meet the brief (2 marks)

AO4: Use English, mathematics, and digital skills as appropriate (4 marks)

AO5: Realise a project outcome and review against the intended project aims (5 marks)

## Core skills

CS6: Communication (written)

CS7: Reflective evaluation

## The evidence I have to submit for this task

Your written reflective evaluation.

## Submission

The following filename convention should be used for all materials produced:

(Provider_number)_(Student registration number)_(Surname)_(First name)_Task6_Reflective_Evaluation

Note: please request your provider and student number from your tutor.

## How the evidence will be assessed

This will be externally marked by examiners.

## Time allowed for completion of task 6

2 hours.

# Appendix 1: literature database

General information on diabetes and insulin treatments

https://www.mayoclinic.org/diseases-conditions/diabetes/diagnosis-treatment/drc-20371451#:~:text=A%20blood%20sugar%20level%20less,mmol%2FL)%20indicates%20prediabetes.

https://www.promegaconnections.com/diabetes-research-measuring-the-activity-of-insulin/

https://en.wikipedia.org/wiki/Insulin_(medication)

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4322747/#:~:text=The%20level%20of%20glucose%20in,%2FdL%20or%20mmol%2FL.

https://www.diabetes.org.uk/guide-to-diabetes/managing-your-diabetes/testing

https://www.ncbi.nlm.nih.gov/books/NBK248/#:~:text=The%20test%20consists%20of%2050,tolerance%20test%20as%20described%20above.

https://wchh.onlinelibrary.wiley.com/doi/10.1002/pdi.2215

https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD003816.pub2/full

https://www.intechopen.com/chapters/66546

https://www.nlm.nih.gov/exhibition/fromdnatobeer/exhibition-interactive/recombinant-DNA/recombinant-dna-technology-alternative.html

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4203937/

https://www.diabetes.co.uk/insulin/animal-insulin.html

https://www.nhs.uk/conditions/type-1-diabetes/about-insulin/

https://www.diabetes.org/blog/history-wonderful-thing-we-call-insulin

https://americanhistory.si.edu/blog/2013/11/two-tons-of-pig-parts-making-insulin-in-the-1920s.html

https://www.webmd.com/drugs/2/drug-53437/purified-pork-insulin-injection/details

https://www.wockhardt.co.uk/medicines/hcp/hypurin/ (select healthcare professional on pop up)

https://www.diabetes.org.uk/about_us/news_landing_page/hypurin-porcine-isophane-insulin-cartridges

# Appendix 2: email from concerned parent

Dear Researcher,

My 13-year-old child has recently been diagnosed with type 1 diabetes. They follow a vegan diet and would be interested in using genetically engineered human insulin over the traditional pig insulin.

Whilst carrying out your research, have you identified any benefits or drawbacks to using synthetic human insulin compared to pig insulin?

Yours Sincerely,

A concerned parent

# Document information



Owner: Head of Assessment Design