Access to Higher Education Diploma (Engineering and Physical Science)

Rules of Combination

For the award of the Access to Higher education Diploma, learners must achieve 60 credits	
Level 3 credits from graded units with academic subject content	45
Level 2 or 3 credits from ungraded units	15
Total credit required	60

Mandatory requirements – graded units – 45 credits

Learners must achieve the following graded units - 45 Credits	
Units	**L3 Graded credits**
Advanced Mathematics	15
Physics	9
Engineering	9
Units from the project module	6
Units from any other module	6

Mandatory requirements – ungraded units – 15 credits

	Learners must achieve the following ungraded units – 15 credits	
Units	**L3 ungraded credits**	**Level 2 credits**
Academic Skills	3	
Pure Mathematics: Equations, Geometry, Trigonometry and Calculus	3	
Matrices, Vectors and Logs	3	
Algebra and Graphs for Engineering		3
A unit from the Study Skills module	3	

Other requirements
Learners must complete at least two time constrained assessments, one of which must be closed book and unseen.

Units

Advanced Mathematics

Trigonometry

Level: Three
Credit Value: 3

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to apply the three trigonometric functions and their inverses.	**1.1** Use the three trigonometric functions for any angles in radians/degrees. **1.2** Apply to problems in two dimensions involving the use of right-angled triangles. **1.3** Apply to problems using the sine and cosine rules.
2. Be able to compute and use the surd form of the sin, cos and tan of certain angles.	**2.1** Derive the surd form for the sin, cos and tan of 30 degrees, 45 degrees and 60 degrees. **2.2** Use these to compute the sin, cos and tan of linear combinations of these angles.
3. Be able to investigate the graphs of the three basic trigonometric functions.	**3.1** Use graphs to interpret, symmetries and periodicities of the functions sin x, cos x and tan x. **3.2** Interpret the effect of simple transformations.

Access to HE Grade Descriptors:

- 2 - Application of Knowledge
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC3.2 Such as y=3 sin x and y=3 sin 2x.

Solutions should be given to a stated level of accuracy in terms of decimal places or significant figures.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Concept, Rules and Simple Applications of Differentiation and Calculus

Level: Three
Credit Value: 3

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the concept of differentiation and find derivatives from first principles.	**1.1** Find simple limits. **1.2** Identify the derivative as a limit. **1.3** Differentiate simple algebraic functions.
2. Be able to differentiate functions using standard rules.	**2.1** Differentiate the functions ax, sinx, cosx, tanx, lnx and e using standard rules. **2.2** Differentiate products, quotients and function of a function using standard rules. **2.3** Determine the second derivative.
3. Be able to use the derivative as a measure of rate of change to solve problems	**3.1** Determine rates of change.

Learning Outcomes The learner will	Assessment Criteria The learner can
	3.2 Solve problems involving displacement, velocity and acceleration. **3.3** Calculate maximum and minimum values.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Concept, Rules and Simple Applications of Integration and Calculus

Level: Three
Credit Value: 3

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the concept of integration.	**1.1** Identify area as the limit of the sum of rectangles.

Learning Outcomes The learner will	Assessment Criteria The learner can
2. Be able to integrate simple functions.	**1.2** Show that integration is the reverse of differentiation. **2.1** Integrate standard functions ax^n, sin x, cos x, e^x and ln x. **2.2** Evaluate definite integrals. **2.3** Use trapezoidal and Simpson's rules to evaluate definite integrals.
3. Be able to use integration to find areas and to solve simple differential equations.	**3.1** Calculate the area under a curve. **3.2** Solve problems involving displacement, velocity and acceleration. **3.3** Solve simple problems in science and engineering that require a determination of a rate of change. Find a rate of change when solving simple problems in science and engineering

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC3.2 A minimum of two problems.
AC3.3 A minimum of two problems.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Pure Mathematics, Equations, Geometry, Trigonometry

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand how to manipulate algebra and solve equations, to use coordinate geometry, to solve problems using trigonometry, and to use basic calculus.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to manipulate algebra and solve equations. (N3.2)	**1.1** Manipulate algebraic expressions. **1.2** Solve linear, quadratic and simultaneous equations.
2. Understand how to use co-ordinate geometry. (N.3, N4.2)	**2.1** Calculate gradients of a line, including parallel and perpendicular lines. **2.2** Determine equations of straight lines. **2.3** Calculate the distance between two points. **2.4** Find the midpoint of a line.
3. Be able to solve problems using trigonometry. (N3.2)	**3.1** Derrive sine, cosine and tangent of any angle. **3.2** Apply trigonometry to right-angled triangles. **3.3** Use sine and cosine rules to solve problems.
4. Understand how to use basic calculus. (N3.2, N4.2)	**4.1** Perform basic differentiation. **4.2** Apply calculus to gradients, tangents and normals. **4.3** Calculate maxima and minima. **4.4** Calculate definitive integrals and areas. **4.5** Use the trapezium rule.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Methods:

Assessment Information:

There is no specific assessment information to be used with this unit.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Algebraic Techniques for Forming and Solving Equations

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand how to use analytical and graphical methods to solve quadratic and simultaneous equations; to be able to find the solutions to problems through use of equations; and to be able to express proper and improper algebraic fractions as partial fractions.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to use analytical and graphical methods to solve quadratic equations and simultaneous equations.	**1.1** Solve quadratic equations by factorisation and by the recognised formula. **1.2** Solve quadratic equations by completing the square. **1.3** Solve simultaneous linear equations analytically and graphically. **1.4** Solve simultaneous equations, one linear and one quadratic, by analysis and graphically.
2. Be able to find solutions to everyday and engineering problems through the use of algebraic equations.	**2.1** Form equations from everyday engineering situations. **2.2** Solve the equations and determine logical answers to the problem.
3. Be able to express proper and improper algebraic fractions as partial fractions.	**3.1** Give examples of algebraic improper fractions and convert to mixed fractions. **3.2** Convert proper fractions containing linear factors, quadratic factors and repeated factors to partial fractions.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

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Assessment Information:

AC 3.1 A minimum of four.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Using Graphs

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand how to represent data graphically, to be able to analyse graphs, to be able to describe graphical methods of solving problems, and to be able to recognise and use transformations.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand how to represent data graphically.	**1.1** Choose suitable scales and plot points from a table or list of coordinates. **1.2** Obtain coordinates from an algebraic equation. **1.3** Draw graphs of simple algebraic relationships, including: straight lines polynomials (order up to at least 3) circles conic sections equations of the form $y = kx^n$ the exponential and log functions.

Learning Outcomes The learner will	Assessment Criteria The learner can
2. Be able to analyse straight line graphs.	**2.1** Describe the equation of a straight line in the form y = mx + c, defining m and c. **2.2** Obtain the equation of a straight line from the gradient and a point, or from two points. **2.3** Determine the angle between two intersecting straight lines. **2.4** Solve problems involving the length, mid-point, gradient and division in a given ratio of a line joining two points.
3. Be able to interpret polynomial graphs.	**3.1** Describe the typical shapes of quadratic and cubic curves. **3.2** Draw tangents at different points on a curve and calculate their gradients. **3.3** Locate and explain stationary points. **3.4** Use graphs to solve simultaneous linear equations. **3.5** Use graphs to solve simultaneous linear and quadratic equations.
4. Understand the use of graphical methods to solve problems involving exponential and log functions.	**4.1** Reduce log equations and relationships to linear form and solve graphically. **4.2** Describe growth and decay relationships using the exponential function. **4.3** Solve growth and decay problems.
5. Be able to recognise and use transformations.	**5.1** State the effect of using the following transformations on y = f(x): y = af(x) y = f(x) + a y = f(x – a) y = f(ax)

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 3 - Application of Skills
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC2.4 A minimum of three problems.
AC3.2 A minimum of two different points.
AC4.3 A minimum of two problems.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Mathematics - Statistics

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand how to collect and interpret statistical data; to calculate measures of central tendency and dispersion; to investigate statistical correlation; and to be able to use probabilities to solve problems.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to collate and organise appropriate statistical data. (N3.1)	**1.1** Specify a simple hypothesis. **1.2** Design a questionnaire to collect the relevant data to test the hypothesis in 1.1. **1.3** Record and group data to produce a frequency table.
2. Be able to represent and interpret data in statistical diagrams, charts and graphs. (N3.1, N3.3, N4.2)	**2.1** Construct statistical diagrams to represent data and to compare frequency distributions. **2.2** Construct and interpret cumulative frequency curves.
3. Understand the calculation of measures of central tendency and dispersion, giving reasons for selecting different measures. (N3.2, N3.3, N4.2, N4.3)	**3.1** Calculate and interpret arithmetic mean, mode and median for different types of frequency distributions. **3.2** Explain selection of measure for particular distributions. **3.3** Estimate quartiles and percentiles from a cumulative frequency curve. **3.4** Calculate the inter-quartile range. **3.5** Find the range of a set of data. **3.6** Calculate standard deviation and variance from a set of data.
4. Be able to investigate statistical correlation. (N3.2, N3.3, N4.2, N4.3)	**4.1** Draw scatter diagrams using two variables. **4.2** Fit a straight line to each graph by eye. **4.3** Give examples of scatter diagrams with positive, negative and no correlation. **4.4** Use the regression formula to fit a line and compare with 4.2. **4.5** Explain limitations of the line. **4.6** Calculate Spearmanâ's rank correlation and interpret the result viz strong or weak, positive or negative correlation.
5. Understand and use probabilities to solve problems. (N2.2, N3.2, N3.3, N4.2, N4.3)	**5.1** Calculate the probability of an event occurring.

