



# MCAST

Malta College of Arts, Science & Technology

MQF Level 4

AS4-03-20

**MCAST Advanced Diploma in Environmental  
Sustainability**

**Course Specification**

## **Course Description**

Awareness of environmental sustainability and related environmentally-based sectors are growing rapidly in Europe, with the Maltese government recently introducing various laws and standards on reducing global warming, climate change, low carbon emissions and the need for conservation in general.

This course includes topics related to environmental monitoring and resources management that are fundamental to the development of environmental awareness, and provides practical skills and techniques that support environmental understanding. This programme prepares you for employment within environmental sustainability sector-based organizations, as well as within medium to large organizations that face many environmental challenges on a daily basis.

## **Programme Learning Outcomes**

At the end of the programme the learner will be able to:

- 1. Understand and apply the principles of sustainable development.*
- 2. Carry out justification exercises and feasibility studies leading to the efficient and effective utilization of resources.*
- 3. Understand current legislation and best practice relevant to waste, pollution and efficiency in resources utilisation.*
- 4. Implement an investigative environmental sustainability project.*

## **Entry Requirements**

MCAST Diploma in Applied Science; or

MCAST Diploma in Mechanical Engineering; or

MCAST Diploma in Engineering (Electronics) or 4 SEC/O-Level/SSC&P (Level 3) passes Compulsory: at least 3 from English, Mathematics, Physics, Chemistry, Biology, Design and Technology, Computer Studies, Environmental Studies

**Current Approved Programme Structure**

<b>Unit Title</b>	<b>ECVET/ECTS</b>
Understanding the Principles of Sustainable Development	6
Basic Environmental Impact Assessment and Water/Energy Auditing	6
Basic Chemistry for Environmental Technicians	6
Energy Management	6
Introduction to Waste Management	6
Sustainable Transport	6
Understanding the Principles of Wildlife Populations, Ecology and Conservation	6
Understanding the Principles of Physical and Biological Environmental Processes	6
Work Related Experience in Environmental Sustainability Sector	6
Undertake an Extended Investigative Project in the Environmental Sustainability Sector	12
Understanding Water Quality	6
Pollution Control and Management	6
Scientific Practical Techniques	6
Sustainable Construction*	6
Geology of Natural Resources*	6
Fish Biology and Behaviour**	6
Understanding Aquaculture Systems**	6
English	6
Mathematics	6
Entrepreneurship	6
Information Technology	6
<b>Total ECVET/ECTS</b>	<b>120</b>

\*Specialist Stream 1

\*\*Specialist Stream 2

# Understanding the Principles of Sustainable Development

**Unit level (MQF):** 4

**Credits:** 6

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## Unit Description

This unit will introduce students to the topical subject of sustainable development, with the aim of fostering a comprehensive understanding of the multi-faceted, complex and sometimes controversial nature of this concept. The origins of ideas of sustainability and sustainable development will be briefly explained, together with a review of how these have evolved over time, through references to key events in history. Current sustainability challenges will be discussed, with reference to both local and global scales.

The various principles that underpin the concept of sustainable development will be explored in detail throughout this unit. The unit will also focus on the key pillars of sustainability, namely environmental, socio-cultural and economic systems. The importance of prudent resource and environmental management in relation to sustainable development will be explained, with an overview of the critical support role provided by environmental systems. Similarly, the influence of social and economic factors on sustainability will be discussed, as will interactions between these three 'pillars'. Finally, the unit will provide an overview of ways in which we can make progress towards improved sustainability and sustainable development, also providing an overview of initiatives to promote sustainability.

This Unit is relevant to learners wishing to improve their understanding of sustainability, and of its relevance to environmental conservation. By the end of the unit, students will be able to explain the meaning of the term 'sustainable development', while appreciating the complexities of this concept. Students will also be able to explain how ideas of sustainability became influential and evolved over time, and will be able to discuss the important link of sustainable development to world environmental, economic and socio-cultural systems. The knowledge gained in this unit will allow students to reflect critically on the concept of sustainability and on its local and global importance.

