



Oxford Cambridge and RSA

## Level 1/Level 2 Cambridge National in Engineering Design

**R040** Design, evaluation and modelling

Set Assignment

Scenario Title: LED Desk Lamp

**Give to candidates on or after 1 June 2023.**

**Valid for assessment in the January and June 2024 assessment series only.**



### INSTRUCTIONS TO TEACHERS

- Read the information for teachers before delivering this set assignment.

### INFORMATION

- The total mark is **60**.
- This document has **21** pages.

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# Information for teachers

## You **must**:

- use this set assignment for summative assessment of students.
- familiarise yourself with the Assessment Guidance relating to the tasks. This is with the unit content in Section 4 of the [Specification](#).
- read and understand **all** the rules and guidance in Section 6 of the [Specification](#) **before** your students complete and you assess the set assignments.
- make sure that completion of the set assignments and assessment fully adhere to the rules and guidance in Section 6 of the [Specification](#).
- give students the Engineering Design [Student guide to NEA assignments](#) before they start the assignments.
- allow students around 10–12 guided learning hours (GLH) to complete all tasks.
- complete the [Teacher Observation Record](#) on page 17 for Task 2 and the [Teacher Observation Record](#) on page 18 for Task 5. You **must** follow the [guidance](#) on page 19 when completing them. A Word version of this document is available to download from the Teach Cambridge website.

## You **must not**:

- change or modify this assignment.
- use or modify this assignment for practice, even when the assignment is no longer valid for assessment. Sample assessment material is provided for this purpose.

## You **can**:

- give your students a Word version of the risk assessment template provided for Task 4. This can be downloaded from the Teach Cambridge website.

# Scenario for the assignment

## Design, evaluation, and modelling

An engineering design agency produces a range of different LED desk lamps and is looking to develop a new product. Desk lamps are used by many people in the office or at home in a study. They are used to help users to read documents, undertake work and add additional light to a room.

The desk lamp must:

- have LED strip light capability
- be aesthetically pleasing
- be a design suitable for mass production
- allow access to a power source
- have good stability and be free standing
- be constructed from suitable materials for indoor use
- be constructed from recyclable materials
- have a base that will not scratch the supporting surface.



### Important Advice:

- Read through all the tasks carefully, so that you know what you will need to do to complete this assignment.
- Look at the marking criteria grids to see how the tasks will be marked. Your teacher can explain the marking criteria if you need help.
- You will need to use relevant skills/knowledge/understanding from other units you have studied in this qualification.
- You can use the risk assessment template provided for Task 4. Your teacher can give you a Word version to use.

# Your tasks and marking grids

## Task 1 – Product analysis

Topic Area 1.1 is assessed in this task.

As a design engineer, you have been asked by the engineering design agency to undertake a product analysis of a range of LED desk lamps to establish the strengths and weaknesses of the designs.

You will need to consider the factors that influence the design of these LED desk lamps, including how they are manufactured and assembled.

You **must**:

- carry out a comprehensive product analysis of the key features of LED desk lamps.
- identify the strengths and weaknesses within existing LED desk lamps.
- compare LED desk lamps using a customer-driven engineering matrix.

Your research outcomes should be presented in a report which will be used to inform further designs of LED desk lamps.

Total marks for Task 1: 9 marks

### Advice

- Use ACCESS FM to help you analyse LED desk lamps.
- Use primary/secondary research to identify the strengths and weaknesses of existing LED desk lamps.
- Use matrix planning, ranking matrices or Quality Function Deployment (QFD) in your comparisons.