Learning Outcomes The learner will	Assessment Criteria The learner can
	5.2 Calculate the probability of a combined event occurring. **5.3** Draw a tree diagram or contingency table to illustrate the combined probabilities of several events. **5.4** Use Bayes' Theorem to solve problems.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC2.1 A minimum of three different types of statistical diagrams.
AC5.3 A minimum of three events.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Higher Skills in Mathematics – Differential Equations, Vectors and Calculus

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand aspects of differential equations and vectors related to engineering studies.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand and use differential equations.	**1.1** Solve differential equations of the form $\frac{dy}{dx} = f(x)$ with a given boundary condition. **1.2** Solve first order differential equations of the form $\frac{dQ}{dt} = KQ$ with a given boundary condition. **1.3** Solve differential equations by separation of variables in the form $\frac{dy}{dx} = f(x)\,g(y)$ **1.4** Apply differential equations to practical situations.
2. Be able to use vectors to model and solve practical problems.	**2.1** Express a position vector in the form $x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ and calculate the distance between two points. **2.2** Manipulate vectors: add and subtract vectors multiply and divide vectors by scalar quantities. **2.3** Calculate the modulus of a vector and use it to find the unit vector in a given direction. **2.4** Use vectors (including resolution) to solve practical problems.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Methods:

Unit Assessment Requirements are not prescribed. They remain as a **recommended** approach to assessment where they still reflect the unit specification.
From September 2021, centre devised assessments are permitted for all units on all Agored Cymru Access to HE Diplomas.
All assessment evidence completed As part Of an Agored Cymru Access To HE Diploma Is subject To external moderation.

Assessment Information:

There is no specific assessment information to be used with this unit.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Mathematics and Calculus

Level: Three
Credit Value: 3

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the arithmetic of integers, fractions, surds and real numbers.	**1.1** Distinguish between rational and irrational numbers. **1.2** Manipulate surds.

Learning Outcomes The learner will	Assessment Criteria The learner can
	1.3 Use the laws of indices to simplify algebraic expressions and evaluate numerical expressions.
2. Understand and use simple algebraic expressions.	**2.1** Expand brackets. **2.2** Factorise quadratics. **2.3** Solve quadratic equations by factors and formula. **2.4** Re-arrange algebraic formulae to change the subject of the expression.
3. Understand and use graphical methods.	**3.1** Use the equation y=mx+c for a straight line, demonstrating that m represents the gradient of the line and c represents the intercept. **3.2** Produce graphs for quadratic and cubic equations. **3.3** Demonstrate transformations of the curves produced in 3.2.
4. Understand and use graphical representations of quadratic equations.	**4.1** Use 'completing the square' to sketch graphs, finding the greatest and least values. **4.2** Find the roots of quadratic equations. **4.3** Solve simple linear and quadratic inequalities.
5. Be able to expand simple binomial expressions using the binomial formula.	**5.1** Expand $(1 + x)^n$ using binomial theorem. **5.2** Expand $(a + b)^n$ using binomial theorem.
6. Understand and use the process of simple differentiation.	**6.1** Differentiate simple expressions from first principles. **6.2** Find the gradient of lines and curves at a given point using differentiation. **6.3** Find the equations of tangents and normals using differentiation.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Methods:

Unit Assessment Requirements are not prescribed. They remain as a **recommended** approach to assessment where they still reflect the unit specification.
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Assessment Information:

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If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Physics

Physics: Waves and Vibrations

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the general properties of mechanical waves and electromagnetic waves; to be able to investigate the properties of sound in air.;

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the nature of waves.	**1.1** Explain how progressive waves are generated. **1.2** Classify waves into transverse or longitudinal and mechanical or electromagnetic. **1.3** Describe the main differences between mechanical waves and electromagnetic waves.

Learning Outcomes The learner will	Assessment Criteria The learner can
	1.4 Define the terms amplitude, wavelength and frequency using wave profile diagrams.
	1.5 Use the equation v=fλ to solve problems.
	2.1 Describe diffraction.
	2.2 Describe the principle of superposition and coherence.
2. Understand the properties of progressive waves.	**2.3** Investigate and describe the interference patterns observed in the Young's Double Slit and diffraction grating experiments.
	2.4 Solve problems relating to Young's Double Slit and diffraction grating.
	3.1 Distinguish between progressive and stationary waves.
	3.2 Describe how a stationary wave is formed and distinguish between nodes and antinodes.
3. Understand the properties of stationary waves.	**3.3** Solve problems related to stationary waves.
	3.4 Describe an experiment to determine the speed of sound in air using a stationary wave.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.5 A minimum of five problems.
AC2.4 A minimum of two problems.
AC3.3 A minimum of two problems.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Energy and Energy Transfer

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the concepts of work energy transfer, heat energy and heat transfer, that energy exists in different forms, heat loss from buildings, and the concept of electrical energy. To understand the effect of nuclear energy changes.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the concept of Work and Energy Transfer.	**1.1** Explain the need to transfer energy in order to exert a force.
2. Appreciate that energy exists in different forms.	**2.1** . Explain the energy transfers which occur in given situations **2.2** Calculate energy changes during free fall.
3. Understand the concept of heat energy and heat transfer.	**3.1** Distinguish between heat energy and temperature. **3.2** Use the concepts of specific heat capacity and specific latent heat to solve problems associated with heat transfer. **3.3** Explain the mechanisms involved in the processes of heat transfer.
4. Understand the concept of electrical energy.	**4.1** Describe how the movement of electrons produces a current in terms of kinetic energy and drift velocity
5. Understand the effect of nuclear energy changes.	**5.1** Explain the need to postulate the existence of the nuclear strong force and identify its purpose

Learning Outcomes The learner will	Assessment Criteria The learner can
6. Understand heat loss from buildings.	**5.2** Distinguish between the different types of nuclear radiation and their nature. **5.3** Use quantities such as activity and half life in calculations. **5.4** Use the Einstein relationship between energy and mass to calculate energy changes in nuclear reactions. **6.1** Explain the main sources of heat loss from buildings. **6.2** Calculate the benefits in energy and financial terms, of various forms of heat insulation.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Methods:

Unit Assessment Requirements are not prescribed. They remain as a **recommended** approach to assessment where they still reflect the unit specification. From September 2021, centre devised assessments are permitted for all units on all Agored Cymru Access to HE Diplomas.
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Assessment Information:

AC 2.1 e.g. during a pole vault.At least two examples

AC 3.3 to include convection, conduction and radiation.

AC 5.2 To include alpha, beta and gamma decay. (Particulate and EM radiation)
AC 6.2 To include roof insulation, cavity wall insulation and double-glazing.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Current Electricity

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand current electricity, its terms and laws.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand a range of electrical terms.	**1.1** Define and explain the following electrical terms: electric charge electric current electric potential difference. electric resistance
	1.2 Define and explain in terms of energy, potential difference and the electromotive force.
	1.3 Describe the mechanism of electrical conduction in metals.
	1.4 Derive and use the drift velocity equation.
2. Understand Ohmâ€™sS Law and be able to calculate the resistance of an electrical conductor and its variation with temperature.	**2.1** Carry out experiments which investigate I-V characteristics of a metallic conductor, filament

Learning Outcomes The learner will	Assessment Criteria The learner can
	bulb and semi-conductor diode/LED.
	2.2 Carry out an experiment to investigate the variation of resistance with temperature.
	2.3 Experimentally determine the temperature coefficient of resistance.
	2.4 Recall and use P=IV and W=IVt.
3. Understand the band theory model of electrical conduction for different materials.	**3.1** Describe the band theory model of solids.
	3.2 Describe the terms valence band, conduction band and forbidden band.
	3.3 Use band theory to explain the temperature dependence of resistance of materials and semi-conductors.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 – Application of Knowledge
- 3 - Application of Skills
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

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Assessment Information:

2.4 on at least two occasions

3.1 For example: conductors and insulators

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Electromagnetism and Capacitance

Level: Three
Credit Value: 3

Purpose and Aim

To prepare learners for Higher Education qualifications in the physical sciences. This unit introduces the underlying principles of electromagnetism and capacitance.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the effect of a static magnetic field on a conductor.	**1.1** Illustrate the magnetic field patterns around magnets and current-carrying conductors. **1.2** Define magnetic flux density, B. **1.3** Describe factors influencing the value of flux density, B. **1.4** Investigate the force exerted on a current-carrying conductor in a magnetic field. **1.5** Explain the left hand rule.
2. Understand the effect of a varying magnetic field on a conductor.	**2.1** Explain Faraday's Law of Electromagnetic Induction. **2.2** Explain Lenz's Law. **2.3** Use the two laws to solve problems on induced emfs. **2.4** Describe the principles of the transformer. **2.5** Explain the operation of a step-up and step-down transformer.
3. Understand the concept of capacitance and the factors affecting it.	**3.1** Define capacitance and the Farad.

