WJEC Level 1/2 Vocational Award in Engineering (Technical Award)

SAMPLE ASSESSMENT MATERIALS

UNIT 2

For teaching from 2022
For award from 2024

Contents

Unit 2: Designing Engineering Products

Assignment

SAMPLE ASSESSMENT MATERIALS

Assessment time: 10 Hours

INSTRUCTIONS FOR CANDIDATES

Read the brief carefully prior to starting the assignment.

You will gain marks for key tasks that are completed in the Assessment window. The total time allocated for assessed tasks will be 10 hours. This is outlined clearly in the brief.

Your work should include knowledge and understanding gained from classroom teaching.

Read the information and assignment tasks carefully to make sure you understand what is needed.

It is important that you work independently from other candidates and make sure the work you produce is your own unaided work.

Check your work carefully to make sure that it is accurate and correct and meets assessment requirements.

INFORMATION FOR CANDIDATES

You and your teacher will be required to sign a declaration that all work presented is the work of you alone.

You must not discuss or share any details of the case studies or tasks until after 5 May 20XX.

WJEC/Eduqas Level 1/2 Vocational Award in Engineering (Technical Award)

Unit 2 Designing Engineering Products

Controlled Assessment

Sample Assessment Brief

Out of this World Computers recently commissioned a new design for a tripod that will hold any model of mobile phone to use for a variety of tasks such as photography, video calls or animation. The product is now a popular seller for the company and sales of the product are good.

Recent feedback from customers has identified that the tripod lacks adjustability and that it can be a little difficult to obtain a good range of angles for placing the mobile phone. Out of this World Computers would now like to modify the tripod to incorporate an element of adjustability that customers are now looking for.

You have been commissioned to use the engineering information provided for Unit 1 and the design specification included with this brief as a starting point to design a solution for the tripod that will allow it to become adjustable.

This is a design task. There is no requirement for modifying or manufacturing the engineered design solution.

You should:

- consider the functions of features of the product, and suggest other engineered products that have similar functional elements, considering mechanical and component properties
- design and present a range of solutions that meet the criteria and evaluate each design for its suitability
- create engineering drawings of the final proposal
- outline a manufacturing specification for a third party to produce the proposed modifications
- calculate the cost of materials for the design solution
- advise a third-party manufacturer about materials and processes to be used in the making of your designed prototype.

Assignment Tasks

Unit content	Tasks:		Evidence Required	Time	Controls	AOs	Marks
2.1.1	1a(i)	Explain the individual functions of the primary features of the product. You should consider (where appropriate): • electrical components • mechanical components • component properties.	Written or digitally produced documents. Evidence should be supported by images (sketched or found).	1hr	Supervision: Direct Guidance: Indirect Resources: Permitted Collaboration: Not permitted	AO2	2
2.1.2	1a(ii)	Suggest **at least two** other engineered products that have similar functional properties to those required by the given brief. N.B. Suggested products may or may not be the same as that required by the design brief.				AO2	2
2.1.3	1b	Justify how the functional properties of the found engineered products meet the requirements of the brief.				AO3	5
2.2.1	2a	Design a range of solutions that meet the brief and design specification. This should include: • identified features that meet the brief • use of models to support, develop and test the functional qualities of their ideas	Work presented in an appropriate way decided by the learner. This could include: • A3/A4 sketch sheets • CAD drawings/ sketches • Digital submission Work to include: • Fully annotated sketches • Evaluative method to determine outcome • Sketch models.	5hrs	Supervision: Direct Guidance: Indirect Resources: Not permitted Collaboration: Not permitted	AO2	4
2.2.2	2b	Evaluate how your designs meet the criteria set in the brief and design specification relating to: • materials • sizes • tolerances • cost • operational parameters and recommend the best solution.				AO3	4
2.2.3	2c	Present your design ideas clearly using suitable media appropriate to the information being displayed. You should consider: • conveying meaning • using appropriate language • having a logical structure • clearly presenting the information using either ICT or traditional hand-written/illustration methods • using appropriate terminology • including visual support such as simple models, CAD visuals or test rigs.				AO2	4

