

# Unit 10: Using Science in the Workplace

<b>Unit code:</b>	<b>L/502/5549</b>
<b>QCF Level 3:</b>	<b>BTEC National</b>
<b>Credit value:</b>	<b>10</b>
<b>Guided learning hours:</b>	<b>60</b>

## ● Aim and purpose

The aim of this unit is to help learners understand the working practices used by organisations while carrying out their day-to-day business. It also aims to put the scientist or technician in context as an important part of the organisation's workforce.

## ● Unit introduction

A real organisation should be used (or realistic case study recommended by the tutor) for the research in this unit to give learners an insight into the world of work that is awaiting them on completion of their studies.

This unit looks at the roles and responsibilities of the employee and the employer and the constraints, both statutory and voluntary, that are imposed on the organisation.

This unit links very closely to experience the learners may have of a scientific workplace. They need to understand how science-based organisations develop products and deliver services. If a learners are already employed in a scientific workplace they will ideally use their own employer for the unit and practical activity, taking into account any sensitive issues. If learners are not employed in a science organisation they will undertake this investigation as an individual or as part of the class group.

Before starting it is important that the organisation to be studied is researched to ensure that the relevant information is available. Owing to the wide variety of organisations that may be studied, the content has been designed to be contextualised to suit the learner's situation or experience.

This unit enables learners to consider what it is like to work in the science industry. It is suitable for all learners who are interested in a career in science.

## ● Learning outcomes

**On completion of this unit a learner should:**

- 1 Understand how science-based organisations develop products and deliver services
- 2 Understand the requirements of science technicians in the organisation
- 3 Be able to carry out relevant scientific practical work
- 4 Know the constraints under which the organisation must operate.

# Unit content

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## 1 Understand how science-based organisations develop products and deliver services

*The organisation:* aims; nature of the business; size of the organisation

*Products or services:* types supplied; their use; type of customer; benefits to the customer

*Processes and principles:* processes used in development of the product or delivery of the service; scientific principles employed; equipment used; health and safety legislation applicable to the organisation, eg COSHH regulations; quality assurance and quality control, eg accreditation by UKAS to BS EN ISO/IEC 17025, working to Good Laboratory Practice (GLP) regulations

## 2 Understand the requirements of science technicians in the organisation

*The science technician:* role in the organisation; safety requirements; standard operating procedures

*Training and development:* internal training, external training, Independent Operational Test (IOT); rewards; incentives

*Workload:* working hours, flexible working, the shift system

*Communication:* lines of authority and accountability to and from other personnel, external suppliers, external servicing staff, lay people; types of communication; relationships with supervisor, scientists, peer group; scientific terminology

## 3 Be able to carry out relevant scientific practical work

*Practical work:* 'scaled down' practical; plan, implement, analyse and evaluate the practical investigation

*Equipment:* equipment used in the industrial context, eg representation of large-scale industrial equipment

*Industrial and laboratory scale processes:* differences; similarities

## 4 Know the constraints under which the organisation must operate

*Controls:* statutory controls, employment law, health and safety, environmental legislation; non-statutory controls eg international standards (ISO 9000 series, ISO 14001); systems used to monitor controls, Investors in People; third-party auditing; accreditation, eg by UKAS, certification, eg by BSI

*Local impact:* environmental; forms of pollution; constraints under which the organisation operates; consequences of non-compliance

*Public perception:* issues relating to the products or services, eg ethical and moral issues, pollution and environmental issues

## Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
<b>P1</b> outline the structure and purpose of the organisation [IE1,2,4]	<b>M1</b> analyse the processes used by the organisation to produce a product or perform a service	<b>D1</b> assess the influence of legislation on the processes used to produce a product or perform a service
<b>P2</b> explain the processes and principles followed by the organisation to develop a product or deliver a service [IE1,2,4]		
<b>P3</b> explain the roles and responsibilities of science technicians in the organisation [IE1,2,4]	<b>M2</b> justify the need for appropriate communication as part of the requirements for science technicians	<b>D2</b> discuss the importance of training and development for science technicians
<b>P4</b> plan a practical investigation in the laboratory to represent an industrial process that is carried out by the organisation [IE2; CT3; RL2,3; TW1; SM3; EP2,3]	<b>M3</b> analyse the results of the practical investigation, giving their contribution to the organisation	<b>D3</b> explain how the industrial scale differs from the laboratory scale
<b>P5</b> carry out a practical investigation in the laboratory to represent an industrial process that is carried out by the organisation [IE2; CT3; RL2,3; TW1; SM3; EP2,3]		
<b>P6</b> describe the controls that the organisation works to [IE1,2,4]	<b>M4</b> explain the systems used by the organisation to monitor that controls are being adhered to	<b>D4</b> evaluate the systems used by the organisation to ensure adherence to the controls
<b>P7</b> outline the impacts that the organisation has on the local environment [IE, CT, RL]	<b>M5</b> discuss the pros and cons for the public of the organisation's work.	<b>D5</b> evaluate the environmental impacts and issues of concern, to determine whether the work of the organisation is justified.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
<b>P8</b> outline public perception relating to the products developed or the services delivered by the organisation.		

**PLTS:** This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

<b>Key</b>	IE – independent enquirers CT – creative thinkers	RL – reflective learners TW – team workers	SM – self-managers EP – effective participators
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# Essential guidance for tutors

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## Delivery

A visit to an industrial state-of-the-art laboratory is strongly recommended. If this is not possible for all learners, then tutors are strongly advised to take any opportunity to visit one themselves. This would give tutors an appreciation of the differences between industrial laboratories and centre-based laboratories to enable them to better deliver the unit. Differences include the clear demarcation of 'clean' and 'contaminated' areas (not only in biological and animal laboratories, but even in many chemistry ones), and the separate space for computers, desks etc that learners may not be aware of. It would also be interesting for learners to see the difference between analytical and product development laboratories.

This unit requires learners to research a selected organisation. It is, therefore, imperative that the organisation chosen has enough relevant and up-to date information freely available. It is also important that a relevant practical can be carried out by the learner in the laboratory.

Work experience or visits are useful but not essential for the successful completion of the unit. Much of the information required can be obtained from company websites. Many utility and manufacturing organisations have specific education sections. Learners will need basic information about how a business is organised and how it operates. This may be delivered as short lectures giving sufficient background for learners to be able to appreciate the information obtained during their own investigation.

The final report will be made up of assignments covering the points listed below. This will be tailored to suit the organisation under investigation.

A basic introduction to the organisation.

The products or services.

The work of the science technician in the organisation.

Practical work relevant to the organisation.

The difference between small and large scale work.

Controls on the employer.

Controls on the employee.

Environmental impact of the organisation on the surrounding area.

The emphasis should be on the use of science in the organisation to produce a scientific product or provide a scientific service. The place of the scientist and technical staff in the organisation should be referred to whenever possible.

Delivery should focus on how principles of science are applied and how the product or service is of use to the customer, rather than on how the business is run.

The safety of the employee, the public and the environment should be studied by investigating the statutory and non-statutory controls imposed on the organisation. Legislation such as health and safety for the employees should be studied, as well as quality standards affecting the effectiveness and efficiency of the organisation in the eyes of employees and the public, including current and potential customers. The impact of these controls will affect the success of the organisation or the demand for its products/services.

## Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction to unit and programme of learning and assessment.
Introduction to the organisation that is to be studied in this unit.
Familiarisation with the website(s) for the organisation.
Learners research the products or service provided by the organisation, the development and processes used and legislation in place.
<b>Assignment 1 – The Organisation Introduction and Products (P1, P2, M1, D1)</b>
Its structure, products or service and the constraints on the organisation.
Learners investigate the place of the science technician in the organisation.
<b>Assignment 2 – The Requirements of Science Technicians (P3, M2, D2)</b>
Requirements, training and development.
Processes used by the organisation that can be scaled down.
<b>Assignment 3 – The Practical Work (P4, P5, M3, D3)</b>
Learners plan and carry out a practical investigation that represents an industrial process carried out by the organisation.
Learners analyse the results explaining the contribution this makes to the organisation.
Learners explain how the laboratory and industrial scale differ.
Learners investigate the controls that are in place in the organisation.
<b>Assignment 4 – The Constraints on the Organisation (P6, M4, D4)</b>
Report on the controls on organisations, how they are monitored both internally and externally.
The impact of the presence of the organisation on the local environment.
The impact on the public of the products or services of the organisation.
<b>Assignment 5 – The Environmental Impact on the Local Area (P7, P8, M5, D5)</b>
Report on the environmental impact of the organisation on the local area.
Is the presence of the organisation justified?
Review of unit and assignment programme.