Learning Outcomes The learner will	Assessment Criteria The learner can
	3.2 Review factors affecting capacitance of a parallel plate capacitor. **3.3** Derive an expression for the energy stored in a capacitor in terms of the potential difference across the plates and the charge stored. **3.4** Solve problems related to capacitance. **3.5** Experimentally determine the time constant of a capacitor discharging through a resistor.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.1 A minimum of three magnetic field patterns
AC2.3 A minimum of three problems
AC3.4 A minimum of five problems. Questions should use the equations addressed in 3.1, 3.2 and 3.3.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

D.C. Circuits

Level: Three
Credit Value: 3

Purpose and Aim

To prepare learners for Higher Education qualifications in the physical sciences. The unit develops learners' ability to apply Ohmâ's law and solve problems relating to practical circuits.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand internal resistance and relate terminal potential difference to electromotive force and the current flowing in a circuit.	**1.1** Define internal resistance and illustrate sources that have it. **1.2** Calculate potential difference across the terminals of a source when it is driving current round a complete circuit. **1.3** Calculate potential difference across the terminals of a source when a current is driven through a source against its electromotive force.
2. Understand resistivity and conductivity.	**2.1** State an expression for resistance of a material in terms of its length, area and resistivity and review factors affecting the resistance of a material. **2.2** Experimentally determine the resistivity of a resistance wires. **2.3** Solve problems relating to resistivity for conductors and insulators.
3. Understand the behaviour of simple branched circuits with ohmic components.	**3.1** Investigate simple DC circuits with resistors connected in series or in parallel. **3.2** Calculate voltage, current and resistance in simple DC circuits with resistors connected in series or in parallel. **3.3** Describe a practical use of a potential divider within circuits.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills

- 5 – Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

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Assessment Information:

AC1.3 A minimum of three problems.
AC2.2 A minimum of three tests/experiments.
AC2.3 A minimum of three problems.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Vectors and Kinematics

Level: Three
Credit Value: 3

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to distinguish between SI and derived Quantities.	**1.1** Name Basic Quantities. **1.2** Name Derived Quantities. **1.3** State the relationship between Derived and SI Quantities.
2. Be able to identify and add vector quantities.	**2.1** Describe a vector quantity and give examples. **2.2** Add vectors using scaled drawings. **2.3** Add vectors using properties of right angled triangles.

Learning Outcomes The learner will	Assessment Criteria The learner can
3. Understand the principles of rectilinear motion of moving objects.	**3.1** Using appropriate units, define the terms: a) Displacement b) Speed c) Velocity d) Acceleration. **3.2** Describe rectilinear motion with examples.
4. Be able to derive and use equations of uniformly accelerated motion in a straight line.	**4.1** Illustrate the variation of displacement and speed with respect to time and solve problems involving gradient and areas of x – t and v – t graphs.
5. Be able to analyse and solve problems involving motion due to a uniform velocity in one direction and uniform acceleration in a perpendicular direction.	**5.1** Describe motion of bodies in uniform gravitational fields. **5.2** Select and apply equations in kinematics.

Access to HE Grade Descriptors:

- 2 - Application of Knowledge
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC 1.1 The six fundamental SI quantities

AC 1.2 include a range. E.g. force, energy, velocity, acceleration, pressure, volume etc.

AC 5.2 To falling objects, projectile motion, motion under gravity.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Radioactivity

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the properties of the atom and isotopes; to be able to observe radioactivity under safe laboratory conditions; to understand radioactivity decay, background radiation and the nature of disintegration.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the origins of chemical, electrical and nuclear properties of the atom.	**1.1** Describe the current model of an atom. **1.2** Identify and describe the constituent particles of an atom. **1.3** Explain which parts of the atom take part in chemical, electrical and nuclear properties.
2. Understand isotopes.	**2.1** Identify elements by proton number and chemical symbol. **2.2** Define the term isotope. **2.3** Use the standard notation for a range of isotopes . **2.4** Explain why some isotopes are radioactive.
3. Be able to observe radioactivity.	**3.1** Investigate absorbers of radiation. **3.2** Describe the nature of different forms of radiation. **3.3** Distinguish between radiation from nuclei and electromagnetic radiation.

Learning Outcomes The learner will	Assessment Criteria The learner can
4. Know safety precautions in the lab.	**4.1** List the safety precautions in the lab in relation to the use of radioactive sources. **4.2** Give reasons for the safety procedure in 4.1.
5. Understand radioactivity decay series.	**5.1** Explain why the products of radioactive decay may themselves be radioactive. **5.2** Perform calculations on radioactive decay series. **5.3** Write equations for radioactive decay.
6. Understand background radiation.	**6.1** List sources of background radiation. **6.2** Calculate his/her individual annual dose of radiation. **6.3** Use the Gray, Sievert and the Becquerel units. **6.4** Outline the effects on humans of **6.5** a range of doses of radiation. Describe an experiment to investigate background radiation.
7. Understand the spontaneous nature of disintegration and the laws of radioactivity decay.	**7.1** Use the decay curve to demonstrate the concept of half-life. **7.2** Simulate radioactive decay. **7.3** Perform calculations involving the decay constant, half-life and activity.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC2.3 Provide notations for five isotopes.
AC3.2 At least three absorbers.

AC3.3 Alpha, Beta and Gamma.
AC5.3 At least the first five in the U238 decay series.
AC6.1 To include artificial and natural - at least three sources of each.
AC6.2 Worksheet available from IOP.org
AC6.4 At least three different doses of radiation.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Mechanics: Linear Motion and Forces

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand motion and its laws, and the relationship between work, energy and efficiency.

Learning Outcomes	Assessment Criteria
The learner will	The learner can
1. Understand the motion of a body moving in a straight line.	**1.1** Identify the difference between vector and scalar quantities. **1.2** Represent linear motion graphically using displacement and velocity vs time graphs. **1.3** Calculate the gradient and area under the curve for the graphs above and identify what these represent.

Learning Outcomes The learner will	Assessment Criteria The learner can
2. Understand Newton's laws of motion.	**1.4** Derive the constant acceleration equations for motion in a straight line and use these to solve problems mathematically, including problems involving the solution of a equation. **1.5** Use the equations to solve problems concerning vertical motion under gravity. **2.1** State and interpret Newton's three laws. **2.2** Define linear momentum **2.3** Use the Principle of Conservation of Momentum to solve problems on colliding bodies.. **2.4** Derive the relation F=ma from Newton's second law.
3. Understand the effects of resistance to motion.	**3.1** Draw diagrams of forces to model given situations. **3.2** Calculate the effect of resistive forces on the motion of a body in a straight line. **3.3** Outline factors affecting terminal velocity.
4. Understand the relationship between work, energy and efficiency.	**4.1** State and discuss the implication of the principle of conservation of energy. **4.2** Define potential energy and derive the relationship PE=mgh. **4.3** Define kinetic energy and derive the relationship $KE=\frac{1}{2}mv^2$. **4.4** Solve problems involving energy transfer e.g. potential to kinetic. **4.5** Describe elastic and inelastic collisions. **4.6** Explain the concept of efficiency. **4.7** Solve problems relating to efficiency of processes.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject

- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.2 A minimum of two examples.
AC1.3 A minimum of two examples.
AC1.4 A minimum of three examples.
AC1.5 A minimum of three examples.
AC2.4 A minimum of three examples.
AC3.3 A minimum of three examples.
AC4.4 A minimum of three examples.
AC4.6 A minimum of three examples.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Waves in Sight and Hearing

Level: Three
Credit Value: 3

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand types and features of waves.	**1.1** Interpret wave types and features.

Learning Outcomes The learner will	Assessment Criteria The learner can
	1.2 Explain amplitude, wavelength, frequency and speed for waves in 1.1.
	1.3 Calculate changes in frequency and wavelength.
	2.1 Explain how each constituent part of the ear's structure facilitates the function of hearing.
2. Understand the structure and function of the ear.	**2.2** Analyse common causes of deafness.
3. Understand the behaviour of light when it passes through a lens.	**3.1** Demonstrate the effect of a range of lenses on parallel light.
4. Understand how the eye works as an optical instrument.	**4.1** Explain how the structure of the human eye is adapted for image formation.
	5.1 Explain the terms short-sightedness and long-sightedness.
5. Understand refractive visual defects and their correction.	**5.2** Explain how the conditions in 5.1 can be corrected.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.1 To include at least:

- sound waves
- electromagnetic waves
- interference
- superposition.

AC2.2 At least three common causes of deafness.
AC3.1 At least three different lenses using ray diagrams.
AC4.1 Include reference to the refractive properties of the various parts of the eye (e.g. vitreous humour).

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Engineering

Computer Aided Design

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to be able to use a computer aided design software package to produce engineering drawings.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to use CAD software packages to produce engineering drawings in 2D and 3D.	**1.1** Create engineering detail and assembly drawings using geometry commands/functions. **1.2** Manipulate and modify geometry using commands/functions. **1.3** Apply dimensions and text in the layout. **1.4** Set layers for functions such as dimensions centreline, text, hatching etc. **1.5** Save and store an engineering drawing.