## Learning Outcomes

**On completion of this unit the learner will be able to:**

1. *Explain fundamental concepts of sustainability and sustainable development.*

2. *Describe the influences of environmental, socio-cultural and economic systems on sustainability.*
3. *Recognize and describe initiatives that aim to foster sustainable development.*
4. *Reflect critically on the goal of sustainability and on how this can be achieved.*

# Basic Environmental Impact Assessment and Water/Energy Auditing

Unit level (MQF): 4

Credits: 6

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## Unit Description

This unit will provide students with an introductory understanding of environmental impact assessment (EIA) and environmental auditing (EA) concepts and processes.

Environmental impacts will first be explained with reference to changes from baseline conditions. The importance of understanding and mitigating environmental impacts in line with key sustainable development principles, notably the precautionary principle and adaptive management will be explained, as will the rationale for EIA and EA. The goals and scope of both these processes will be outlined. Following this, typical EIA and EA processes will be described, enabling students to understand the logical sequence of these processes and the way in which each step builds on previous ones. The unit will also familiarise students with relevant instruments relating to EIA and EA, including the European Union's EIA Directive and its transposition into local legislation, the EU Eco-Management and Audit Scheme (EMAS), and ISO 14001 certification. Finally, the unit will take a closer look at the auditing of water and energy, providing an overview of the key parameters addressed by these two processes.

The Unit is relevant to learners wishing to develop basic comprehension of EIA and EA processes. On completion of the unit, learners will be conversant with relevant terminology, and will be familiar with the various stages of both processes. Students will also be able to understand and explain why EIA and EA are fundamental to sustainable development and environmental protection, as also how and why EA can be beneficial to the functioning of organisations.

## Learning Outcomes

On completion of this unit the learner will be able to:

1. *Explain the rationale for assessment and auditing of environmental impacts.*
2. *Describe the fundamentals of Environmental Impact Assessment (EIA).*
3. *Describe the fundamentals of environmental auditing.*
4. *Identify and describe basic principles of water and energy auditing.*

## Basic Chemistry for Environmental Technicians

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

This unit assumes knowledge of basic chemistry, up to SEC (O Level Standard). However, the initial part of the course shall cover all the introductory chemistry that is normally delivered in SEC classes.

Learners shall be first exposed to the principles of chemistry that are essential to grasp the applications of chemistry to environmental studies. All the basic principles of chemistry shall be related to environmental applications wherever possible.

Environmental Chemistry is the science of reactions and pathways of matter that influences mankind and his environs. It deals with the air we breathe, the water we drink, the soil that grows our food. There is a tremendous concern today about the uses—and particularly the misuses— of chemistry as it relates to the environment, ranging from individual exposures to toxicants to phenomena on a global scale that may cause massive, perhaps catastrophic, alterations in climate.

The unit shall deal with the origins, transport, reactions, effects, and fates of chemical species in the water, air, earth, and living environments and the influence of human activities thereon.

**Basic Chemistry for Environmental Technicians** (Level 4), provides a framework for the study of chemistry, dealing with basic chemical concepts such as organic chemistry, chemical analysis, physical chemistry and toxicological chemistry, which directly relate to environmental chemistry. The objective is to break down the barriers that tend to compartmentalize chemistry by laying two major goals:

- a) to provide an overview of chemical science within an environmental chemistry framework,
- b) to provide the basics of environmental chemistry for technicians.

A crucial part of chemistry is an understanding of the nature of chemical compounds, the chemical formulas used to describe them, and the chemical bonds that hold them together. It is essential to know some things about the chemical reactions by which chemical compounds are formed. These are topics that are included in this unit in order to give the student the essential concepts and terms required to understand more-advanced environmental chemical material.

Chemistry is responsible for the observed variation, processes such as ozone depletion, greenhouse effect and global warming, in Atmospheric Chemistry and Air Pollution.

Chemistry is required to understand the organic and inorganic chemical processes controlling the chemical composition of the aquatic environment and the fate of pollutants in the Aquatic Environment.

Chemistry controls the chemical and physical characteristics of soils Soil Chemistry, as well as the various ways in which soils are polluted.