### Topic Area 1.1: Product Evaluation – Product Analysis

MB1: 1–3 marks	MB2: 4–6 marks	MB3: 7–9 marks
Produces a <b>basic</b> product analysis of the key features of products using ACCESS FM.	Produces an <b>adequate</b> product analysis of the key features of products using ACCESS FM.	Produces a <b>comprehensive</b> product analysis of the key features of products using ACCESS FM.
Provides a <b>basic</b> description of the strengths and weaknesses of existing products.	Provides an <b>adequate</b> description of the strengths and weaknesses of existing products.	Provides a <b>comprehensive</b> description of the strengths and weaknesses of existing products.
<b>Basic</b> use of an engineering matrix.	<b>Appropriate</b> use of an engineering matrix.	<b>Effective</b> use of an engineering matrix.

If your work does not meet Mark Band 1 criteria, you will be awarded zero marks for this task.

## Task 2 – Product disassembly

Topic Area 1.2 is assessed in this task.

The engineering design agency has reviewed your report and would now like you to undertake further product analysis through disassembly of a desk lamp (**either LED or non-LED**).

You **must**:

- consider the variety and function of components that are housed within the desk lamp.
- establish the most suitable material, production, assembly and manufacturing method.
- use appropriate tools and instruments to undertake the disassembly.
- ask your teacher to complete a Teacher Observation Record for this task.

Your disassembly outcomes should be presented within a report which will be used to inform further design of desk lamps.

Total marks for Task 2: 9 marks

### Advice

- Ensure photographs are taken during the disassembly.
- Use tools and instruments carefully.
- Present good quality photographs of each component.

### Topic Area 1.2: Product Evaluation – Product Disassembly

MB1: 1–3 marks	MB2: 4–6 marks	MB3: 7–9 marks
Disassembly of a product is <b>dependent</b> upon assistance or help from other sources.	Disassembly of a product is carried out with <b>some</b> assistance or help from other sources.	Disassembly of a product is carried out <b>independently</b> .
<b>Limited</b> understanding of potential hazards and safety considerations when using tools and equipment.	<b>Adequate</b> understanding of potential hazards and safety considerations when using tools and equipment.	<b>Clear</b> understanding of potential hazards and safety considerations when using tools and equipment.
Produces a <b>limited</b> analysis of the components, materials, production methods, assembly, and manufacturing methods used in an engineered product.	Produces an <b>adequate</b> analysis of the components, materials, production methods, assembly, and manufacturing methods used in an engineered product.	Produces a <b>comprehensive</b> analysis of the components, materials, production methods, assembly, and manufacturing methods used in an engineered product.

If your work does not meet Mark Band 1 criteria, you will be awarded zero marks for this task.

## Task 3 – Virtual CAD 3D

Topic Area 2.1 is assessed in this task.

The engineering design agency would now like you to create a 3D model based upon its product specification.

The CAD drawing of the desk lamp could be **rendered** in the style of:

- cardboard
- modelling foam
- acrylic
- timber
- manufactured board
- or a combination of materials.

The LED desk lamp drawing is shown in **Fig. 1** on page 8.

You **must**:

- use CAD software to produce an accurate virtual 3D model of the desk lamp.
- use CAD software to produce individual components.
- use the mate tools to create a CAD assembly using the individual components.
- use CAD software to demonstrate the model from different viewpoints and with the lights on/off.

Total marks for Task 3: 12 marks

### Topic Area 2: Virtual CAD 3D

MB1: 1–4 marks	MB2: 5–8 marks	MB3: 9–12 marks
Produces a <b>basic</b> 3D virtual model using CAD.	Produces an <b>adequate</b> 3D virtual model using CAD.	Produces a <b>comprehensive</b> 3D virtual model using CAD.
Produces a <b>simple</b> 3D virtual model consisting of a very limited number of components.	Produces an <b>adequate</b> 3D virtual model consisting of some mated components.	Produces a <b>complex</b> 3D virtual model consisting of many mated components.
Demonstration of complex industry-related CAD activities is <b>dependent</b> upon assistance or help from other sources.	Demonstration of complex industry-related CAD activities is carried out with <b>some</b> assistance or help from other sources.	Demonstration of complex industry-related CAD activities is carried out <b>independently</b> .

If your work does not meet Mark Band 1 criteria, you will be awarded zero marks for this task.