Learning Outcomes The learner will	Assessment Criteria The learner can
	1.6 Retrieve an item from a library file.
	1.7 Produce a hard copy of an engineering drawing on a printer and/or plotter.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.1 i.e. Line, Circle, Arc, Offset, Hatch.
AC1.2 i.e. Move, Copy, Rotate, Mirror, Fillet/Chamfer, Trim, Extend, Erase.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Chemical Science

Level: Three
Credit Value: 6

Purpose and Aim

To enable the learner to understand aspects of chemical science related to engineering studies.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand electron configuration within the atom, bonding and the main properties of metals and non-metals.	**1.1** Explain electronic configuration **1.2** within an atom and how it **1.3** determines the properties of an element Describe different types of chemical bonding and their characteristics Compare the properties of metals and non metals..
2. Understand the concepts of periodicity for the first 36 elements in the Periodic Table.	**2.1** Explain with reference to electronic configuration, patterns associated with increasing atomic number.
3. Understand the behaviour of metals.	**3.1** Explain the properties of metals with respect to: reactivity series corrosion.
4. Understand the behaviour of d-block elements.	**4.1** Explain the properties of the period 4 transition metals, (Sc) to Zinc (Zn).
5. Understand the structures and properties of simple organic compounds.	**5.1** Identify the chemical structures and the characteristic properties of simple organic compounds.
6. Understand principles of acid-base equilibrium.	**6.1** Explain the terms: strong and weak acids and bases pH scale and measurement buffer solutions.
7. Understand and interpret kinetic data.	**7.1** Explain kinetic theory. **7.2** Describe factors affecting rate of reaction and methods of measuring reaction rates. **7.3** Explain the term activation energy.
8. Understand energetics and heat changes during chemical reactions.	**8.1** Explain the terms:

Learning Outcomes The learner will	Assessment Criteria The learner can
	Heat of reaction Internal energy Enthalpies of reaction.
	9.1 Describe the following industrial processes production of ammonia distillation of chemicals hydrogenation of fats electrolysis of brine
9. Understand principles of chemical plant technology.	**9.2** Describe the safe storage and transportation of chemicals.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of knowledge
- 4 – Use of Information
- 5 Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC2.1 e.g. first ionisation energies, atomic and ionic radii, boiling points, reaction with oxygen and chlorine, oxidation numbers.
AC4.1 e.g. metallic character, variable valency, co-ordination compounds, characteristic ion colours, behaviour as catalysts.
AC5.1 e.g. alkanes, alkenes, haloalkanes, alcohols, aldehydes, ketones, caboxylic acids and polymers

9.2 For one solid, one liquid and one gas

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Materials Science

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the general properties of materials, how materials are affected by the application of forces and their behaviour under stress and strain.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the general properties of materials.	**1.1** Define the terms: density strength stiffness toughness malleability ductility. **1.2** Link the properties of a material to its applications in industry.
2. Be able to investigate the properties of materials.	**2.1** Measure the properties of solids. **2.2** Measure the properties of liquids. **2.3** Explain how the properties of alloys can be calculated.
3. Be able to investigate the extensions of springs using forces.	**3.1** Define the terms: force extension spring constant. **3.2** Investigate the relationship between force and extension in a simple spring system.

Learning Outcomes The learner will	Assessment Criteria The learner can
4. Understand the properties of material under stress and strain.	**3.3** Calculate the spring constant from experimental data obtained in 3.2. **3.4** Explain what happens to a spring when it exceeds the limit of proportionality. **3.5** Calculate the energy stored within a simple spring system. **4.1** Define the following terms giving their equations: stress strain. **4.2** Explain the effects of compressive and tensile stress on a material. **4.3** Explain Young's modulus and how it can be calculated experimentally. **4.4** Interpret the stress/strain graphs of different materials.
5. Understand the behaviour of materials under stress and strain.	**5.1** Define the terms: brittle fracture ductile fracture fatigue creep. **5.2** Explain how the terms in 5.1 can be used in determining the failure of a material. **5.3** Explain how mechanical processes can be used to prevent fractures. **5.4** Explain how composite materials can be used to improve the properties of the base materials in relation to stress and strain.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 3 - Application of Skills

- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.2 A minimum of four different applications.
AC2.1 A minimum of two solids.
AC2.2 A minimum of two liquids
AC2.3 A minimum of three solids, including at least one regular and one irregular shaped solid.
AC3.5 A minimum of three different spring systems.
AC4.4 A minimum of three materials with different properties including plastic, glass and steel
AC5.4 Applications, including carbon fibre, GRP and reinforced concrete.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Design Project

Level: Three
Credit Value: 6

Purpose and Aim

To enable the learner to understand how to produce and communicate a design project from a given design brief, with alternative solutions being available.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to prepare a design specification for an engineered product from a given design brief.	**1.1** Establish customer requirements. **1.2** Determine the design requirements. **1.3** Obtain and evaluate design information and legislations. **1.4** Prepare a full Product Design Specification.
2. Be able to produce alternative design solutions for an engineered product.	**2.1** Produce conceptual design solutions. **2.2** Prepare an analysis of the possible design solutions. **2.3** Evaluate the potential of alternative concepts for the design solution. **2.4** Select and justify the optimum design solution.
3. Be able to communicate the final design solution through engineering drawings.	**3.1** Produce engineering drawings (manual or CAD) to communication the design solution. **3.2** Prepare a final report.

Access to HE Grade Descriptors:

- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 6 - Autonomy / Independence
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

There is no specific assessment information to be used with this unit.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Other Mappings:

Access to HE Grade descriptors:

- 2 - Application of knowledge
- 4 - Use of information
- 5 - Communication and presentation
- 6 - Autonomy
- 7 - Quality

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Mechanical Science

Level: Three
Credit Value: 9

Purpose and Aim

To enable the learner to understand aspects of mechanical science related to engineering studies.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to apply correct S.I. unit terminology to the solution of practical problems.	**1.1** Solve practical problems using the S.I. system of units.
2. Be able to apply the concept of Free Body Diagrams in solving practical problems.	**2.1** Solve practical problems using the concept of Free Body Diagrams.
3. Be able to use practical investigation and calculation to demonstrate turning moment as a torque.	**3.1** Determine the value of torques and couples as applied to gears. **3.2** Apply moments to the equilibrium of beams and levers.

Learning Outcomes The learner will	Assessment Criteria The learner can
4. Understand the relationship between mass, velocity and momentum for linear motion.	**4.1** Define the concepts of: mass, momentum, impulse, impact. **4.2** Use vector diagrams to solve problems.
5. Be able to use practical investigations and calculation to demonstrate the principle of moments and system equilibrium, with reference to working situations.	**5.1** **5.1** Determine the reactions due to **5.2** concentrated and uniformly distributed loads. Calculate the equilibrium of uniform, simply-supported beams and other simple force systems i.e. levels.
6. Be able to interpret the results of tests to show the effect of shear force on, and the application of, shear stress, to engineering materials.	**6.1** Analyse the results of tests carried out on engineering materials to determine: the Shear Modulus and compare it with Young's Modulus the effect of torsion and double shear.
7. Be able to solve problems involving potential and kinetic energy.	**7.1** Calculate : potential energy as energy due to position kinetic energy as due to motion. **7.2** Apply the principle of conservation of energy to systems in motion.
8. Be able to construct shear force and bending moment diagrams.	**8.1** Calculate: simply supported beams and cantilevers, point and uniformly distributed loads and combined loading, the point of contraflexure. **8.2** Determine the magnitude and position of the maximum bending moment for different load configurations.

Learning Outcomes The learner will	Assessment Criteria The learner can
9. Be able to use practical investigations to explain the concept of force.	**9.1** Determine the forces producing internal and external equilibrium in systems such as: compound bars. forces in rotation, including single-plane balancing.
11. Be able to solve problems involving energy transfer through mechanical power plant, braking systems and rotating shafts.	**11.1** Describe: the relationship between heat, work and power the concept of energy transfer as work done the concept of energy transfer due to temperature change friction as a cause of energy loss the principle of conservation of energy; the energy balance. **11.2** Apply the above concepts to determine the power transmitted by rotating shafts, mechanical power plant and braking systems.
12. Be able to solve problems to determine the energy transfer involved in phase change.	**12.1** Demonstrate by calculation: the concepts of sensible and latent heat single and two-phase systems. **12.2** Apply the concept of latent heat energy transfer e.g. a domestic refrigerator system.
13. Be able to investigate the basic gas laws.	**13.1** Examine the differences between gases and liquids. **13.2** Solve problems involving the combined gas equation PV/T = K and the characteristic gas equation pV=nRT, 13.2

Learning Outcomes The learner will	Assessment Criteria The learner can
	13.3 Examine the limitations of the gas laws at extreme pressure and temperatures.
	13.4 Apply the thermodynamic property tables.
14. Be able to derive Bernoulli's Equation.	**14.1** Apply Bernoulli's equations to solve simple problems.
15. Be able to apply the continuity and Beroulli's equation to practical problems involving fluids in motion.	**15.1** Apply the continuity equation and Bernoulli's equation to practical flow systems e.g. central heating systems, cooling systems, fuel flow systems.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 3 - Application of Skills
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

2.1 A minimum of three practical problems.

3.2 A maximum of 3 examples of each

7.1 Calculate 3 of each

14.1 a maximum of 3

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Principles of Engineering

Level: Three
Credit Value: 3

Purpose and Aim

To provide learners with the opportunity to develop an understanding of the concepts of work, power and efficiency, the principles in the study of electrical energy and the turning effect of forces.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the concepts of work, power and efficiency.	**1.1** Define work and calculate the work done when the force is in the direction of motion and when the force is not in the direction of motion at angles or perpendicular. .
	1.2 Describe the principle of conservation of energy, including knowledge of gravitational potential energy and kinetic energy.
	1.3 Define power and efficiency and calculate power and efficiency in various physical contexts.
	1.4 Describe instances in which dissipative forces cause energy to be transferred from the system.
2. Understand the principles employed in the study of electrical energy.	**2.1** Calculate the energy and power for electrical devices.
	2.2 Demonstrate the way in which the efficiency of electrical devices can be calculated.