2.3.2	3a	Draw, using conventions, engineering drawings of your final design solution: To do this, you must: • include 3rd angle dimensioned orthographic views of the product • include an isometric view.	Drawings produced either by hand or using CAD Presented either on paper or digitally.	2hrs	Supervision: Direct Guidance: Direct Resources: Not permitted Collaboration: Not permitted	AO2	6
2.3.1	3b	Outline a manufacturing specification that addresses key points required to manufacture the design solution.	A written or digitally produced document showing key information.	0.5 hrs		AO1	3
2.4.1	4a	Apply mathematical techniques to determine specific problems identified in the given brief. To do this, you must: • show all calculations • use the correct units • use mathematical conventions.	May be evidenced in a written/digital document or be included on sketch sheets or other drawing responses.	0.5 hrs		AO2	4

2.4.2
2.4.3
	4b	The prototype is to be manufactured by a third party.
		You must advise the third party about:
		• materials which may be used in the manufacture of the proposed design modification. Choices should be justified according to properties and testing results
		• processes for manufacturing the component parts of the modified design, which must consider:
		  • material removal and shaping
		  • joining and assembly details
		  • heat and chemical treatment methods
		  • finishing details
		where appropriate. Choices should be justified.
			Either a written or digitally produced documents showing key information.	1hr	Supervision:
					Direct
					Guidance:
					Direct
					Resources:
					Not permitted
					Collaboration:
					Not permitted
						AO3	6

					Total Marks	**40**	

Guide to Controls

There are a number of different aspects that are controlled within the internal assessment of our Vocational Awards. These are:

- supervision
- guidance
- resources
- collaboration.

Redrafting

Re-drafting is allowed within the time of the controlled assessment and without teacher feedback.

Time

The total time allocated for assessed tasks is 10 hours. Candidates cannot exceed this time. Unit 2 tasks feature recommended timings that are for guidance only. Centres should discourage candidates from exceeding the recommended times or devoting insufficient time to this work.

Supervision

One level of supervision features throughout the Unit 2 assessment:

Direct supervision	The use of resources is tightly prescribed. The centre must ensure that: • all candidates are within direct sight of the supervisor throughout the session(s) • display materials which might provide assistance are removed or covered • there is no access to e-mail, the internet or mobile phones • candidates complete their work independently • interaction with other candidates does not occur • no assistance of any description is provided. Candidates' work must remain within the centre at all times and must be stored securely between timetabled sessions. Where direct supervision is specified, the centre must ensure that the JCQ No Mobile Phone poster and JCQ Warning to Candidates is displayed.

Guidance

Two levels of guidance feature throughout the Unit 2 assessment:

Category of Advice/Feedback:	Direct	Indirect
Teachers can:		
Review candidates' work and provide oral and written advice at a **general** level in order to secure a functional outcome.	X	✓
Evaluate progress to date and propose broad approaches for improvement.	X	X
Provide detailed specific advice on how to improve drafts to meet assessment criteria.	X	X
Give detailed feedback on errors and omissions which leave candidates with no opportunity to show initiative themselves.	X	X
Intervene personally to improve the presentation or content of work.	X	X

Resources

Two levels of resources feature throughout the Unit 2 assessment:

Not permitted	The use of resources is not allowed. Access to the Internet is not permitted. Candidates' work must remain within the centre at all times and must be stored securely between timetabled sessions. If the specification allows candidates to bring their own computers or other electronic devices into formally supervised sessions, appropriate checks must be carried out to ensure that all materials stored on the devices is permissible and that access to the internet is disabled.
Permitted	Candidates have access to resources and/or preparatory notes as directed by the brief or unit guidance. Candidates' work must remain within the centre at all times and must be stored securely between timetabled sessions. Centres should refer to specifications for subject-specific guidance.