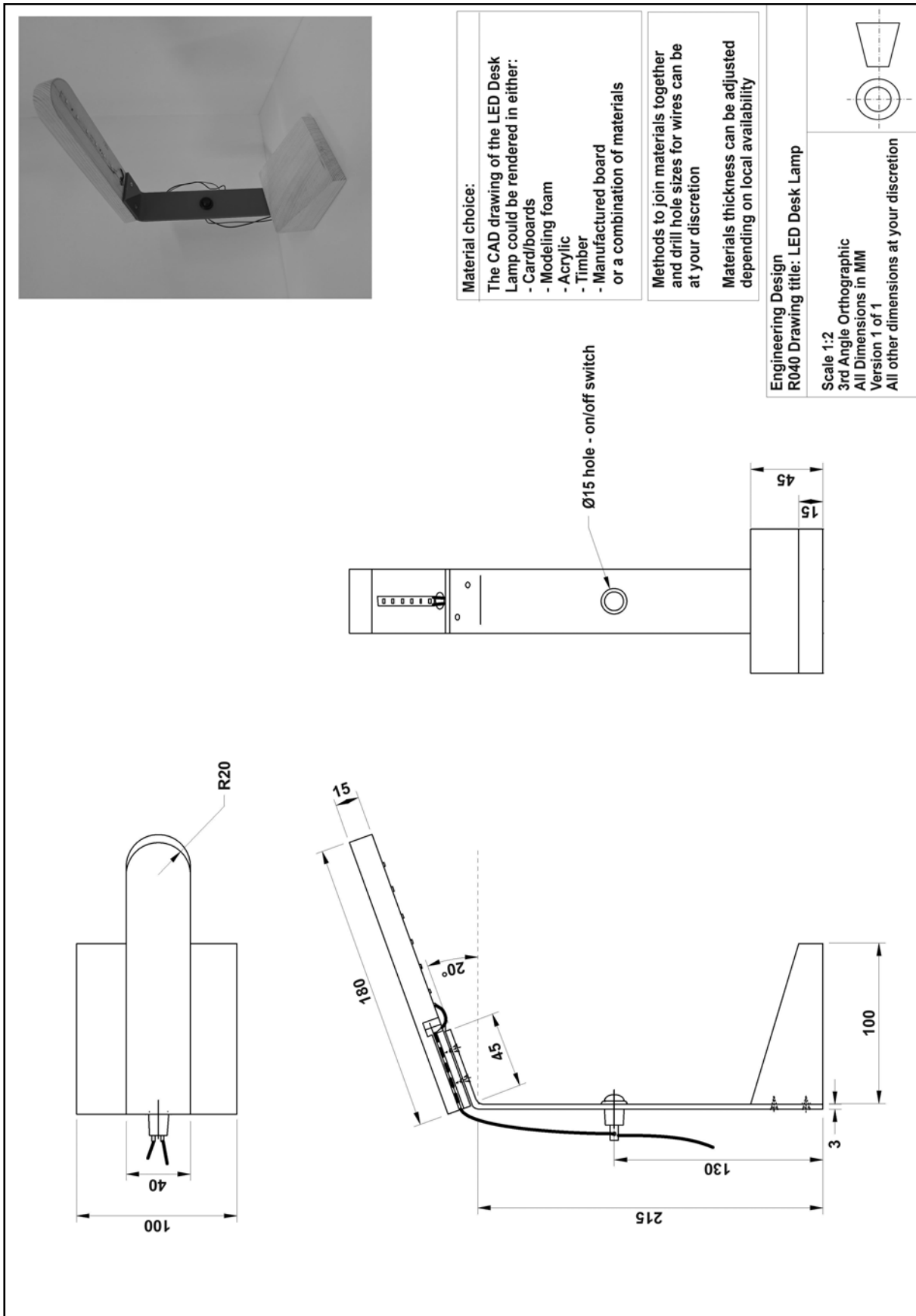


Fig. 1



## Task 4 – Physical modelling – production planning

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Topic Area 2.1.2 is assessed in this task.

