



**LEVEL 3**

**Diploma in Environmental Science /  
Extended Diploma in Environmental Science**

**Overview of the qualifications**

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## The qualifications

WJEC have developed two qualifications at level 3 in Environmental Science:

- Level 3 Diploma in Environmental Science (one GCE A level equivalent);
- Level 3 Extended Diploma in Environmental Science (two GCE A level equivalent).

These qualifications have been developed with the DfE criteria for an Advanced General Vocational qualification in mind. This has enabled us to develop a qualification that enables:

- development of knowledge, understanding and skills in a meaningful vocational area (Environmental Science);
- a variety of assessment methods to be used that test knowledge, understanding and skills of Environmental Science;
- allows assessment opportunities to be spread through the teaching of the qualification.

### **For whom are the qualifications intended?**

The Level 3 Diploma in Environmental Science has been developed for learners aged 16+, who have enjoyed and already have been successful in science. Typically, learners starting this qualification will already have science qualifications at level 2, e.g. GCSEs in science subjects, GCSE Additional Applied Science or equivalent level 2 vocational science qualifications, e.g. WJEC Award in Applied Science and WJEC Award in Science for Work.

### **The main purpose of the qualifications**

The main purpose of the qualifications is to provide learners with the knowledge, understanding and skills in key scientific principles to support progress to higher education or employment in areas related to environmental science. The qualifications require learners to apply biological, chemical and physical principles to environmental issues and to provide solutions to environmental problems.

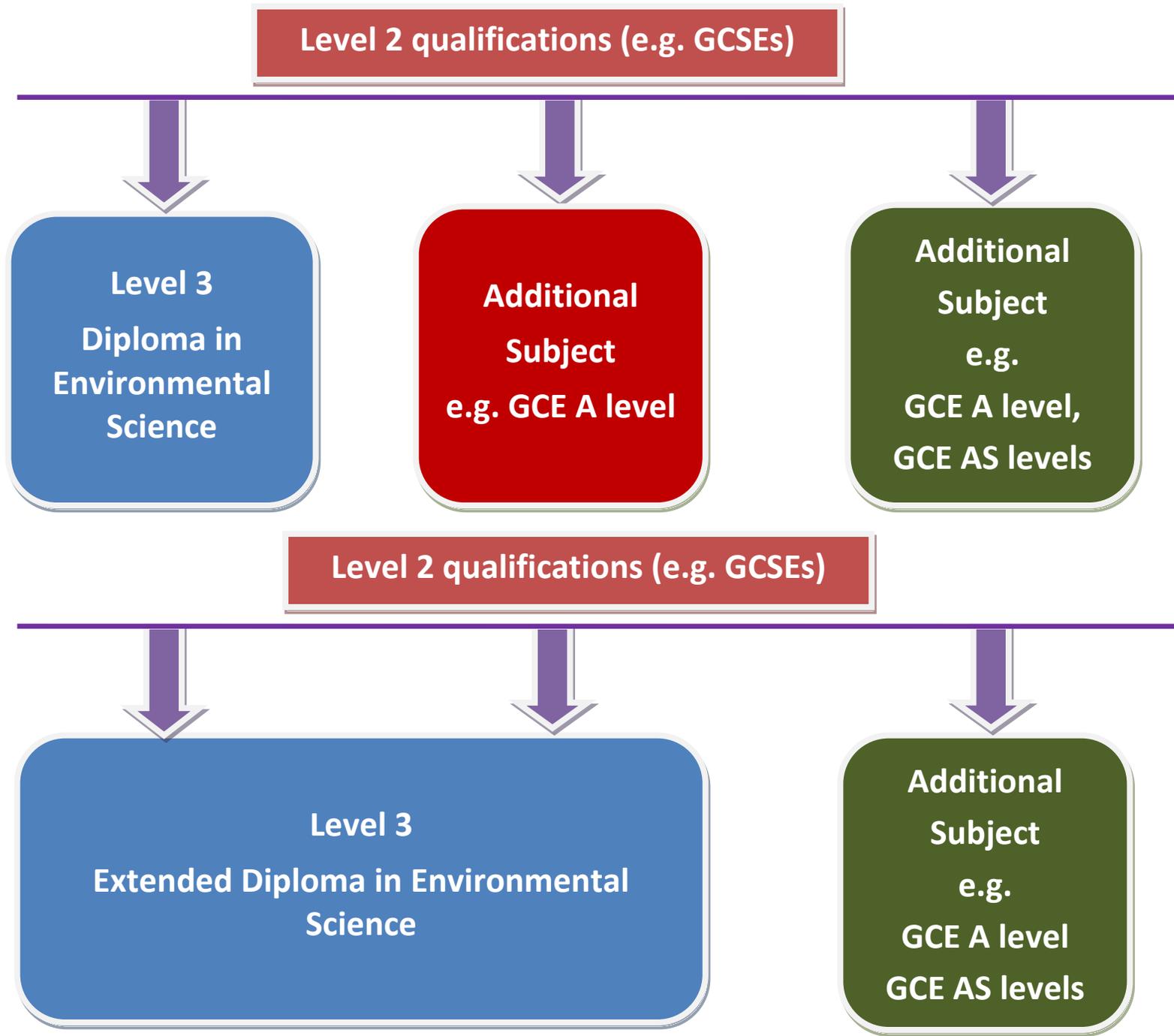
Learners who complete the qualifications should have a broad appreciation of work in the environmental sector allowing for progression into further education, employment or training.

