Unit 43: Understanding Organism Identification

Unit code: A/600/9194

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to introduce learners to the skills and knowledge in identification of organisms and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

Unit introduction

Learners involved in countryside management and conservation will benefit from being able to identify to species level, for surveying, habitat management, interpretation and guided walks.

The unit introduces learners to the history and development of classification and explores, compares and evaluates the commonly used classification systems. Learners will gain an understanding of the hierarchy taxonomy system and be able to explain its use and relevance for particular organisms. They will become familiar with the main scientific names and formats used in classification and the reasons for their use.

The five kingdoms system is commonly used and will be explored together with the identifying features used to classify organisms within the different kingdoms and sub-divisions of the system.

Learners will develop the ability to use and compare a range of classification keys, using real examples, and to develop and evaluate their own keys.

Learning outcomes

On completion of this unit a learner should:

1   Understand the principles underpinning classification and taxonomy

2   Understand the importance of classification

3   Know the identifying features of the five kingdoms

4   Be able to use classification skills.

Unit content

1 Understand the principles underpinning classification and taxonomy

Significant points in the development of classification: key figures eg Aristotle, Linneaus, Darwin; key findings

Forms of classification: five kingdom model; domain model (prokaryota, eukaryota)

Comparison of different classification methods: homology of physical features eg limbs, organs; embryology; phylogenetics; cladistics

Taxonomy: hierarchy kingdom (phylum/division, class, order, family, genus, species); reasons for use; layout of taxonomic list

2 Understand the importance of classification

Principles of classification: international framework for communication of species (common identification of organisms, variety of taxonomy forms creates confusion, informing scientists and public, language rules); species relationships (between similar and dissimilar organisms); biodiversity (easier identification against vast range of organisms); conflict in classification methodology; reasons for use of scientific nomenclature (common language and identification of organisms, identification of species relationships; differentiation of binomial name from rest of written medium)

3 Know the identifying features of the five kingdoms

Monera: cellular features single celled, prokaryotic; exemplar organism

Protista: cellular features often single celled, eukaryotic; exemplar organism

Fungi: cellular features eukaryotic, non-cellulose cell wall; main identifying features of Zygomycota, Ascomycota and Basidiomycota; exemplar organism

Plantae: cellular features eukaryotic, photosynthetic, cellulose cell wall; main identifying features of Bryophyta eg mosses and liverworts, Filicinophyta eg ferns, Gymneophyta eg conifers and Angiospermophyta including monocotyledons and dicotyledons eg flowering plants; exemplar organism

Animalia: cellular features eukaryotic, non-photosynthetic, no cell wall, aggregate into colonial or tissue level of organisation; main identifying features of Cnidaria, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda, Echinodermata and Chordata Pisces, Reptilia, Amphibia, Aves, Mammalia; exemplar organism

4 Be able to use classification skills

Types of keys: dichotomous keys; random-access keys (multi-access keys); pictoral keys

Use of keys: appropriate key selection; mode of operation; advantages and disadvantages of keys; dichotomous key construction; combination of keys to ensure correct identification of species

Use of scientific nomenclature: formatting rules (binomial names in italics for print and underlined for handwritten notes, binomial names having the initial letter of the genus capitalised but the species name lower case, use of the initial of the genus only in subsequent use of the binomial name and when another species of the same genus is introduced, capitalisation of the initial letter for kingdom, class, order, family and genus, but not species when written in scientific form)

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:
P1 explain the principles that underpin classification and taxonomy	**M1** explain why hierarchical taxonomy is used to exhibit organism classification	**D1** evaluate the different methods used to classify organisms
P2 compare methods used to classify organisms [IE]		
P3 explain the need for the classification of organisms	**M2** discuss the effect of conflict in scientific classification methods	
P4 discuss reasons for the development of scientific nomenclature		
P5 describe identifying features for the five kingdoms	**M3** explain the advantages and disadvantages of the five kingdoms system	
P6 describe, where appropriate, significant taxa within the five kingdoms [IE]		
P7 select identification keys for given organisms [IE]	**M4** explain the use of selected keys	**D2** justify the choice of particular keys for a given situation
P8 use identification keys to the level of species from each significant taxon		
P9 develop dichotomous keys [CT, IE, RL]		

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

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Tutors delivering this unit have opportunities to use as wide a range of techniques as possible. Lectures, discussions, seminar presentations, site visits, supervised identification practicals, internet and/or library-based research and the use of personal and/or industrial experience would all be suitable.