The engineering design agency is keen to see a prototype of the LED desk lamp so that it can be tested and evaluated prior to being mass-produced. As a design engineer, produce a production plan prior to the manufacture of your prototype.

You **must**:

- create a detailed plan for manufacturing the prototype portable desk lamp, identifying the most important production considerations including risk assessment.
- demonstrate knowledge of the safe use of tools and equipment that will be required during the manufacture of the prototype desk lamp.

Total marks for Task 4: 6 marks

### Advice

- Consider and plan the different stages of manufacturing.
- Carefully consider the risk assessment for each stage of manufacturing.
- Break down the stages of manufacture into manageable chunks and consider how long it will take to undertake each task.
- You can use the template provided on page 20 for your risk assessment.

### Material choice

- The desk lamp can be **modelled** using either:
  - cardboard
  - modelling foam
  - materials including acrylic, timber, metal
  - manufactured board
  - or a combination of materials.
- An example of an LED strip light (50 mm or 100 mm in length) that could be used during the manufacture of the desk lamp is shown in **Fig. 2**.
- An example of the switch that could be assembled to allow the desk lamp to be switched on and off is shown in **Fig. 3**.



**Fig. 2**



**Fig. 3**

**Topic Area 2: Physical modelling – Production Planning**

<b>MB1: 1–2 marks</b>	<b>MB2: 3–4 marks</b>	<b>MB3: 5–6 marks</b>
<p>A <b>basic</b> description of the planning stages to be used in the manufacturing of the prototype.</p> <p>Shows <b>limited</b> understanding of safety considerations.</p> <p>Completion of the production plan is <b>dependent</b> upon assistance or help from other sources.</p>	<p>An <b>adequate</b> description of the planning stages to be used in the manufacturing of the prototype.</p> <p>Shows <b>some</b> understanding of safety considerations.</p> <p>Completion of the production plan is carried out with <b>some</b> assistance or help from other sources.</p>	<p>A <b>comprehensive</b> description of the planning stages to be used in the manufacturing of the prototype.</p> <p>Shows a <b>detailed</b> understanding of safety considerations.</p> <p>Completion of the production plan is carried out <b>independently</b>.</p>

If your work does not meet Mark Band 1 criteria, you will be awarded zero marks for this task.

## Task 5 – Physical modelling – prototype production

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Topic Area 2.1.2 is assessed in this task.

Using your production plan, you are tasked with creating a model of your prototype for the engineering design agency. The prototype desk lamp is to be manufactured following your production plan. You should do this applying safe working practices and considering your risk assessment. You must also record the stages of making the prototype.

**There are aspects of your production plan that you do not need to take forward into the manufacture of your prototype. These include:**

- **installation of the LED strip light**
- **connection to a power source.**

You **must**:

- use your production plan to manufacture the prototype desk lamp (see engineering drawing on page 8).
- select and use appropriate tools and materials to produce the desk lamp.
- record all the key stages of making the prototype.
- ask your teacher to complete a Teacher Observation Record for this task.

Total marks for Task 5: 18 marks

### **Advice**

- Ensure you take photographs during each stage of the manufacture of the desk lamp.
- You could keep a 'Making Diary' to record all the key stages of making the prototype.
- Ensure you wear appropriate PPE whilst undertaking practical work in line with your risk assessment.
- Follow your manufacturing plan to ensure you manufacture an accurate desk lamp.