Learning Outcomes The learner will	Assessment Criteria The learner can
	2.3 Solve problems relating to electrical energy, power and efficiency.
	3.1 Define the principle of moments or describe what is meant by the principle of moments
	3.2 Solve problems related to the principle of moments.
3. Understand the turning effect of forces.	**3.3** Define the centre of gravity.
	3.4 Describe an experiment to determine the centre of gravity of a non-uniform shape.
	3.5 Determine an unknown mass by using the principle of moments.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.4 A minimum of three instances.
AC2.3 A minimum of three problems.
AC3.2 A minimum of three problems.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Aircraft Gas Turbine Engines

Level: Three

Credit Value: 9

Purpose and Aim

To enable the learner to understand the propulsion systems of aircraft.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the principles of aircraft propulsion.	**1.1** Explain the principles of aircraft propulsion. **1.2** Summarise the working cycle of a gas turbine engine.
2. Understand the construction, configuration and principles of operation of gas generator components.	**2.1** Assess the component parts that are encountered in gas turbine engines. **2.2** Investigate the function and operation of the components in a gas turbine engine. **2.3** Summarise the configuration of typical gas turbine engines.
3. Understand the function and principle of operation of intakes, exhausts, propelling nozzles and thrust augmentation systems.	**3.1** Explain how thrust augmentation is obtained through the operation of intakes, exhaust and propelling nozzles, turbo-fan and turbo-shaft. **3.2** Evaluate gas turbine engine types and compare their use and function on aircraft types. **3.3** Evaluate the factors that affect gas turbine engine performance. **3.4** Analyse the factors which affect the performance of gas turbine engines.
4. Understand the function and principle operation of engine driven ancilliaries, starting systems and the auxiliary power unit.	**4.1** Analyse engine driven accessories, starting systems and auxiliary power units.

Learning Outcomes The learner will	Assessment Criteria The learner can
	4.2 Summarise the operation of engine driven ancillaries, APUs and starting systems. **4.3** Describe the causes and effects of operating problems associated with gas turbine engines and auxiliary systems. **4.4** Explain how operating problems are identified, making recommendations for corrective actions.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 6 - Autonomy / Independence
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC 3.2 e.g. turbo-fan and turbo-shaft.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Aircraft Airframe Systems

Level: Three
Credit Value: 9

Purpose and Aim

To enable the learner to understand the construction, operation and maintenance of a range of aircraft airframe systems and components.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the construction, operation and maintenance of aircraft hydraulic systems and their associated components.	**1.1** Describe the construction of aircraft hydraulic systems. **1.2** Describe the function and operation of aircraft hydraulic systems. **1.3** Interpret diagrams relating to the function and operation of an aircraft hydraulic power supply system down to component level.
2. Understand the construction, operation and maintenance of aircraft environmental control systems and their associated components.	**2.1** Describe the construction, function and operation of typical air conditioning and pressurisation systems for aircraft operating in differing environments. **2.2** Explain underlying physical principles which govern the operation of air cycle and vapour cycle cooling systems and their associated components. **2.3** Evaluate the operation, within an aircraft pressurisation system, of a typical pneumatic pressure controller. **2.4** Diagnose faults, using circuit diagrams and associated documentation, that may occur in aircraft environmental control systems.
3. Understand the construction, operation and maintenance of aircraft oxygen systems and their associated components.	**3.1** Explain the system arrangement, function and operation of typical passenger and crew oxygen systems.

Learning Outcomes The learner will	Assessment Criteria The learner can
4. Understand the construction, operation and maintenance of aircraft protection systems and fuel systems and their associated components.	**3.2** Diagnose faults, using circuit diagrams and associated documentation that may occur in aircraft oxygen systems. **4.1** Describe the process of ice accretion. **4.2** Describe the methods and systems used to remove and prevent the formation of ice accretion. **4.3** Evaluate the construction of a typical fuel supply system. **4.4** Explain the procedure and safety precautions to be adopted when carrying out refuel/defuel operations on a multi-tank aircraft. **4.5** Diagnose faults, using circuit diagrams and associated documentation, that may occur in aircraft fuel systems.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills
- 6 - Autonomy / Independence
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC2.4 A minimum of two faults
AC3.2 A minimum of two faults
AC4.5 A minimum of two faults

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Materials Engineering

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to be able to search for information; test, assess and propose materials; understand the effects of changing material properties; and to be able to work safely.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to communicate in appropriate technical terms.	**1.1** Apply the technical terminology to describe materials and associated processes including: type of materials description of processes property descriptions micro structural characteristics of steels failure descriptions.
2. Be able to carry out information searches for a specified set of properties.	**2.1** Compare, contrast and select information sources. **2.2** Analyse, gather and collate information for the sources in 2.1. **2.3** Investigate the suitability of a material for a particular application.
3. Be able to obtain standard test data to determine the properties of specific materials.	**3.1** Apply testing of a range of engineering materials to determine the properties of those materials to include:

Learning Outcomes The learner will	Assessment Criteria The learner can
	strength ductility modulus toughness hardness.
	3.2 Determine the properties of a material, given its internal structure
	3.3 Compare and contrast the results from the test in 2.2 obta ined with normal expectations for similar materials.
	4.1 .
5. Be able to recognise a material and its processing route to produce a specific structure with appropriate properties for a given application.	**5.1** Critically examine processes which will produce required changes in material properties by altering the material structure.
6. Be able to propose materials for a given application.	**6.1** Investigate material properties to match a design specification and function of the required product. **6.2** Identify materials with the required properties. **6.3** Investigate processing routes for proposed materials.
7. Be able to work within the required safety parameters.	**7.1** Investigate hazards associated with specific materials. **7.2** Carry out all investigative work with regard for health and safety of self and others.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC7.1 i.e. use, handling, processing, storage, disposal (COSHH -Control of Substances Hazardous to Health) (Health and Safety at Work) (PUWER - Provision and Use of Work Equipment Regulations).

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Chemistry

The Chemistry of Living Cells

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the main biochemical features of carbohydrates, lipids, proteins, nucleic acids and their biological importance; the process of protein synthesis; and to be able to carry out basic food tests.

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Understand the biochemistry of carbohydrates, lipids and proteins.	**1.1** Express carbohydrates, lipids and proteins as molecular structure. **1.2** Express chemical reactions in words and symbols. **1.3** Explain the function of carbohydrates, lipids, triglycerides, sterols and proteins in:

Learning Outcomes The learner will	Assessment Criteria The learner can
	cell chemistry physiological processes.
2. Understand the process of protein synthesis.	**2.1** Summarise the process of protein synthesis. **2.2** Analyse protein synthesis within organisms.
3. Understand the structure and function of nucleic acids.	**3.1** Relate the structure of nucleic acids to protein synthesis. **3.2** Explain the chemical and biological functions of nucleic acids.
4. Be able to determine the composition of biological samples.	**4.1** Analyse biological samples to identify their composition.

Access to HE Grade Descriptors:

- 2 - Application of Knowledge
- 3 - Application of Skills
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

Barred combinations with:

- Energy transfer within Cells
- Biological Molecules
- DNA, Polypeptide Synthesis and DNA Technology
- The Digestive System and Nutrition.

AC1.3 A minimum of one physiological process and cell chemistry for each biological molecule must be given.
AC2.2 A minimum of two organisms must be given.
AC4.1 At least three biological samples.
If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

The Periodic Table and Redox Reactions

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the nature of the periodic table, periodicity in terms of the physical properties of elements, the concept of the oxidation number, and reactions with reference to groups 2 and 7.

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Understand the structure of the periodic table in term groups and periods.	**1.1** Describe the periodic table in terms of the arrangement of elements: by increasing atomic number in periods showing repeating trends in physical and chemical properties in groups having similar physical and chemical properties
2. Understand periodicity in terms of the physical properties of the elements.	**2.1** Interpret the variation of the first ionisation energies of elements: across a period down a group. **2.2** Interpret data and describe variation in a range of physical properties in elements.
3. Understand the concept of oxidation number.	**3.1** Apply the rules for assigning oxidation number to atoms in elements, compound and ions. **3.2** Describe the terms oxidation and reduction in terms of:

Learning Outcomes The learner will	Assessment Criteria The learner can
	electron transfer changes in oxidation number **3.3** Construct formulae using oxidation number.
4. Understand redox reactions with reference to Group 2 and Group 7 elements.	**4.1** Explain a range of redox reactions for Group 2 and 7 elements using both electron transfer and oxidation numbers.
5. Understand the reactions of Group 2 and Group 7 elements.	**5.1** Explain the trend in reactivity of Group 2 and Group 7 elements down the group in terms of ease of forming ions, atomic size, shielding and nuclear charge. **5.2** Describe the action of water on oxides of Group 2. **5.3** State the range of pH values of any resulting solutions. **5.4** Explain commercial uses involving the reactions of calcium hydroxide ($Ca(OH)_2$) and magnesium hydroxide ($Mg(OH)_2$). **5.5** Describe the term 'disproportionation' in terms of oxidation and reduction.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC2.2 Electron configurations, atomic radii, first ionisation energies, melting point and boiling points to demonstrate periodicity.
AC3.3 A minimum of three examples.
AC4.1 May include reactions with hydrochloric and sulphuric acid.
AC5.4 To include at least one example of each.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Energetics, Kinetics and Equilibria Chemistry

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand enthalpy changes and reaction rates, dynamic equilibrium, electrochemistry, and the differences between oxidation and reduction.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand enthalpy changes.	**1.1** Produce energy profiles for exothermic and endothermic reactions. **1.2** Perform enthalpy calculations.
2. Understand reaction rates.	**2.1** State the main factors which affect reaction rates. **2.2** Identify order of reaction from data given.
3. Understand dynamic equilibrium.	**3.1** Apply Le Chatelier's principle to identify most favorable conditions for yields in named industrial processes. **3.2** Describe solubility in terms of an equilibrium. **3.3** Define Kc and use it to discuss position of equilibrium. **3.4** Explain weak acidity and Ka. **3.5** Calculate pH for strong and weak acids and alkalis.
4. Understand electrochemistry.	**4.1** Define 'electrode potential'. **4.2** Find the electromotive force (EMF) of an electrochemical cell from electrode potentials.