If used to support delivery of this unit, work placements should be monitored regularly in order to ensure the quality of the learning experience. It would be beneficial if learners and supervisors were made aware of the requirements of this unit before any work-related activities are undertaken so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to use capture methods or make in situ observations and they should ask for observation records and/or witness statements to be provided as evidence of this. Guidance on the use of observation records and witness statements is provided on the Edexcel website.

Whichever delivery methods are used, it is essential that tutors stress the importance of animal welfare when using live animals for identification work.

Health and safety issues relating to the use of live or preserved material must be stressed and reinforced regularly, and risk assessments must be undertaken before any practical activities.

Tutors should consider integrating the delivery, private study and assessment for this unit with other relevant units and assessment instruments learners are taking as part of their programme of study.

Delivery of learning outcomes 1 and 2 is likely to be predominantly classroom and research based, providing learners with an understanding of the reasons behind and development of classification systems. Delivery will be most effective if learners have the opportunity to try out different methods used to classify organisms, using live or preserved materials. A guest speaker, such as a field biologist, may add relevance and interest.

Delivery of learning outcomes 3 and 4 needs to ensure that learners have sufficient opportunity to practise using identification key and to learn the identifying features of the five kingdoms. Delivery is likely to include a mix of formal classroom input, practical sessions and independent learner research.

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 gives **an indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value**.

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Introduction and overview of the unit.
Assignment 1: Background to Classification (P1, P2, P3, P4, M1, M2, D1)
Tutor introduces the assignment brief.
History of classification, and the need for the classification of organisms.

Topic and suggested assignments/activities and/assessment
Explain why hierarchical taxonomy is used, with examples.
Reasons for the development of scientific nomenclature: use examples of the same animal having different names to illustrate this.
Demonstrate how and why conflict in classification occurs – use examples.
Different methods used for classification.
Assignment 2: The Five Kingdoms (P5, P6, M3)
Tutor introduces the assignment brief.
The five kingdom system, identifying the features of each kingdom.
Features of the significant taxa in each kingdom.
Assignment 3: Practical Classification of Organisms (P7, P8, P9, M4, D2)
Tutor introduces the assignment brief.
Types of keys: dichotomous keys; random-access keys (multi-access keys); pictoral keys.
Use a range of keys to identify organisms, justify choice of keys.
Evaluate the use of identifying features.
Develop their own dichotomous keys and evaluate their use.
Unit review.

Assessment

For P1, they must explain the principles that underpin classification and taxonomy. Learners are expected to cover the range of methods listed in the unit content. This will include descriptions of the key findings of the highlighted philosophers and naturalists, the methods used to group species together and a description of hierarchy (but not an explanation of why hierarchy is used). Evidence could take the form of a pictorial presentation, a timeline with notes (possibly using appropriate software or an overhead projector), an annotated poster or a project. Alternatively, it could be linked to assessment for P2 and P3.

P2 requires learners to compare methods used to classify organisms. They should explain the main differences between the methods listed in the unit content. This could be linked to the assessment of P1 and P3.

P3 requires learners to explain the need for the classification of organisms. This could be covered by written work and closely linked to P1. Learners should describe the role of classification in providing a framework for communicating species information to other scientists and the general public. P3 also requires learners to cover the importance of highlighting relationships and the biodiversity of species and the language rules used to allow communication of information around the world.

P4 requires learners to discuss reasons for the development of scientific nomenclature. They must explain why this particular form of language has been developed, particularly with its formatting rules. This could be linked to assessment for P1, P2 and P3.

