VOCATIONAL

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WJEC LEVEL 1 / 2 AWARD in ENGINEERING

REGULATED BY OFQUAL AND CCEA REGULATION
DESIGNATED BY QUALIFICATIONS WALES

SPECIFICATION

Teaching from 2013

Version 4 November 2022

WJEC LEVEL 1/2 VOCATIONAL AWARD IN ENGINEERING

SPECIFICATION 9790A1

For first teaching from 2013

SUMMARY OF AMENDMENTS

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1 INTRODUCTION

1.1 Qualification Titles and Codes

WJEC Level 1/2 Vocational Award in Engineering.

Qualification Number listed on The Register 600/8645/2.

Qualifications Wales Designation Number listed on QiW: C005072/7.

1.2 Rationale

WJEC Level 1/2 Vocational Award in Engineering offers a learning experience that focuses learning for 14-16 year olds through applied learning, i.e. acquiring and applying knowledge, skills and understanding through purposeful tasks set in sector or subject contexts that have many of the characteristics of real work.
The qualification is built from discrete units, but allows for both synoptic learning and assessment. Each unit has an applied purpose which acts as a focus for the learning in the unit. The applied purpose is the vehicle through which the learning contained in the unit is made relevant and purposeful. It is also the means by which learners are enthused, engaged and motivated to study engineering. The applied purpose provides the opportunity for authentic work related learning, but more than this, it will require learners to consider how the use and application of their learning impacts on individuals, employers, society and the environment. The applied purpose will also enable learners to learn in such a way that they develop:

- skills required for independent learning and development;
- a range of generic and transferable skills;
- the ability to solve problems;
- the skills of project based research, development and presentation;
- the fundamental ability to work alongside other professionals, in a professional environment;
- the ability to apply learning in vocational contexts.

The qualifications have been devised around the concept of a 'plan, do, review' approach to learning where learners are introduced to a context for learning, review previous learning to plan activities, carry out activities and review outcomes and learning. This approach mirrors engineering production and design processes and also provides for learning in a range of contexts thus enabling learners to apply and extend their learning. As such, the qualification provides learners with a broad appreciation of work in engineering related industries and wider opportunities for progression into further education, employment or training.

The qualification has been designed to build on the skills, knowledge and understanding acquired at Key Stage 3, particularly skills related to literacy, numeracy, use of technology and design.

1.3 Progression

The WJEC Level 1/2 Vocational Award in Engineering have been designed to develop in learners the skills needed for progression from Key Stage 4 and GCSE learning to further education, employment and training.

The successful completion of this qualification could provide the learner with opportunities to access a range of Level 3 qualifications including GCE, apprenticeships and vocationally related qualifications. These include:

- GCE in Engineering;
- GCE in Design & Technology;
- Principal Learning Level 3 in Engineering;
- Apprenticeships in Engineering.

Learners would normally be expected to have attained other qualifications at this level, including GCSE Maths at grade C or above.

Equally, the skills and understanding developed, including Essential Skills (Wales), Functional Skills, Key Skills and Personal, Learning and Thinking Skills (PLTS), are relevant to any qualification at Level 3, whether 'General' or 'Vocational'.

2 QUALIFICATION STRUCTURE

2.1 WJEC Level 1/2 Vocational Award in Engineering Unit Titles

WJEC Level 1/2 Vocational Award in Engineering			
Unit Number	**Unit Title**	**Assessment**	**GLH**
9791	Engineering Design	Internal	30
9792	Producing Engineering Products	Internal	60
9793	Solving Engineering Problems	External	30

NB For qualifications awarded <u>from 2020 onwards learners must pass each unit</u> in order to achieve the qualification

2.2 Guided Learning Hours (GLH) and Total Qualification Time (TQT)

Each unit in this qualification has been allocated a number of Guided Learning Hours (GLH). This is the number of guided learning hours that WJEC expects centre to provide to support learners to achieve a unit. Guided learning means activities such as classroom-based learning, tutorials and online learning, which is directly supervised by a teacher, tutor or invigilator. It also includes all forms of assessment which take place under the immediate guidance or supervision of a teacher, supervisor or invigilator.

The total number of GLH assigned to this qualification is 120 hours.

In addition to the GLH, WJEC also specifies a total number of hours that it is expected learners will be required to undertake in order to complete the qualification: this is referred to as the Total Qualification Time (TQT). Activities which can contribute to a qualification's TQT include independent and unsupervised research, unsupervised coursework, unsupervised e-learning and e-assessment and all guided learning.

The total number of TQT assigned to this qualification is 160 hours.

3 UNIT STUCTURE

The unit title summarises in a concise manner the content of the unit.

Guided learning hours (GLH)

Guided learning time represents only those hours in which a tutor is present and contributing to the learning process. In some organisations this is known as 'contact time'. This time includes lecturers, supervised practical periods and supervised study time.

Aim and purpose

The aim and purpose provides a brief and clear summary of the unit. It also indicates the applied purpose for the unit.

Unit Introduction

This is written to the learner and gives a summary of the unit content. It sets the vocational context of the unit and highlights the purpose of the learning in the unit.

Learning outcomes

Learning outcomes state what the learner should know, understand or be able to do as a result of completing the learning in the unit.

Assessment Criteria

The assessment criteria specify the standard a learner is expected to meet to demonstrate that the learning outcomes of that unit have been achieved.

Unit content

The indicative content defines the breadth and depth of learning for each assessment criteria. It is expected that all the indicative content will be delivered during the programme of learning. It is not required to assess every aspect of the content when assessing the unit. Learners will be expected to apply the knowledge, understanding and skills acquired through the learning to the specifics of the assessment context.

Performance Bands

These are used to determine the summative unit grade. Performance bands do **not** add additional requirements to the assessment criteria. Performance bands are used to determine the grade for a unit.

Assessment

WJEC Level 1/2 Vocational Award in Engineering units are assessed through controlled internal assessment or external assessment. This section of the unit summarises assessment requirements.

Guidance for delivery

This gives the tutor some ideas on how to deliver the internally assessed units in a vocational setting consistent with the philosophy of the qualification and intent of the unit. A minimum of three sample contexts are provided for each unit. The guidance also gives ideas of vocational settings for the unit and suggests possible contacts that could be made in the delivery of the learning. This section also includes details of how the unit supports the development of Skills - PLTS, Key Skills, Functional Skills and Essential Skills (Wales).

Resources

This identifies useful resources to help in the delivery of the learning. Many of the resources listed are suitable for using with learners.

4 ASSESSMENT

The WJEC Level 1/2 Vocational Award in Engineering is assessed using a combination of internal and external assessment.

4.1 External assessment

Unit 3: Solving Engineering Problems will be externally assessed. Details of the external assessment are as follows:

- 90 minute examination;
- Total of 60 marks;
- Three questions on each paper;
- Short and extended answer questions, based on stimulus material and applied contexts;
- Each question will have an applied problem solving scenario;
- One question will have a scenario from which a series of discrete, specific problems need to be addressed;
- Each paper will have questions that address at least **two** of mechanical, electronic and structural engineering problems;
- At least **5** marks will be awarded for demonstration of mathematical skills. This could include interpretation, calculation or use of mathematical terminology;
- At least **10** marks will be awarded for demonstrating drawing skills;
- Available in June of each year;
- Learners are allowed one re-sit opportunity. The highest grade will contribute towards the overall grade for the qualification;
- WJEC will produce a mark scheme which will be used as the basis for marking the examination papers;
- Graded Level 1 Pass, Level 2 Pass, Level 2 Merit and Level 2 Distinction.

Grades will be awarded on the basis of the following performance descriptions. Performance descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades for external assessment. The descriptions must be interpreted in relation to the content specified in the specification; they are not designed to define that content. The grade awarded will depend in practice upon the extent to which the candidate has met these descriptors. Shortcomings in some aspects of the examination may be balanced by better performances in others.

Level 1 Pass

Learners recall, select and communicate limited knowledge and understanding of engineering. They analyse and evaluate limited information and data to apply limited knowledge and understanding to engineering problems. They show limited use of mathematical techniques in making calculations and producing engineering drawings. Learners present information with limited clarity.