Further information on the purpose of the qualifications can be found within each qualification specification.

### **Progression**

When supported by other appropriate qualifications such as GCSE English and mathematics, and at level 3, such as GCE AS/A levels, e.g. in a science, geography or another vocational qualification, the WJEC Level 3 (Extended) Diploma in Environmental Science will enable progression to higher education. The qualification is designed to enable progression on to degree courses in areas such as Environmental Studies, Environmental Science etc.

Examples of programmes of study can be found overpage.



## Overview of qualifications

Learners who follow the Diploma qualification will study four units. The units that will be studied are:

- Managing energy for a sustainable future;
- The living environment and conservation;
- Monitoring our physical environment;
- Scientific principles and the environment.

Learners who study for the Extended Diploma will also need to study four additional units:

- Dealing with pollution;
- Climate change or Transport systems and the environment;
- Managing agriculture for a sustainable future;
- Environmental impact analysis.

### **Units and Environmental Purpose**

Each unit has a clear environmental purpose which focuses the learning of scientific principles and skills in the unit in a meaningful environmental context. The units have been written to help develop the:

- knowledge and understanding of biological, chemical and physical principles underlying environmental science;
- skills necessary to perform laboratory and field work;
- ability to solve problems in an environmental context;
- skills needed to do project based research and presentation;
- ability to learn in work-related contexts;
- ability to work alongside others in a professional manner;
- skills for independent learning and development. These are very important to employers and higher education.

## Unit Overview

This section summarises the key sections of each unit

### Unit 2 The living environment and conservation

WJEC unit entry code

Guided learning hours 90

#### Aim and purpose

This unit develops knowledge and understanding of biodiversity, interdependence of organisms and conservation. Learners investigate key environmental concepts, and develop the skills needed to monitor ecosystems and to know how various agencies work for the protection of the environment.

The unit will enable the learners to acquire knowledge and understanding of the interrelationships within ecosystems, how they are affected by human activity and how they may be conserved. Learners will also develop skills to monitor and measure the effect these influences are having.

#### Unit introduction

How do living and non-living factors interact within an ecosystem? Why have ecosystems developed in the way they have? How has human activity impacted on ecosystems? Does all human activity have to be negative? Can we conserve the environment for future generations? How can ecosystems be monitored? This unit helps provide you with the skills to understand and carry out assessment of ecosystems.