P5 requires learners to describe identifying features for the five kingdoms. They should describe identifying features for the different kingdoms at a cellular level. As a minimum, learners should provide evidence covering three identifying features, where possible, for each kingdom.

P6 requires learners to describe, where appropriate, significant taxa within the five kingdoms. Learners should then cover the main identifying features at division level for Fungi and Plantae and to phylum level for Animalia, with the exception of Chordata, which should be taken to class level. The number of different features has not been set as it will vary depending on the taxon. This could be linked to assessment for P5.

P7 requires learners to select identification keys for given organisms. Tutors should identify the organisms or agree them through discussion with learners. As a minimum, learners should provide evidence covering one organism from each taxon. Learners should cover pictorial, random or multi-access and dichotomous keys. This could be covered by a written report or learner presentation. P7 would benefit from being part of a larger assignment which could be linked to P8.

P8 requires learners to use identification keys to the level of species from each significant taxon. Tutors should identify the species or agree them through discussion with learners. This could be assessed through learners annotating hand drawings or photographs of species provided by the tutor. Alternatively, learners could produce annotated drawings or photographs of live or preserved organisms.

P9 requires learners to develop dichotomous keys. Learners need to develop a minimum of two keys covering a minimum of two kingdoms.

M1 requires learners to explain why hierarchical taxonomy is used to exhibit organism classification. This allows for an extension from P1 and allows learners to expand on the understanding shown from describing the principles of classification. Learners should indicate hierarchical taxonomy groups species in terms of ever-increasing similarities. They should also comment on the typical layout of a taxonomic list. This can be in the form of written work or pictorial representation as suggested for P1.

M2 requires learners to discuss the effect of conflict in the scientific classification of organisms. Learners could comment on the range of taxonomic tables available, depending on when a textbook was published, or the various genus names an organism may have had since it was first named (for example the harbour ragworm has variously been called Nereis diversicolor and Neanthes diversicolor). Evidence could be an extension of work provided for P3 and P4.

M3 requires learners to explain the advantages and disadvantages of the five kingdoms system. This could be linked to assessment for P5 and P6.

M4 requires learners to explain the use of selected keys. These are likely

to be those used in P7. Learners should cover their mode of operation and inherent advantages and disadvantages. Learners should also indicate the benefits of using more than one method for identifying organisms. This could be linked to assessment for P7 and P8.

D1 requires learners to evaluate the different methods used to classify organisms. Learners must cover the advantages and disadvantages of homologous physical features, embryological similarities and the use of phylogenetics and propose, with reasons, which method they would use to taxonomically group the unit content. This could be linked to assessment for M1, M2 and M3.

For D2 learners are required to justify the choice of particular keys for a given situation. Learners need to justify the use of keys for two different situations from different kingdoms in the five kingdom system. Learners need to justify why they chose the keys they used and why they did not use other available keys. This could be linked to assessment for M4.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the 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, P3, P4, M1, M2, D1	Background to Classification	You have been asked to write an article for a wildlife magazine aimed at the general public. The editor asks you to cover the history of classification, the need for the classification of organisms, reasons for the development of scientific nomenclature, why hierarchical taxonomy is used with examples, and to demonstrate how and why conflict in classification occurs with examples. Include a comparison and evaluation of the different classification methods used.	Written article.
P5, P6, M3	The Five Kingdoms	The editor was pleased with your article and has asked you to do a follow-up piece on the five kingdom system. Include an explanation of the five kingdom system and the significant taxa, and describe at least three main identifying features at cellular level for each kingdom. In your article cover the main identifying features at division level for Fungi and Plantae and to phylum level for Animalia, with the exception of Chordata, which should be taken to class level. Explain the advantages and disadvantages of the five kingdom system.	Written article.
P7, P8, P9 M4, D2	Practical Classification of Organisms	As a newly qualified field biologist you have been asked to prepare and use keys to identify a range of organisms. Use at least one each of dichotomous keys; random-access keys (multi-access keys); pictorial keys to identify the specified organisms to species level, and explain the use of each key. Develop your own dichotomous key for species of your own choice. Select keys for a specified situation, clearly justifying why you have chosen each key.	Demonstrate use of keys and written explanation.

