Non-Examined Assessment

Band 2 Exemplar Learner Response

NCFE Level 1/2 Technical Award in Engineering (603/7006/3)

V1.0 October 2023

Contents

Introduction

The following are sample learner responses for each task within an assignment alongside examiner commentary for each assignment. They show how learners might respond and can help assessors in making their overall marking decisions.

Learner responses

Each learner response should demonstrate *what* a **mark band two/third band** response looks like alongside any evidence which is required to be completed. All responses use content from the mark schemes and align with the standards in the mark band descriptors and indicative content.

Assessor commentary

The assessor commentary demonstrates *why* the responses given throughout the assignment meet the criteria for the mark band they have been awarded. The assessor commentary will be linked to, and supported by, the descriptors in the mark scheme.

Task 1 – Materials selection		
Band	**Marks**	**Descriptors**
4	10–12	**AO1 – excellent** ability to research, reflecting a wide range of research sources in relation to the brief. All elements will be researched in a **detailed** and **effective** way. **AO2 – excellent** ability to apply knowledge and understanding to the scenario within the brief. **Highly suitable** creative selections, **very relevant** to the engineering piece. **AO3 – excellent** analysis of the brief, showing analytical thinking skills, with **highly reasoned** justifications and decisions in the choice of materials and tools/machinery. Learner has offered well considered approaches in order to meet the brief.
3	7–9	**AO1 – good** ability to research, reflecting a wide range of research sources in relation to the brief. Most elements of the brief will be researched in a **detailed** way. **AO2 – good** ability to apply knowledge and understanding to the scenario within the brief. **Suitable** creative selections, relevant to the engineering piece. **AO3 – good** analysis of the brief, showing some analytical thinking skills, with **reasoned** justifications and decisions in the choice of materials and tools/machinery. Learner has offered considered approaches in order to meet the brief.
2	4–6	**AO1 – reasonable** ability to research, reflecting a range of research sources in relation to the brief. **Some** elements will be researched in a reasonably detailed way. **AO2 – reasonable** ability to apply knowledge and understanding to the scenario within the brief. **Some** suitable creative selections, relevant to the engineering piece. **AO3 – limited** analysis of the brief, showing a limited level of analytical thinking, with **poorly** reasoned justifications and decisions in the choice of materials and tools/machinery. Learner has shown **limited** consideration of approaches to meet the brief.
1	1–3	**AO1 – limited** ability to research, reflecting limited use of research sources in relation to the brief. **Some** elements may be researched in a limited way. **AO2 – limited** ability to apply knowledge and understanding to the scenario within the brief. **Limited** suitable creative selections, relevant to the engineering piece. **AO3 – limited** analysis of the brief, showing limited analytical thinking, justification and decisions in the choice of materials and tools/machinery. Learner has shown **very limited** consideration of approaches to meet the brief.
0	0	No rewardable material

Project brief

You work for a mechanical engineering company who manufacture light fittings for household and office furnishing companies.