Level 2 Pass

Learners recall, select and communicate some knowledge and understanding of engineering. They analyse and evaluate some information and data to apply some relevant knowledge and understanding to solving some engineering problems. They show use of some mathematical techniques in making mainly accurate calculations and producing engineering drawings that show some use of engineering conventions. Learners use some effective written communication skills to present information that is mainly clear and accurate.

Level 2 Distinction

Learners recall, select and communicate detailed knowledge and thorough understanding of engineering. They analyse and evaluate information and data to apply relevant knowledge and understanding to solving a range of engineering problems. They show use of mathematical techniques in making accurate calculations and producing engineering drawings, making consistent use of engineering conventions. Learners use effective written communication skills to present information clearly and accurately.

4.2 Internal assessment

The following units are internally assessed:

- *Unit 1: Engineering Design*
- *Unit 2: Producing Engineering Products*

For internal assessment please consult 'WJEC's Instructions for conducting controlled assessment'. This document can be accessed through the WJEC website (www.wjec.co.uk). Each centre must ensure that internal assessment is conducted in accordance with these controls.

The following principles apply to the assessment of each internally assessed unit:

- Units are assessed through summative controlled assessment;
- Controls for assessment of each internally assessed unit are provided in a model assignment;
- Each internally assessed unit must be assessed independently. Learners may produce a piece of evidence that contributes to assessment criteria for more than one unit. This is acceptable provided it can be clearly attributed to a specified assessment criterion and has been produced under the appropriate controlled conditions for each unit;
- Performance bands are provided for Level 1 Pass, Level 2 Pass, Level 2 Merit and Level 2 Distinction. Evidence must clearly show how the learner has met the standard for the higher grades.

There are three stages of assessment that will be controlled:

- Task setting
- Task taking
- Task marking

Task setting

For internal assessment, WJEC has produced model assignments for each unit. Centres are, however, allowed to modify the assignment within specified parameters. This will allow centres to tailor the assessment to local needs. The model assignment has been written to ensure the following controls are in place:

- Each unit is assessed through one assignment;
- Each assignment must have a brief that sets out an applied purpose. An applied purpose is a reason for completing the tasks that would benefit society, a community, organisation or company. Further details are in the rationale in Section 1.2;
- The assignment can specify a number of tasks but tasks must be coherent, i.e. show how the assessment requirements all contribute to the achievement of the applied purpose of the assignment;
- The assignment must provide each learner with the opportunity to address all assessment criteria and all performance band requirements;
- The assignment must indicate the acceptable forms of evidence. These must conform to those forms set out in the model assignment;
- Where a centre has adapted the model assignment, there must be evidence of quality assuring its fitness for purpose. Sample documentation for this activity is provided with each model assignment.

Task taking

There are five areas of task taking that are controlled: time, resources, supervision, collaboration and resubmission.

Time

Each model assignment will specify the total amount of time available for summative assessment. Centres have the discretion for how that time is allocated to each task.

Resources

The assessor can determine which resources should be provided to all learners to ensure fair and valid assessment takes place. Where specific resource controls must be in place, these will be stated in the model assignment.

Supervision

Learners must normally be supervised by an assessor whilst completing controlled assignment tasks. Model assignments will specify if supervision is not required. Centres must have in place systems to ensure learners cannot access evidence they have been developing outside of supervised activities.

Authentication

Supervision is in place to ensure the authenticity of evidence produced for summative assessment. Assessors are not expected to provide input or guidance to learners during the controlled assessment time. This includes providing formative feedback on the evidence being produced. Assessors can provide guidance on the requirements of the task and remind learners of the performance bands and how they can be interpreted. Assessors must intervene where there is a Health and Safety hazard observed.

Learners can review and redraft evidence independently within the time controls for the assessment.

Learners must sign a declaration to confirm that all evidence submitted for moderation is their own work and that any sources used have been acknowledged.

Assessors must sign a declaration to confirm that evidence submitted for moderation was completed under the controlled conditions set out in the model assignments.

Collaboration

The model assignment will indicate whether:

- Group work must take place;
- Group work is forbidden;
- Centres can elect to complete tasks through group work.

Where group work takes place, the following principles must be applied:

- Tasks should allow each member of the group to have full access to all performance bands for all assessment criteria;
- Learners **must** provide an individual response as part of any task outcome;
- Evidence of individual response may include written evidence (e.g. notes, evaluations, mind maps, etc.) and/or audio-visual evidence (e.g. recordings, photographs, drawings, designs, etc.);
- Evidence must be clearly attributable to each individual member of the group;
- Individual contributions must be clearly identified and stated on the accompanying authentication sheet which must be signed by both the teacher and the candidate;
- Assessment of the individual must be based on the individual contribution to the evidence produced;
- Learners achievement must not be affected by the poor performance of other group members;
- Learners achievement must not benefit from the performance of other group members.

Re-sitting

Learners may re-enter internally assessed units. The learner must submit a new assessment, completed within the same levels of control. They cannot improve previously submitted work.

Learners have one resit opportunity for each assessed unit.

Where an individual learner who has previously submitted group work for assessment wishes to resit an internally assessed unit, one of the following options **must** be taken:

- the candidate must create a new piece of work within the same group;
- the candidate must create a new piece of work within a new group;
- the candidate must create a new piece of work with non- assessed candidates;
- the candidate must create an individual piece of work.

The same levels of control for group work, as outlined above, will apply to candidates who choose to re-sit.

Task marking

All marking of evidence must be made against the assessment criteria and performance band statements given in each unit specification. Evidence marked must comply with the controlled requirements set out in the model assignment. Written evidence must be annotated to show how it relates to the assessment criteria and performance band requirements.

Performance evidence, for example of giving a presentation, must be made on observation records. Observation records will include a description of learner performance as well as a summative statement on the quality of that performance. Where performance is observed by someone other than an assessor, the 'witness' must complete a witness statement. Assessors will need to authenticate the statement either through scrutiny of supporting evidence and/or questioning of the learner and/or witness. If the statement is authenticated, it can be allowed to contribute to the evidence for assessment. Evidence of authentication will also need to be included. Each model assignment that allows performance evidence will include a sample observation record and witness statement.

Marking should only be undertaken by a designated assessor. An assessor should have appropriate expertise in the subject and level for a specified unit. The assessor is responsible for ensuring that:

- Assessment is conducted under specified controlled conditions;
- They are clear about the requirements of the learning outcomes, assessment criteria and performance band statements prior to commencing controlled assessment;
- Evidence presented for assessment is authentic;
- Assessment decisions are accurately recorded;
- Evidence is appropriately annotated;
- Observation records contain sufficient detail for objective corroboration of decisions;
- Judgements are only made against the performance band statements.

4.3 Synoptic assessment

Synoptic assessment is

'a form of assessment which requires a candidate to demonstrate that s/he can identify and use effectively in an integrated way an appropriate selection of techniques, concepts, theories and knowledge from across the whole vocational area, which are relevant to a key task'

'Qualifications for 14 -16 year olds and Performance Tables: Technical guidance for Awarding organisations' DfE p7

All units in WJEC Level 1/2 Vocational Award in Engineering have been designed to require learners to develop their learning by working towards work related purposeful tasks. Learners will select and apply their learning in completion of these tasks.
In addition, *Unit 3: Solving Engineering Problems* allows learners to reinforce their learning from units 1 and 2 in different contexts in order to propose solutions to engineering problems.

4.4 Standardisation

Centres are expected to standardise internal assessment decisions. This is the process by which centres ensure that all learners are judged to the same standard across different assessors, teaching groups and from year to year. Evidence of standardisation should be submitted with learner evidence.
Where more than one assessor is involved, the centre must appoint a Lead Assessor. The role of the Lead Assessor is to:

- Document all activities;
- Ensure that the assignment presented to learners is fit for purpose and complies with all controls;
- Ensure all assessors have appropriate documentation in place to support fair and valid assessment decisions;
- Ensure all assessment activities are in accordance with the task taking controls for the unit;
- Sample assessment judgements at appropriate times to ensure the performance bands are correctly and consistently applied;
- Provide feedback to assessors;
- Provide support to assessors on interpretation of performance band requirements.

4.5 Training Lead Assessors

WJEC will provide training for Lead Assessors and assessors each academic year. Assessor support material, including sample documentation, will also be made available to assessors and Lead Assessors.