## Learning Outcomes

On completion of this unit the learner will be able to:

1. *Comprehend basic chemistry concepts as applied to environmental concepts.*
2. *Develop and enhance the essential skills and techniques required in the monitoring of environment chemical parameters.*
3. *Apply the skills and techniques required in recognising the risks to the air water and ground environment from natural and anthropogenic chemical parameters.*
4. *Apply the skills and techniques required in applied environmental chemistry decision making following monitoring and analysis.*



## Energy Management

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

As fossil fuel prices have been increasing drastically during the past few years, the cost of energy and its sustainability is undoubtedly a major global concern. In a world where energy consumption is on the increase, the term 'Energy Conservation' is by far more than a frivolous term.

Fossil fuel resources are depleting and as a result, their cost is continually increasing. Furthermore, their use is contributing to high levels of pollution and greenhouse gas emissions. These lead to very rapid climatic changes and thus affect undeniably the quality of human life. In this scenario, today more than ever, it has become increasingly important to develop energy efficient processes and it is imperative to seek for alternative energy resources other than conventional fuels, which are still the dominant energy source. Such possible alternative energy sources are renewable energies, which, as their name imply, are defined as energies derived from resources that are regenerative or for all practical purposes cannot be depleted. Types of renewable energy resources include moving water (hydro, tidal and wave power), thermal gradients in ocean water, biomass, geothermal energy, solar energy, and wind energy. Municipal solid waste (MSW) is also considered to be a renewable energy resource.

This unit is aimed to enable learners to be knowledgeable about various aspects regarding energy management. Learners will be exposed to legislation and international agreements concerning energy management. They will also learn strategies to identify key performance indicators in order to improve the energy efficiency of processes, and thus reducing the carbon footprint. Learners will also be able to devise and carry out an energy audit according to required specifications and will also be capable of monitoring and making recommendations for energy-saving measures.

By the end of this unit learners should be able to gain knowledge about energy management, be able to plan and carry out an energy management audit. They should also be capable of monitoring and targeting energy savings.

This study unit is suitable for learners wishing to gain and/or enhance their knowledge on energy management in general. This unit is aimed for learners wishing to increase their awareness on energy conservation, both on a personal and organisational level.

## Learning Outcomes

On completion of this unit the learner will be able to:

1. *Recognise various aspects regarding energy management.*
2. *Devise an energy audit according to required specifications.*
3. *Perform an energy audit according to required specifications.*
4. *Monitor and make recommendations for energy reduction measures.*

## Introduction to Waste Management

**Unit level (MQF):** 4

**Credits:** 6

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### Unit description

Mismanagement of waste is unsustainable, mainly because it squanders earth's resources and pollutes the environment. Yet, human activities, be they of a domestic or industrial nature, produce waste. Each year in the European Union alone approx. 3 billion tonnes of waste are generated.

Sustainable waste management addresses the challenges posed by waste by reducing the amount of waste that is produced, by recovering materials and energy from unavoidable waste, and by reducing the environmental impact related to its final disposal.

Sustainable management of waste benefits the economy of a country by reducing environmental degradation and by creating green jobs. However, in managing waste there are environmental risks. This is the reason why in the European Union the activity is tightly regulated by approx. 30 binding legislative instruments. Moreover, the process of regulating the waste sector is a dynamic one, with old legislation being reviewed and new legislation being adopted. This is challenging to the waste sector itself and to businesses that generate the waste.

For the above reasons, it is of the utmost importance that tomorrow's workforce be fully informed of the obligations and opportunities that are related to the waste sector.

This is a knowledge-based Unit and is designed to provide the students with basic knowledge on how waste can be sustainably managed and the legislative controls that are in place. The Unit also prepares those students who intend to further develop their knowledge on the subject.

### Learning Outcomes

**On completion of this unit the learner will be able to:**

- 1. Identify the main factors related to the generation of waste.*
- 2. Recognise the nature of waste and its effects on human health and the environment.*
- 3. Outline the main legislative instruments related to the management of waste.*

4. *Review the waste hierarchy and selected techniques for managing waste.*

## Sustainable Transport

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

This is a skills based unit and will allow learners to demonstrate they have the necessary skills to be able to understand the term sustainability as applied to transport. Learners will be able to understand the importance of making the right choices when making use of transport facilities. They will also be able to understand our various means of transportation outside the concept of being carried away from point A to point B. Hence the concept of utilising alternative and more sustainable means of transport which are more environment friendly and which have a lower impact on the surrounding environment.

