BTEC

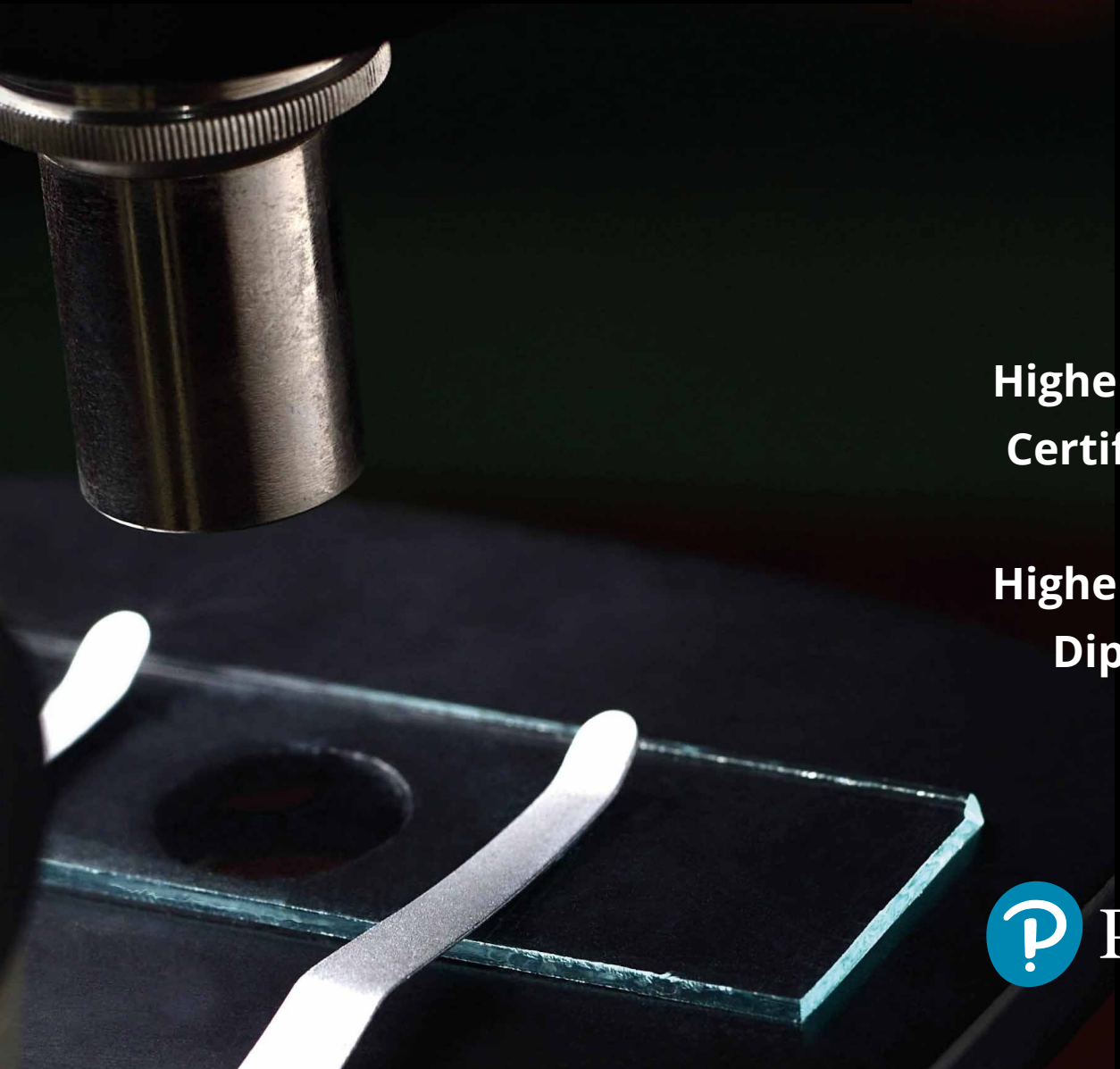
HIGHER NATIONALS

Applied Sciences

Example Assessment Briefs

For use with the Higher National Certificate and Higher National Diploma in Applied Sciences

First teaching from September 2019



Higher National Certificate Lvl 4

Higher National Diploma Lvl 5

Pearson

Edexcel, BTEC and LCCI qualifications

Edexcel, BTEC and LCCI qualifications are awarded by Pearson, the UK's largest awarding body offering academic and vocational qualifications that are globally recognised and benchmarked. For further information, please visit our qualifications website at qualifications.pearson.com. Alternatively, you can get in touch with us using the details on our contact us page at qualifications.pearson.com/contactus

About Pearson

Pearson is the world's leading learning company, with 35,000 employees in more than 70 countries working to help people of all ages to make measurable progress in their lives through learning. We put the learner at the centre of everything we do, because wherever learning flourishes, so do people. Find out more about how we can help you and your learners at qualifications.pearson.com

Contents

1 Introduction **4**

1.1 Guidance only 4

2 Support materials **5**

2.1 Training Video - Assignment Writing and Assessment for RQF Pearson BTEC Higher Nationals 5

2.2 Training Video – Pearson-Set Assignment for RQF Pearson BTEC Higher Nationals 5

3 Example Assessment Briefs **6**

Unit 1: Fundamentals of Laboratory Techniques 7

Unit 2: Scientific Data Handling Approaches and Techniques 11

Unit 3: Regulation and Quality in the Applied Sciences 23

Unit 27: Analysis of Scientific Data and Information 28

Unit 28: Applied Sciences Research Project 38

1 Introduction

The Assessment Brief forms a critical part of the assessment process for students and teachers. The Brief should provide the student with a clear opportunity to achieve pass, merit or distinction through engaging in an assignment that will allow them to evidence their knowledge and skill through their achievement of learning. A well-structured assignment brief, that is contextualised by a vocational scenario, should provide the student with a modelled real-world situation that reflects the type of work that they may undertake in future employment.

Pearson Example Assessment Briefs (EABs) provide tutors with a reference point for the development of unique assignments; that are tailored to a specific location, employment context and the centre's approach to the subject. In addition, the EABs offer suggestions to encourage the development of collaborative and interpersonal skills as well as developing cognitive skills and understanding of the professional behaviours associated with the relevant industry or sector. As with any assessment brief, the Pearson EABs are intended to provide a model of an assessment that is valid, sufficient, authentic, appropriate and relevant.

This booklet includes an EAB for every unit within the relevant Higher National qualification. Reviewing these will provide tutors with suggestions about the types of assignments that might be used for assessment, the structure and language of assignment briefs, and inspiration for how to develop new approaches.

1.1 Guidance only

EABs are for guidance and support only. They are **not** to be used directly for assessment.