5 AWARDING AND GRADING

Unit achievement is based on a learner's ability to meet the assessment criteria. Units can be awarded a summative grade of Level 1 Pass, Level 2 Pass, Level 2 Merit or Level 2 Distinction.

Awarding a summative unit grade

Internally Assessed Units

Performance bands have been written to enable learners to demonstrate their ability against the assessment criteria. There are no additional requirements to achieve higher grades.

To be awarded a **Level 1 Pass** grade for a unit, a learner must meet all of the minimum requirements of all assessment criteria for the unit, as set out in the Level 1 Pass performance band.

To be awarded a **Level 2 Pass** grade for a unit, a learner must additionally meet all of the Level 2 pass minimum requirements, as set out in the Level 2 Pass performance band.

To be awarded a **Level 2 Merit** grade for a unit, a learner must additionally meet all of the Merit minimum requirements, as set out in the Merit performance band.

To be awarded a **Level 2 Distinction** grade for a unit, a learner must additionally meet all of the minimum requirements, set out in the Distinction performance bands.

Externally Assessed Units

All Learning Outcomes will be assessed at every assessment opportunity. All Assessment Criteria will be covered within the mark allocation.

Assessment Grid

Learning Outcomes	Assessment Criteria	Marks	%
LO1 understand effects of engineering achievements	**AC1.1** describe engineering developments	15-21	25-35%
	AC1.2 explain effects of engineering achievements		
	AC1.3 explain how environmental issues affect engineering applications		
LO2 understand properties of engineering materials	**AC2.1** describe properties required of materials for engineering products	9-15	15-25%
	AC2.2 explain how materials are tested for properties		
	AC2.3 select materials for a purpose		
LO3 know forming processes of engineering materials	**AC3.1** describe engineering processes	5-12	8-20%
	AC3.2 describe applications of engineering processes		
LO4 be able to solve engineering problems	**AC4.1** use mathematical techniques for solving engineering problems	18-24	30-40%
	AC4.2 convert between isometric sketches and 3rd angle orthographic projections		
	AC4.3 analyse situations for engineering problems		
	AC4.4 propose solutions in response to engineering problems		
TOTAL		**60**	**100%**

Grade boundaries for external units in WJEC Vocational Awards and Certificates are determined each year through an awarding process and published on the WJEC website when results are released. These boundaries state the minimum number of marks needed to achieve each grade. In any exam, the level of challenge may vary from session to session. Consequently, boundaries may vary from session to session to ensure the standard required to achieve a specific grade remains the same over time.

Grading the qualification

Each WJEC Level 1/2 Vocational Award in Engineering will be graded Level 1 Pass, Level 2 Pass, Level 2 Merit, Level 2 Distinction or Level 2 Distinction*. The qualification grade is awarded on the basis of the aggregation of unit grades achieved. Each unit grade achieved by learners will be translated to a Unit Mark for the purpose of awarding the qualification.

From 2020 candidates **must** achieve a **minimum of a level 1 pass for each unit** in order to be awarded a grade for the qualification.

For qualifications awarded <u>from 2020 onwards learners must pass each unit</u> in order to achieve the qualification.

Points available are shown in the following table:

Unit	**Points per unit**			
	Level 1	**Level 2 Pass**	**Level 2 Merit**	**Level 2 Distinction**
Unit 9791	1	2	3	4
Unit 9792	2	4	6	8
Unit 9793	1	2	3	4

Centres should note that these tables have been published to provide guidance to centres. Some variations on the requirements for candidates to achieve each grade may occur between sessions. These requirements, including the points tables, will be published each year on the WJEC and Eduqas websites on the same day results are released to candidates.

The qualification grade is then calculated by comparing the learner's point score to the qualification grade table below.

Qualification	**Overall grading points**	
WJEC Level 1 Vocational Award in Engineering **9790**	Pass	4-6
WJEC Level 2 Vocational Award in Engineering **9790**	Pass	7-10
	Merit	11-13
	Distinction	14-15
	Distinction*	16

6 UNITS

Unit 1 Engineering Design

WJEC reference: 9791

Guided learning hours: 30

Unit aim and purpose
The purpose of this unit is for learners to analyse engineered products in order to propose design solutions to meet requirements.
Unit Introduction
What makes an MP3 player work? How can you make a games controller for young children? Can you make a basketball post that fits into a backpack? How does a 'wind-up' radio work? Could you power a television the same way? Manufacturers, sales teams, technical teams will often ask engineers to find answers to these types of questions. Design consultancies or research and development teams will aim to design products that work, but these products also have to meet different needs. This could be to make the product portable or smaller or cheaper. Whether making something new or adapting an existing product, engineers follow a design process. In this unit, you will learn about that design process. You will learn how to analyse a product so you can see what features make it work and how it meets certain requirements. You will learn how to take ideas from different products in order to produce a design specification for a product.

Learning outcomes	**Assessment criteria**	**Content**
The learner will:	*The learner can:*	
LO1 know how engineered products meet requirements	**AC1.1** identify features that contribute to the primary function of engineered products	**Features** • Of component parts • Electrical components • Mechanical components • Properties of component materials
	AC1.2 identify features of engineered products that meet requirements of a brief	**Requirements** • Aesthetic • Environment (where used) • User/customer/client • Cost • Safety • Ergonomics • Size • Limits • Sustainability
	AC1.3 describe how engineered products function	**Function** • How components interrelate

LO2 be able to communicate design solutions	**AC2.1** draw engineering design solutions	**Draw (using British Standards)**
		• 3rd angle orthographic projection
		• Isometric
		• Dimensions and associated symbols
		  ○ Diameter, circumference, radius, height, depth, width
		• Conventions
		  ○ Title block
		  ○ Dimension lines
		  ○ Extension lines
		  ○ Centre lines
		  ○ Metric units of measurement
		• Hidden detail
		• Scale

Learning outcomes	**Assessment criteria**	**Content**
The learner will:	*The learner can:*	
	AC2.2 communicate design ideas	**Communicate** • Convey meaning • Using appropriate language • Logical structure • Presentation of information • Clarity of language and presentation • Use of appropriate terminology • Audiences (engineers, non-engineers) • Use of visual support, e.g. mock-ups, CAD
LO3 be able to propose design solutions	**AC3.1** develop creative ideas for engineered products	**Creative ideas** • Identify features of other engineered products • Generate ideas • Explore implementation of ideas
	AC3.2 evaluate options for design solutions	**Evaluate** • Constraints • Design requirements • Fit for purpose • Best fit • Operating performance • Reliability **Evaluation techniques** • Total Design Model • SWOT analysis • Advantages and disadvantages
	AC3.3 produce design specifications	**Design specifications** • Clear communication • Demands/wishes • Using prepared templates • Using set criteria

Learning Outcome	**Assessment criteria**	**Performance bands**			
		Level 1 Pass	**Level 2 Pass**	**Level 2 Merit**	**Level 2 Distinction**
LO1 know how engineered products meet requirements	**AC1.1** identify features that contribute to the primary function of engineered products	Identifies features that contribute to the function of engineered products although some features may not contribute to primary function.	Identifies accurately a limited range of features that contribute to the primary function of engineered products.	Identifies accurately a range of features that contribute to the primary function of engineered products.	
	AC1.2 identify features of engineered products that meet requirements of a brief	Identifies features of engineered products although some features may not meet the requirements of a brief.	Identifies accurately a limited range of features that meet requirements of a brief.	Identifies accurately a range of features that meet requirements of a brief.	
	AC1.3 describe how engineered products function	Outlines how engineered products function with limited accuracy.	Describes how engineered products function.	Describes in some detail and with some accuracy how a range of engineered products function.	Accurately describes in detail how a range of engineered products function.
LO2 be able to communicate design solutions	**AC2.1** draw engineering design solutions	Drawings will be in proportion but there may be significant omissions and limitations in use of conventions. Evidence is likely to be focussed on two dimensional sketching.	Drawings will be in scale and proportion but there may be errors omissions and limitations in use of conventions. Evidence is likely to be weighted towards one type of sketching.	Drawing will be to scale and in proportion but there may be omissions and limitations in use of conventions Evidence is balanced in terms of isometric and 3rd angle orthographic.	Drawings will be fully dimensioned, in proportion and will use the appropriate conventions. Evidence is balanced in terms of isometric and 3rd angle orthographic.
	AC2.2 communicate design ideas	Essential elements of design ideas are communicated with some clarity. There is limited effective use of visual aids.	Design ideas are communicated with some clarity. Essential elements of ideas are conveyed effectively. There is some effective use of visual aids.	Design ideas are communicated clearly and effectively. There is effective use of visual aids.	