Where the level of control is 'permitted', candidates' notes are limited as follows:

Task:	Resources permitted:
1a(ii)	Access to the internet is permitted for research of other engineered products.

Collaboration

One level of collaboration features in the Unit 2 assessment:

Not permitted	Candidates should not collaborate in any way during the task.

Mark scheme

Guidance

Assessment grids for Controlled Assessment Unit 2

Generic marking principles

- Marks awarded are always whole marks (not half marks, or other fractions).
- Answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
- Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
- Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Banded mark schemes

Banded mark schemes are divided so that each band within a section has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks.

Before marking, assessors should first read and annotate a candidate's work to pick out the evidence that is being assessed. Once the annotation is complete, the mark scheme can be applied. This is done as a two-stage process.

Stage 1 – Deciding on the band

Beginning at the lowest band, assessors should look at the appropriate section of the candidate's work and check whether it matches the descriptor for that section's mark band. If the descriptor at the lowest band is satisfied, assessors should move up to the next band and repeat this process for each band until the descriptor matches the work.

If a candidate's work covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the candidate's work should be used to decide on the mark within the band. For instance, if work is mainly in band 2 but with a limited amount of band 3 content, the work would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Assessors should not seek to mark candidates down as a result of small omissions in minor areas of their work.

Stage 2 – Deciding on the mark

Once the band has been decided, assessors can then assign a mark. WJEC will provide exemplar work already awarded a mark, and this should be used as reference material when assessing the work.

When marking, assessors can use these examples to decide whether a candidate's work is of a superior, inferior or comparable standard to the example. Assessors are reminded of the need to revisit the work as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the work submitted.

Where work is not creditworthy, that is, contains nothing of any significance to the project, or has been omitted, no marks should be awarded.

Internal standardisation

It is essential that where there is more than one teacher in a centre, work from all teaching groups is standardised internally. This is to ensure that the final assessment reflects a single agreed standard for all teaching groups involved. All centres will receive detailed feedback from moderation via the secure web site on results day.

Differentiation within our mark schemes

The following grid demonstrates our starting point to formulating our mark schemes. These are used in order to ensure differentiation between our bands. Mark schemes will use this table as the basis for the assessment of each question but will reflect the specific demands of the question.

Band Descriptor	AO1	AO2	AO3
Excellent	• Aware of a wide range of detailed and accurate knowledge. • Demonstrates fully developed understanding that shows relevance to the demands of the question. • Effective and precise use of terminology.	• Knowledge and understanding is consistently applied to the context of the question/task. • Practical skills are consistently and effectively applied and are of a high standard. • Is able to form a fully developed and thorough interpretation that is fully accurate.	• Analysis and evaluation skills are used in a highly effective way. • Evidence is selected to construct an effective and balanced argument. • Detailed and substantiated evaluation that offers secure judgements leading to rational conclusions.
Very Good	• Has a range of detailed and accurate knowledge. • Demonstrates well developed understanding that is relevant to the demands of the question. • Precise use of terminology.	• Knowledge and understanding is applied to the context of the question/task. • Practical skills are effectively applied and are of a high to medium standard. • Is able to form a developed interpretation that is mostly accurate.	• Analysis and evaluation skills are used in an effective way. • Evidence is selected to construct a developed argument, that may not be presented in equal measure. • Detailed evaluation that offers generally secure judgements, with some link between rational conclusions and evidence.
Good			