These EABs are not developed with a context specific to a set of students or a location; both of which are critical to the development of good assessments. Centres **should** develop their own assignments; as they will be able to provide students with a relevant context and scenario.

EABs may be used as a starting point for the development of an assignment, however centres **must** modify and revise the Example Assessment Brief to provide students with a brief that is sufficiently localised, with a relevant vocational context/scenario, and a locally relevant set of assessment evidence requirements; in order that the assessment is rooted in the 'real world' of the students' experience.

All assignments must still be verified in line with Pearson's requirements for internal verification of assignments and assessment results. For additional support and guidance please refer to our *Pearson BTEC Assignment Checking Service* on our website http://qualifications.pearson.com

2 Support materials

In addition to these EABs, Pearson have a range of additional support materials available. These are intended to provide you with further information to enhance your development of assignments and assessment practice.

2.1 Training Video - Assignment Writing and Assessment for RQF Pearson BTEC Higher Nationals

This training video explores:

- The principles and ethos of assessment in the new RQF Pearson BTEC Higher Nationals
- Approaches to and development of assignment briefs mapped to learning outcomes and assessment
- Documentation and requirements for assignments briefs
- The importance and process of internal verification

We highly recommend tutors to watch the training video on the Pearson YouTube channel here.

2.2 Training Video – Pearson-Set Assignment for RQF Pearson BTEC Higher Nationals

This training video explores:

- The purpose of the Pearson-set
- The timeline for release of themes and topics
- Writing an assignment for the Pearson-set
- Integrating external links in learning, teaching and assessment
- Related support materials

We highly recommend tutors to watch the training video on the Pearson YouTube channel here.

3 Example Assessment Briefs

Unit 1: Fundamentals of Laboratory Techniques

Please note that this Example Assessment Brief is NOT an authorised assignment brief. It is provided as a reference only.

Centres must develop assignments and assessment materials that meet the needs of their students and align with their curriculum planning. This Example Assessment Brief may be used as a starting point for the development of an assignment, however Centres are expected to modify and revise the Example Assessment Brief to meet the specific needs of their students and curriculum. All assessment briefs must be Internally Verified.

Example Assessment Brief

Student Name/ID Number	
Unit Number and Title	**1 Fundamentals of Laboratory Techniques**
Academic Year	
Unit Tutor	
Assignment Title	**Portfolio of Basic Chemistry and Biology Practical Work**
Issue Date	
Submission Date	
IV Name & Date	
Submission Format	
Collated Scientific Reports for the practical work in the assignment Three risk assessments (for the thin layer chromatography (TLC) of analgesics, titration of copper (II) sulphate solution with ethylenediaminetetraacetic acid (EDTA) solution, and streak plate practicals) Action plan for improving the level of skill demonstrated in microscopy, aseptic technique, risk assessment and compliance with standards of good practice in the laboratory.	
Unit Learning Outcomes	
LO1 Carry out qualitative and quantitative analysis **LO2** Carry out synthetic chemistry **LO3** Demonstrate use of microscopy and aseptic technique **LO4** Demonstrate good practice with respect to reporting, health safety, and laboratory organisation	

Assignment Brief and Guidance

Scenario

You have been employed as a laboratory technician in a pharmaceutical company. You must undertake basic training in a range of laboratory techniques before you are assigned to a specific laboratory (e.g. in process development, quality control, microbiology). To progress beyond basic training, you must submit a portfolio of reports and other documentation for the experiments undertaken. The laboratory managers expect you also to demonstrate a good knowledge of health, safety and risk assessment and an evaluative approach you development of your skills in the laboratory.

Activity

Produce a portfolio of reports for the following experiments. (Each report should show that you fully understand the theory behind the experiment and the reasons for carrying out the steps in the procedures and contain any records of calibration checks or calibration that you carried out. You must also evaluate the validity and quality of the outcomes of the practical work, the success of any chemical syntheses and the quality of the practical work carried out with respect to good laboratory practice, health and safety and laboratory organisation.)

- TLC of analgesics
- Titration of a copper (II) sulfate solution with EDTA
- Determination of Cu^{2+} in a copper (II) sulfate solution
- Determination of nitrate in bottled water using ultraviolet spectroscopy
- Synthesis of cyclohexene from cyclohexanol
- Synthesis of antifebrin
- Microscopy – drawing tissue slides seen through a microscope
- Preparation of a streak plate using aseptic technique

Carry out a risk assessment for the TLC, copper (II) titration and streak plate experiments using the standard methodology

Find out about the practical work that you will undertake for other units in the course and produce an appropriate action plan for improving your level of skill in microscopy, aseptic technique, risk assessment and compliance with standards of good practice in the laboratory, fully justifying the structure and content of the action plan.

*Please access HN Global for additional resources support and reading for this unit. For further guidance and support on report writing please refer to the Study Skills Unit on HN Global www.highernationals.com

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Carry out qualitative and quantitative analysis		
P1 Carry out a chromatographic technique **P2** Carry out titration and Beer Lambert Law applications to determine the concentrations of solution	**M1** Explain the theory underpinning each technique	**D1** Evaluate the validity of the results obtained from the analytical techniques
LO2 Carry out synthetic chemistry techniques		
P3 Undertake a procedure to synthesise and purify an organic liquid **P4** Undertake a procedure to synthesise and purify an organic solid	**M2** Explain the reasons for carrying out the steps in the syntheses	**D2** Evaluate the success of the syntheses

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO3 Demonstrate use of microscopy and aseptic technique</td><td rowspan="4">LO3 and LO4

D3 Justify an action plan for improving the level of skill demonstrated in microscopy, aseptic technique, risk assessment and compliance with standards of good practice in the laboratory</td></tr>
<tr><td>P5 Create labelled diagrams from tissue slides

P6 Carry out practical work that involves the use of aseptic technique</td><td>M3 Explain the purposes of the component steps in the procedure(s) that use aseptic technique</td></tr>
<tr><td colspan="2">LO4 Demonstrate good practice with respect to reporting, health and safety, and laboratory organisation</td></tr>
<tr><td>P7 Report on each of the practical exercises undertaken

P8 Carry out risk assessments for a minimum of three of the techniques undertaken

P9 Carry out relevant calibration and checks on calibration</td><td>M4 Evaluate the quality of the practical work carried out with respect to good laboratory practice, health and safety and laboratory organisation</td></tr>
</table>

Unit 2: Scientific Data Handling Approaches and Techniques

Please note that this Example Assessment Brief is NOT an authorised assignment brief. It is provided as a reference only.