LO3 be able to propose design solutions	**AC3.1** develop creative ideas for engineered products	Ideas developed show limited creativity and reference to other engineered products.	Ideas developed show limited creativity. There is limited evidence of exploration of ideas and reference to other engineered products.	Ideas developed show creativity. There is evidence of exploration of ideas with some links between other engineered products and ideas demonstrated.	Ideas developed show creativity. There is clear evidence of exploration of ideas with links between other engineered products and ideas demonstrated.
	AC3.2 evaluate options for design solutions	Options are evaluated against a limited range of relevant criteria. Conclusions are mainly stated.	Options are evaluated against a limited range of relevant criteria. There is limited reasoning in conclusions.	Options are evaluated against a range of relevant criteria. Conclusions are reasoned.	Options are evaluated against a range of relevant criteria. Conclusions are clear with detailed reasoning
	AC3.3 produce design specifications	Design specifications are produced. There may be errors in content and presentation.	Design specifications are produced with some accuracy and clarity.	Design specifications are produced with accuracy and clarity.	

Assessment

Requirements for centres

This unit is internally assessed and externally moderated. All assessment must be conducted under controlled assessment conditions and controls have been determined for each stage of the assessment process: task setting, task taking and task marking.

Task setting:

To assist centres in the assessment of this unit, WJEC has provided a model assignment along with guidance and criteria related to using it. The model assignment consists of tasks that are applied and holistic in their approach. Model assignments are designed so that they can be used as they are or adapted by centres to fit with the local sector needs and allow the usage of local resources available to the centre. The model assignment includes information on which aspects of the assignment can be adapted.

Task taking:

Under the process of task taking, controls are set for the key aspects of time, resources, supervision and collaboration.

- The time taken will be specified within the model assignment.
- Resources must be provided that give learners fair and full access to the marking criteria and are appropriate for the assessment and requirements of the unit. Details of specific controls will be given within the model assessment.
- Directions on where direct supervision is provided in the model assignment.
- Directions on where collaboration is allowed within this unit will be detailed in the model assignment for this unit.
- Guidance on collaboration, and where it is permitted, will be given with the model assignment.

Within WJEC model assignments, timing may be suggested for some individual tasks within the overall assessment time. The purpose is to give consortia additional guidance to help to manage the assessment task.

Task marking:

The centre must mark learner's assessment evidence against the performance bands for each assessment criteria. The performance bands describe the depth which the assessment criterion has been achieved by the learner.

Guidance for Delivery

Making teaching vocationally relevant

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

- arranging visits to colleges, universities and training providers for master classes in sketching, including use of CAD. These could be provided by product design graduates;
- visiting a manufacturer to disassemble products and analyse product features;
- arranging talks by visiting speakers, for example a design engineer, showing how they arrived at a design solution.

The following are examples of approaches to delivery which could be used to enhance the learners understanding of the vocational importance of engineering design.

Example 1
A health care facility supporting people with Parkinson 's disease is looking for a design solution for a computer keyboard. Learners meet with representatives to discuss their requirements and, in small groups, design a solution. They present their ideas orally, together with sketches and a 'mock-up' to potential users for feedback.

Example 2
A charity operating overseas has been helping families deal with the aftermath of an earthquake. They meet with learners to describe some of the problems they encounter and the solutions they have implemented. Learners are set a design challenge of designing temporary housing that can be stored in a UK based warehouse and transported and erected at short notice in difficult situations. Learners are given electronic messaging access to representatives of the charity as they develop their ideas, seeking feedback on an ongoing basis. Their final ideas are communicated to overseas representatives using e-media for feedback.

Example 3
As a result of feedback from customers, a retailer is introducing a new product range for its camping department. It has asked for a table and set of four chairs to be designed that can be stored in a box the size of a microwave. Learners visit the retailer to investigate the range of products that are sold. They then present their ideas to the retailer.

Making Contacts

Examples of organisations that may be approached to provide help include:

- retailers;
- engineering producers;
- design consultants;
- service providers;
- community groups.

Essential Skills

This unit provides opportunities for learners to develop a range of skills. Appendix 1 in the specification shows the links to Personal, Learning and
Thinking Skills (PLTS) Key Skills, Functional Skills and Essential Skills (Wales).

Resources

General

- Drawing boards
- Layout paper
- Isometric grid paper
- Set squares
- Selection of sketching pencils.

Textbooks

Pugh S (1991) ***Total Design*** Addison Wesley Publishers ISBN 9780201416398
Neil Phelps and Colin Simmons (2007) ***Revised Drawing Practice BS 8888:2006*** 3rd Edition ISBN 978-0-580-50868-4
Dick Powell (1990) ***Presentation Techniques*** Little, Brown & CompanyISBN-13: 978-0316912433
Koos Eissen, Roselien Steur (2007) ***Sketching: Drawing Techniques for Product Designers*** Bis Publishers ISBN-13: 978-9063691714

Websites

http://accessfm.com/
http://www.bpf.co.uk/Plastipedia/Default.aspx
http://www.roymech.co.uk/Useful_Tables/Drawing/Drawing.html
http://www.roymech.co.uk/Useful_Tables/Drawing/Electical_Control_symbols.html
http://www.estfoundations.com/background3-basic%20project%20skills-sketching.html
http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html
http://l2teautomotive.wikispaces.com/file/view/ENGINEERING+SKETCHING+INFORMATION+SHEETS+MEL02INF2430+v1.1.pdf
http://www.design-technology.org/metalspresentation.ppt
http://www.designandtech.com/
http://www.technologystudent.com/
http://www.btinternet.com/~hognosesam/gcse/
http://www.sda-uk.org/
http://www.stepin.org/
http://www.dtonline.org/
http://www.bbc.co.uk/schools/gcsebitesize/design/
http://www.howstuffworks.com/
http://www.animatedworksheets.co.uk/
http://www.btinternet.com/~hognosesam/gcse/
http://www.design-technology.org/tvs.htm
http://ergonomics4schools.com/

Unit 2 Producing Engineering Products

WJEC reference: 9792

Guided learning hours: 60

Unit aim and purpose

The purpose of this unit is for learners to use skills developed to produce an engineered product.

Unit Introduction

What are vernier callipers? How do I know how to make something? How do I use a centre lathe? Can you use computers in engineering? Can I use a saw to cut metal? How important is it to get measurements right?
It doesn't matter whether making parts for space travel or toys, for bridges or power generation, using the right tools and equipment in a safe way is critical to production engineering. Production engineers, skilled machinists and maintenance engineers will use a range of engineering processes, equipment and tools to make engineered products. They will work from engineering information, whether provided by design consultants, quality managers or colleagues, or they will produce their own information as they try out different ways of engineering a product.
Through this unit, you will learn to interpret different types of engineering information in order to plan how to make engineered products. You will develop the skills needed to work safely with a range of engineering processes, equipment and tools. With these skills, you will learn to make a range of engineered processes that are fit for purpose.