The Unit is relevant to learners wishing to further develop their knowledge about alternative and environmental friendly modes of transportation. On completion of the Unit learners will be able to distinguish between various forms of fuels and the impacts these have on our environment. They will be able to understand the benefits of reducing transport movements. They will also be able to choose the best mode of transport with the least environmental impact in different scenarios. They will be able to understand the relationship between modes of transport and the atmospheric gases found in our environment and the consequential effects these might have on our lives.

Learners will carry out fieldwork in order to better understand the correlation between vehicular movements and atmospheric pollution. This will be done through traffic counts at junctions and atmospheric pollution results. Learners will carry out fieldwork to obtain data about predominant modes of transport used at different times of the day and localities in the Maltese Islands.

Finally, learners should have the underpinning knowledge and understanding to recommend sustainable modes of transportation in different local scenarios.

### Learning Outcomes

**On completion of this unit the learner will be able to:**

- 1. Explain the relationship between fuel use, transportation and our wellbeing.*
- 2. Explain the impacts of transport.*
- 3. Explain the pros and cons of conventional and alternative modes of land transport.*

4. *Explain how to make transportation sustainable.*

# Understanding the Principles of Wildlife Populations, Ecology and Conservation

**Unit level (MQF):** 4

**Credits:** 6

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## Unit Description

This unit introduces learners to the ecological concepts of populations and ecosystems and how these are applied in practice for environmental management and conservation. Awareness and understanding of the importance of ecology and conservation has increased in recent times, particularly due to the promotion of causes and campaigns for conservation and management of natural resources, to reduce human impact on the environment and ensure long-term environmental sustainability. This unit is therefore designed to enable learners to understand the basic principles of ecology and dynamics of wildlife populations, and how the application of such principles in different conservation strategies.

In this unit learners will develop an understanding of ecosystem ecology and population dynamics, with particular reference to natural changes in ecosystem components and population abundance of individual species, and how these are affected by different anthropogenic activities. Such knowledge will be related to the aspects of environmental conservation, with particular reference to the management of wildlife populations and their habitats. This will be linked to field studies of populations and habitat surveys, enabling learners to appreciate the role of such studies in providing the information on the status of species and habitats that is necessary to set conservation goals and guide management decisions.

## Learning Outcomes

**On completion of this unit the learner will be able to:**

1. *Describe changes in global ecosystems.*
2. *Examine population dynamics.*
3. *Outline conservation strategies for wildlife and their habitats.*
4. *Conduct a field study of habitats and wildlife populations.*

# Understanding the Principles of Physical and Biological Environmental Processes

Unit level (MQF): 4

Credits: 6

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## Unit Description

This unit is designed to introduce students to the physical and biological environmental processes that are fundamental to the functioning of planet Earth. The unit will first address the crucial role of energy as a driving force of Earth processes, before looking at the transfer of energy to planet Earth through the atmosphere. The second part of the unit will focus on the geological resources of planet Earth through a focus on the lithosphere, providing students with an explanation of how this operates through the rock cycle. The third theme of the unit will be the biosphere, with a focus on the necessities of life and on the fundamental processes that occur in all ecosystems. Finally, the unit will consider the hydrosphere and the crucial role of water for life.

The Unit is relevant to learners wishing to develop a basic understanding of Earth processes. On completion of the Unit, learners will have intermediate level competence in this subject area and should be able to draw links between the different physical and biological processes discussed, to understand how these are all interconnected. The unit will also familiarise students with the way in which these processes determine various physical characteristics of the Maltese Islands.

## Learning Outcomes

On completion of this unit the learner will be able to:

1. *Describe the scientific principles and processes that influence energy transfer and the atmosphere as part of the earth-atmosphere system.*
2. *Describe physical and biological processes occurring within the lithosphere.*
3. *Describe physical and biological processes occurring within the biosphere.*
4. *Recognise how water is managed and used within the hydrosphere.*



## Work-related Experience in the Environmental Sustainability Sector

Unit level (MQF): 4

Credits: 6

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### Unit Description

This is a skills based unit that will allow learners to demonstrate that they have the necessary skills to be able to understand the importance of sustainable approaches on the workplace, and to be able to plan, undertake and review work-based experience in the environmental sustainability sector. Students will familiarise themselves with important aspects of sustainable approaches, such as their importance, impacts, the opportunities they provide and several popular techniques currently implemented.