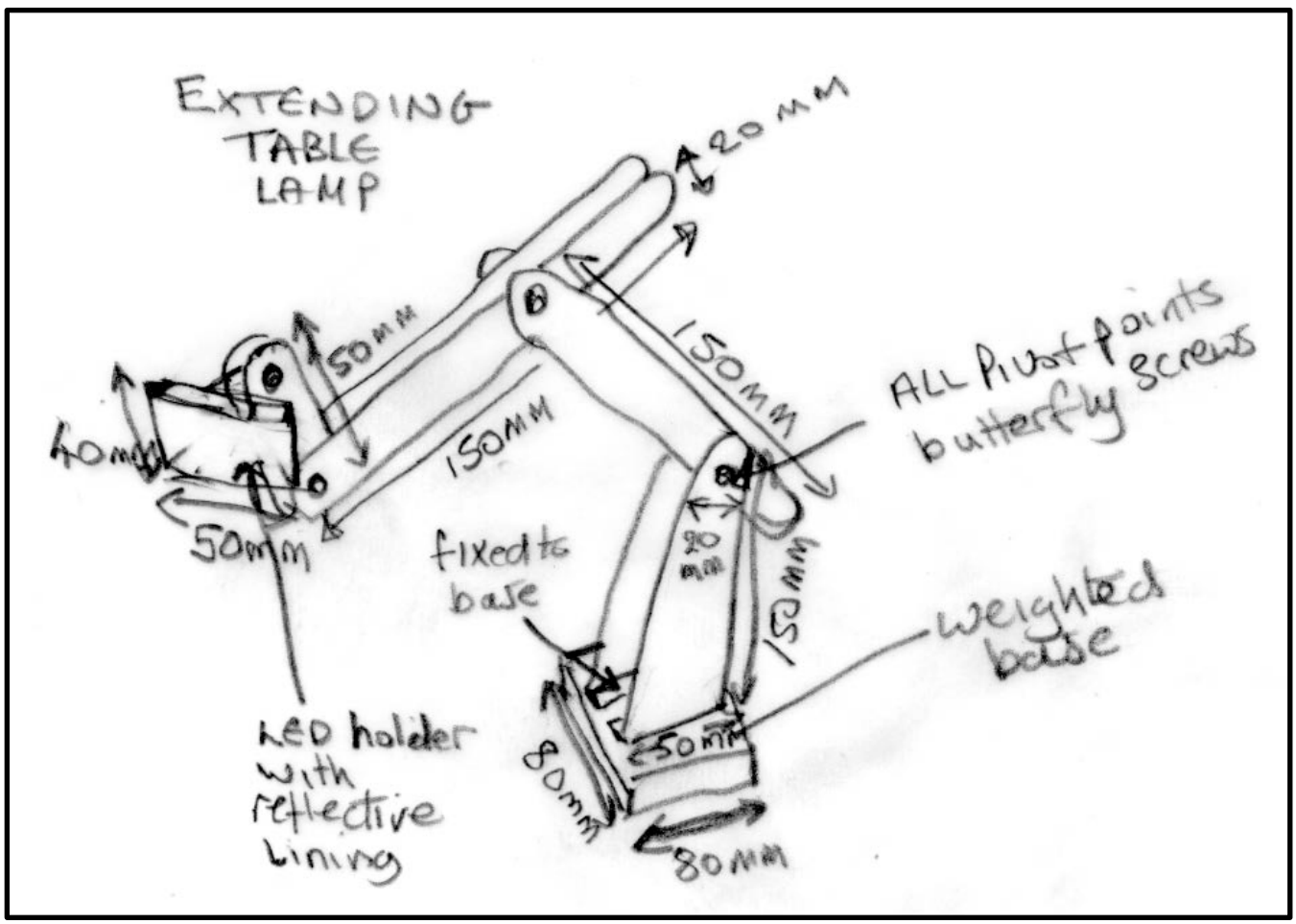
You have been asked to work on a new model of an LED table lamp and are required to produce a working, scaled model of the object to present to the board of directors.

You are required to produce a portfolio to accompany the model.

The portfolio should include isometric engineering drawings of the LED table lamp, a plan of production, evidence of testing and an evaluation.

You have been provided the free-hand sketch of the new LED table lamp.

Use this sketch throughout the project, as required.



Evidence

Information on materials, tools and/or machinery.

You need to show that you have researched and selected:

- materials required to manufacture
- tools and/or machinery required to manufacture.

You need to show:

- supporting information to justify the selection of materials, tools and/or machinery.

You must include your internet browsing history used for research and planning purposes.

You could use the following formats to provide evidence for your research:

- written report
- annotated diagrams
- digital presentation.