Learning outcomes	**Assessment criteria**	**Content**
The learner will:	*The learner can:*	
LO1 be able to interpret engineering information	**AC1.1** interpret engineering drawings	**Interpret** • Symbols • Conventions • Information • Calculations **Sources** • Sketches • Drawings • Design specifications
	AC1.2 interpret engineering information	**Engineering information** • Data charts • Data sheets • Job sheets • Specifications • Tolerances
LO2 be able to plan engineering production	**AC2.1** identify resources required	**Resources** • Materials • Equipment • Tools • Time
	AC2.2 sequence required activities	**Sequence** • Prioritise activities • Which are needed before something else can be done • Within designated parameters • Consideration of resources available • Contingencies
LO3 be able to use engineering equipment	**AC3.1** use tools in production of engineering products	**Tools** • Hand tools • Lathe tools • Turning tools • Portable power tools **Health and safety** • Awareness and application of Health and Safety practices

Learning outcomes	**Assessment criteria**	**Content**
The learner will:	*The learner can:*	
	AC3.2 use equipment in production of engineering products	**Equipment** • Centre lathes • Drilling machines • Milling machines • Portable power tool equipment • Multimeters • UV PCB light box • PCB tank **Health and safety** Awareness and application of Health and Safety practices
LO4 be able to use engineering processes	**AC4.1** use engineering processes in production of engineered products	**Materials** • Metals • Non-metals, e.g. wood, plastics **Engineering processes** • Marking out • Cutting • Finishing • Preparing • Shaping • Drilling • Turning • Brazing • Joining • Filing • Soldering **Health and safety** Awareness and application of Health and Safety practices
	AC4.2 evaluate quality of engineered products	**Evaluate** • Inspection techniques • Against success criteria • Against engineering information

Learning Outcome	**Assessment criteria**	**Performance bands**			
		Level 1 Pass	**Level 2 Pass**	**Level 2 Merit**	**Level 2 Distinction**
LO1 be able to interpret engineering information	**AC1.1** interpret engineering drawings	Interprets limited information from engineering drawings with limited accuracy. Some information may not be appropriate.	Interprets information from engineering drawings with some accuracy. Some information may not be appropriate.	Accurately interprets most appropriate information from engineering drawings.	Accurately interprets a wide range of appropriate information from engineering drawings.
	AC1.2 interpret engineering information	Interprets engineering information with limited accuracy. Some information may not be appropriate.	Interprets appropriate engineering information with some accuracy.	Accurately interprets appropriate engineering information.	
LO2 be able to plan engineering production	**AC2.1** identify resources required	A limited range of appropriate resources is identified. There are some significant inaccuracies and omissions.	A range of appropriate resources is identified. There are some inaccuracies and minor omissions.	A range of appropriate resources is accurately identified.	
	AC2.2 sequence required activities	A limited range of appropriate activities is identified. There is some attempt to sequence activities although not always taking account of external factors.	A range of appropriate activities is identified. There is some logical sequencing of activities, with some account of external factors.	A range of appropriate activities is identified. Most are logically sequenced, with clear account taken of some external factors.	Appropriate activities are identified and sequenced logically, taking clear account of a range of external factors.
LO3 be able to use engineering equipment	**AC3.1** use tools in production of engineering products	A limited range of tools is used in engineering production. There is some evidence of safe working, although some intervention is required. The learner is able to access information or use tools with guidance. Use of tools may lead to a limited range of outcomes.	A range of tools is used in engineering production. There is evidence of independent safe working although some intervention may be required. The learner is able to use information or tools with limited guidance. Use of tools may lead to outcomes with some quality issues.	A range of tools is used effectively in engineering production. There is evidence of independent, safe working. Use of tools may lead to outcomes meeting most quality requirements.	A range of tools is used effectively in engineering production. There is evidence of independent, safe working. Use of tools will lead to outcomes meeting all quality requirements.

	AC3.2 use equipment in production of engineering products	A limited range of equipment is used in engineering production. There is some evidence of safe working, although some intervention may be required. The learner is able to access information or use equipment with guidance. Use of equipment may lead to a limited range of outcomes.	A range of equipment is used in engineering production. There is evidence of independent safe working, although some intervention may be required. The learner is able to use information or equipment with limited guidance. Use of equipment may lead to outcomes with some quality issues.	A range of equipment is used effectively in engineering production. There is evidence of independent, safe working. Use of equipment may lead to outcomes meeting most quality requirements.	A range of equipment is used effectively in engineering production. There is evidence of independent, safe working. Use of equipment will lead to outcomes meeting all quality requirements.
LO4 be able to use engineering processes	**AC4.1** use engineering processes in production of engineered products	A limited range of processes is used in engineering production. There is some evidence of safe working, although some intervention may be required. The learner is able to access information or use processes with guidance. Use of processes may lead to a limited range of outcomes.	A range of processes is used in engineering production. There is evidence of independent safe working, although some intervention may be required. The learner is able to use information or processes with limited guidance. Use of processes may lead to outcomes with some quality issues.	A range of processes is used effectively in engineering production. There is evidence of independent, safe working. Use of processes may lead to outcomes meeting most quality requirements.	A range of processes is used effectively in engineering production. There is evidence of independent, safe working. Use of processes will lead to outcomes meeting all quality requirements.
	AC4.2 evaluate quality of engineered products	Quality of engineered products is evaluated. Conclusions are mainly straightforward.	Quality of engineered products is evaluated using some appropriate techniques. Conclusions show some reasoning based on evidence.	Quality of engineered products is evaluated using mainly appropriate techniques. Conclusions show clear evidence based reasoning.	

Assessment

Requirements for centres

This unit is internally assessed and externally moderated. All assessment must be conducted under controlled assessment conditions and controls have been determined for each stage of the assessment process: task setting, task taking and task marking.

Task setting:

To assist centres in the assessment of this unit, WJEC has provided a model assignment along with guidance and criteria related to using it. The model assignment consists of tasks that are applied and holistic in their approach. Model assignments are designed so that they can be used as they are or adapted by centres to fit with the local sector needs and allow the usage of local resources available to the centre. The model assignment includes information on which aspects of the assignment can be adapted.

Task taking:

Under the process of task taking, controls are set for the key aspects of time, resources, supervision and collaboration.

- The time taken will be specified within the model assignment.
- Resources must be provided that give learners fair and full access to the marking criteria and are appropriate for the assessment and requirements of the unit. Details of specific controls will be given within the model assessment.
- Directions on where direct supervision is provided in the model assignment.
- Directions on where collaboration is allowed within this unit will be detailed in the model assignment for this unit.
- Guidance on collaboration, and where it is permitted, will be given with the model assignment.

Within WJEC model assignments, timing may be suggested for some individual tasks within the overall assessment time. The purpose is to give consortia additional guidance to help to manage the assessment task.

Task marking:

The centre must mark learner's assessment evidence against the performance bands for each assessment criteria. The performance bands describe the depth which the assessment criterion has been achieved by the learner.

Guidance for Delivery

Making teaching vocationally relevant

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

- arranging a video conference presentation from a health and safety officer of an engineering business. This could be supported by access to a webcam of the engineering plant;
- visiting a manufacturer to observe a production line and the different engineering processes used in the making of an engineered product;
- a work related project, set by an engineering business, for learners to carry out quality checks on engineered products.

The following are examples of approaches to delivery which could be used to enhance the learners understanding of the vocational importance of the impact of producing engineering products.

Example 1

A manufacturer could set a project for learners to make a wind turbine. The wind turbine would require a number of components to be made and then assembled, together with other existing components. Learners would have to plan the production, taking account of access to available tools and equipment. This could also provide opportunities to develop team working skills, negotiating with peers over the use of equipment. Learners could potentially organise themselves into a production line, each taking responsibility for one of the engineering processes. Learners could inspect the wind turbines produced by their peers, taking the role of Quality Manager in the process, giving feedback on the quality of the outcomes.

Example 2

Learners could be presented with engineering drawings and circuit diagrams for the production of a toy radio controlled car. Learners interpret information and plan production. Learners could test their cars using a local community group or primary school for potential users. Learners would observe the operation of the cars in order to evaluate their quality. As a group, they could then discuss any changes that would be recommended to the drawings and/or diagrams.

Example 3

As a result of feedback from customers, a retailer is introducing a new product range for its camping department. It has asked for a table and set of four chairs to be designed that can be stored in a box the size of a microwave. Learners use designs they put together when working on Unit 1 and make one or more of their proposed engineered products.

Making Contacts

Examples of organisations that may be approached to provide help include:

- retailers
- engineering producers
- design consultants

Essential Skills

This unit provides opportunities for learners to develop a range of skills. Appendix 1 in the specification shows the links to Personal, Learning and Thinking skills (PLTS) Key Skills, Functional Skills and Essential Skills (Wales).

Resources

General

A workshop with:

- centre lathe;
- milling machine;
- CNC equipment;
- Micrometer;
- vernier callipers;
- tap & dies;
- engineers square.