Environmental scientists need to understand the relationship between living and non-living factors on the environment. An understanding of how we as humans affect the planet on which we live is fundamental for developing more sustainable ways of living. Environmental scientists work for government agencies, universities and private companies. Environmental scientists usually begin their careers in the field; while more experienced workers will spend more time inside the office or laboratory. Some of the features which characterise the work of environmental scientists such as meeting deadlines, attention to detail, methodical approach and analytical thinking are important transferable skills, applicable in all aspects of life and work. They must also have good communication skills as liaison with other agencies is often necessary.

This unit is designed to help you to understand how an environmental biologist/scientist works so that you will be able to tackle problems and answer questions in an environmental context. You will be taught about how living and non-living factors are interdependent and how we, as humans have affected the delicate balance within ecosystems. You will learn how to measure species in their natural surroundings and the limitations of the techniques used. At the end of this unit you will have gained the relevant knowledge, understanding and practical techniques to analyse ecosystems.

#### UNIT TITLE

THE TITLE SUMMARISES IN A CONCISE MANNER THE CONTENT OF THE UNIT.

#### AIM AND PURPOSE

THE AIM AND PURPOSE PROVIDES A BRIEF AND FORMALSUMMARY OF THE UNIT. IT ALSO INDICATES THE APPLIED PURPOSE FOR THE UNIT.

#### UNIT INTRODUCTION

THIS IS WRITTEN TO THE LEARNER AND GIVES A SUMMARY OF THE UNIT CONTENT. IT SETS THE VOCATIONAL CONTEXT OF THE UNIT AND HIGHLIGHTS THE PURPOSE OF THE LEARNING IN THE UNIT.

**LEARNING OUTCOME**

THE LO STATE WHAT THE LEARNER SHOULD KNOW, UNDERSTAND OR BE ABLE TO DO AS A RESULT OF COMPLETING THE LEARNING IN THE UNIT.

**ASSESSMENT CRITERIA**

SPECIFY THE STANDARD A LEARNER IS EXPECTED TO MEET TO DEMONSTRATE THAT THE LEARNING OUTCOMES OF THAT UNIT HAVE BEEN ACHIEVED.

**CONTENT**

THE INDICATIVE CONTENT DEFINES THE BREADTH AND DEPTH OF LEARNING FOR EACH AC. IT IS EXPECTED THAT ALL THE INDICATIVE CONTENT WILL BE DELIVERED DURING THE PROGRAMME OF LEARNING. IT IS NOT REQUIRED TO ASSESS EVERY ASPECT OF THE CONTENT WHEN ASSESSING THE UNIT

| <b>Learning outcomes</b>  | <b>Assessment criteria</b>  | <b>Content</b>   |
|---|---|--|
| <i>The learner will:</i>  | <i>The learner can:</i>   |  |
| <b>LO1</b> understand the inter-relationships within ecosystems | <b>AC1.1</b> define an ecosystem  | <b>Definition</b>  |
|   | <b>AC1.2</b> explain energy transfers between organisms in an ecosystem | <b>Energy transfers</b> <ul style="list-style-type: none"> <li>• producers, primary consumers, secondary consumers, tertiary consumers, decomposers</li> <li>• role of photosynthesis</li> <li>• energy losses from food chains</li> <li>• efficiency of energy transfer between trophic levels</li> <li>• gross and net production</li> <li>• pyramids of number, biomass and energy</li> </ul>   |
|   | <b>AC1.3</b> explain the role of decomposers in ecosystems              | <b>Decay, nitrogen and carbon cycles</b> <ul style="list-style-type: none"> <li>• requirements for decay</li> <li>• decomposers</li> <li>• nitrogen fixation</li> <li>• nitrification</li> <li>• denitrification</li> </ul>  |
|   | <b>AC1.4</b> explain how factors affect ecosystem populations           | <b>Factors</b> <ul style="list-style-type: none"> <li>• biotic factors<br/>e.g. inter-specific and intra-specific competition, predation, mutualism, commensalism, immigration and emigration, density dependent and independent factors, birth and death rate</li> <li>• abiotic factors<br/>e.g. sunlight, temperature, soil, water, height and pressure</li> <li>• carrying capacity</li> </ul> |
|   | <b>AC1.5</b> analyse patterns in population data                        | <b>Patterns in population data</b> <ul style="list-style-type: none"> <li>• lag phase</li> <li>• log/exponential phase</li> <li>• stationary phase</li> <li>• decline phase</li> </ul>   |

PERFORMANCE BANDS

THESE ARE USED TO DETERMINE THE OVERALL UNIT MARK.