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

This unit forms part of the BTEC land-based sector suite. This unit has particular links with:

Level 2	Level 3
Undertaking Ecological Surveys and Techniques	Understanding Principles of Physical and Biological Environmental Processes

Essential resources

Learners will need access to a range of identification keys. Whilst printed media may be used for identification purposes, it is highly recommended, and preferred, that a collection of live or preserved organisms (covering the range of taxa indicated in the unit content) is made available to learners.

It is also highly recommended that learners have access to stereo and compound microscopes and hand lenses and to a range of habitat types for in-the-field identification opportunities.

Employer engagement and vocational contexts

It is recommended that every opportunity is taken to carry out practical work using real specimens in a vocational context. This will give learners the opportunity to visit employer estates and involve employers in delivery of the unit.

Indicative reading for learners

Textbooks

Barnes R, Calow P, Olive P, Golding D and Spicer J – *The Invertebrates: A Synthesis, Third Edition* (Blackwell Publishers, 2001) ISBN 0632047615

Buczacki S and Shields C – *Collins Fungi Guide: The Most Complete Field Guide to the Mushrooms and Toadstools of Britain and Europe* (HarperCollins Publishers, 2006) ISBN 0007242905

Burton J – *Field Guide to the Mammals of Britain and Europe* (Kingfisher Books, 1991) ISBN 0862726921

Campbell N and Reece J – *Biology* (Pearson Higher Education, 2005) ISBN 140581800X

Cullen J – *The Identification of Flowering Plant Families, Fourth Edition* (Cambridge University Press, 1997) ISBN 0521585503

Eppinger M – *Field Guide to Trees and Shrubs of Britain and Europe* (New Holland Publishers, 2006) ISBN 1845374754

Fish J and Fish S – *A Student's Guide to the Seashore, Second Edition* (Cambridge University Press, 1996) ISBN 0521468191

Fitter R, Fitter A and Blamey M – *The Wild Flowers of Britain and Northern Europe, Fifth Edition* (HarperCollins Publishers, 1996) ISBN 0002200627

Flegg J – *Jim Flegg's Field Guide to the Birds of Britain and Europe* (Cornell University Press, 1993) ISBN 0801425050

Gibson R, Hextall B and Rogers A – *Photographic Guide to the Sea and Shore Life of Britain and North-West Europe* (Oxford University Press, 2001) ISBN 0198507097

Hume R – *RSPB Birds of Britain and Europe, Second Edition* (Dorling Kindersley Publishers, 2006) ISBN 1405307536

Leadlay E and Jury S – *Taxonomy and Plant Conservation* (Cambridge University Press, 2006) ISBN 0521607205

Rose F and O'Reilly C – *The Wild Flower Key: How to Identify Wild Plants, Trees and Shrubs in Britain and Ireland* (Frederick Warne, 2006) ISBN 0723251754

Taylor D, Green N and Stout G – *Biological Science 1 and 2, Third Edition* (Cambridge University Press, 1997) ISBN 0521561787

Tilling S – *A Key to the Major Groups of British Terrestrial Invertebrates* (Field Studies Council, 1987) ISBN 1851531882

Websites

www.bbc.co.uk   BBC

anthro.palomar.edu/animal/animal_1.htm   classification of living things

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are …
Independent enquirers	researching the history and background to classification
Creative thinkers	creating their own keys
Reflective learners	evaluating the use of their own keys.

Although PLTS opportunities 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 …
Team workers	identifying organisms together
Effective participators	identifying organisms together
Self-managers	producing assignments.

Functional Skills – Level 2

Skill	When learners are …
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	designing their own keys
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	
Manage information storage to enable efficient retrieval	
Follow and understand the need for safety and security practices	
Troubleshoot	
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	researching the background and history of classification
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	
Bring together information to suit content and purpose	
Present information in ways that are fit for purpose and audience	presenting assignments
Evaluate the selection and use of ICT tools and facilities used to present information	
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	

Skill	When learners are ...
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	researching the background and history of classification
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	writing assignments