**Topic Area 2: Physical Modelling – Prototype Production**

<b>MB1: 1–6 marks</b>	<b>MB2: 7–12 marks</b>	<b>MB3: 13–18 marks</b>
<p><b>Dependent</b> upon assistance to produce a prototype from a production plan.</p> <p><b>Dependent</b> upon prompts to use PPE equipment when working with tools, machines, materials, chemicals, finishes and solvents.</p> <p>Use tools and processes with <b>limited</b> effectiveness to produce and assemble an outcome that partly meets the production plan. The prototype will be incomplete.</p> <p>Produces a <b>limited</b> record of the key stages of making the prototype.</p>	<p>Requires <b>some</b> assistance to produce a prototype from a production plan.</p> <p>Requires <b>some</b> prompting to use appropriate PPE when working with tools, machines, materials, chemicals, finishes and solvents.</p> <p>Use tools and processes with <b>some</b> effectiveness to produce and assemble an outcome that mostly meets the production plan. The prototype will be mostly complete.</p> <p>Produces an <b>adequate</b> record of most of the key stages of making the prototype.</p>	<p><b>Independently</b> produces a prototype from a production plan.</p> <p><b>Independently</b> uses appropriate PPE when working with tools, machines, materials, chemicals, finishes and solvents.</p> <p>Use tools and processes <b>effectively</b> to produce and assemble an outcome that is of a high quality, accurate and fully meets the production plan. The prototype will be fully complete.</p> <p>Produces a <b>detailed</b> and accurate record of the key stages of making the prototype.</p>

If your work does not meet Mark Band 1 criteria, you will be awarded zero marks for this task.

## Task 6 – Physical modelling – evaluation of a prototype

Topic Area 2.1.2 is assessed in this task.

Before providing the engineering design agency with your model, you are required to evaluate the prototype to identify any further improvements that could be made to the design.

You **must**:

- compare the final prototype against the design specification.
- consider ways that the prototype could be improved.

Total marks for Task 6: 6 marks

### Advice

- Evaluate your desk lamp against the design specification, ensuring that you justify each point.
- Explain and sketch your suggestions for ways to improve your desk lamp.

### Topic Area 2: Physical Modelling – Evaluation of a Prototype

MB1: 1–2 marks	MB2: 3–4 marks	MB3: 5–6 marks
Produces a <b>basic</b> evaluation of the prototype outcome against the product specification.	Produces an <b>adequate</b> evaluation of the prototype outcome against the product specification.	Produces a <b>comprehensive</b> evaluation of the prototype outcome against the product specification.
Provides <b>limited</b> potential improvements. No justification is provided.	Provides <b>some</b> potential improvements, with justification.	Provides <b>detailed</b> potential improvements with justification.

If your work does not meet Mark Band 1 criteria, you will be awarded zero marks for this task.

# Marking criteria words

The tables below show the descriptor words that will be used in the Marking Criteria grids. They explain the type of evidence that you should expect to see to meet each descriptor word.

## Mark Band (MB1) Words:

Word	Meaning
<b>Basic</b>	<ul style="list-style-type: none"> <li>• Work includes the minimum required. It is a starting point but is simplistic and not developed.</li> <li>• Understanding and skills are applied in a way that partly achieves the wanted or intended result, but it would not be useable without further input or work.</li> </ul>
<b>Brief/Briefly</b>	<ul style="list-style-type: none"> <li>• Work includes a small number of relevant facts or concepts but lacks detail, contextualisation or examples.</li> </ul>
<b>Dependent</b>	<ul style="list-style-type: none"> <li>• The student can perform a task when given regular assistance or help.</li> </ul>
<b>Few</b>	<ul style="list-style-type: none"> <li>• Work produced is restricted or narrow. It includes less than half of the information or examples expected for a full response.</li> </ul>
<b>Inefficient</b>	<ul style="list-style-type: none"> <li>• Outputs are produced but with great expense or effort because of poor organisation or design and not making the best use of available resources.</li> </ul>
<b>Limited</b>	<ul style="list-style-type: none"> <li>• Work produced is restricted in range or scope and includes only some of the information required. It evidences partial rather than full understanding.</li> <li>• Work produced is a starting point rather than a developed process, concept or output.</li> </ul>
<b>Minimal</b>	<ul style="list-style-type: none"> <li>• Includes very little in amount or quantity required.</li> </ul>
<b>Simple</b>	<ul style="list-style-type: none"> <li>• Includes a small number of relevant parts, which are not related to each other.</li> </ul>
<b>Superficial</b>	<ul style="list-style-type: none"> <li>• Work completed lacks depth and detail.</li> </ul>