PERFORMANCE BANDS DO NOT ADD ADDITIONAL REQUIREMENTS TO THE ASSESSMENT CRITERIA.

| Learning Outcome   | Assessment criteria  | Performance bands  |  |   |
|--|--|--|--|---|
| <i>The learner will:</i>                                 | <i>The learner can:</i>  | Band 1   | Band 2   | Band 3  |
| LO1 understand the inter-relationships within ecosystems | AC1.1 define an ecosystem  | Gives a definition of an ecosystem<br>1-2  | Gives a detailed description of an ecosystem<br>3  |   |
|  | AC1.2 explain energy transfers between organisms in an ecosystem | Gives an explanation of how energy is transferred between organisms with some accuracy<br><i>Low level explanations may not always clearly show reasoning</i><br>1-2 | Gives a mainly accurate and coherent explanation showing some detailed reasoning of how energy is transferred between organisms<br>3-4 | Gives an accurate and coherent explanation showing detailed reasoning of how energy is transferred between organisms<br>5-6 |
|  | AC1.3 explain the role of decomposers in ecosystems              | Gives an explanation of the role of decomposers in ecosystems with some accuracy<br><i>Low level explanations may not always clearly show reasoning</i><br>1-2       | Gives a mainly accurate and coherent explanation showing some detailed reasoning of the role of decomposers in ecosystems<br>3-4       | Gives an accurate, detailed and coherent explanation of the role of decomposers in ecosystems<br>5-6                        |
|  | AC1.4 explain how factors  | Gives an explanation of how  | Gives a mainly accurate and  | Gives an accurate, detailed and   |

## Assessment

This unit is externally assessed by an assignment provided by WJEC annually in September of each academic year. This assignment will be downloadable from the WJEC secure website. Further information about the assessment of this unit can be found in **section 3.1.1** of the specification.

## Guidance for Delivery

### Making teaching vocationally relevant

It is important that learners recognise the knowledge and understanding they develop are vocationally relevant. There are a number of ways in which this can be achieved:

- Arranging visits to universities with environmental Science courses
- Visits to and from companies, agencies and organisations involved with managing the environment and environmental issues. E.g. Governmental and non-governmental agencies linked to AONBs (Areas of Outstanding Natural Beauty), National Parks, Nature Reserves, SSSIs (Sites of Special Scientific Interest), Environmental Agency
- Visits to AONBs, National Parks, SSSIs to conduct fieldwork

The following are examples of approaches to delivery which could be used to enhance the learners' understanding of the vocational importance of the living environment and conservation.

#### Example 1

Council representatives (e.g. from planning departments) could be invited to speak about environmental impact assessments. They could focus on the role of councils in development planning, conservation areas, ecology and landscapes. Discussion could focus around the need to balance the requirements for food, attitudes of people towards economic development and the needs of wildlife.

#### Example 2

A representative from a conversation group could be invited to speak about issues associated with trying to conserve species biodiversity.

For example, a proposed cull of badgers in order to reduce the spread of bovine TB. This could be followed up by learners presenting arguments for and against the proposed cull. There are numerous such issues which apply to various regions of the UK.

#### Example 3

Learners could visit a farm to see how human's need for food is balanced with the needs of wildlife. Learners could discuss the restrictions that apply within the farming community and issues associated with trying to reduce 'food miles'. Other issues may also be addressed depending on the farm, for example how cloning techniques may be used in plants and animals and the impact of cloning on reduction of variation.

## ASSESSMENT

WJEC LEVEL 3 (EXTENDED) DIPLOMA IN ENVIRONMENTAL SCIENCE IS ASSESSED THROUGH BOTH CONTROLLED ASSESSMENT AND EXTERNAL ASSESSMENT. THIS SECTION OF THE UNIT SUMMARISES THE FORM OF ASSESSMENT USED.