Access to HE Grade Descriptors:

- 2 - Application of Knowledge
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC 2.1 In terms of temperature, pressure, concertation and catalysis.

AC3.1 e.g. Haber, contact process.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Proportions by which Chemicals React

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the atomic scale of mass; and to be able to construct chemical formulae and equations; and to be able to complete molar and reactant and product mass calculations.

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Understand the atomic scale of mass for atoms and molecules and the mole concept.	**1.1** Calculate relative formula masses from relative atomic masses. **1.2** Calculate mole quantities from relative atomic and relative formula masses.
2. Be able to construct chemical formulae given appropriate data.	**2.1** Write chemical formulae (ionic and molecular) for simple compounds.
3. Be able to construct balanced equations given appropriate data.	**3.1** Use chemical formulae to show reactions as balanced equations.

Learning Outcomes The learner will	Assessment Criteria The learner can
4. Be able to calculate reactant and product masses from equations.	**4.1** Perform calculations to determine reactant and product masses from balanced equations.
5. Be able to complete molar calculations.	**5.1** Perform a range of molar calculations from balanced equations including solutions.

Access to HE Grade Descriptors:

- 2 - Application of Knowledge
- 3 - Application of Skills
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.1 A minimum of three to be calculated.
AC1.2 A minimum of three to be calculated.
AC2.1 A minimum of three to be calculated.
AC3.1 A minimum of three different types of reactions to be included.
AC4.1 A minimum of three to be calculated.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Atomic Structure and Bonding

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand atomic structure, quantum levels and sublevels; the relationship between electronic structure, the periodic table and valency; bonding variables and general properties of ionic and covalent compounds.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the fundamental particles involved in atomic structure.	**1.1** Define the terms used in atomic and electronic theory. **1.2** **1.2** Define the terms: atom ion molecule isotope
2. Know the principal quantum levels and sublevels (s, p and d) and the distribution of electrons in atoms up to atomic number thirty six.	**2.1** Deduce electronic structures from atomic numbers to determine electronic structures in terms of s,p,d configurations **2.2** Determine the position of an element in the periodic table from the electronic structure.
3. Understand the relationship between electronic structure, the periodic table and valency.	**3.1** Determine formulae of simple ions from atomic number.
4. Understand ionic, covalent, intermolecular and metallic bonding.	**4.1** predict bonding types from physical properties. **4.2** Describe the different types of bonding and attraction.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.1 a minimum of three explanations for atomic theory and three for electronic theories from:

- atomic number
- atomic mass number
- periodic table
- principal quantum number
- sub level
- Hund's rule
- The Pauli exclusion principle.

AC2.1 This should include elements from a minimum of five different groups of the periodic table.
AC4.2 The descriptions of the formation of bonding types should be supported by a diagram to include

- ionic
- covalent
- Van der Waals forces and Hydrogen bonding metallic bonding.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Organic Chemistry - Hydrocarbons, Alcohols and Acids

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the properties of hydrocarbons; the reactions of alcohols and carbonyl compounds; and the properties of carboxylic acids.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the properties of hydrocarbons.	**1.1** Define the terms homologous series and functional groups. **1.2** Name hydrocarbons of up to eight carbon atoms. **1.3** Construct formulae and structure of alkenes, including geometrical isomers. **1.4** Describe the structure of benzene and evaluate the experimental evidence for this. **1.5** Compare chemical properties of alkanes, alkenes and benzene. **1.6** Describe trends in physical properties of hydrocarbons within a homologous series.
2. Understand the main reactions of alcohols.	**2.1** Name alcohols of up to five carbon atoms. **2.2** Describe oxidation and esterification reactions of alcohols.
3. Understand the preparation and reactions of carbonyl compounds.	**3.1** Describe addition, oxidation and reduction reactions of carbonyl compounds.
4. Understand the properties of carboxylic acids.	**4.1** Describe acid base reactions of carboxylic acids.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.2 A minimum of three hydrocarbons.
AC1.3 A minimum of three formulae.
AC2.1 Must be IUPAC name - a minimum of three alcohols.
AC2.2 To include the chemical equation of the reaction.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Analytical Procedures in Chemistry

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand how to select and use a range of basic and analytical laboratory equipment, and to understand the principles and techniques of a range of analytical techniques.

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Be able to select and use laboratory equipment.	**1.1** Given a variety of pieces of equipment, select the most appropriate for the task in hand. **1.2** Demonstrate safe use of laboratory equipment in a range of situations in accordance with COSHH regulations.
2. Be able to use accurately a range of basic analytical equipment.	**2.1** Demonstrate the variability in accuracy of a range of laboratory glassware. **2.2** Explain how the correct use of equipment can minimise experimental error.
3. Understand the principles and techniques of a range of chromatographic techniques.	**3.1** Explain the principles of paper and thin layer chromatography. **3.2** Explain the principles of gas chromatography. **3.3** Interpret chromatograms and graphical plots.
4. Understand the principles of colorimetric and spectrophotometric analysis.	**4.1** Describe the electromagnetic spectrum and distinguish between forms of radiation in terms of wavelength and frequency.

Learning Outcomes The learner will	Assessment Criteria The learner can
	4.2 Compare the operation and principles of a colorimeter and spectrophotometer. **4.3** Use infrared spectrometer output to identify the presence of organic functional groups.
5. Be able to use basic titration techniques.	**5.1** Set up and use titration apparatus. **5.2** Accurately determine the molar concentration of a substance using a standard solution. **5.3** Produce a balanced equation for the titration in AC5.2'. Balancing equations is covered in Proportions by which Chemicals React.
6. Be able to use flame tests and chemical tests for qualitative analysis.	**6.1** Demonstrate the use of flame and chemical tests to identify a range of elements.

Access to HE Grade Descriptors:

- 2 - Application of Knowledge
- 3 - Application of Skills
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC3.1 To include reference to partition.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Medicinal Chemistry

Level: Three

Credit Value: 6

Purpose and Aim

To provide the learner understanding of medicinal chemistry.

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Understand the basics of drug discovery, design and development.	**1.1** Summarise the discovery of pharmaceutical drugs. **1.2** Describe drug target optimisation strategies. **1.3** Describe the process of drug design and development, including modern tools used.
2. Understand the classification of pharmaceutical drugs.	**2.1** Differentiate how pharmaceutical drugs are classified based on mechanism of action, physiologic effect and chemical structure. **2.2** Summarise the purpose of drug classification.
3. Understand the chemical structure, properties and activities of pharmaceutical drugs.	**3.1** Differentiate the chemical structure elements and properties of drugs. **3.2** Illustrate the nature of drug activity.
4. Understand how drugs elicit a response in living systems and the interactions between drugs.	**4.1** Explain how drugs should cause a specific response in living systems. **4.2** Evaluate adverse drug reactions and interactions between drugs.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.1, 1.2, 1.3 and 3.1 Summarising and describing the discovery, development, chemical properties and activity of a pharmaceutical drug of learner's choice.
AC2.1 and 2.2 Summarise the purpose of drug classification by using and explaining a specific example of a classification system (e.g., comprehensive systems, chemical class, mode of action, mechanism of action, therapeutic class).
AC3.2 To include a minimum of three drugs.
AC 4.1 To include a minimum of four examples (e.g., antibacterial, antiviral, anticancer, analgesics, cholinergics).

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Concepts of Carbon, Redox and Acid/Base Chemistry

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand the nature of carbon and its compounds; the oxidation, reduction and redox reactions; and the nature of acids and bases.

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Understand the chemical and physical nature of carbon and its compounds.	**1.1** Describe the ways in which carbon can combine with itself and other elements to produce a range of compounds.
2. Understand oxidation, reduction and redox reactions.	**2.1** Describe the processes of oxidation and reduction. **2.2** Describe redox processes in a range of situations.