**Mark Band (MB2) Words:**

Word	Meaning
<b>Adequate(ly)</b>	<ul style="list-style-type: none"> <li>• Work includes the appropriate number of relevant facts or concepts but does not include the full detail, contextualisation or examples.</li> </ul>
<b>Assisted</b>	<ul style="list-style-type: none"> <li>• The student can perform a task with occasional assistance or help.</li> </ul>
<b>Part(ly)/Partial</b>	<ul style="list-style-type: none"> <li>• To some extent but not completely.</li> <li>• Work produced is inclusive in range and scope. It evidences a mainly developed application of understanding, performance or output needed.</li> <li>• Work produced results in a process, concept or output that would be useable for its purpose.</li> </ul>
<b>Some</b>	<ul style="list-style-type: none"> <li>• Work produced is inclusive but not fully comprehensive. It includes over half the information or examples expected for a full response.</li> </ul>
<b>Sound</b>	<ul style="list-style-type: none"> <li>• Valid, logical, shows the student has secured most of the relevant understanding, but points or performance are not fully developed.</li> <li>• Applies understanding and skills to produce the wanted or intended result in a way that would be useable.</li> </ul>

**Mark Band (MB3) Words:**

<b>Word</b>	<b>Meaning</b>
<b>Accurate(ly)</b>	<ul style="list-style-type: none"> <li>Acting or performing with care and precision.</li> <li>Correct in all details.</li> </ul>
<b>All</b>	<ul style="list-style-type: none"> <li>Work produced is fully comprehensive and wide-ranging. It includes almost all, or all the information or examples expected for a full response.</li> </ul>
<b>Clear(ly)</b>	<ul style="list-style-type: none"> <li>Focused and accurately expressed, without ambiguity.</li> </ul>
<b>Complex</b>	<ul style="list-style-type: none"> <li>Includes many relevant parts, all of which relate to each other logically.</li> </ul>
<b>Comprehensive(ly)</b>	<ul style="list-style-type: none"> <li>The work produced is complete and includes everything required to show depth and breadth of understanding.</li> <li>Applies the understanding and skills needed to successfully produce the wanted or intended result in a way that would be fully fit-for-purpose.</li> </ul>
<b>Consistent(ly)</b>	<ul style="list-style-type: none"> <li>A level of performance which does not vary in quality over time.</li> </ul>
<b>Critical</b>	<ul style="list-style-type: none"> <li>Objective analysis and evaluation in order to form: a judgement, evaluation of the evidence or effective trouble shooting/fault finding.</li> </ul>
<b>Detailed</b>	<ul style="list-style-type: none"> <li>Gives point by point consideration of all the key information.</li> </ul>
<b>Effective</b>	<ul style="list-style-type: none"> <li>Applies the skills required to the task and is successful in producing the desired or intended result.</li> <li>The work produced is effective in relation to a brief.</li> </ul>
<b>Efficient</b>	<ul style="list-style-type: none"> <li>Able to produce results or outputs with the minimum expense or effort, because of good organisation or design and making the best use of available resources.</li> </ul>
<b>Full(y)</b>	<ul style="list-style-type: none"> <li>Work produced is comprehensive in range and scope. It evidences a fully developed application of understanding, performance or output needed.</li> <li>Work produced results in a process, concept or output that would be fully fit-for-purpose.</li> </ul>
<b>Independent(ly)</b>	<ul style="list-style-type: none"> <li>The student can perform a task without assistance or reliance on others.</li> </ul>
<b>Justify/Justified</b>	<ul style="list-style-type: none"> <li>The reasons for doing something are explained in full.</li> </ul>
<b>Most(ly)</b>	<ul style="list-style-type: none"> <li>Includes nearly all of what is expected to be included.</li> </ul>
<b>Wide (ranging)</b>	<ul style="list-style-type: none"> <li>Includes many relevant details, examples or contexts; all of which are fully detailed, contextualised or exemplified.</li> </ul>



# Teacher Observation Record

Please read the **guidance notes** on page 19 before you complete this form.