## GUIDANCE FOR DELIVERY

THIS GIVES THE TUTOR SOME IDEAS ON HOW TO DELIVER THE UNIT IN A VOCATIONAL SETTING CONSISTENT WITH THE PHILOSOPHY OF THE QUALIFICATIONS AND INTENT OF THE UNIT.

SAMPLE CONTEXTS ARE PROVIDED FOR EACH UNIT. THE GUIDANCE ALSO GIVES IDEAS OF VOCATIONAL SETTINGS FOR THE UNIT AND SUGGESTS POSSIBLE CONTACTS THAT COULD BE MADE IN THE DELIVERY OF THE LEARNING.

## Resources

### Textbooks

There are a number of A-level Biology textbooks that can be used as a resource for this unit. Examples include

New Understanding Biology for Advanced Level (G Toole and S Toole) (4<sup>th</sup> Edition)  
Advanced Biology (G Monger, M Reiss and M Roberts)

### Websites

Thinkquest – lots of information on interdependence  
<http://library.thinkquest.org/11353/ecosystems.htm>

Natural Selection simulation  
<http://www.biologyinmotion.com/evol/index.html>

Biozone – numerous resources for the study of evolution, human impact on the environment, interdependence  
<http://www.thebiozone.com/links.html>

Communities.gov.uk – an information resource for teachers regarding environmental impact assessments and planning  
<http://www.communities.gov.uk/publications/planningandbuilding/environmentalimpactassessment>

Practical Biology – linked to the Society of Biology and Nuffield Curriculum Centre  
[www.practicalbiology.org](http://www.practicalbiology.org)

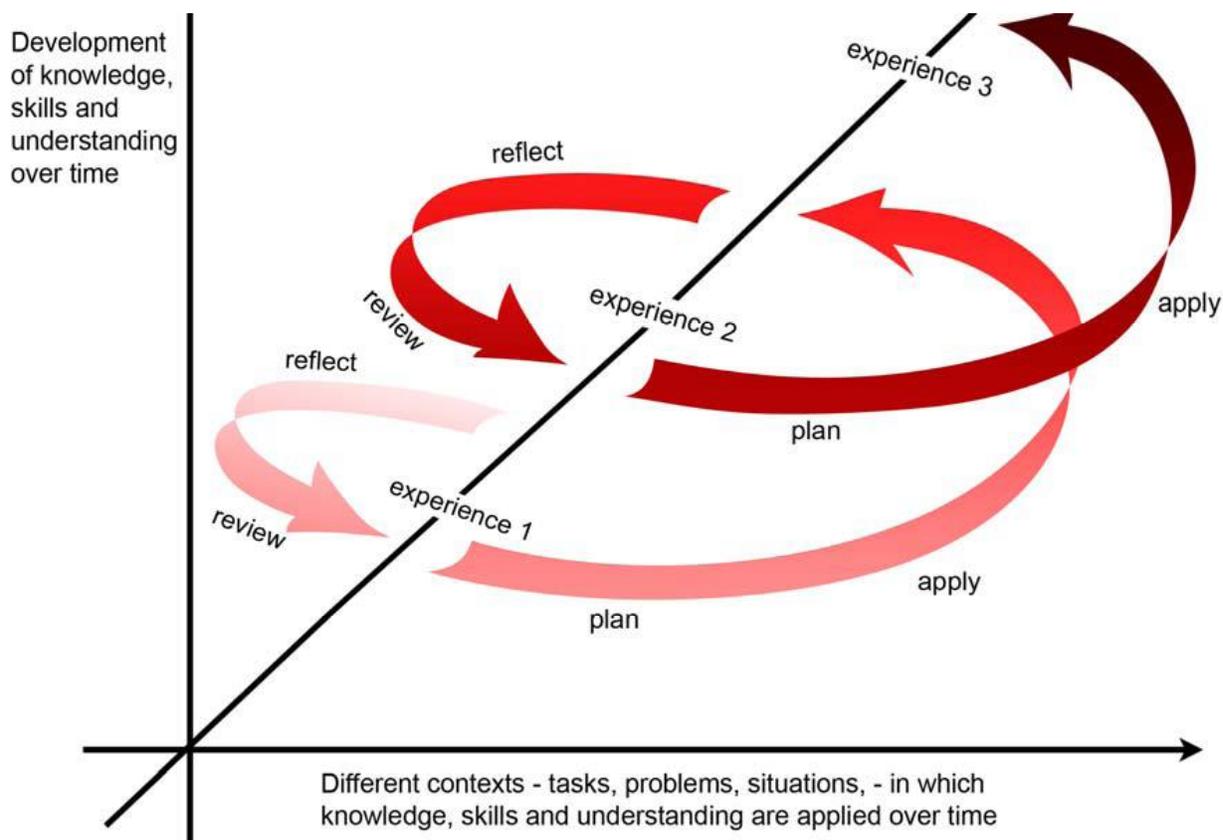
SEP (Science Enhancement Programme)  
[www.sep.org.uk](http://www.sep.org.uk)