Centres must develop assignments and assessment materials that meet the needs of their students and align with their curriculum planning. This Example Assessment Brief may be used as a starting point for the development of an assignment, however Centres are expected to modify and revise the Example Assessment Brief to meet the specific needs of their students and curriculum. All assessment briefs must be Internally Verified.

Example Assessment Brief 1

Student Name/ID Number	
Unit Number and Title	**2 Scientific Data Handling Approaches and Techniques**
Academic Year	
Unit Tutor	
Assignment Title	**A survey of blackcurrant-flavoured soft drinks**
Issue Date	
Submission Date	
IV Name & Date	

Submission Format
A short report, word-processed (1000 words, maximum) about units used in measurement. A word-processed report (5000 words maximum) about a survey of blackcurrant-flavoured soft drinks. The report must contain an introduction, plan of the data collection and analysis methodology to be used, the data collected, qualitative and quantitative data analysis including appropriate graphical representations and an evaluation of the data collection, data analysis and presentational methods used. You should include at least one graphical representation that is not effective in terms of visual clarity with and explanation about why it is inappropriate. The report should have appropriate headings and subheadings. All data tables and graphical representations should be appropriately labelled and include the units of measurement used. Both reports should include a bibliography and in-text referencing in a Harvard style.

Unit Learning Outcomes
LO1 Demonstrate handling of data and information to scientific standards

Assignment Brief and Guidance

Scenario

You are employed in a company that designs and makes flavours for soft drinks. The company has been asked to design a flavour for a new blackcurrant-flavoured drink. The background research involves carrying out a survey amongst members of the public to find out which of the branded blackcurrant-flavoured drinks, currently on the market, are most popular. The sugar content and the acidity of the new drink will be important so you will need to survey those for the drinks, currently on the market.

Activity 1

Before starting any data analysis, it is important to appreciate the units associated with quantities. Starting with the 7 basic scientific quantities, from which all others may be derived, provide a comprehensive list of scientific quantities with their SI units, including recognised symbols. Explain the use of prefixes for units and, using suitable examples, justify the use of units with prefixes e.g. kilometres.

Activity 2

You have been tasked with investigating the sugar and acid content and public perception of the taste of a range of soft drinks. Prepare a report on the collection and analysis of qualitative data and quantitative data. This should include an introduction explaining the purpose of the data collection and analysis, a plan, the data collected and analysis using both quantitative and qualitative methodology. The analysis should include graphical presentation and the choice of particular types of graphical representation should be fully justified. You must provide at least one example of an inappropriate method of displaying data, explaining why it lacks visual clarity. You must evaluate and draw conclusions about the relevance and validity of the data collected and the data analysis methodology.

*Please access HN Global for additional resources support and reading for this unit. For further guidance and support on report writing please refer to the Study Skills Unit on HN Global www.highernationals.com

Example Assessment Brief 2

Student Name/ID Number	
Unit Number and Title	**2 Scientific Data Handling Approaches and Techniques**
Academic Year	
Unit Tutor	
Assignment Title	**Using Equations**
Issue Date	
Submission Date	
IV Name & Date	

Submission Format
Worked solutions to questions in a time-constrained assignment A word-processed report (approximately 3000 words) on the applications of a range of mathematical functions in science in general and, in particular, justifying the importance of logarithms in science. The report should also include how differential and integral calculus is used to analyse real world problems and should illustrate how the nature of stationary points in functions may be determined by using first and second derivatives. Suitable examples should be carefully selected throughout. The report should include a bibliography and in-text referencing in a Harvard style.

Unit Learning Outcomes

LO2 Identify the relevance of mathematical methods to a variety of conceptualized scientific examples

LO4 Solve problems using differential and integral calculus

Assignment Brief and Guidance

Scenario

Many of the standard analytical procedures in your workplace involve calculations, some of which are complex. The calculations are carried out by entering data into spreadsheets. Your company wants you to understand mathematical techniques so that you will be able to write spreadsheets in the future and so that you will recognise if the current spreadsheets contain mistakes.

Activity 1

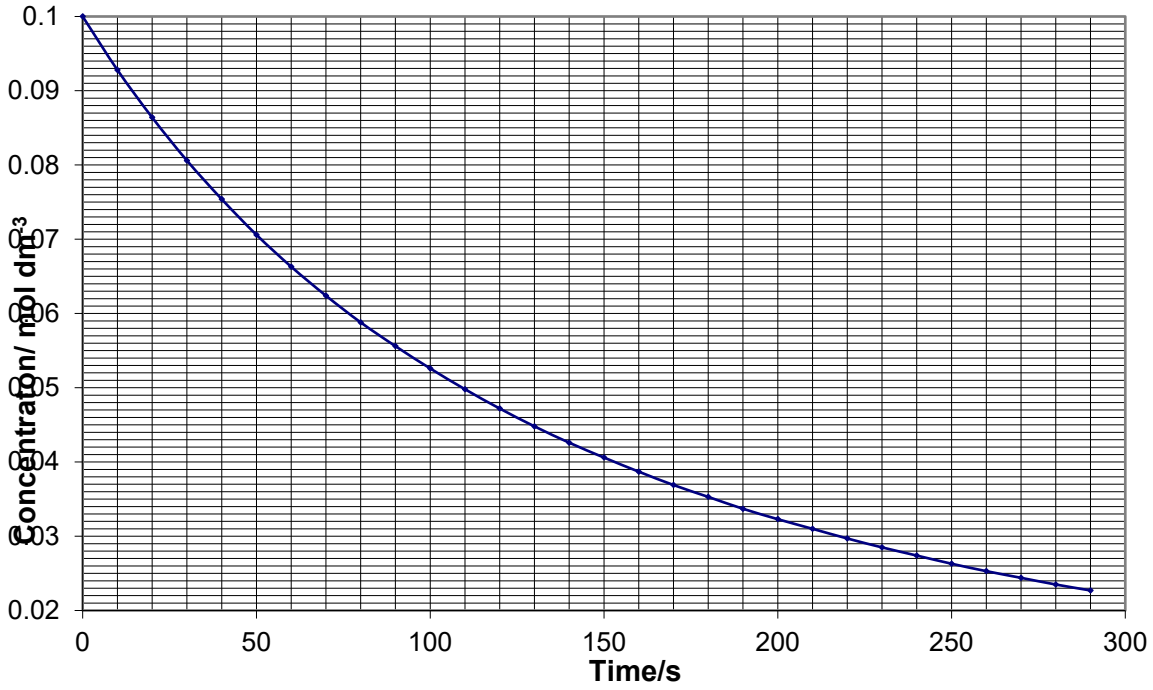
You are provided with a time-constrained question paper (below). You should provide worked solutions with as much explanation as possible for each question.