The Unit is relevant to learners wishing to further develop their knowledge and understanding of a sustainable approach to businesses, and the ways with which they can access the various career opportunities this stream offers. On completion of the Unit, learners will have grasped the three step process to preparing for sustainable based work-related experience: prepare, undertake and review. They will obtain insight into what steps are required in the application process, what skills are required in an interview, and how they can prepare to start work. Furthermore, learners will gain knowledge of various methods with which they can keep track of their progress, as well as methods of how they can review their performance for self-improvement. Learners will also be able to implement a Personal Development Plan for their work-related experience.

Learners will carry out independent research and study to obtain important inductive insight into work-based experience in the environmental sustainability sector.

### Learning Outcomes

On completion of this unit the learner will be able to:

1. *Describe the importance of applying a sustainable approach in the workplace.*
2. *Prepare for a sustainable work-related experience in the environmental sustainability sector.*
3. *Undertake a work-related experience in the environmental sustainability sector.*
4. *Review a work-related experience in the environmental sustainability sector.*

## Undertake an Extended Investigative Project in the Environmental Sustainability Sector

**Unit level (MQF):** 4

**Credits:** 12

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### Unit Description

“Anyone who has ever worked on a project will agree that making a project succeed is no simple task. The difficulties manifest themselves in delays, budget over-runs, inadequate results, dissatisfied customers, high stress among the project team and other undesirable outcomes. What is the cause of all of these problems?

Projects are characterised by four features: a group of people, a goal, limited time and money, and a certain level of uncertainty regarding whether the goals will be achieved. Project managers are involved with all of these aspects. Supervising and directing a project is thus anything but an easy task.” [1]

The aim of this study unit is to train learners in all the processes involved in proposing and undertaking an extended investigative project in the environmental sustainability sector. The learners should be able to conduct a literature review, compile a proposal, identify, plan, carry out an investigative project, and evaluate and present the results of the project.

Learners should carry out the investigative project within an organisation, be it a local authority, a charity or voluntary organisation, an industry organisation, or a local community group. The project can be carried out over a single stretch of a few weeks, or else during weekends or recess periods. The project will help the learners to develop project management and communication skills by investigating a topic of their choice.

It is suggested that the learners explore three topic areas that interest them and are relevant to their field of study. Subsequently, and following supervisors’ advices, they should reduce these to one are of study that form the basis of their investigative project. Learners will develop this skill of taking responsibility of their own learning by choosing independently their own research problem to be solved. They should produce a breakdown of resources and a project action plan including intermediate deadlines.

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[1] [http://www.projectmanagement-training.net/download/book\\_project\\_management.pdf](http://www.projectmanagement-training.net/download/book_project_management.pdf)

## Learning Outcomes

On completion of this unit the learner will be able to:

1. *Conduct a literature review related to environmental sustainability.*
2. *Write a proposal for an investigative project in the environmental sustainability sector.*
3. *Design and produce a detailed plan for an investigative project in the environmental sustainability sector.*
4. *Construct an investigative project in the environmental sustainability sector and monitor all the phases involved.*
5. *Review and evaluate an investigative project in the environmental sustainability sector.*
6. *Perform an impact assessment for a project in the environmental sustainability sector.*

## Understanding Water Quality

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

A good standard of water quality is essential for every living thing on our planet to survive. Water pollution can have devastating effects on aquatic life and humans. Recording, monitoring and controlling water quality is vital to ensuring standards are maintained.

This unit aims to equip learners with the skills and knowledge associated with water quality analysis. Learners will gain an understanding of the factors that impact on water quality including human activity. Physical, biological and chemical factors will be investigated and a thorough understanding of their influence on water quality will be gained. The principles of water treatment will be covered to ensure learners have an understanding of the processes involved and the management of water quality in a work based setting.

Scientific techniques will be experienced by learners to allow them to confidently progress into industry. Skills including recording results, interpreting data and drawing conclusions from analytical data will be practiced.