Task 1: Materials research and materials selection

		FACTS & OPINIONS	CHOSEN AND USE
PLYWOOD (Arms)	 https://www.amazon.co.uk/Shuttering-Plywood	• Plywood is stable and strong • High strength to weight ratio • Attractive surface finish • Can be painted & varnished easily • Can be sanded to fine finish • Retains strength even in thinner sheets.	• Plywood will be used for the lamp arms • It can be cut to fine shapes and be sanded smooth • It also takes finishes well so could be painted, dyed, varnished or waxed • Strong enough even at sizes for the lamp.
OAK	 https://www.cutmyplastic.co.uk/	• Hardwood with close grained finish • Strong and durable • Can be hard to finish by hand • Expensive.	• Maybe for the base if weighted.
PINE	 https://www.woodshopdirect.co.uk/	• Inexpensive multipurpose softwood • Easy to cut and shape • May not be strong enough with thin pieces • Not strong enough for the arms because of knots in the wood.	• Maybe for the base if weighted.
DOWEL SPACERS	 https://www.wickes.co.uk	• Hardwood dowels • Easy to cut and shape • Also could use softwood dowels.	• Will be used for spacers on the bolts between each arm joint • Hardwood dowels are better as they will last longer and won't wear out with each adjustment of the arms.
MDF/ Veneered board	 School sourced	• Heavy for size • Already has a finished surface which matches the plywood for the arms.	• Chosen for use as was available and had a good weight • Recycled material but also suitable for use as the base.

		FACTS & OPINIONS	CHOSEN AND USE
WOOD DESKLAMP	 https://www.litfad.com/beige-trapezoid-shade-table-light-modernist-1-bulb-wood-desk-lamp-with-adjustable-arm	• Desk lamp like the sketch in the brief • Shows that wood can be used for a lamp and works as a product.	• This will be like how the final lamp will look • Maybe the shade will be smaller as the size is quite small.
WOOD AND METAL DESKLAMP	 https://www.naken.co.uk/products/garden-trading-folgate-table-lamp-ink	• Adjustable arms that can be moved along the slots to make it longer or shorter • Additional flexibility and movement with the slots • Metal shade used as higher power bulb generates more heat than LED • Small metal base is heavier than most wood.	

Assessor comments

In this section, the learner has done a reasonable amount of research on materials and tools which are necessary for prototyping the LED table lamp.

The learner has referenced the use of this table lamp and then, based on its application, tried to choose the proper materials and tools for prototyping. They have applied knowledge and understanding of the required functions of the end product as well as identifying some of the necessary components.

The learner has made some mention of the advantages and drawbacks of each of the materials, showing a reasonable understanding of their properties.

The chosen materials and tools are generally suitable and though justifications are limited, they show a reasonable level of understanding of the scenario and brief, though the analysis of this is not explicit in the work produced.

The range of approaches to meet the brief at this stage are clearly limited.

BOLTS AND WING NUT	 https://www.toolstation.com/search?q=M6+BOLTS https://www.toolstation.com/wing-nut/	• M6 bolts would be the best size for the lamp as the lamp arms are a minimum of 20mm • Thread Size (T): M6 (6mm) https://www.accu.co.uk/full-thread-hexagon-bolts/19455-SEBF-M6-20-A48 • Wing nuts allow easier adjustment to the lamp arms.	• Will be used to connect each arm and will allow arms to move.
SCREWS AND GLUE	 https://www.toolstation.com/single-thread-countersunk-pozi-screw https://www.toolstation.com/everbuild-502-interior-exterior-pva-wood-glu	• Wood screws – strong and can help attach pieces of wood • PVA glue makes a good bond with wood.	• Screws could be used to attach a block on the base so that the arms can be stuck on too at the bottom • Wood glue could be used to attach the base block (and screws).
SCROLL SAW/COPING SAW/TENON SAW	 https://cpc.farnell.com  https://www.toolstation.com/ https://www.amazon.co.uk/	• Scroll saw to be used cut the parts of the lamp from lengths cut by the teacher or the technician • Can cut curves on each end of the arms as quite thin • Can cut the dowel which will be used as a space between each arm section • Coping saw – can cut curves and dowels by hand • Tenon saw – can do short accurate cuts.	