## Assessment

This unit requires learners to plan, carry out and report on an investigation appropriate to the learning outcomes of the role of science technician. A series of standard exercises set and controlled by the tutor will not meet the requirements of this unit.

The topics for investigation can be set by the tutor or selected by the learner, but must involve the contextualisation of the role of the technician appropriate to the learner's programme of study. The learning outcomes may be met by individual or group investigations. In the latter case, tutors must document each learner's contribution to the investigation and provide appropriate authentication of the evidence presented.

Much of the evidence for this unit will be generated by investigative work. The quality of each learner's work will be only partially reflected in the final portfolio. It is important that the tutor observes all phases of the work and records each learner's performance. These records should be included in the learner's evidence as authentication of performance and to support the grade recommended for the work. The tutor's judgement must reflect the overall quality of the work, and should not be overly influenced by the media used by the learner.

All grades require learners to undertake some initial planning before starting assignment work. Learners should consider carefully what is involved in the work, and how they are to approach the constituent tasks.

Pass grade learners will require significant assistance from a tutor to achieve all the outcomes of the unit. A brief must be provided to guide the learners through the requirements of the unit. Availability of the internet and relevant information will help the learners to achieve the outcomes.

For P1 and P2, learners can use the organisation's website and other information to find out what the organisation is doing. For M1, learners must analyse the processes investigated in P1 and P2. For D1, learners must assess the influence of legislation on the organisation performing the service or producing the product.

For P3, learners must investigate the requirements for becoming a science technician in the organisation using a different section of the website. For M2, learners should justify the types of communication used by technicians within the workplace. For D2, learners need to discuss the importance of training and professional development to the technician.

For P4 and P5, learners have to plan and carry out a practical investigation in the laboratory to represent a process that is carried out by the organisation. They should also prepare a written report. For M3, learners need to analyse the results of the practical work, showing how these type of results will be of use to the organisation. The analysis may take the form of the discussion section of the practical report. For D3, learners must explain how and why laboratory and industrial scale work will differ. This could form part of the conclusion of the practical report.

P6 requires learners to investigate the controls that the organisation has to abide by. For M4, learners should show how the organisation adheres to systems used to control and monitor in the workplace. For D4, learners must evaluate the systems used by the organisation to ensure adherence to the controls in place.

P7 and P8 require the learner to think about the impact that the organisation has on the local environment taking into account the public's concerns. For M5, learners must discuss the pros and cons of the work of the organisation in the eyes of the public. For D5, learners must use their judgement to decide whether the perceived environmental risks and impacts of the organisation's work are justified by the benefits for the public.

## Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, M1, D1	The Organisation Introduction and Products	Researcher for a scientific magazine.	Article about the company and its products.
P3, M2, D2	The Requirements of Science Technicians	A new science technician in an organisation researching the role.	Report into the role of science technicians, appropriate communication and the importance of training.
P4, P5, M3, D3	The Practical Work	Scientist carrying out a practical investigation – contextualised to suit the organisation under investigation.	A report containing information from practical work.
P6, M4, D4	The Constraints on the Organisation	Internal investigation following an incident.	Report of the findings from an organisation representative.
P7, P8, M5, D5	The Environmental Impact on the Local Area	Environmental group looking at the safety and constraints/controls on the organisation for a local residents group.	Report for the group showing findings of investigation.

## Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Applied Science sector suite. This unit has particular links with the units shown below in the BTEC Applied science suite of qualifications:

Level 1	Level 2	Level 3
Scientific Toolkit (FLT)	Science and the World of Work	Working in the Science Industry
	Working with Science	

## Essential resources

Learners must have access to the internet, a library or a learning resource centre for access to the company websites, current reports and up-to-date legislation.

A database of industrial contacts that can provide guest speakers, work placements and visits to pharmaceutical laboratories and diagnostic laboratories would prove useful.

Visits to industrial laboratories would enable learners to talk to technical staff in a scientific environment. If industrial visits are not possible then visits from the organisations are recommended.

The use of as much technical equipment as possible pertaining to the implementation of the laboratory investigation is encouraged.

## Employer engagement and vocational contexts

Learners will gain an insight into different areas of work involved in science. The wider view of the role of the science technician/scientist should make them better employees with a better understanding of the work in which they are engaged and their place in the organisation. Learners on day release could use their own organisation, if appropriate, including relevant practical work.

## Indicative reading for learners

There are no textbooks that relate specifically to this unit as information must be acquired from an up-to-date source usually an organisation's website.

Articles from newspapers, television or radio transcripts or other scientific/business journals may also be useful.

### Journals

*Nature*

*New Scientist*

*Scientific American*

### Websites

[www.ase.org.uk](http://www.ase.org.uk)

The Association for Science Education

[www.ciec.org.uk](http://www.ciec.org.uk)

Chemical Industry Education Centre (CIEC)

[www.glaxowellcome.co.uk](http://www.glaxowellcome.co.uk)

Glaxo Wellcome

[www.gsk.com](http://www.gsk.com)

GlaxoSmith Kline

[www.iop.org](http://www.iop.org)

The Institute of Physics

[www.pfizer.co.uk](http://www.pfizer.co.uk)

Pfizer

[www.rsc.org](http://www.rsc.org)

The Royal Society of Chemistry

[www.sep.org.uk](http://www.sep.org.uk)

Science Enhancement Programme

[www.soci.org](http://www.soci.org)

Society of Chemical Industry

[www.societyofbiology.org](http://www.societyofbiology.org)

Society of Biology

## Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
<b>Independent enquirers</b>	[IE1,2,4] using research skills to obtain the information needed
<b>Creative thinkers</b>	[CT3] putting themselves into the role required for the assignment
<b>Reflective learners</b>	[RL2,3] using results from practical work to draw conclusions
<b>Team workers</b>	[TW1] working together in research, practical and presentation work
<b>Self-managers</b>	[SM3] completing the work to the required standard and on time
<b>Effective participators</b>	[EP2,3] adding ideas at planning and discussion stages working on research, practical and presentation work.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
<b>Independent enquirers</b>	[IE3,5] using the unit to consider ideas for a future career
<b>Creative thinkers</b>	[CT5,6] problem solving to produce a complete piece of work
<b>Reflective learners</b>	[RL1,5] assessing themselves during the work
<b>Team workers</b>	[TW4,5] learning to work cooperatively as would happen in the workplace
<b>Self-managers</b>	[SM5,7] putting aside other issues to concentrate on the work in hand
<b>Effective participators</b>	[EP4] listening to others' point of view.

## ● Functional Skills – Level 2

Skill	When learners are ...
<b>ICT – Use ICT systems</b>	
Manage information storage to enable efficient retrieval	saving information from different sources for later use
<b>ICT – Find and select information</b>	
Select and use a variety of sources of information independently for a complex task	using various internet sources to research information
<b>ICT – Develop, present and communicate information</b>	
Enter, develop and format information independently to suit its meaning and purpose including: <ul style="list-style-type: none"> <li>• text and tables</li> <li>• images</li> <li>• numbers</li> <li>• records</li> </ul>	displaying research results in appropriate format, presenting reports and data, presenting conclusions and suggestions for improvement
Bring together information to suit content and purpose	producing reports, posters, leaflets
Present information in ways that are fit for purpose and audience	producing reports, posters, leaflets
Evaluate the selection and use of ICT tools and facilities used to present information	selecting the best media for use in presentation
<b>English</b>	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	presenting information on a researched topic
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	researching from multiple sources
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	completing the written work for assessment.