Q1 The change in Gibbs energy (J mol^{-1}) for a reaction $\Delta G = -RT\ln K$
where R is the Gas Constant (8.314 $JK^{-1}mol^{-1}$)
T is the temperature in Kelvin (K)
K is the equilibrium constant for the reaction.
If ΔG = 5000 J mol^{-1}, calculate the equilibrium constant for the reaction.

Q2. Rate of a reaction in terms of concentration of reactant A = -d[A]/dt
The reaction is nth order with respect to the concentration of A, [A]:
Rate = $-d[A]/dt = k[A]^n$ where k is the rate constant
i) Show, using rules of logarithms, that at a typical concentration, $[A]_1$
$\ln k = \ln rate_1 - n \ln[A]_1$ where $rate_1$ is the rate at concentration $[A]_1$
and at concentration $[A]_2$
$\ln k = \ln rate_2 - n \ln[A]_2$ where $rate_2$ is the rate at concentration $[A]_2$
and hence $n = \frac{\ln rate_2 - \ln rate_1}{\ln [A]_2 - \ln [A]_2}$

ii) You are presented with a graph of concentration/mol dm^{-3} ([A]) versus time/s (below). By drawing suitable tangents, find the rate of reaction at two different concentrations and hence the order of reaction, n.

FIGURE 1 Concentration of Reactant versus Time



Q3 This question is about the shape of quadratic curves

i) By factorising the following two functions, determine their roots.

$y = 2x^2 + x - 14$ and $y = -x^2 - x + 12$

ii) Use differential calculus to determine the stationary point of each function and determine whether they are a minimum or a maximum

iii) Sketch the curves (without using a spreadsheet)

iv) Find the equation of the tangents to both curves at x = 1

Q4 In a biochemical equilibrium reaction taking place in solution, substances A and B react to form products, C and D.

$A + B \rightarrow C + D$

The equilibrium constant for the reaction, K, is given by

$K = \frac{[C][D]}{[A][B]}$ where [A], [B], [C], [D] are the concentrations of each reactant and product and at 298K, K = 0.36

At the start of the reaction, there are 0.1 mol of A and 0.05 mol of B in solution in 500 cm^3. Once equilibrium is established, there are x moles of C and x moles of D.

i) By writing a suitable expression for K, derive and solve a quadratic equation in x to find the number of moles of each product in solution.

ii) Sketch the graph for the quadratic equation

iii) Use differential calculus to find the stationary point and explain whether it is a maximum or minimum

iv) Find the equation of the tangent to the curve when the number of moles of product is 0.02 mol.

Q5 Produce graphs of the following functions and compare the shapes of graphs (i)-(iv) and (v) – (viii):

i) $y = e^x$
ii) $y = 2e^x$
iii) $y = e^{2x}$
iv) $y = e^{-x}$
v) $y = \cos x$
vi) $y = -\cos x$
vii) $y = \cos 2x$
viii) $y = 2 \cos x$
ix) $y = 2 \sin x$
x) $y = \tan x$
xi) $y = \ln x$
xii) $y = 1/x$

Q6 The relationship between rate constant, k, of a reaction (e.g. food deterioration) and temperature T/K is given by:

$k = A \exp (E_a/RT)$ where A is a constant, E_a is the activation energy, R is the gas constant (8.314 JK^{-1} mol^{-1})

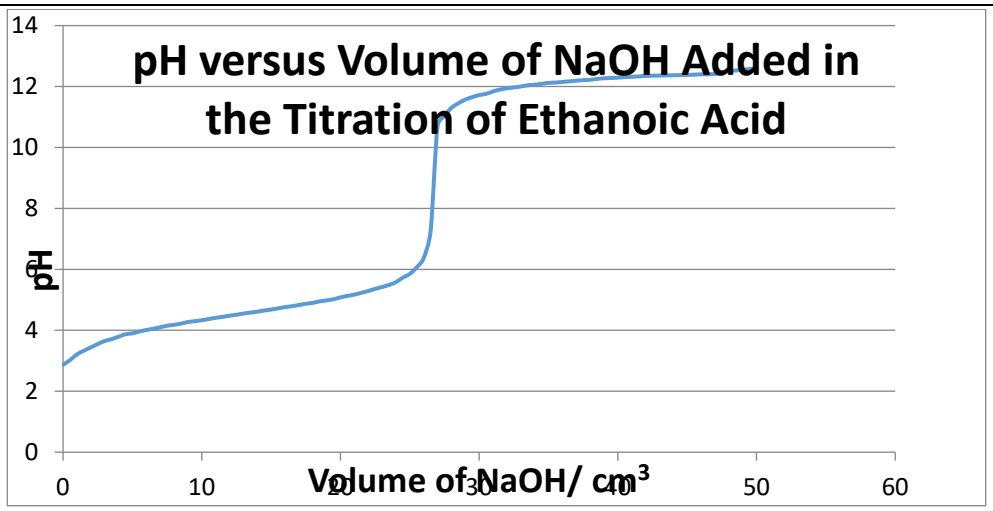
Rate constant was measured at a range of temperatures:

Rate constant k/ dm^3 mol^{-1} s^{-1}	0.100	0.335	1.41	3.06	8.13	21.1	50.1
Temperature/^{0}C	20	30	40	50	60	70	80

By drawing a suitable graph, work out the activation energy E_a in J mol^{-1} and kJ mol^{-1}

Q7 A sample of ethanoic acid was titrated with 0.1 mol dm^{-3} sodium hydroxide, using a pH electode.

i) Explain how the pH value is related to the concentration of hydrogen ions, $[H^+]$, in solution.
ii) A graph of pH versus volume of sodium hydroxide is shown below.
Sketch the first derivative plot □pH/ □volume versus volume of sodium hydroxide and explain why this is useful when finding the end-point of the titration.
iii) The pH at the end point of the titration is 10.71. Calculate the concentration of hydrogen ions, $[H^+]$, at the end point of the titration.



Q8 Determine the first derivatives with respect to x (dy/dx) for the following functions:

i) $y = x^3$
ii) $y = 4x^5 – 7x^2 + 8x – 17$
iii) $y = 1/x$
iv) $y = e^x$
v) $y = \sin x$
vi) $y = \cos x$

Q9Determine the indefinite integrals of the functions below
i) $4x$
ii) $12x^3 – 9x^3$
iii) $\sin x$
iv) $-e^x$

Q10 Determine the definite integrals of the functions between the limits shown:
i) $-3x^2 + 5$ between the limits x = -1 and x = 1
ii) x^3 between the limits x = -3 and x = 0 and between x = 0 and x = 3

Q11 The differential rate equation for a reaction that is second order in the concentration of reactant A is

Rate = $-d[A]/dt = k [A]^2$ where [A] is the concentration of A (mol dm^{-3}), t is time (s), k is the second order rate constant (dm^3 mol^{-1} s^{-1})

i) Integrate the differential equation with respect to time, t, between the limits of t=0 and t=t

ii) Use the integrated rate equation to calculate the rate constant, k ($dm^3mol^{-1}s^{-1}$), given that the initial concentration was 0.1mol dm^{-3} and the concentration after 5 min was 0.05 mol dm^{-3}

iii) Calculate concentration of [A] after 2 min.