## RESOURCES

THIS IDENTIFIES USEFUL RESOURCES TO HELP IN THE DELIVERY OF THE LEARNING. MANY OF THE RESOURCES LISTED ARE SUITABLE FOR USING WITH LEARNERS.

## Applied and experiential learning

The units have been developed to support delivery using applied and experiential learning pedagogy. Applied and experiential learning is a process that stresses the central role of experience in learning related to the world of work. Learners reflect on their experience, draw out and articulate lessons learnt (generalise), and then apply their learning to new situations or activities. This approach is shown in the diagram below



The learner's objective experience is critical to the learning process. To support delivery through experiential learning, each unit has been designed around a central applied purpose which should act as a focus for learning. The applied purpose is the vehicle through which the learning in the unit is made relevant and purposeful. It is also the means by which learners are enthused, engaged and motivated to study science. The applied purpose will demand authentic work related learning, but more than this it will require learners to consider how the use and application of science impact on individuals, employers, society and the environment. The applied purpose will also enable learners to learner in such a way that they develop:

- A range of generic and transferable skills
- The ability to solve problems
- The skills of project based research, development and presentation

- The ability to apply mathematical and ICT skills
- The fundamental ability to work alongside other professionals, in a professional environment

The qualification builds upon the concept of a 'spiral' approach to learning where learners are introduced to learning in a series of spirals, as shown in the diagram above. Each spiral may introduce learners to new concepts or introduce new learning contexts so taking the learners deeper into the unit content with each turn.

Most units have theoretical and practical learning outcomes and so it is expected that the delivery of the theory is supported by the development of practical skills and or the other way round. Using the applied learning approach, learners will be introduced to a context and the learning outcome will be delivered with relevant content in relation to that context. This is likely to be a familiar and straightforward context, ideally supported by employer input. Learners will then be introduced to a new context, starting with a review of previous learning:

- how does it help to plan the learning for the new context?
- what new learning is needed?
- how can existing learning be applied?
- What new skills are needed or what skills need to be adapted for a new context, environment, equipment etc

This guidance document suggests how this approach can be used in delivery. Guidance for each unit has examples of different contexts that can be used for delivery. The guidance also takes one of those examples and shows in further detail, how it can be implemented.

## **Employer engagement**

In order to support applied and experiential learning, delivery would benefit from engagement with employers. Each unit gives some ideas for employer engagement. There are a number of ways in which employers can engage in learning and/or assessment that will benefit learner's achievement and attainment.

### **Work experience**

Whether as part of a statutory requirement or as part of an enhanced curriculum, opportunities to work at an employer's facility would benefit learning, providing this experience has direct links to unit content and learning outcomes. This would require direct engagement with the employer to ensure learners are able to participate in meaningful activities. Learners would need to be prepared for the specific activities they would be expected to participate in during this work experience.