Textbooks

Neil Phelps and Colin Simmons (2007) ***Drawing Practice BS 8888:2006*** 3rd Edition ISBN 978-0-580-50868-4
Code of practice BS4163 (2007) ***Health and safety for design and technology in schools and similar establishments*** ISBN 978 0 580 50452 5

Godfrey N and Wallis S (2004) ***GCSE Engineering*** Nelson Thornes ISBN 0748785515

Higgins R (2006) ***Materials for Engineers and Technicians*** Newnes ISBN 0750668504

Timings RL (1998) ***Engineering Materials vol. 1*** Longman ISBN 0582319285

Timings RL (2000) ***Engineering Materials vol. 2*** Longman ISBN 0582404665

Websites

http://www.denford.ltd.uk/index.php?option=com_content&task=view&id=88&Itemid=52

http://www.bpf.co.uk/Plastipedia/Default.aspx

http://www.roymech.co.uk/Useful_Tables/Drawing/Drawing.html (BS 8888)

http://www.tresnainstrument.com/how_to_read_a_vernier_caliper.html

http://www.technologystudent.com/equip1/vernier3.htm

http://www.upscale.utoronto.ca/PVB/Harrison/Vernier/Vernier.html

www.hse.gov.uk/

www.technologystudent.com/health1/ed1.htm

http://www.cat.org.uk

http://www.technologystudent.com/

http://www.btinternet.com/~hognosesam/gcse/

http://www.sda-uk.org/

http://www.stepin.org/

http://www.papertoys.com/

http://www.school-electronics.co.uk/

http://www.edutek.ltd.uk/

http://www.dtonline.org/

http://www.bbc.co.uk/schools/gcsebitesize/design/

http://www.howstuffworks.com/

http://www.animatedworksheets.co.uk/

http://www.btinternet.com/~hognosesam/gcse/

http://www.design-technology.org/tvs.htm

http://ergonomics4schools.com/

Unit 3 Solving Engineering Problems

WJEC reference: 9793

Guided learning hours: 30

Unit aim and purpose

The purpose of this unit is for learners to use their knowledge and understanding of engineering processes and material properties to solve problems.

Unit Introduction

What materials can be used to go into space? Are some vacuum cleaners really innovative? How important was the development of the jet engine? Do robots make better engineers than people? How do I install a gate? How can engineers help communities after an earthquake? How do engineers use computers and technology? How do I tell steel from aluminium? Does it matter?

Engineers can have a major impact on industry and society. The achievements they have made have improved the quality of our everyday life, from the buildings we live and work in to the transport we use to get around and how we enjoy our leisure time. Engineers are able to find solutions to problems, whether it is adapting or combining materials used to produce a product to make it withstand severe weather conditions or fixing materials in a different way to make something more portable. Problem solving is critical to working in engineering. In this unit you will learn about how engineers in the past have found solutions to problems and how other engineers use their ideas to solve problems today. You will learn about materials, processes and maths that engineers use and how they are used to solve problems. In solving problems, you will learn to follow a process and develop drawing skills to communicate your solutions.

Learning outcomes	**Assessment criteria**	**Content**
The learner will:	*The learner can:*	

LO1 understand effects of engineering achievements	**AC1.1** describe engineering developments	**Developments**
		• Engineering
		  ○ Structural
		  ○ Mechanical
		  ○ Electronic
		• Engineers involved
		  ○ UK
		  ○ International
		• Key outputs
		• Applications
		• Technologies
		• Materials

	AC1.2 explain effects of engineering achievements	**Effects** • In the home • In industry • In society
	AC1.3 explain how environmental issues affect engineering applications	**Environmental issues** • Use • Disposal • Recycling • Materials development • Engineering processes • Costs • Transportation • Sustainability **Applications** • Engineering processes • Engineering products

Learning outcomes	**Assessment criteria**	**Content**
The learner will:	*The learner can:*	
LO2 understand properties of engineering materials	**AC2.1** describe properties required of materials for engineering products	**Engineering products** • Structural, e.g. buildings, bridges • Mechanical, e.g. gearbox, crane, bicycle • Electronic, e.g. mobile phone, communications, alarm **Properties** • Tensile strength • Hardness • Toughness • Malleability • Ductility • Conductivity • Corrosive resistance • Environmental degradation • Elasticity
	AC2.2 explain how materials are tested for properties	**Tests** • Destructive tests • Non-destructive tests **Properties** • As in AC2.1
	AC2.3 select materials for a purpose	**Materials** • Ferrous • Non-ferrous • Thermoplastics • Thermosetting plastics • Smart • Composite

Learning outcomes	**Assessment criteria**	**Content**
The learner will:	*The learner can:*	

LO3 know forming processes of engineering materials	**AC3.1** describe engineering processes	**Processes**
		• Marking out
		• Cutting
		• Finishing
		• Preparing
		• Shaping
		• Drilling
		• Turning
		• Brazing
		• Joining
		  ○ Permanent
		  ○ Temporary fixings
		• Filing
		• Soldering

	AC3.2 describe applications of engineering processes	**Applications** • For material removal • For shaping and manipulation • For joining and assembly • For heat and chemical treatment

Learning outcomes	**Assessment criteria**	**Content**
The learner will:	*The learner can:*	

LO4 be able to solve engineering problems	**AC4.1** use mathematical techniques for solving engineering problems	**Mathematical techniques**
		• Use of formulae
		  ○ Ohms law
		  ○ Efficiency
		• Areas and volumes of geometric shapes
		• Calculation
		• Measuring
		• Estimation
		• Mean
		• Units of measurement
		  ○ Metric
		  ○ Metres, millimetres
		  ○ Pounds, pence

	AC4.2 convert between isometric sketches and 3rd angle orthographic projections	**Convert** • Section views • Construction lines • Centre lines • Hidden detail • Standard conventions
	AC4.3 analyse situations for engineering problems	**Analyse** • Filter information • Synthesise information • Identify salient points • Identify requirements
	AC4.4 propose solutions in response to engineering problems	**Propose solutions** • Communication • Logical structure

Assessment

This unit is externally assessed. The external assessment will be available in the June of each year. The specification for the external assessment is as follows:

Duration: 1 hour 30 minutes

Number of marks: 60

Weightings of Learning Outcomes

	LO1	LO2	LO3	LO4
%	**25-35%**	**15-25%**	**8-20%**	**30-40%**
Marks	**15-21**	**9-15**	**5-12**	**18-24**

Grading: Level 1 Pass, Level 2 Pass, Level 2 Merit, Level 2 Distinction

Format: short and extended answer questions based around applied situations. Learners will be required to use stimulus material to respond to questions.

Engineering: questions could relate to mechanical engineering, electronic engineering, structural engineering or any combination of the three types of engineering.

Guidance for Delivery

Making teaching vocationally relevant

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

- arranging visits to colleges, universities and training providers for master classes in sketching. These could be provided by product design graduates;
- visiting a manufacturer to observe engineers working with different processes and materials;
- arranging talks by visiting speakers, for example a design engineer showing how they used understanding of engineering to solve a problem.

The following are examples of approaches to delivery which could be used to enhance the learners understanding of the vocational importance of the impact of solving engineering problems.

Example 1

Learners visit a heritage or transport museum observing the exhibits and identifying related engineering achievements. As a result, they produce a 'family tree' showing the relationship between the exhibits and engineers. Learners are then asked to identify a suitable exhibit to be added to the museum that would extend their family tree to current times. They present their ideas to the museum representatives.

Example 2

A manufacturer of a printer is receiving feedback of maintenance issues with the machine and learners are asked to review the materials and manufacturing processes used to make the printer to propose solutions. Learners investigate engineering achievements in order to determine which could be applied to the problem. Learners present their ideas to the manufacturer for feedback.

Example 3

A charity operating overseas has been helping families dealing with the aftermath of an earthquake. They meet with learners to describe some of the problems they encounter and the solutions they have implemented. Learners are set a design challenge of designing temporary housing that can be stored in a UK based warehouse and transported and erected at short notice in difficult situations. Learners are given electronic messaging access to representatives of the charity as they develop their ideas, seeking feedback on an ongoing basis. Their final ideas are communicated to overseas representatives using e-media for feedback.

Example 4

Learners visit a manufacturer of parts for the aerospace industry. They are presented with a range of materials that are used by the manufacturer and, in groups, they use a variety of tests to determine the properties of the materials. They compile a table summarising the properties of materials. Learners are then given details of components and their use in aerospace and learners match the materials to the components. Representatives of the manufacturer then show learners how the materials are actually used.