Activity 2

Write a report to comprehensively illustrate the use of a range of mathematical functions (polynomial, exponential, logarithmic, circular) in science and to illustrate the importance of using logarithms in the treatment of scientific data, using a range of carefully chosen examples. Justify why logarithms are highly regarded in science.

Your report should also show, by using suitable illustrative examples, how the nature of secondary points on graphs may be analysed by the use of first and second derivatives. Applications of calculus to real world scientific problems should also be illustrated in your report.

*Please access HN Global for additional resources support and reading for this unit. For further guidance and support on report writing please refer to the Study Skills Unit on HN Global www.highernationals.com

Example Assessment Brief 3

Student Name/ID Number	
Unit Number and Title	**2 Scientific Data Handling Approaches and Techniques**
Academic Year	
Unit Tutor	
Assignment Title	**Using Statistics**
Issue Date	
Submission Date	
IV Name & Date	

Submission Format
A word-processed report (5000 words approximately) about the relationships between the chemistry of a stretch of river, the flora and fauna surrounding it and its amenity value. This should be supported by an Appendix of raw and analysed data from the various class groups and a suitable bibliography with in-text referencing. The report should have appropriate headings and sub-headings. It must include use of a range of justified and valid statistical methods.

Unit Learning Outcomes
LO3 Explore raw scientific data using statistical methods
Assignment Brief and Guidance

Scenario

You work for an organisation that carries out surveys of stretches of the local rivers and lakes. The organisation tests the quality of the water, looks at biodiversity and also interviews people using the area about its amenity value.

Activity 1

A stretch of a river is going to be studied by your class. Working as part of a small group, you shall be allocated part of that stretch of river in order to determine whether the quality of the water is related to the surrounding wildlife and to try to determine what influences whether members of the public visit the area or not. Your group shall carry out some chemical testing of the river water. It shall also determine the main plant species, invertebrate species and bird species and interview people who use the area. The group should decide on appropriate sampling and data gathering strategies. Once all the raw data has been collected, as individuals, each group should analyse the data using descriptive statistical techniques. You should use appropriate statistical methods to determine whether there are any relationships between water quality, numbers of particular plant and animal species and reasons why people visit the area. Using inferential statistical methods, you should determine whether the small stretch of river is representative of the whole.

As an individual, you should prepare a report explaining all the work that has been carried out on the river and justify how the statistical data handling and evaluation methods could be improved.

*Please access HN Global for additional resources support and reading for this unit. For further guidance and support on report writing please refer to the Study Skills Unit on HN Global www.highernationals.com

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Demonstrate handling of data and information to scientific standards		
P1 Describe SI units and prefix notation **P2** Examine the collection and handling of quantitative and qualitative data with appropriate graphical representations	**M1** Explain the impact on the visual clarity of data if inappropriate graphs are used with appropriate examples	**D1** Present an analysis of scientific data using both computational and qualitative methods
LO2 Identify the relevance of mathematical methods to a variety of conceptualised scientific examples		
P3 Construct graphs for quadratic, exponential, logarithmic and circular functions **P4** Determine and interpret solutions of functional equations to scientific examples	**M2** Illustrate the use of mathematical functions in applied science by the use of examples	**D2** Justify why logarithms are highly regarded in science giving real world examples in the process

Pass	Merit	Distinction
LO3 Explore raw scientific data using statistical methods		
P5 Assess qualitative and quantitative raw scientific data from a range of examples using appropriate statistical methods **P6** Assess the use of appropriate statistical methods supported by specific scientific examples	**M3** Evaluate the differences in application between descriptive statistics, inferential statistics and measuring association	**D3** Make valid recommendations and judgements for improving data handling and evaluation through the application of statistical methods
LO4 Solve problems using differential and integral calculus		
P7 Solve practical problems by using differential calculus and by determining rate of change graphically **P8** Use integral calculus to solve practical problems	**M4** Analyse the nature of stationary points on the graphs of functions by using first and second derivatives	**D4** Research applications of calculus to real world scientific problems

Unit 3: Regulation and Quality in the Applied Sciences

Please note that this Example Assessment Brief is NOT an authorised assignment brief. It is provided as a reference only.

Centres must develop assignments and assessment materials that meet the needs of their students and align with their curriculum planning. This Example Assessment Brief may be used as a starting point for the development of an assignment, however Centres are expected to modify and revise the Example Assessment Brief to meet the specific needs of their students and curriculum. All assessment briefs must be Internally Verified.

Example Assessment Brief

Student Name/ID Number	
Unit Number and Title	**3 Regulation and Quality in the Applied Sciences**
Academic Year	
Unit Tutor	
Assignment Title	**Regulation and Quality in an Organisation**
Issue Date	
Submission Date	
IV Name & Date	

Submission Format
An A4 introductory handbook for new employees which will help them to become familiar with the regulatory environment for a specific science-based organisation. This should be word processed, 1.5 spacing, with appropriate headings and subheadings. A bibliography should be included. In-text references to should in Harvard style. It is permissible to include documentation, specific to the organisation in Appendices at the end of the handbook. The approximate word count for the handbook, excluding bibliography and Appendices is 5000 words. A developmental slide deck, supported by the slides with notes, for new employees, explaining the features of a quality system, quality management, continuous improvement and what is involved in accreditation to a specific quality standard.

Unit Learning Outcomes
LO1 Review health, safety, environmental and other legislation relevant to a particular sector or pathway **LO2** Analyse how a specific sector is externally regulated **LO3** Illustrate the links between quality standards, continuous improvement cycles and quality systems **LO4** Explore internal regulation and relevant responsibilities of individuals in relation to a particular sector or pathway.

Assignment Brief and Guidance

Scenario

You have been asked by an organisation in the applied sciences sector to prepare information about regulation and quality that will be useful to new employees. The information will make them aware of the external constraints on the organisation and how the organisation and individuals in the organisation are expected to behave as a result.

Activity

Base your work on science-based organisations with which you are familiar or about which you can easily find detailed information.