Satisfactory	• Includes accurate knowledge. • Demonstrates sound understanding that is relevant to the demands of the question/task • Generally precise use of terminology.	• Knowledge and understanding is mainly applied to the context of the question/task. • Practical skills are appropriately applied and are of a medium standard. • Is able to form a sound interpretation that is generally accurate.	• Analysis and evaluation skills are used in an appropriate and sound way. • Evidence is selected to construct a sound argument OR • Evidence is selected to construct a detailed one-sided argument. • Evaluation that offers some judgements, with some link between conclusions and evidence.
Basic	• Shows some accurate knowledge. • Demonstrates partial understanding that is relevant to the demands of the question. • Some use of appropriate terminology.	• Knowledge and understanding is partially applied to the context of the question/task. • Practical skills are of a medium to low-level standard. • Is able to form some interpretation that shows some accuracy.	• Analysis and evaluation skills are used in a suitable way with a sound level of competence but may lack precision. • Evidence is selected to construct a one-sided argument • Evaluation that offers generalised judgements and conclusions, with minimal use of evidence.
Limited	• Limited knowledge with some relevance to the topic or question. • Little or no development seen. • Very little or no use of terminology.	• Knowledge and understanding is applied in a minimal manner to the context of the question/task. • Practical skills are of a low-level standard. • Can only form a simple interpretation, if at all, with very limited accuracy.	• Analysis and evaluation skills are used with limited competence. • Unsupported evaluation that offers simple or no judgements/conclusions.

When you look at each of our mark schemes, each band has a sequence of performance descriptors. The descriptors work like a ladder: from a bottom rung, to a top. The lower level band 'Limited' is the simplest descriptor in terms of candidates' performance. The descriptors progress through the grid to the more challenging aspect of that assessment objective. It's important to note that not all questions will use every bullet point listed in the table above, however candidates should demonstrate **all of the requirements** that are included in the published mark schemes in order to achieve full marks at a particular level. If a candidate gets full marks at a particular level, markers should see whether they're also demonstrating any of the requirements from the next level up. Often candidates will achieve some of the descriptors at one level, but not all of them. In this case, apply a best fit principle.

Further information on how the mark schemes for our Vocational Awards have been constructed, including information on the use of the mark bands for Excellent, Very Good and Good can be found in the Vocational Awards Administration Guide.

Task 1(a)(i)

Explain the individual functions of the primary features of the product.

Candidates should consider (where appropriate):

- *electrical components*
- *mechanical components*
- *component properties.*

[2 marks]

AO1	AO1	AO2	AO3	Total marks
Award **two** marks for a developed explanation of all the key parts of the product. Award **one** mark for a basic explanation of some of the key parts of the product.	-	2	-	2

Task 1(a)(ii)

Suggest at least two other engineered products that have similar functional properties to those required by the given brief.

N.B. Suggested products may or may not be the same as that required by the design brief. *[2 marks]*

AO2	AO1	AO2	AO3	Total marks
Award **two** marks for good application of knowledge and understanding to suggest two or three appropriate products that meet key parts of the given brief. Award **one** mark for basic application of knowledge and understanding to suggest two or three products that may not be wholly appropriate in meeting key parts of the given brief.	-	2	-	2

Task 1(b) *Justify how the functional properties of the found engineered products meet the requirements of the brief.* *[5 marks]*	
Band	AO3: *Analyse and evaluate information, making reasoned judgements and presenting conclusions.*
3	**5 marks** A very good response which demonstrates: • highly effective and detailed justifications of how the functional elements of the engineered products meet the constraints of the brief • well-developed and balanced arguments • fully considered judgements, with relevant links between conclusions and evidence.
2	**3-4 marks** A good response which demonstrates: • detailed justifications of how the functional elements of the engineered products meet the constraints of the brief • balanced arguments OR • developed arguments about a limited range of functional properties • considered judgements, with links between conclusions and evidence.
1	**1-2 marks** A basic response which demonstrates: • some justifications of how the functional elements of the engineered products meet the constraints of the brief • some judgements, with conclusions that may not be supported.
	0 marks Response not creditworthy or not attempted.