Learning Outcomes The learner will	Assessment Criteria The learner can
3. Understand the nature of acids and bases and the reaction between them.	**3.1** Describe the properties and behaviour of acids and bases and their reactions.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

AC1.1 A minimum of six ways.
AC2.1 e.g. in terms of loss or gain of hydrogen/oxygen, loss or gain of electrons and change in oxidation number.
AC2.2 A minimum of four named situations.
AC3.1 Using relevant ionic equations.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Investigative Project / Extended Essay

Access to HE Investigative Project / Extended Essay

Level: Three
Credit Value: 6

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to plan and propose an investigative project/extended essay.	**1.1** Identify an area for research. **1.2** Produce a **research proposal** for an investigative project/extended essay.
2. Be able to conduct research.	**2.1** Conduct research for an investigative project/extended essay. **2.2** Evaluate established resources that address the research topic.
3. Be able to produce an investigative project/extended essay.	**3.1** Analyse findings of completed research. **3.2** Present the research as an investigative project/extended essay.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 6 - Autonomy / Independence
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

Investigative project/extended essay in this unit is defined as a written account of a piece of research, contextualised by the Access to HE Diploma title, of up to 3000 words.

AC1.2 **Research proposal.** This must include a research question to answer, a rationale, the selection of appropriate forms of research, identifying established secondary resources, collating findings, time scales and analytical methods to be used (500-800 words).

AC2.1 **Conduct research.** The forms of research and analytical methodologies selected must be fit for purpose for the area of study. These may include exploratory research, constructive research, empirical research, quantitative research, qualitative research, intersubjectivity, evidence-based research. the investigative project/extended essay must be based on secondary research only.

Evidence generated for this unit cannot be used as evidence for any part of the unit 'Academic Skills'.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Practical Scientific Project - Analysis and Presentation

Level: Three
Credit Value: 3

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to process, represent and analyse data/results.	**1.1** Process data/results using appropriate diagrammatic, tabular, graphical or statistical techniques to illustrate results. **1.2** Analyse results including reference to validity and reliability of data.
2. Understand evidence and reach appropriate conclusions.	**2.1** Draw relevant conclusions from processed results, with reference to the original hypothesis or aim. **2.2** Use scientific knowledge, where appropriate to explain and clarify the conclusions.
3. Be able to evaluate own practical scientific project.	**3.1** Evaluate strengths and limitations of design and procedure. **3.2** Suggest justified improvements and modifications to design and procedures.
4. Be able to present the practical scientific project in an appropriate style.	**4.1** Produce the practical scientific project using correct scientific convention throughout.

Learning Outcomes The learner will	Assessment Criteria The learner can
	4.2 Present the practical scientific project clearly and logically using correct scientific terminology. **4.3** Use appropriate scientific citation and referencing.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 4 - Use of Information
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

There is no specific assessment information to be used with this unit.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Practical Scientific Project - Design and Implementation

Level: Three
Credit Value: 3

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to define a practical research project.	**1.1** Identify and justify a relevant scientific topic with reference to appropriate sources. **1.2** Produce an hypothesis and clear aims for the project.
2. Be able to plan and design a practical scientific project.	**2.1** Develop a plan which addresses all relevant tasks including: timescale/priority acquisition of equipment and materials. **2.2** State anticipated method of data collection with regard for subsequent method of analysis. **2.3** Explain and justify planned methods with reference to controlled and uncontrolled variables, accuracy and reliability. **2.4** Link probable outcomes to relevant theories or previous work. **2.5** Identify any ethical, practical or safety issues and how these will be managed/overcome. **2.6** Carry out and record a risk assessment of the work.
3. Be able to carry out and refine practical scientific research.	**3.1** Use planned and stated techniques to obtain results/data with due regard for: precision and accuracy reliability. **3.2** Make modifications to plan as appropriate. **3.3** Record raw data appropriately for future processing. **3.4** Identify and record errors in equipment or method.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 2 - Application of Knowledge
- 3 - Application of Skills
- 4 - Use of Information
- 5 - Communication and Presentation
- 6 - Autonomy / Independence
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Information:

There is no specific assessment information to be used with this unit.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Mathematics L3 ungraded

Pure Mathematics – Equations, Geometry, Trigonometry and Calculus

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand how to manipulate algebra and solve equations, to use coordinate geometry, to solve problems using trigonometry, and to use basic calculus.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to manipulate algebra and solve equations. (N3.2)	**1.1** Manipulate algebraic expression. **1.2** Solve linear, quadratic and simultaneous equations.
2. Understand how to use co-ordinate geometry. (N.3, N4.2)	**2.1** Calculate gradients of a line, including parallel and perpendicular lines. **2.2** Find equations of straight lines. **2.3** Calculate the distance between two points.

Learning Outcomes The learner will	Assessment Criteria The learner can
	2.4 Find the midpoint of a line.
3. Be able to solve problems using trigonometry. (N3.2)	**3.1** Find sine, cosine and tangent of any angle. **3.2** Apply trigonometry to right-angled triangles. **3.3** Use sine and cosine rules to solve problems.
4. Understand how to use basic calculus. (N3.2, N4.2)	**4.1** Perform basic differentiation. **4.2** Apply calculus to gradients, tangents and normals. **4.3** Calculate maxima and minima. **4.4** Calculate definitive integrals and areas. **4.5** Use the trapezium rule.

Access to HE Grade Descriptors:

- 1 - Understanding of the Subject
- 3 - Application of Skills
- 5 - Communication and Presentation
- 7 - Quality

Achievement of this unit should only be graded if being delivered as part of an Access to HE Diploma programme of study.

Assessment Methods:

Unit Assessment Requirements are not prescribed. They remain as a **recommended** approach to assessment where they still reflect the unit specification.
From September 2021, centre devised assessments are permitted for all units on all Agored Cymru Access to HE Diplomas.
All assessment evidence completed As part Of an Agored Cymru Access To HE Diploma Is subject To external moderation.

Assessment Information:

There is no specific assessment information to be used with this unit.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Matrices, Vectors and Logs (new unit)

Level: Three
Credit Value: 3

Purpose and Aim

The aim of the unit is to underline mathematical concepts for engineering. .

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Be able to compute with indices and laws of logs.	**1.1** Demonstrate an understanding of the relationship between indices and logs. **1.2** Utilise log base 10 and log base a **1.3** Demonstrate the use of the laws of logs for multiplication, division and power. 1.4 demonstrate an understanding of exponential functions and their logs (growth and decay).
2. Be able to use vectors.	**2.1** Demonstrate the use of vectors to find magnitude, direction and midpoints. **2.2** Identify position vectors and unit vectors in 2D **2.3** Calculate with Vectors using addition.
4. Be able to perform calculations on matrices.	**4.1** 4.1. Perform calculations using matrix operations to include: Addition Subtraction Scalar Multiplication

Learning Outcomes The learner will	Assessment Criteria The learner can
	Matrix Multiplication Transpose With square and rectangular matrices of order 2x3 or higher. **4.2** Perform the calculations listed in 4.1 with matrices of a range of orders from order 4x4 and above.

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If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Mathematics L2 ungraded
Algebra and Graphs for Engineering

Level: Two
Credit Value: 3

Purpose and Aim

To give learners knowledge and skills required in algebra and graphs for engineering.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to apply the laws of precedence.	**1.1** Use brackets and the hierarchy of operations in calculations.
2. Be able to use rules of indices to simplify expressions.	**2.1** Use index laws to simplify numerical and algebraic expressions. **2.2** Perform calculations using indices.
3. Be able to solve problems using formulae.	**3.1** Describe given situations using algebraic formulae. **3.2** Apply formulae to make calculations.
4. Be able to perform basic operations on simple algebraic expressions and inequalities.	**4.1** Manipulate algebraic expressions by expanding brackets and collecting like terms. **4.2** Factorise algebraic expressions by extracting common factors. **4.3** Solve linear equations. **4.4** Solve linear inequalities. **4.5** Change the subject of formulae.
	5.1 Use Pythagoras to find missing sides in right angle triangles. 5.2 Use the three trig ratios sign cos and tan to calculate missing sides and angles in right angle triangles.
6. Be able to interpret and plot graphs. **7.** Be able to interpret and plot non linier graphs	**6.1** Plot Cartesian coordinates in all four quadrants. **6.2** Identify coordinates of given points. **6.3** Plot and draw straight line graphs. **6.4** Find the coordinates of the midpoint of a line segment. 7.1 Plot Quadratic graphs 7.2 Plot Cubic graphs 7.3 Plot exponential graphs

Assessment Methods:

There are no prescribed assessment methods for this unit. Assessments used should be fit for purpose for the unit and learners, and generate evidence of achievement for all the assessment criteria.

Assessment Information:

AC1.1 A minimum of five calculations.
AC2.1 A minimum of five expressions.
AC2.2 A minimum of five calculations.
AC3.1 A minimum of three situations.
AC4.1-4.5 A minimum of five of each.
AC4.1 The expressions should be up to and including the form ax (bx ±c).
AC4.2 The expressions should include letters and numbers and be up to and including the form $ax^2 \pm bx$.
AC4.3 On at least one occasion, an unknown is required on both sides of the equation. At least one of the equations should include brackets. At least one of the equations should include a negative solution.
AC5.1 A minimum of two..
AC6.1-6.3 A minimum of three of each.
AC6.3 Graphs should include:

- those in the form of y=mx+C

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level

Academic Skills
Academic Skills

Level: Three
Credit Value: 3

Purpose and Aim

To provide opportunities for learners to demonstrate the academic skills needed to complete assessments on Access to Higher Education Diplomas.