Prepare an introductory handbook for new employees which will help them to be familiar with the regulatory environment for a specific organisation. This should include:

- Full details of the specific pieces of legislation (health and safety, environmental and sector-specific) with which an organisation of your choice must comply.
- An explanation of the relevance and significance of that legislation to the organisation
- A description, using appropriate examples, of how the organisation as a whole and individuals within it comply with the identified legislation
- The regulatory bodies with respect to the legislation
- Other regulatory bodies which regulate practice within the organisation
- An analysis of how all the relevant regulatory bodies regulate practice (including the scope of audits and the documentation and practice that regulators would expect to see)
- An analysis of the impact of external regulation on how the organisation carries out its operations
- Analysis of the impact of external regulation on how individuals carry out their roles

- An analysis of the full consequences of non-compliance with regulatory requirements on the organisation
- An evaluation of how regulation of another type of organisation differs from the regulation of the chosen organisation
- A description of the organisation's own internal rules, systems and practices
- An explanation of how any of those rules, systems and practices relate to external regulatory requirements

Prepare a developmental PowerPoint presentation, supported by the slides with notes, for new employees, explaining the features of a quality system, quality management, continuous improvement and what is involved in accreditation to a specific quality standard. This should include

- An explanation of what is involved in a quality management system
- How a quality management system delivers continuous improvement
- A description of a quality standard
- A description of how an organisation may gain accreditation to a quality standard
- An analysis of the benefits of accreditation to a quality standard
- An analysis of whether it is possible to have a quality system and continuous improvement without accreditation to a quality standard
- An evaluation of the continuous improvement of a specific organisation's internal regulatory systems

*Please access HN Global for additional resources support and reading for this unit. For further guidance and support on report writing please refer to the Study Skills Unit on HN Global www.highernationals.com

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Review health, safety, environmental and other legislation relevant to a particular sector or pathway</td><td rowspan="5">LO1 and LO2

D1 Evaluate the level of regulation within the selected sector/pathway in comparison to other sectors/pathways</td></tr>
<tr><td>P1 Identify the legislation relevant to the selected sector or pathway

P2 Outline actions that an organisation and its employees must take in order to comply with the identified legislation</td><td>M1 Explain why the legislation identified is relevant to the sector or pathway</td></tr>
<tr><td colspan="2">LO2 Analyse how a specific sector is externally regulated</td></tr>
<tr><td>P3 Analyse how relevant bodies carry out external regulation in a specific sector

P4 Analyse the impact of external regulation on the roles of a range of individuals in a specific sector and on the organisation as a whole</td><td>M2 Differentiate between external regulation in relation to compliance with legislation and in relation to customer confidence</td></tr>
</table>

Pass	Merit	Distinction
LO3 Illustrate the links between quality standards, continuous improvement cycles and quality systems		
P5 Describe the benefits of accreditation against a quality standard for a particular organisation **P6** Using suitable examples, show how maintaining accreditation against a quality standard involves quality systems and continuous improvement	**M3** Analyse whether it is possible to implement a quality system and engage in continuous improvement without accreditation to a quality standard	**LO3 and LO4** **D2** Evaluate how internal regulatory systems are, or may be, continuously improved for a specific organisation
LO4 Explore internal regulation and relevant responsibilities of individuals in relation to a particular sector or pathway		
P7 Describe how an organisation carries out internal regulation of its activities **P8** Describe examples of actions taken by an individual in an organisation in relation to internal regulation	**M4** Explain how internal regulatory systems relate to external regulation	

Unit 27: Analysis of Scientific Data and Information

Please note that this Example Assessment Brief is NOT an authorised assignment brief. It is provided as a reference only.

Centres must develop assignments and assessment materials that meet the needs of their students and align with their curriculum planning. This Example Assessment Brief may be used as a starting point for the development of an assignment, however Centres are expected to modify and revise the Example Assessment Brief to meet the specific needs of their students and curriculum. All assessment briefs must be Internally Verified.

Example Assessment Brief 1

Student Name/ID Number	
Unit Number and Title	**27 Analysis of Scientific Data and Information**
Academic Year	
Unit Tutor	
Assignment Title	**Analysis of Scientific Data and Information**
Issue Date	
Submission Date	
IV Name & Date	

Submission Format
A word-processed report (approximately 2000 words) on the use of statistical, graphical and numerical analysis methods that includes: • A discussion, based on the use of descriptive statistics, of whether supplied data from analysing the control samples for a chloride electrode establishes that it follows a normal distribution • A description of the use of a statistical test to determine whether there is a significant different in the means resulting from an analysis of the chloride control samples by the electrode and the titration methods • A discussion of how one-tailed and two-tailed tests are used • A discussion of how three other significance tests may be used • A discussion of how graphical and numerical analysis has been used during the course and of the validity and reliability, uncertainty and significant figues associated with the data and the data analysis methods • A review of typical data analysis methods used in the sector • A critical evaluation of the suitability of the data analysis methods used in the sector The report should have appropriate headings and subheadings, a bibliography and suitable Harvard-style in-text referencing.
Unit Learning Outcomes
LO1 Process and analyse scientific data using statistics **LO4** Approximate solutions of contextualised examples with graphical and numerical methods, and assess limitations and concluding results

Assignment Brief and Guidance

Scenario

You work, as a trainee technician, for a global organisation that uses applied science to produce huge range of products including food, cleaning products, personal care products and fertilisers. Business is carried out at several locations in the United Kingdom and you are likely to move location as part of the technician training scheme. The organisation's work involves many different disciplines and types of data: results of chemical analysis of raw materials, water, effluent and products; microbiology in relation to the efficacy of deodorants and biocidal products, food quality and sterility; environmental surveys of areas used to test fertilisers; testing of polymers used in specialist packaging; opinions of panels about whether final products are fit for purpose; observations of the number of items in a particular category; large surveys equivalent to the population of results; smaller survey from which all the results may be inferred etc. The operation of instrumentation often depends on computer software performing algebraic calculations or interpreting results using calculus or matrix algebra. In order to maximize customer confidence, the organisation is externally accredited. As a result, data must be presented in a standard way and all technicians are trained to understand the measures put in place to ensure the reliability and validity of the data.

As part of your training, you must show that you understand several ways of processing statistical data. You must also demonstrate that you can present data for your current science sector to the expected standard and be able to justify its validity to external auditors from the accreditation organisation.

Activity 1

Prepare a report that illustrates the use of statistical, graphical and numerical analysis, using the following guidelines.