<b>Student name:</b>	
<b>Qualification:</b>	OCR Level 1/Level 2 Cambridge National in Engineering Design
<b>Unit number and title:</b>	Unit number: R040
	Unit title: Design, evaluation and modelling
<b>Activity observed:</b>	Task title: Product disassembly
	Task number: 2
<b>Date activity completed:</b>	
<b>Additional evidence attached:</b>	

<b>TEACHER SECTION:</b>	
<p><b>How did the student complete the activity?</b> Your response must provide details of what the student did and how this relates to the relevant marking criteria.</p>	
<b>STUDENT SECTION:</b>	
I agree with my teacher's description of how I completed this activity.	Yes <input type="checkbox"/>
Additional student comments:	
<b>Student's signature:</b>	<b>Date:</b> (DD/MM/YYYY)
<b>Teacher's name:</b>	
<b>Teacher's signature:</b>	<b>Date:</b> (DD/MM/YYYY)

# Teacher Observation Record

Please read the **guidance notes** on the next page before you complete this form.

<b>Student name:</b>	
<b>Qualification:</b>	OCR Level 1/Level 2 Cambridge National in Engineering Design
<b>Unit number and title:</b>	Unit number: R040
	Unit title: Design, evaluation and modelling
<b>Activity observed:</b>	Task title: Physical modelling – prototype production
	Task number: 5
<b>Date activity completed:</b>	
<b>Additional evidence attached:</b>	

<b>TEACHER SECTION:</b>	
<p><b>How did the student complete the activity?</b> Your response must provide details of what the student did and how this relates to the relevant marking criteria.</p>	
<b>STUDENT SECTION:</b>	
I agree with my teacher's description of how I completed this activity.	Yes <input type="checkbox"/>
Additional student comments:	
<b>Student's signature:</b>	<b>Date:</b> (DD/MM/YYYY)
<b>Teacher name:</b>	
<b>Teacher's signature:</b>	<b>Date:</b> (DD/MM/YYYY)

# Teacher Observation Record Guidance notes

The class teacher and student being observed are responsible for completing this form.

The teacher uses the Teacher Observation Record to detail their observation of the student completing an activity. The completed form must give contextualised details of what the student did and how this relates to the marking criteria. Simply providing statements from the marking criteria is not acceptable. The evidence provided must be individual to the student.

The Teacher Observation Record is also used to show that the student agrees with the teacher's assessment of this activity.

The information given by the teacher must be shared with the student for the student to agree, or otherwise. If the student does not agree with the teacher's comments and links to the marking criteria, they must have the chance to talk about these further with the teacher to reach an agreed outcome **before** the work is submitted for moderation.

Both the teacher and student must sign and date the form to provide evidence of this agreement.

Additional evidence of the student completing the activity must also be provided with the form. The types of additional evidence that are acceptable are detailed in Tasks 2 and 5.

## Teacher Observation Records must:

- describe what the teacher observed the student doing
- state how well the activity was completed and the reasons for this evaluation
- include confirmation from the student that they agree with the comments and reasons
- be accompanied by additional evidence as required in Tasks 2 and 5.

## Teacher Observation Records must not:

- be a simple repeat of the grading criteria
- be completed by anyone except the teacher observing the activity and the student completing the activity
- be written by the student for the teacher to sign
- contain just a list of skills
- be used to evidence the achievement of a whole unit or task in isolation.

# Risk Assessment Template

Risk assessment for \_\_\_\_\_

The Potential Hazards
Risks
Control Measures



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