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Be able to plan and complete a written academic assessment.	**1.1** Plan a written academic assessment showing logical structure. **1.2** Make use of source material. **1.3** Produce a written academic assessment.
2. Be able to plan and deliver an academic presentation.	**2.1** Plan an academic presentation with a logical structure for an intended audience. **2.2** Summarise information from a range of sources. **2.3** Deliver an academic presentation using a range of techniques.
3. Be able to participate in an academic discussion.	**3.1** Prepare to participate in an academic discussion. **3.2** Participate in an academic discussion. **3.3** Produce a summary of an academic discussion.
4. Be able to take notes.	**4.1** Produce notes from a variety of sources.
5. Be able to reference source material.	**5.1** Apply referencing in line with established academic conventions to indicate the use of sources.

Assessment Methods:

Unit assessment requirements are no longer prescriptive. They are recommended assessment plans. Centres can devise their own assessment plan for this unit.

Assessment Information:

AC1.2 Can include digital and non-digital source material.
AC1.3 The **written academic assessment** may be an essay or a report and must be produced for a graded unit with academic subject content.
AC2.1 The **intended audience** must comprise of two people including the assessor.
AC2.3 **Presentation techniques** can be variable and may include digital resources. Learners may deliver a presentation based on an academic poster that they have produced. Delivery can be either face to face or online. Online presentations can be either delivered synchronously or asynchronously. The presentation must be approximately 15 minutes in length.
AC4.1 Sources may include lectures, presentations and written texts.

Evidence generated for the unit Access to HE Investigative Project / Extended Essay cannot be used for evidence for this unit.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Study Skills

Thinking Skills

Level: Three
Credit Value: 3

Purpose and Aim
This unit provides learning opportunities for developing thinking skills and embedding these skills across a range of tasks and learning.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand methods of improving thinking skills.	**1.1** Describe **methods** of developing thinking skills. **1.2** Evaluate a method of developing thinking skills.
2. Be able to apply a range of thinking skills.	**2.1** Evaluate own thinking skills used in assessments. **2.2** Create a reflective portfolio.
3. Understand their development in the context of thinking skills.	**3.1** Evaluate their progress in terms of reflective practice and thinking skills.

Assessment Methods:

There are no prescribed assessment methods for this unit. Assessments used should be fit for purpose for the unit and learners, and generate evidence of achievement for all the assessment criteria.

Assessment Information:

AC1.1 A minimum of two methods.
AC2.1 A minimum of two assessments completed for units with academic subject content.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Planning and Time Management
Level: Three
Credit Value: 3

Purpose and Aim

This unit provides opportunities for the learner to plan, prepare and set targets as part of an overall time management strategy for study.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand personal planning needs and time management issues.	**1.1** Evaluate their own time management skills in relation to study. **1.2** Develop a weekly study timetable. **1.3** Identify the **problems and solutions** to the implementation of the timetable **1.4** Meet deadlines when submitting assessed work.
2. Be able to plan a programme of study.	

Learning Outcomes The learner will	Assessment Criteria The learner can
2. Be able to assess programme/timetables to achieve goals.	**2.1** Review their study plans to establish potential revisions to timetables.

Assessment Methods:

Unit assessment requirements are no longer prescriptive. They are recommended assessment plans. Centres can devise their own assessment plan for this unit.

Assessment Information:

AC1.2 To consider workload, time available and possible unforeseen circumstances.
AC1.3 A minimum of two **potential problems and solutions**.
AC1.4 Across all formal assessments.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Revision and Exam Skills

Level: Three
Credit Value: 3

Purpose and Aim

The unit will provide the learner with opportunities to develop their examination and revision techniques and overall planning.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Be able to prepare for an examination.	**1.1** Analyse their strengths and weaknesses in relation to examination strategies. **1.2** Develop detailed personal revision strategies/plans to prepare for an examination.
2. Be able to respond to the requirements of an examination.	**2.1** Produce evidence of planning activities undertaken as part of the examination process. **2.2** Produce relevant, structured and substantial answers to the questions set within the time allowed. **2.3** Communicate answers clearly, concisely and accurately in a required format using necessary conventions.
3. Be able to evaluate revision and examination performance.	**3.1** Evaluate own revision schedule. **3.2** Evaluate own stress management skills. **3.3** Evaluate own strengths and weaknesses in exams.

Assessment Methods:

Unit assessment requirements are no longer prescriptive. They are recommended assessment plans. Centres can devise their own assessment plan for this unit.

Assessment Information:

AC2.1: For example, mind-mapping, rough plans.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Academic Writing

Level: Three
Credit Value: 3

Purpose and Aim

To enable the learner to understand how to:

- use punctuation and grammar in writing
- prepare for a piece of extended writing
- bring together ideas and information from different sources
- produce a piece of extended writing.

Learning Outcomes The learner will	Assessment Criteria The learner can
1. Understand the correct use of punctuation and grammar in writing.	**1.1** Explain the purpose of the following punctuation marks: colon semicolon hyphen apostrophe. **1.2** Give examples of the use of the marks in 1.1 within own writing. **1.3** Explain the use of coordinating and subordinating conjunctions. **1.4** Explain how to punctuate quoted statements within a piece of writing. **1.5** Explain the following grammatical errors: comma splice pleonasm run on sentences.

Learning Outcomes The learner will	Assessment Criteria The learner can
	1.6 Explain the key features of a well-structured paragraph.
2. Understand how to prepare for a piece of extended writing.	**2.1** Identify the purpose and audience for a piece of extended writing. **2.2** Describe key features of the genre to be used.
3. Know how to bring together ideas and information from different sources.	**3.1** Define the term plagiarism. **3.2** Make notes from reading on the selected topic. **3.3** Record references to reading accessed.
4. Be able to produce a piece of extended writing.	**4.1** Produce a piece of extended writing which demonstrates the correct use of grammar and punctuation.

Assessment Methods:

There are no prescribed assessment methods for this unit. Assessments used should be fit for purpose for the unit and learners, and generate evidence of achievement for all the assessment criteria.

Assessment Information:

AC1.1 The possessive and omission use of the apostrophe must be explained.
AC1.2 A minimum of two examples of each.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Digital Information Literacy (new unit)

Level: **Three**
Credit Value: **3**

Purpose and Aim: To understand how search history is used by third parties. To use and evaluate the digital information to complete complex tasks.

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The learner will	The learner can
1. Understand techniques used to gather and evaluate digital information.	**1.1** Explain how search results may be manipulated by a variety of processes. **1.2** Explain techniques used by third parties to gather information about website users. **1.3** Explain the advantages and limitations of digital information. **1.4** Explain ways to evaluate digital information.
2. Be able to search for, evaluate and use digital information to complete a complex task.	**2.1** Plan a complex task requiring the application of digital information. **2.2** Use advanced search techniques to obtain the required information. **2.3** Justify his/her choice of search engine. **2.4** Evaluate the results of the searches in 3.2. **2.5** Organise, classify and save the information in a structured format so that it can be applied to the task in 3.1.
3. Be able to use and review digital information to complete a task.	**3.1** Use digital information found in 2.4 to complete the complex task stated in 2.1. **3.2** Evaluate the appropriateness of the information obtained for the stated task.

NOS:
Other Mappings:
Assessment Methods:
Assessment Evidence:
Assessment Information: 2.1 The task should be of a complexity appropriate to the level of the unit and require the application of at least three different items of digital information.

For example: Research for an assignment or enterprise project, research for presentations, research to provide advice and guidance.
Assessor Requirements: There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.
Prerequisites: There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.

Professional Behaviours (new unit)

Level: Three
Credit Value: 3

Purpose and Aim

To provide opportunities for learners to Identify the professional behaviours relevant to a professional setting

Learning Outcomes The learner will	**Assessment Criteria** The learner can
1. Understand the characteristics required to work in a professional setting.	**1.1** Analyse the characteristics required to work in a professional setting with reference to associated principles and concepts of professionalism.
2. Understand effective communication and team working skills.	**2.1** Distinguish between effective and ineffective skills with reference to a relevant model for each of the following: communication teamwork. **2.2** Evaluate the effectiveness of own communication skills, with reference to: verbal skills

Learning Outcomes The learner will	Assessment Criteria The learner can
	non-verbal skills. **2.3** Evaluate own team working skills.
3. Know how to manage risk and deal effectively with problems.	**3.1** Summarise the principles of risk management and problem-solving. **3.2** Explain how to solve a problem and manage any associated risk, using an actual or hypothetical problem relevant to a professional setting.
4. Reflect on own skills and develop a personal and professional development plan.	**4.1** Evaluate their own skills against those expected in a professional setting using a chosen model of reflective practice. **4.2** Identify own development needs based on evaluations in 4.1. **4.3** Produce a plan to meet personal and professional development objectives based on an evaluation of different options. **4.4** Reflect on own performance against the plan, identifying learning needs for the future throughout the duration of the Access to HE Diploma.

Assessment Methods:

It is recommended that this unit is assessed by way of a reflective learning journal in part or in its entirety.

Assessment Information:

AC1.1 Learners to identify a professional setting associated with their intended progression route

AC4.1 Learners must evaluate the skills they have developed through their particular life experiences. This may include work (paid or voluntary), education, travel, family commitments.

If not specifically stated in the assessment information, **a plural statement in any assessment criterion means a minimum of two**.

Assessor Requirements:

There is no information regarding specific assessor requirements for this unit. Centres should select assessors who are trained in assessment, and who have subject specific competence to assess at this level.