Task 2(a)

Design a range of solutions that meet the brief and design specification. This should include:

- *identified features that meet the brief*
- *use of models to support, develop and test the functional qualities of their ideas.*

[4 marks]

AO2	AO1	AO2	AO3	Total marks
Award **four** marks for excellent application of knowledge and understanding of how to design a range of detailed and appropriate solutions, each with identified features that convincingly meet the brief and that make effective and meaningful use of models. Award **three** marks for good application of knowledge and understanding of how to design a range of appropriate solutions, each with identified features that meet the brief and that make effective use of models. Award **two** marks for basic application of knowledge and understanding of how to design a range of solutions, each with features that mostly meet the brief, and that make some effective use of models. Award **one** mark for limited application of knowledge and understanding of how to design some solutions with some features that meet the brief and that make some use of models.	-	4	-	4

Task 2(b)

Candidates should evaluate how their designs meet the criteria set in the brief and design specification relating to:

- *materials*
- *sizes*
- *tolerances*
- *cost*
- *operational parameters*

and recommend the best solution. *[4 marks]*

AO2	AO1	AO2	AO3	Total marks
Award **four** marks for a response that demonstrates an excellent evaluation of how the full range of designs meet the given criteria set in the brief and a well-reasoned and rational recommendation for the best solution. Award **three** marks for a response that demonstrates a good evaluation of how the full range of designs meet the given criteria set in the brief and a reasoned and sensible recommendation for the best solution. Award **two** marks for a response that demonstrates a basic evaluation of how the range of designs meet the given criteria set in the brief and a sensible recommendation for the best solution. Award **one** mark for a response that demonstrates a limited evaluation of how the range of designs meet the given criteria set in the brief and a superficial recommendation for the best solution.	-	-	4	4

Task 2(c)

Present design ideas clearly using suitable media appropriate to the information being displayed.
Cadidates should consider:

- *conveying meaning*
- *using appropriate language*
- *having a logical structure*
- *clearly presenting the information using either ICT or traditional hand-written/illustration methods*
- *using appropriate terminology*
- *including visual support such as simple models, CAD visuals or test rigs.* *[4 marks]*

AO2	AO1	AO2	AO3	Total marks
Award **four** marks for an excellent presentation of ideas that successfully conveys meaning, uses appropriate language including a range of effective and precise terminology. It has a logical structure, and makes wholly effective use of ICT or traditional hand-written/illustration methods and visual support such as simple models, CAD visuals or test rigs. There are few, if any errors. Award **three** marks for a good presentation of ideas that conveys meaning, uses appropriate language including appropriate terminology. It has a logical structure, and makes effective use of ICT or traditional hand-written/illustration methods and visual support such as simple models, CAD visuals or test rigs. There may be some minor errors. Award **two** marks for a basic presentation of ideas that conveys some meaning, uses mostly appropriate language including some appropriate terminology. It makes use of ICT or traditional hand-written/illustration methods and some use of visual support such as simple models, CAD visuals or test rigs. There are some errors. Award **one** mark for a limited presentation of ideas that conveys some meaning, uses some appropriate language including little terminology. It makes some use of ICT or traditional hand-written/illustration methods and some use of visual support such as simple models, CAD visuals or test rigs. There are some obvious errors.	-	4	-	4

Task 3(a)

Candiate should draw, using conventions, engineering drawings of their final design solution:

To do this, candidates must:

- *include 3rd angle dimensioned orthographic views of the product*
- *include an isometric view.* *[6 Marks]*