The salt content of one of the products is tested during production using a chloride ion-sensitive electrode. Every time the electrode is used, it is calibrated and the results from a control sample of known concentration are entered into a spreadsheet. The results from analysis of the control samples should conform to a normal distribution. You are required to describe the features of a normal distribution and to use descriptive data analysis techniques on a sample of continuous data from testing the chloride concentration of the control samples in order to determine whether the results are within a normal distribution.

Chloride concentration is also measured by titration with silver nitrate solution, using potassium chromate indicator. You are provided with the chloride concentration data for the control sample analysis using this method. You should determine whether the difference in the mean is significant using appropriate statistical analysis.

Sometimes it may be appropriate to use one-tailed tests and in other circumstances two tailed tests. Using suitable examples, discuss the application of one-tailed and two-tailed tests.

You will have chosen on type of statistical test to determine whether the difference in the means of the chloride results is significant. Many other types of significance tests are available. Discuss how three other tests would be used in appropriate contexts, using appropriate examples.

During your course, you will have produced and analysed data. Collate the significant examples of data analysis in relation to the units that you have studied. You may also use workplace data if you are employed or from a work placement. Illustrate the full scope of the graphical and numerical analysis that you have undertaken by discussing examples from your work. You should also discuss the validity, reliability, uncertainty and use of significant figures of the data and data analysis in this work.

Using appropriate examples, review data analysis methods that are typical of the pathway you are following. Critically evaluate whether these methods are suitable and suggest whether there are any other methods that may be more suitable in helping you draw conclusions.

*Please access HN Global for additional resources support and reading for this unit. For further guidance and support on report writing please refer to the Study Skills Unit on HN Global www.highernationals.com

Example Assessment Brief 2

Student Name/ID Number	
Unit Number and Title	**27 Analysis of Scientific Data and Information**
Academic Year	
Unit Tutor	
Assignment Title	**Analysis of Scientific Data and Information**
Issue Date	
Submission Date	
IV Name & Date	

Submission Format
Fully worked solutions to questions in the time-constrained, open-book part of the assignment. This could be hand-written or word-processed A report of about 1000 words, word-processed explaining matrix operations, how a system of 3 linear equations may be solved, using matrix algebra, an discussion of the application of matrix algebra in science, a discussion about the real world applications of growth and decay models and an assessment of how calculus may be used in formulating predictions of growth and decay. The report should include a bibliography and in-text referencing should be in a Harvard style.

Unit Learning Outcomes
LO2 Use matrix methods to solve systems of linear equations relevant to science applications **LO3** Examine how differential and integral calculus can be used to solve scientific problems

Assignment Brief and Guidance

Scenario

You work, as a trainee technician, for a global organisation that uses applied science to produce huge range of products including food, cleaning products, personal care products and fertilisers . Business is carried out at several locations in the United Kingdom and you are likely to move location as part of the technician training scheme. The organisation's work involves many different disciplines and types of data: results of chemical analysis of raw materials, water, effluent and products; microbiology in relation to the efficacy of deodorants and biocidal products, food quality and sterility; environmental surveys of areas used to test fertilisers; testing of polymers used in specialist packaging; opinions of panels about whether final products are fit for purpose; observations of the number of items in a particular category; large surveys equivalent to the population of results; smaller survey from which all the results may be inferred etc. The operation of instrumentation often depends on computer software performing algebraic calculations or interpreting results using calculus or matrix algebra.

As part of your training, you must show that you are familiar with the use and applications of techniques based on calculus and matrix algebra.

Activity 1

In this time-constrained, open-book part of the assignment, you have 2 hours to answer the following nine questions:

Q1 Differentiate the function $y = (x^3 + 3)^4$ with respect to x

Q2 Differentiate the function $y = \exp(x^3 - 3x)$ with respect to x

Q3 Differentiate the function $y = a \sin(ax)$ with respect to x

Q4 Differentiate the function $y = \sin(x)/x^2$ with respect to x

Q5 Differentiate the function $y = x^2 \ln(x)$ with respect to x

Q6 Determine the integral of $4xe^x$ with respect to x

Q7 Determine the integral of $p \cos(p)$ with respect to p

Q8 Determine the integral of $t^2\ln(t)$ with respect to t

Q9 A drug mixture of drugs X and Y from a capsule is dissolved in methanol and made up to a known volume. X and Y have peaks at 269 nm and 315nm respectively in the ultraviolet spectrum. The absorbance of the solution of the mixture was measured to be 0.948 at the wavelength 269 nm and 0.562 at the wavelength 315 nm. Construct a system of linear equations which will allow you to determine the concentrations of X and Y using matrix algebra.

It may be assumed that the Beer Lambert Law is obeyed

Absorbance = ε x c x l where ε is the molar absorptivity/$dm^3\ mol^{-1}\ cm^{-1}$

c is the concentration/mol dm^{-3}

l is the path length of the quartz cell in cm

The molar absorptivity of X and Y at each wavelength is given in the table below:

	Molar Absorptivity at 269 nm/$dm^3\ mol^{-1}\ cm^{-1}$	Molar Absorptivity at 269 nm/$dm^3\ mol^{-1}\ cm^{-1}$
X	16400	3990
Y	3870	6420

Activity 2

You should prepare a report on the use of matrices and the use of calculus in relation to growth and decay models. This should include a discussion of:

The nature of matrices, including consideration of the numbers of rows and columns

How matrices may be added, subtracted, multiplied by a scalar and other matrices

The identity matrix

How the determinant and the inverse of a 2 x 2 matrix is constructed

How a simple system of 2 linear equations may be solved by using matrix algebra

How multiplication of the 2 x 1 matrix, representing (x,y) co-ordinates (a column vector) by other matrices transforms the 2 x 1 matrix, in terms of dilatation, reflection in the x and y axes and the line x=y

How a 3 x 3 matrix may be used to solve a system of 3 linear equations

Applications of matrix algebra in science

Real world examples of growth and decay models

An assessment of how calculus may be used in formulating predictions of growth and decay

*Please access HN Global for additional resources support and reading for this unit. For further guidance and support on report writing please refer to the Study Skills Unit on HN Global www.highernationals.com

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Analyse scientific data using statistics		
P1 Assess the use of descriptive statistics to establish whether data conforms to a normal distribution **P2** Apply significance testing to establish whether a hypothesis is correct	**M1** Discuss the application of one-tailed and two-tailed tests	**D1** Critically analyse the application of different statistical tests using suitable examples
LO2 Use matrix methods to solve systems of linear equations relevant to science applications		
P3 Explore matrix operations relevant to science applications **P4** Apply matrix algebra to to solve a system of linear equations to scientific problems	**M2** Calculate the inverse matrix for given 3x3 matrices to solve a set of 3 linear equations	**D2** Analyse the applications of matrix algebra with the solutions you derived
LO3 Examine how differential and integral calculus can be used to solve scientific problems		
P5 Determine rates of change for algebraic, logarithmic and circular functions using the quotient, product and chain rules **P6** Use integral calculus to solve practical problems relating to the applied sciences	**M3** Formulate predictions of exponential growth and decay models, using integration methods	**D3** Research real world applications of exponential growth and decay models to evaluate how closely they correlate