### Learning Outcomes

On completion of this unit the learner will be able to:

1. *Describe factors that impact on water quality.*
2. *Measure basic water quality factors.*
3. *Record and interpret water quality data.*
4. *Explain the principles of water treatment.*

## Pollution Control and Management

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

This unit enables learners to gain an understanding of air, noise, land and water pollution control and management. Moreover, the unit extends the learners' comprehension of the environmental impacts of pollution. Learners will also investigate the practical application of pollution control and management.

The natural environment is threatened by a wide range of anthropogenic activities, including emissions of contaminants and waste generation. In order to protect the environmental health, it is necessary that emissions to the environment are controlled. In instances where contamination has already taken place, it may be fundamental to remediate the contaminated sites. This unit focuses on the nature and sources of different pollution types and how they affect the natural systems, and how effective environmental management can control and mitigate the impacts of pollution.

This unit introduces the learner to pollution and how it affects the natural environment and systems. The key types of pollution in the Maltese Islands are then investigated. Using a specific fieldwork investigation, the learners will assess the impact of pollution on the environment. The learners will be exposed to the relevant current legislation in the Maltese Islands and will develop an understanding of the roles that national agencies play in the control and management of pollution.

### Learning Outcomes

**On completion of this unit the learner will be able to:**

- 1. Define pollution and describe the natural environment and systems that are affected by pollution.*
- 2. Identify the causes and effects of key types of environmental pollution in the Maltese Islands.*
- 3. Assess the impact of a local marine activity or a coastal developmental site on the environment.*
- 4. Discuss current legislation related to pollution.*

## Scientific Practical Techniques

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

This is a skills based unit that will allow learners to demonstrate that they have the required skills needed to carry out a variety of analytical techniques that are commonly used on a daily basis in the laboratory. Learners will be able to carry out both quantitative and qualitative techniques and become familiar with the most common analytical techniques used in the laboratory.

This unit is relevant to learners who wish to become familiar with analytical techniques used to separate and assess the purity of substances. These include sampling methods for solids, liquids and gases; separation techniques used on mixtures and solutions and the common methods used for the estimation of purity of a sample. Learners will become familiar with quantitative analytical techniques that are used for routine analysis in the laboratory together with qualitative techniques for the identification of cations and anions in solids and solutions.

The learner will be provided with the ability to be able to use a variety of instruments in order to determine a number of physical and chemical properties of substance. This unit will enable the learners to understand both the theory and application of analytical techniques. It will require the learner to actively participate and undertake experiments in the laboratory.

Finally, the learners should be able to apply the knowledge and understanding acquired during the unit to follow written procedures, plan and carry out laboratory experiments; followed by reporting of the data obtained in the experiments.

### Learning Outcomes

**On completion of this unit the learner will be able to:**

1. *Describe a variety of scientific techniques to separate and determine the purity of substances.*
2. *Apply quantitative and qualitative analytical techniques.*
3. *Use a variety of instruments that are commonly used to determine the chemical composition and physical properties of substances.*
4. *Perform experiments to identify and determine quantity or purity of a substance.*

## Sustainable Construction

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

The aim of this unit is to enable learners to understand the impact of building construction activities on natural environment. Learners will find out about how the natural environment can be protected against these activities using the sustainable construction techniques.

The construction industry poses a major potential pollution threat to our environment and this unit will provide a fundamental understanding of how the activities of the construction sector impact on the natural environment. The techniques, processes and procedures used to protect the natural environment are investigated and the advantages of adopting a sustainable approach to construction work are explored in the contexts of energy, materials and waste.

### Learning Outcomes

**On completion of this unit the learner will be able to:**

- 1. Identify the important features of the natural environment that need to be protected.*
- 2. Explain how the activities of the construction and built environment sector impact on the natural environment.*
- 3. Explain how the natural environment can be protected against the activities of the construction and built environment sector.*
- 4. Describe sustainable construction techniques that are fit for purpose.*

## Geology of Natural Resources

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

The aim of this unit is to explore the nature of rock, mineral and hydrocarbon resources. They will learn the formation of natural resources, their exploration and extraction as well as the environmental impact to these activities. Oil, metal ores and minerals are the essential part of our economy. We depend on these resources. Geological resources have been formed beneath the Earth's surface over millions of years. They have been formed by igneous, sedimentary and metamorphic processes throughout geological time. Geologists are involved in studying the formation of natural resources, carrying out prospecting, exploration, extraction and processing of these resources. This unit examines how the environmental issues can be minimised during the resource exploitation.

