T-LEVELS | Institute for Apprenticeships & Technical Education

# T Level Technical Qualification in Science

Occupational specialism assessment (OSA)

# Laboratory Sciences

Assignment 3 - Pass

Guide standard exemplification materials

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**T Level Technical Qualification in Science**
**Occupational specialism assessment**

# Guide standard exemplification materials

## Laboratory Sciences

Assignment 3

# Contents

# Introduction

The material within this document relates to the Laboratory Sciences occupational specialism sample assessment. These exemplification materials are designed to give providers and students an indication of what would be expected for the lowest level of attainment required to achieve a pass or distinction grade.

The examiner commentary is provided to detail the judgements examiners will undertake when examining the student work. This is not intended to replace the information within the qualification specification and providers must refer to this for the content.

In assignment 3, the student must review the results and analyse them, and review errors.

After each live assessment series, authentic student evidence will be published with examiner commentary across the range of achievement.

# Scenario

You are a laboratory scientist working for a company that specialises in environmental monitoring. The company has a contract for the monitoring of water quality, including the pH in a group of lakes used for recreation.

A fieldwork team uses a field pH meter at the lakes as part of their weekly on-site analysis. The pH probe must be calibrated before use. Recently, the fieldwork team have commented that pH values at sampling sites seem to be low for the time of year.

These low values may reflect true environmental values, but there is a possibility that the field pH meter is producing inaccurate data.

Each month a batch of samples from the same sites are returned to the laboratory for full chemical analysis. The pH is measured in the lab using a bench pH meter. All pH values are recorded on the laboratory information management system (LIMS).

As a laboratory scientist for the company, you have been asked to investigate the low pH values. It is possible to access the pH data from both the bench and field pH probes using the LIMS. This data is provided for your use in this task. A summary of the data (means and standard deviations) is also provided.

## Task 1

Using the information provided, comment on the accuracy of the data obtained from the field pH meter. Evaluate whether recent low field pH values reflect true conditions in the lakes or are due to inaccurate readings produced by the field pH probe.

Use the LIMS data and data summary to inform your judgement.

(8 marks)
(30 mins)

# Student evidence

The field pH meter is probably not very accurate. The fact that the lab pH probe has been calibrated and is giving the same reading on the 2 May as it was on the 11 April would suggest that the readings from this meter are right, and therefore the field meter is probably wrong. The field meter gave similar readings to the lab meter on the 11 April which would show that at that point the field meter was working properly but stopped working properly later on. I can be sure of this as the lab pH meter is calibrated and so it should be working correctly as the proper quality control measures are in place.

## Task 2

Using the information provided, comment on the type of errors in the data obtained from the field pH meter. Explain the evidence for any random or systematic errors. Use the LIMS data and data summary to inform your explanation.

(6 marks)
(30 mins)

# Student evidence

The readings from the field pH meter are the same at all of the lake sites, with a low variation in each lake, this would probably be a systemic error where the pH meter isn't working properly since all of the lakes are affected the same. If the variation was caused by random errors, you would expect there to be no pattern or correlation to the differences seen.

## Task 3

Identify factors that could cause data errors in measurements made with a field pH meter.
Justify which factors are likely to cause the data errors measured.

Use the information provided, as well as your own knowledge, to help you.

(8 marks)
(30 mins)

# Student evidence

If the field probe hasn't been calibrated it won't be able to accurately and reliably measure the pH of the lakes. The pH in the lakes drops suddenly on the 25 April, which might mean that the probe calibration was out on this day or it was broken or damaged on this day so isn't giving accurate readings.

## Task 4

Describe the steps that should be taken to find out what is causing the error in the field pH meter.
You should also describe the actions that should be taken to improve techniques for using the field pH meter in order to minimise future errors.
Use the information provided, as well as your own knowledge, to help you.

(8 marks)
(30 mins)

# Student evidence

Now that the error in the field probe has been identified we need to determine why it isn't working. A good first step would be to visually inspect the pH probe for obvious cracks or other damage. As it may not have been calibrated, we should calibrate the probe so that it works properly. If that doesn't fix the low readings, then it might be that the pH meter is broken so it should be replaced to make sure it works properly. We could also test the samples from the field samples with both probes each week for a while to see if they give the same results.

## Task 5

The field pH meter was recalibrated. The pH of a series of samples were then measured using both the field pH meter and laboratory pH meter. This data is provided in the LIMS for your use in this task.

a) Use the LIMS data to calculate the mean and standard deviation for the field and lab pH meters. You should use the spreadsheet to carry out your calculations.

b) Explain how a named statistical technique could be used to test if there is a significant difference between the 2 sets of measurements.

The formula and calculations are not required.