### **Visits to employer facilities**

A visit to an employer's facility could require significant planning and organisation, including health and safety checks and risk assessments. It is important, therefore, that this added time brings with it real benefits to learning. To support applied learning, the most benefit to learning would be where learners engage in a real or realistic situation. This could include

- carrying out experiments using equipment not available to them in their normal learning environment
- interviewing employees to obtain specific information on processes used
- working with employees to resolve issues and solve simple problems normally encountered

### **Contact between employers and learners**

Many centres have contacts with professionals working in the scientific community or working with science in the context of their work. Inviting these professional to engage with learning could bring benefits to learning. The most benefit is where these visits extend beyond straightforward presentations. Employer representatives could

- set realistic problems for learners to solve
- give masterclasses in the use of techniques and/or equipment
- provide feedback to learners on formative or summative assessment activities.

This contact need not necessarily be face to face. Professionals could appear through webcam or give feedback using electronic messaging. Employer representatives do not need to be senior staff, who might find it difficult to take time away from their work. Learners might find apprentices or junior staff more engaging and accessible

### **Provision of supporting information and documentation**

Employers could, for example, provide example documentation that is used to record the outcomes of experiments; learners could use these to complete with outcomes of their own experiments. Employers could also provide information such as data from experiments that learners could use to develop their analytical and numerical skills.

## Unit assessment

Units are either assessed through internal assessment (a form of controlled assessment) or external assessment.

| Unit   | Assessment type            | Raw Mark | UMS mark | UMS grade boundaries |    |    |
|--------|----------------------------|----------|----------|----------------------|----|----|
|        |                            |          |          | D                    | M  | P  |
| 1      | Internal                   | 120      | 120      | 96                   | 72 | 48 |
| 2      | <b>External</b>            | 120      | 120      | 96                   | 72 | 48 |
| 3      | Internal                   | 120      | 120      | 96                   | 72 | 48 |
| 4      | <b>External (synoptic)</b> | 90       | 140      | 112                  | 84 | 56 |
| 5      | <b>External</b>            | 100      | 120      | 96                   | 72 | 48 |
| 6 or 7 | Internal                   | 100      | 120      | 96                   | 72 | 48 |
| 8      | Internal                   | 100      | 120      | 96                   | 72 | 48 |
| 9      | <b>External (Synoptic)</b> | 100      | 140      | 112                  | 84 | 56 |

Diagrammatic annotations: A bracket on the left groups units 1-4 as 'Diploma'. A bracket on the right groups units 2, 4, 5, and 9 as 'Extended Diploma'.

### Internal Assessment

Internally assessed units are assessed through a form of controlled assessment. WJEC publishes model assessments that centres can use. These model assessments can also be adapted by centres. Each model assessment indicates the allowed changes for the assessment.

It is important to understand that the assessment activities also exemplify the way we expect knowledge, understanding and skills to be developed by the candidate through a teaching programme. The assessment activities require to carry out tasks for a purpose; this purpose is described in the unit introduction. Many of the tasks can be 'taken out' of the assessment context and used in teaching material set in a different context. Indeed it is important to do this if the candidates are to develop understanding and skills that they can apply to environmental issues. Effectively, assessment is the last turn of the spiral described on page 9.

Further information on the management of internally assessment can be found in the separate document '**Overview of Internal Assessment**' available on the open webpage for Environmental Science.

## External assessment

External assessment takes a number of different forms in the Environmental Science qualifications.

**Unit 4** is a 2 hour external examination consisting of two sections. This examination is available each June. It is also a synoptic assessment for the diploma qualification.

- **Section A** is based upon a **pre-release article**. This is available before the examination for candidates to download. It sets an environmental context to Section A and also allows for questions involving data analysis and evaluation
- **Section B** will be short question – short answer response questions.
- One resit is permitted for this unit.

A sample examination and mark scheme is available on the open website.

**Unit 2 and 5** are activity based assessments set by WJEC. This is supervised by centres and marked by WJEC. The activities will be changed each year.

**Unit 8** is a **synoptic** assessment for the extended diploma qualification. Learner's select from project titles set by WJEC. In these projects, candidates carry out an environmental impact analysis. Centres are directed to SAM document for further clarification of the tasks candidates need to carry out and the evidence they need to produce for assessment of this unit.