Making Contacts

Examples of organisations that may be approached to provide help include:

- retailers
- engineering producers
- design consultants
- museums
- community groups

Essential Skills

This unit provides opportunities for learners to develop a range of skills. Appendix 1 in the specification shows the links to Personal, Learning and Thinking skills (PLTS) Key Skills, Functional Skills and Essential Skills (Wales).

Resources

Textbooks

Godfrey N and Wallis S (2004) ***GCSE Engineering*** Nelson Thornes ISBN 0748785515

Websites

http://www.bpf.co.uk/Plastipedia/Default.aspx

http://www.roymech.co.uk/Useful_Tables/Drawing/Drawing.html (BS 8888)

http://www.technologystudent.com

http://accessfm.com/

http://www.youtube.com/watch?v=_K00xt_cxbI

http://www.youtube.com/watch?v=IPvSFIqIfCk

http://www.greatachievements.org/

http://www.technologystudent.com/joints/matprop1.htm

http://www.cat.org.uk

http://www.technologystudent.com/

http://www.enged.com.au/

http://www.btinternet.com/~hognosesam/gcse/

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hthttp://www.papertoys.com/tp://robotics.nasa.gov/rcc

http://www.sda-uk.org/

http://www.stepin.org/

http://www.school-electronics.co.uk/

http://www.btinternet.com/~hognosesam/gcse/

hhttp://ergonomics4schools.com/

ttp://www.edutek.ltd.uk/

http://www.dtonline.org/

http://www.bbc.co.uk/schools/gcsebitesize/design/

http://www.howstuffworks.com/

http://www.ohmfree.com/

7 ENTRY PROCEDURES

WJEC Level 1/2 Vocational Award in Engineering will be available for certification from June 2014.

Thereafter, each qualification will be available for certification each June. Entries for the June series must be submitted no later than 21st February.

Candidates may resit internally assessed units once only and externally assessed units twice, the best grade will be used for aggregation.

Should candidates wish to enter any internally assessed unit for a third time, **no results** from units taken previously may be used in aggregating the new grade. Therefore, all units in the qualification must be taken again.

Should candidates wish to enter any externally assessed unit for a fourth time, **no results** from units taken previously may be used in aggregating the new grade. Therefore, all units in the qualification must be taken again.

Unit entry

Entry for individual units must be made by submitting the relevant unit codes as indicated on each unit of the specification.

Qualification entry

Learners will be entered for the qualification when entering for aggregation (cash-in). Aggregation does not take place automatically: it is necessary to enter the relevant code for aggregation to take place.

8 EXTERNAL MODERATION

The consistency of assessment practices and decisions across centres will be assured through the external moderation of a sample of work.

Each centre will have access to a consultative moderator. The consultative moderator will be available to discuss assessment requirements with centres.

For each series where learners are entered, centres will submit a sample, according to the formula below.

Total number of candidates	***Work to be submitted***
1-10	All
11-99	10 to cover a representative sample of Level 1 Pass, Level 2 Pass, Level 2 Merit and Level 2 Distinction candidates
100-199	15 to cover a representative sample of Level 1 Pass, Level 2 Pass, Level 2 Merit and Level 2 Distinction candidates
200+	25 to cover a representative sample of Level 1 Pass, Level 2 Pass, Level 2 Merit and Level 2 Distinction candidates

** The score is based upon the total points the learners obtain for their units before converting to a qualification grade.*

Centres should ensure they keep all learner portfolios not sent to the moderator in their possession for two months after the closing date for sending samples for moderation. WJEC may require all portfolios for moderation and centres must be able to comply immediately with such a request.

Centres should submit a sample for **each unit** that includes:

- The controlled assignment brief used to set the assessment activity;
- A controlled assessment activities sheet completed and signed by the assessor to confirm that the controls for the unit, including authenticity of evidence, have been applied;
- Completed mark record sheets outlining which performance bands are met by the evidence;
- All evidence produced by learners in completion of the controlled assessment, annotated appropriately by the assessor.

Moderators will review all evidence presented to ensure standards are aligned. Evidence will be judged against the following criteria:

- Task setting – were tasks set within the controls set by WJEC in the model assignment?
- Task taking – is there evidence that tasks were completed under the controlled conditions set out in the model assignment?
- Performance bands – does the evidence support assessor's judgement of a learner against national standards?
- Annotation – is the evidence produced by learners appropriately annotated?
- Authentication- is it clear that the evidence submitted was authentically produced by the learner?
- Standardisation – is there evidence of effective standardisation/internal quality assurance within the centre?

Timetable

Samples of work must be submitted for external moderation, and related mark sheets returned to WJEC by 5 May for the June series. Centres will need to ensure that internal submission dates are set sufficiently in advance of this to allow for authentication, assessment and standardisation.

Feedback

The outcome of moderation will be to either accept or amend a centre's assessment decisions. Guidance on actions needed before re-sitting of specified units at a subsequent moderation series will be also be provided.

Feedback will be provided through a centre moderator's report for each certification title, covering the units entered by the centre and will be accessible through WJEC secure website. The report will address the criteria referred to above.

A Principal Moderator's report will be provided for each series.

9 AWARDING AND REPORTING

Awarding and reporting of results in WJEC Level 1/2 Vocational Award in Engineering will take place in August of each year.

A **Qualification Certificate,** issued at a later date, will confirm the

- Title
- Level
- Grade of qualification (Level 1 Pass, Level 2 Pass, Level 2 Merit, Level 2 Distinction, Level 2 Distinction*)
- Unit titles contributing to the qualification

10 ACCESS AND SPECIAL CONSIDERATION

Qualifications at this level often require assessment of a broad range of competencies. This is because they are general qualifications and, as such, prepare candidates for a wide range of occupations and higher level courses.

This specification has been designed to offer fair access for all and to minimise the need to make reasonable adjustments for learners who have particular requirements. It is expected that normally, individual learners' abilities, interests and needs will be appropriately catered for by centres through:

(a) the choice of units and qualifications available, and
(b) the potential for personalisation of controlled assessment.

If there are any queries about the use of this flexibility inherent in the specification to meet learners' needs, or about the use of reasonable adjustments, centres should contact WJEC.

Reasonable adjustments are made for disabled candidates in order to enable them to access the assessments. For this reason, very few candidates will have a complete barrier to any part of the assessment. Information on reasonable adjustments is found in the Joint Council for Qualifications document *Regulations and Guidance Relating to Candidates who are eligible for Adjustments in Examinations.* This document is available on the JCQ website (www.jcq.org.uk).

11 POST-RESULTS SERVICES

If a centre wishes to query the outcome of the moderation and/or examination process this must be done formally by the head of the centre, notifying WJEC within 21 days of the publication of results.

The sample of work submitted for moderation will be reviewed by a moderator/examiner not involved in the original process, and the centre informed of the outcome.

Should the centre not be satisfied with the outcome of the review, there is provision for an appeal to WJEC.

12 CLASSIFICATION CODES

Every specification is assigned a national classification code indicating the subject area to which it belongs. The classification code for this specification is XA1. Centres should be aware that candidates who enter for more than one qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Performance Tables.

Centres may wish to advise candidates that, if they take two specifications with the same classification code, schools and colleges are very likely to take the view that they have achieved only one of the two qualifications. The same view may be taken if candidates take two specifications that have different classification codes but have significant overlap of content. Candidates who have any doubts about their subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

13 THE WIDER CURRICULUM

Opportunities for use of technology

Learners are expected to make effective use of ICT in ways that are appropriate to these qualifications. Opportunities will arise during normal classroom activities as follows:

- use spreadsheets for data analysis;
- use the Internet as sources of secondary evidence;
- using multi-media software to present information;
- using technological equipment when making engineering products;
- using software to produce design solutions, e.g. CAD.

Spiritual, Moral, Ethical, Social and Cultural Issues

Developing engineering outcomes that have applications to individuals, societies and businesses require learners to consider the points of view of others, including employers, communities, governments and audiences, in both written and spoken forms, presented in a variety of ways.

Learners will have opportunities to develop critical and analytical skills in their study of information on engineering achievements. They will also have opportunities to reflect on their reading, their own wider experience, and the experience of others, in both written and oral form. In classroom discussion and writing, they will be required to reflect on a range of spiritual, moral, ethical, social, and cultural issues when discussing applications of engineering achievements.