Pass	Merit	Distinction
LO4 Approximate solutions of contextualised examples with graphical and numerical methods, and assess limitations and concluding results		**D4** Critique the use of numerical estimation methods, commenting on their applicability and the accuracy of the methods
P7 Estimate solutions of sketched functions using graphical and numerical estimation methods **P8** Assess the accuracy of a model and the results obtained using the outcomes of processing carried out on experimental data	**M4** Solve scientific problems and formulate mathematical models, using graphical and numerical integration **M5** Discuss validity and confirmation of experimental results obtained prior to concluding	

Unit 28: Applied Sciences Research Project

Please note that this Example Assessment Brief is NOT an authorised assignment brief. It is provided as a reference only.

Centres must develop assignments and assessment materials that meet the needs of their students and align with their curriculum planning. This Example Assessment Brief may be used as a starting point for the development of an assignment, however Centres are expected to modify and revise the Example Assessment Brief to meet the specific needs of their students and curriculum. All assessment briefs must be Internally Verified.

Example Assessment Brief

Student Name/ID Number	
Unit Number and Title	**28 Applied Sciences Research Project**
Academic Year	
Unit Tutor	
Assignment Title	**Applied Sciences Research Project**
Issue Date	
Submission Date	
IV Name & Date	

Submission Format
A laboratory notebook or other log of activity over the duration of the project. This could be hand-written or a word-processed. There is no set format or word limit. A word-processed report (approximately 10 000 words) with appropriate heading and subheadings, in an accepted scientific format, containing a contents page, the research question and hypothesis, a literature review and other secondary information, appropriate theory and explanations of experimental methodologies and data analysis techniques, relevant philosophical and ethical issues, an appendix/appendices containing raw experimental data/questionnaires and collated secondary research, explanations of calculations and statistical analyses, results, discussion of findings, analysis of the accuracy and validity of your results and findings, critical evaluation of the approach and methodologies adopted, justified conclusions and recommendations for improvements or alternatives to the methodologies used and suggestions further work on the topic, a bibliography with appropriate in text referencing. There should be clear evidence of the use of critical reflection. A slide share presentation given to an appropriate audience, supported by copies of slides and notes and an observation report by your tutor in relation to delivery and ability to answer questions effectively.

Unit Learning Outcomes
LO1 Examine research methodologies and approaches appropriate to applied sciences, as part of the research process **LO2** Conduct and analyse research relevant to the applied science research project topic chosen **LO3** Communicate the outcomes of the research project to identified stakeholders **LO4** Reflect on the application of research methodologies and concepts

Assignment Brief and Guidance

Scenario

You are employed by a local organisation that uses applied science. It is very important that you develop problem-solving and research skills and to take ownership of your work tasks, if you are to progress within the organisation. In order to develop the required skills, you have been asked to carry out a research project.

Activity

Working with your supervisor/tutor and other appropriate people, identify a topic area for research that is in line with the specific pathways that you are studying. Carry out an appropriate literature review and investigate other relevant sources of information (e.g. talking to members of staff who have undertaken similar studies, reading project reports written by former students etc.). Examine a range of experimental methodologies and scientific techniques and potential sources of secondary information. Choose and fully justify a research question, a hypothesis and the experimental and data analysis methodologies that will be adopted in terms of relevant theory and philosophy and what is practicable and viable for the laboratory or other scientific workplace that you are in.

Plan and carry out your research within an appropriate timescale. Collect and analyse appropriate primary and secondary data and analyse the results of your research. Ensure that you keep a log or activities/laboratory notebook of what was done to enable the appropriateness of the chosen methodologies to be evaluated.

Identify the target audience(s) for your research. Prepare a suitable scientific project report, supported by a bibliography and raw data. Ensure that the validity and accuracy of the data is discussed in the report and justify the extent to which research objectives were met. The report should include conclusions, evaluation of the methodologies used, alternative approaches that could have been adopted and recommendations for improvements and further work in this topic area. There should be evidence of critical reflection.

In addition to the report, you should communicate your research approach and findings by delivering a presentation to an appropriate audience and answering relevant questions. (This should be supported by an observation report from your tutor.)

*Please access HN Global for additional resources support and reading for this unit. For further guidance and support on report writing please refer to the Study Skills Unit on HN Global www.highernationals.com

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Examine research methodologies and approaches appropriate to applied sciences, as part of the research process</td><td rowspan="5">LO1 and LO2

D1 Critically evaluate research methodologies and processes in application to a research project in applied sciences to justify chosen research methods and analysis</td></tr>
<tr><td>P1 Produce a research proposal that clearly defines a research question or hypothesis supported by a literature review

P2 Examine appropriate research methods and approaches to primary and secondary research</td><td>M1 Evaluate different research approaches and methodologies and make justifications for the choice of methods selected based on philosophical/theoretical frameworks</td></tr>
<tr><td colspan="2">LO2 Conduct and analyse research relevant to the applied science research project topic chosen</td></tr>
<tr><td>P3 Conduct primary and secondary research, using appropriate methods for a research project in applied science that also considers ethical issues

P4 Apply appropriate analytical tools, analyse research findings and data</td><td>M2 Discuss merits, limitations and pitfalls of approaches to data collection and analysis</td></tr>
</table>

Pass	Merit	Distinction
LO3 Communicate the outcomes of the research project to identified stakeholders		**D2** Communicate critical analysis of the outcomes and make valid and justified recommendations
P5 Communicate research outcomes in an appropriate manner for the intended audience	**M3** Coherently and logically communicate outcomes to the intended audience, demonstrating how outcomes meet set research objectives	
LO4 Reflect on the application of research methodologies and concepts.		**D3** Demonstrate reflection and engagement in the research process leading to recommended actions for future improvement
P6 Reflect on the effectiveness of research methods applied for meeting objectives of the research project in applied sciences **P8** Consider alternative research methodologies and lessons learned in view of the outcomes	**M4** Provide critical reflection and insight that results in recommended actions for improvements and future research considerations	

September 2019

For information about Pearson Qualifications, including Pearson Edexcel, BTEC and LCCI qualifications visit qualifications.pearson.com

Pearson Education Limited. Registered in England and Wales No. 872828
Registered Office: 80 Strand, London WC2R 0RL.

VAT Reg No GB 278 537121