(11 marks)

(1 hour)

# Student evidence

a)

| Sample number | pH measured with field pH probe | pH measured with laboratory pH probe |
|---|---|---|
| 1 | 6.4 | 6.3 |
| 2 | 6.3 | 6.4 |
| 3 | 6.3 | 6.4 |
| 4 | 6.3 | 6.2 |
| 5 | 6.2 | 6.1 |
| 6 | 6.3 | 6.4 |
| 7 | 6.2 | 6.2 |
| 8 | 6.4 | 6.5 |
| 9 | 6.3 | 6.4 |
| 10 | 6.5 | 6.5 |
| 11 | 6.4 | 6.4 |
| 12 | 6.4 | 6.5 |
| 13 | 6.3 | 6.3 |
| 14 | 6.5 | 6.5 |
| 15 | 6.2 | 6.3 |
| **Mean** | 6.3 | 6.4 |
| **Standard deviation** | 0.1 | 0.1 |

b)

A T test would be able to determine if the difference is real by comparing the means from each set of samples, a value of less than 0.05 would mean that the difference is real and not down to chance.

# Examiner commentary

The student presents a correct and logical, but limited, analysis of the potential source of the error, correctly identifying that the field meter is likely to be the source of the error, but only through assessment of the fact that the lab pH meter is displaying concordant results between samples. However, the student does suggest ways of checking the accuracy of the 2 probes by comparing them. The student is able to interpret the results given and use their knowledge of how the data should be assessed for errors to correctly identify the source of the error.

The student provides a limited explanation as to the types of errors possible, relating it briefly to the evidence in the LIMs system, showing satisfactory knowledge and understanding of the process. The student identifies only a limited range of evidence that could be contributing to errors and does not explain in full how these could be contributing to the errors within. Similarly, only limited suggestions are made to rectify the errors, using only a limited range of knowledge to address the brief. The means are calculated correctly but the standard deviations are given to an inappropriate number of significant figures, the suggested statistical test, is appropriate, is not fully explained beyond a basic level.

# Grade descriptors

The performance outcomes form the basis of the overall grading descriptors for pass and distinction grades.

These grading descriptors have been developed to reflect the appropriate level of demand for students of other level 3 qualifications, the threshold competence requirements of the role and have been validated with employers within the sector to describe achievement appropriate to the role.

| | |
|---|---|
| Pass | The evidence is logical but displays minimal relevant knowledge or understanding in response to the demands of the brief. |
| | The student makes some use of relevant knowledge and understanding of how it informs practices of the sector and demonstrates a limited understanding of skills or approaches associated with the laboratory sciences sector. |
| | The student makes adequate use of facts/theories/approaches/concepts and attempts to demonstrate breadth and depth of knowledge and understanding of the different aspects of the task. |
| | The student is able to identify some information from appropriate sources and makes use of appropriate information/appraise relevancy of information and can combine information to make decisions. |
| | The student makes only select judgements/takes appropriate action/seeks clarification with guidance and is able to make limited progress towards solving non-routine problems in real life situations. |
| | The student demonstrates skills and knowledge of the relevant concepts and techniques reflected in a laboratory science setting and generally applies this across different contexts. |
| | The student shows adequate understanding of unstructured problems that have not been seen before, using limited knowledge to find solutions to problems and make justification for strategies for solving problems, explaining their reasoning. |
| Distinction | The evidence is precise, logical and provides a detailed and informative response to the demands of the brief. |
| | The student makes extensive use of relevant knowledge and has extensive understanding of the principles and practices of the sector and demonstrates an understanding of the different approaches/skills associated with the laboratory science sector. |
| | The student makes decisive use of facts/theories/approaches/concepts, demonstrating extensive breadth and depth of knowledge and understanding and selects highly appropriate skills//tasks/techniques/methods. |
| | The student is able to comprehensively identify information from a range of suitable sources and makes exceptional use of appropriate information/appraises relevancy of information and can combine information to make coherent decisions. |

| | |
|---|---|
| | The student makes well founded judgements/takes appropriate action/seeks clarification and guidance and is able to use that to reflect on real life situations in a laboratory science role. |
| | The student demonstrates extensive knowledge of relevant concepts and techniques reflected in a laboratory science role and precisely applies this across a variety of contexts and tackles unstructured problems that have not been seen before, using their knowledge to analyse and find suitable solutions to the problems. |
| | The student can thoroughly examine data/information in context and apply appropriate analysis in confirming or refuting conclusions and carrying out further work to justify strategies for solving problems, giving concise explanations for their reasoning. |

# Document information

The T Level Technical Qualification is a qualification approved and managed by the Institute for Apprenticeships and Technical Education.



Owner: Head of Assessment Design

## Change History Record

| Version | Description of change | Approval | Date of Issue |
|---|---|---|---|
| **v1.0** | Published final version. | | June 2021 |
| **v1.1** | NCFE rebrand | | September 2021 |