Band	AO2: *Apply skills (including practical skills), knowledge and understanding in a variety of contexts and in planning and carrying out investigations and tasks.*
3	5-6 marks A very good response which demonstrates: • a fully developed engineering drawing in orthographic view which shows all elevations of the product • a highly detailed isometric drawing showing a three dimensional view of the product • a highly detailed range of dimensions • drawings are to fully to scale and titleblocks are completed to a very high standard • a very high quality engineering drawing that shows all key details of the design and uses conventions accurately .
2	3-4 marks A good response which demonstrates: • a developed engineering drawing in orthographic view which shows most elevations of the product • a detailed isometric drawing showing a three dimensional view of the product • a detailed range of dimensions • drawings are to mostly to scale and titleblocks are completed to a high standard • a high quality engineering drawing that shows most key details of the design and uses conventions mostly accurately .
1	1-2 marks A basic response which demonstrates: • an engineering drawing in orthographic view which shows some elevations of the product • an isometric drawing showing a three dimensional view of the product • a narrow range of dimensions • drawings are not to scale and titleblocks are completed to a low standard • a low quality engineering drawing that shows some key details of the design and uses some conventions with some accuracy.
	0 mark Response not credit worthy or not attempted.

Task 3(b)

Outline a manufacturing specification that addresses key points required to manufacture the design solution.

[3 marks]

AO1	AO1	AO2	AO3	Total marks
Award **three** marks for very good knowledge and understanding of how to produce a manufacturing specification that contains precise details of manufacturing requirements presented in textual form and/or included on drawings, and that contains a full range of specification points including materials information, technical details and finishing details. Award **two** marks for good knowledge and understanding of how to produce a manufacturing specification that contains details of manufacturing requirements presented in textual form and/or included on drawings, and that contains a range of specification points including materials information, technical details and finishing details. Award **one** mark for basic knowledge and understanding of how to produce a manufacturing specification that contains some details of manufacturing requirements presented in textual form and/or included on drawings, and that contains a some specification points including materials information, technical details and finishing details.	3	-	-	3

Task 4(a)

Apply mathematical techniques to determine specific problems identified in the given brief.
To do this, candidates must:

- *show all calculations*
- *use the correct units*
- *use mathematical conventions.* *[4 marks]*

AO2 Award **four** marks for the correct answer, correct units and correct method. Award **three** marks for the correct answer, the correct units but a minor error in application of the correct method. Award **two** marks for correct answer and the correct use of units or a correct answer with correct method. Award **one** mark for correct answer without method or for a correct method with an incorrect answer.	AO1	AO2	AO3	Total marks
	-	4	-	4

Task 4(b)

The prototype is to be manufactured by a third party. Candidates must advise the third party about:

- *materials which may be used in the manufacture of the proposed design modification. Choices should be justified according to properties*
- *processes for manufacturing the component parts of the modified design, which must consider:*
  - *material removal and shaping*
  - *joining and assembly details*
  - *finishing details*

where appropriate. Choices should be justified. *[6 Marks]*

Band	AO3: *Analyse and evaluate information, making reasoned judgements and presenting conclusions.*
3	5-6 marks A very good response which demonstrates: • detailed and effective advice that covers the full range of considerations, including materials and their properties and processes for manufacture • well-developed and balanced arguments • fully considered judgements, with relevant links between conclusions and evidence.
2	3-4 marks A good response which demonstrates: • effective advice that covers a range of considerations, including materials and their properties and processes for manufacture • balanced arguments • considered judgements, with links between conclusions and evidence.
1	1-2 marks A basic response which demonstrates: • advice that covers some considerations, such as materials and their properties and processes for manufacture • some judgements, with few, if any, links between conclusions and evidence.
	0 mark Response not credit worthy or not attempted

2. Unit 2 Assessment Criteria

Question			Mark Allocation Section										Total	AO1	AO2	AO3
			2.1.1	2.1.2	2.1.3	2.2.1	2.2.2	2.2.3	2.3.1	2.3.2	2.4.1	2.4.2	2.4.3				
1	**a**	**i**	2											**2**		2	
		ii		2										**2**		2	
	b				5									**5**			5
2	**a**					4								**4**		4	
	b						4							**4**			4
	c							4						**4**		4	
3	**a**									6				**6**		6	
	b								3					**3**	3		
4	**a**										4			**4**		4	
	b											3	3	**6**			6
Total			2	2	5	4	4	4	3	6	4	3	3	**40**	**3**	**22**	**15**