### Learning Outcomes

**On completion of this unit the learner will be able to:**

1. *Explain how geological resources are formed under the Earth's surface by geological processes.*
2. *Identify minerals, rocks and the geological structures.*
3. *Explain the strength of geological materials.*
4. *Identify methods used to explore the geological resources and to investigate their impact on the environment.*



## Fish Biology and Behaviour

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

This unit is designed for centre based delivery, preparing learners for entry to the aquaculture, fisheries, or ornamental sector at an operative level, or progression to higher education.

Fish populations need to be managed effectively in order to satisfy a range of aims, whether found in capture based fisheries, fish farms or aquaria. Fish propagation and growth, whilst achieving high standards of animal welfare and safeguarding the environment, are applicable to all industry sectors. Equipped with an underpinning knowledge of fish biology, learners will appreciate how environmental conditions can influence fish behaviour and the importance of minimising fish stress in order to sustain fish health and productivity. By heightening their animal welfare and environmental awareness, learners will develop the necessary legal, moral and ethical responsibility to ensure that fish under their care are provided the correct conditions to thrive and exhibit normal behaviour.

Initially, learners will familiarise themselves with internal and external fish anatomy, relating the normal anatomical features of healthy fish to important physiological processes. Subsequently, an understanding of normal and abnormal fish behaviour will be developed through making observations and with reference to physiological processes which can influence behaviour and indicate the condition of their environment. Finally, the interrelationships between fish and their environment will be explored more comprehensively with reference to their feeding behaviour, nutritional requirements and metabolism.

Although Teleost fin fish of commercial significance to either aquaculture, fish capture or the ornamentals sector in the Mediterranean region provide the short list, the unit does allow learners the freedom to study specific fish species of personal interest in more depth.

## Learning Outcomes

**On completion of this unit the learner will be able to:**

1. *Describe the external and internal anatomy of specific fish species with reference to the visual signs of poor health.*
2. *Explain the functions of the major organs of specific fish species with reference to their physiological role.*
3. *Describe the normal and abnormal behaviour of specific fish species with reference to their tolerance limits.*
4. *Describe the feeding behaviour for specific fish species with reference to their metabolism.*

## Understanding Aquaculture Systems

**Unit level (MQF):** 4

**Credits:** 6

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### Unit Description

The aim of this unit is to introduce learners to the basic concepts of aquaculture including the most important principles, the various systems and to provide them with hands-on experience of how to apply such concepts in practice. It aims to provide knowledge on international aquaculture practices with specific emphasis to the local aquaculture sector.

The aquaculture industry has boomed in recent years and its importance is related to the production of food for human consumption, for ornamental purposes as well as to relief pressure from capture-based fisheries. The practice of farming of fish and other aquatic species has been going on for a very long time but industrial aquaculture is a relatively novel industry. Indeed, a lot of research is still being done in an attempt to achieve greater diversity in production, maximise production and to address the different concerns present amongst others. Such concerns include, but are not limited to the environmental impacts that aquaculture systems may pose and the need to ensure that practices are sustainable. It is thus of utmost importance that aquaculture systems and techniques are well-understood, designed and appropriate management skills are employed.

The first part of this unit looks at the fundamental principles of aquaculture and the different types of aquaculture systems present. General information and an overview of the global aquaculture industries, species cultured and the different systems will be discussed. It will also tackle on-going research on aquaculture as well as the understanding of aquaculture coming from capture-based fisheries.

The second part of the unit will look into the environmental implications of aquaculture systems as well as the new technologies and management strategies that are being introduced to improve the situation. It will also deal with the planning and designing aquaculture systems. Learners will be familiarized with the requirements of specific production units such as nurseries, hatcheries and offshore cages and culture methods for the different species. Pest control methods including treatments and methods of administration will also be discussed.

## Learning Outcomes

**On completion of this unit the learner will be able to:**

- 1. Understand basic concepts of aquaculture and cultured species.*
- 2. Explain the importance of aquaculture research and Capture fisheries aquaculture.*
- 3. Identify control methods and environmental impacts related to aquaculture.*
- 4. Plan and design aquaculture production units and understand management operations.*