FLAT FILE	 https://www.axminstertools.com/		• Hand files will be used to round off the edges or to remove materials that the machine sander cannot get to • Different shapes are available –square/triangular/ half round • Probably will use a flat file which is not too rough so that I don't take off too much material from the surface of the parts.	
TRI SQUARE/ RULER	  https://www.toolstoday.co.uk https://www.amazon.co.uk/		• A tri square and ruler will be used to mark up the materials before they are cut or shaped.	
SANDPAPER AND BELT SANDER	 https://www.screwfix.com/	• Sandpaper used to smooth off any pieces of wood that cannot be sanded on the belt sander or a hand sander • May be used with a cork block or wrapped around a piece of wood or file so it is not going to tear.		• Used to sand the edges of the wooden parts to make sure they will be smooth after they have been cut with a saw.
PILLAR DRILL/CORDLESS DRILL	 https://cpc.farnell.com	 https://www.toolstation.com	Used to drill different parts: • The holes in the arms • Screw holes in the base • Countersinking for the screws • Can be used also as a screwdriver.	

Assessor comments

Here the learner has correctly identified that the marking out tools that could be used would require accurate marking out of components, as well as the joining and finishing materials.

Task 2: hand-drafted engineering drawings

Evidence

- your description of BS 8888
- hand-drawn engineering drawing(s) of the LED table lamp.

BS 8888

BS 8888 defines the requirements for the technical specification of products and their component parts. The standard explains the way in which engineering drawings outline and present these specifications and covers all of the symbology and information that engineers and designers need to include on their drawings, whether they are produced in 2D or in 3D, created using CAD systems and 3D modelling.

BS 8888 brings together all international standards needed to prepare technical product specifications.
https://www.bsigroup.com/en-GB/about-bsi/media-centre/press-releases/2017/february/uks-national-standard-for-engineering-drawings-revised/
https://blogs.glowscotland.org.uk/nl/public/standrewstechnical/uploads/sites/27423/2016/03/Guide-to-British-Standards.pdf

Drawings using BS8888 must include the following so that they can be recognised by any designer or engineer.

1. Title block – at the bottom of the page in the right corner. A title block should include information about the product – name/projection symbol/title/date/scale used/drawing number/tolerance of the dimensions.
2. Drawing scales allow anybody looking at the drawing to work out how much bigger the product would be compared to the drawing. For example, a scale of 1:5 indicates the product would be 5 times larger than the drawing on the page.
3. Line types – different lines indicate different parts of the drawing / product or whether something would not be seen on the product from that view. Some lines are just projection lines which carry dimensions from one view to another view drawing.
4. BS8888 drawings use a layout called 3RD Angle orthographic. A third angle orthographic drawing has three views on the drawing.

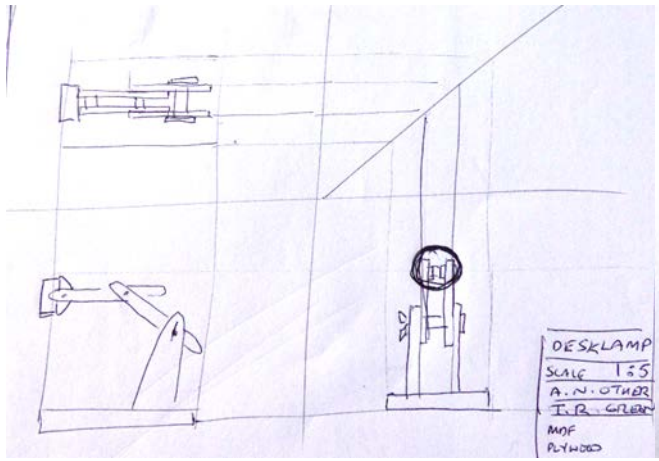
The front view is at the bottom of the page on the left with a plan or top view directly above it and the side view directly to the right of the front view.
Each view should be drawn in line with the other two views using projection lines between them which helps to keep the dimensions exact and the positions of each drawing correct.