Citizenship

The applications and implications of engineering in society, which are inherent in this specification, encourage the development of a responsible attitude to citizenship. An understanding that individuals have a collective responsibility is fostered in relation to various ethical issues included in the specification.

The specification gives learners opportunities to develop the skills of critical and analytical reading and listening. It also allows them to both express and develop their point of view in writing and speaking, whilst encouraging them to consider critically and constructively the views of others. This ability to make informed and considered judgements is a skill vital in the development of individual citizenship. This specification also underpins the development of a range of skills which are of vital importance to individuals in the wider world.

Environmental Issues

This specification affords candidates the opportunity to read about, write about, and discuss environmental issues associated with engineering processes and materials. Whether using smart materials, energy consuming engineering processes or designing disposable engineering products, there are opportunities to develop an awareness of environmental issues and controversies.

Health and Safety Consideration

At all times both teachers and candidates should be aware of Health and Safety issues arising from work both within and outside the centre. Risk assessments are required for all practical work whether it takes place in an engineering workshop or IT room. The specifications require candidates to develop the relevant skills and awareness of Health and Safety issues.

The European Dimension

The approach used in constructing the specification lends itself to the establishment of links with other areas of study, particularly those involving economic and industrial understanding. It may also be used to illustrate the European dimension and requires consideration of the issues posed by different perspectives.

APPENDICES

Appendix 1 Skills Mapping

Personal, Learning and Thinking Skills (PLTS)

PLTS	*Unit 1*	*Unit 2*	*Unit 3*
Independent enquirers	✓	✓	✓
Creative thinkers		✓	✓
Reflective learners	✓	✓	✓
Team workers	✓	✓	✓
Self managers	✓	✓	✓
Effective Participators	✓	✓	✓

KEY SKILLS AND ESSENTIAL SKILLS (WALES)

Application of Number

	Unit 1	*Unit 2*	*Unit 3*
Understand numerical data	✓	✓	✓
Carry out calculations	✓	✓	✓
Interpret results and present findings	✓	✓	✓

Communication

	Unit 1	*Unit 2*	*Unit 3*
Speaking and listening	✓	✓	✓
Reading	✓	✓	✓
Writing	✓	✓	✓

ICT

	Unit 1	***Unit 2***	***Unit 3***
Use ICT systems	✓	✓	✓
Find, select and exchange information, using ICT	✓	✓	✓
Develop and present information, using ICT	✓	✓	✓

Improving own Learning and Performance

	Unit 1	***Unit 2***	***Unit 3***
Set targets using information from appropriate people and plan how these will be met	✓	✓	✓
Take responsibility for your learning, using your plan to help meet targets and improve your performance	✓	✓	✓
Review progress and establish evidence of your achievements	✓	✓	✓

Problem Solving

	✓ ***Unit 1***	✓ ***Unit 2***	✓ ***Unit 3***
Explore a problem and identify ways of tackling it	✓	✓	✓
Plan and implement at least one way of solving the problem	✓	✓	✓
Check if the problem has been solved and review your approach to problem solving	✓	✓	✓

Working with Others

	Unit 1	***Unit 2***	***Unit 3***
Plan work with others	✓	✓	✓
Seek to develop co-operation and check progress towards your agreed objectives	✓	✓	✓
Review work with others and agree ways of improving collaborative work in the future	✓	✓	✓

Appendix 2 Glossary

A 2.1 Knowledge learning outcomes

Knowledge learning outcomes are effectively assessed through the learner giving the 'facts' of a situation.

Differentiators

Differentiators in performance are often given using the following terms:

Accuracy

Is what they are claiming as fact actually correct?

Breadth/range

Is there an expectation of breadth rather than depth i.e. they should have superficial knowledge of a lot of facts rather than in-depth knowledge of a few. The evidence presented is sufficiently varied to give confidence that the knowledge and principles are understood in application as well as in fact.

Clarity

This is often related to communication skills; however written form should be focussed and accurately expressed, without ambiguity.

Depth/detail

Have they given sufficient detail to confirm that they really do know something? To describe something item by item, giving all the facts.

Detailed

Point-by-point consideration of, e.g. analysis, argument

Relevance /application

Correctly focused on the activity. Putting to a special use or purpose. Do the facts have to be relevant to the situation? Is it simply pure theory or do you want them to show knowledge through their discarding of what they consider is not relevant.

Command Verbs

A consideration of the command verbs used in the AC, can help determine which differentiators could be used. Below are definitions of knowledge related command verbs.

Describe – set out characteristics, paint a picture in words, describe could be extended to merit and/or distinction, but could also be pass only. If it is to be extended to distinction, then there will probably need to be a number of qualifiers.

Define – state the meaning of a term. It is unlikely this could be extended to merit or distinction level.

Identify – recognise, distinguish and establish what something is. It is unlikely that this could be extended to distinction level. Differentiation is likely to be about relevance and accuracy.

Illustrate – exemplify, describe with reference to examples. This could be extended to merit and distinction level.

Outline – set out main characteristics, gives a sketch of the situation, gives an overall impression. This is unlikely to be extended to merit and distinction level.

State – make an assertion. This would not extend beyond pass.

A 2.2 Understand learning outcomes

Understanding learning outcomes are effectively assessed through the learner showing how they have applied their knowledge through effective reasoning.

Differentiators

Clarity Is the reasoning explicit or implicit? Focussed and accurately expressed, without ambiguity. Where reasoning is implicit the level of understanding has to be interpreted. Explicit reasoning shows the understanding clearly exists.

Depth How detailed is the reasoning?

Justification Reasoning is explained in full; well-grounded Are you persuaded of their argument and reasoning?

Substantiation Has the learner drawn on evidence to support any conclusions made.

Validity Is the reasoning valid? Is it accurate? Is it based on the context of the situation? Is it based on theory?

Command Verbs

Below are definitions of understanding related command verbs.

Analyse – examine in detail, break into component parts, examine relationships.

Assess – make a judgement about the quality or value of something

Compare – explain similarities and differences

Evaluate –make judgements against criteria, usually based on analysis and data, taking into account different factors and using available knowledge/experience

Explain – set out the purposes or reasons

Justify – persuade someone of the validity of an argument, to validate a proposal. Reasoning is explained in full; well-grounded.

A 2.3 Be able to learning outcomes

'Be able to' learning outcomes focus on learner's development of skills. They involve practical, hands on activities. Related AC's are often assessed through the production of ephemeral evidence, such as witness testimonies and observation records.

Differentiators

Accuracy

Acting or performing with care and precision; within acceptable limits from a standard. Were they able to elicit accurate information by using the skills?

Adaptation
Can they use the skill in different contexts?

Appropriate

Relevant to the purpose/task. Was the skill used appropriately, taking account of the situation/location?

Confidence

Exhibiting certainty; having command over one's information/argument etc . Very difficult to assess as it is an intrinsic feeling so assessors will find this challenging to determine. It is sometimes used, however.

Effectiveness

Did the use of the skill produce the expected outcomes?

Effective versus efficient: both express approval of the way in which someone or something works but their meanings are different. **Effective** describes something which successfully produces an intended result, without reference to morality, economy or effort, or efficient use of resources. **Efficient** applies to someone or something able to produce results with the minimum expense or effort, as a result of good organisation or good design and making the best use of available resources.
Independence

Were the learners able to demonstrate the skill without support or guidance from others?

Command Verbs

Below are definitions of 'be able to' related command verbs.

Collaborate – make a contribution to the work of a team, supporting team members as required

Communicate – ensure information is received effectively

Display – organise and present information diagrammatically

Handle – manipulate a tool/equipment to a desired effect

Monitor – observe and record activity, could also include ensuring expected progress is maintained

Maintain - to keep in an appropriate condition

Plan – organise a range of components into a logical sequence. This could also include timings. It could also include how this organisation is presented.

Present – organise and communicate in a way that can be clearly followed and understood.

1. Produce an exposition/resumé for an audience, e.g. at the conclusion of the project to demonstrate what has been done and the outcome.

2. Set out (project) aims, content, outcomes and conclusions clearly/logically for the use/benefit of others.

Process – use a series of actions to elicit results

Record – obtain and store data and information

Use – employ something for a purpose