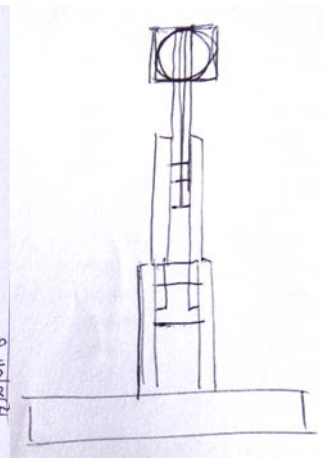
Assessor comments

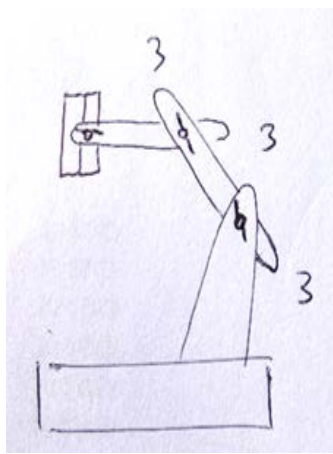
In Task 2, the learner has some understanding of relevant British standards.

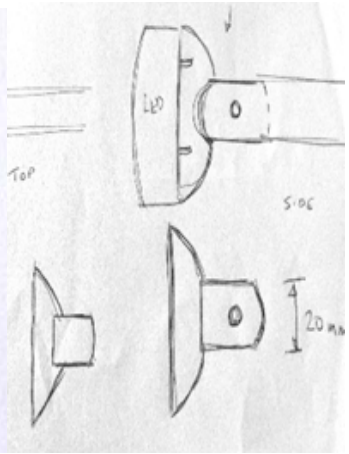
There is some reasonable demonstration of how to construct hand-drawn engineering drawings, which has some detail.

However, it would have been good to see the drawings showing further detail. For example, by showing the dimensions (such as angles/lengths/diameters) and the scale and unit of measurement. This should be clearly demonstrated on the drawings.

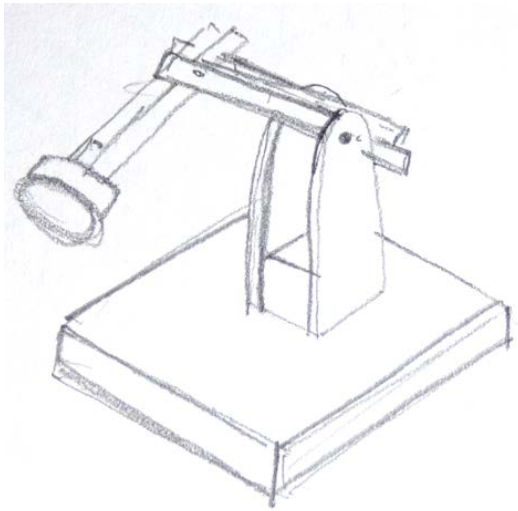


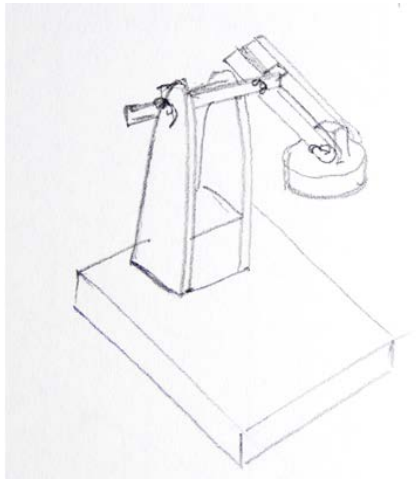






I did some sketches to help visualize the lamp from different views so that I could then plan and make templates for the different parts. I had intended to do an orthographic drawing to match BS8888. However, I noticed that the brief asked for an Isometric drawing not an orthographic drawing.



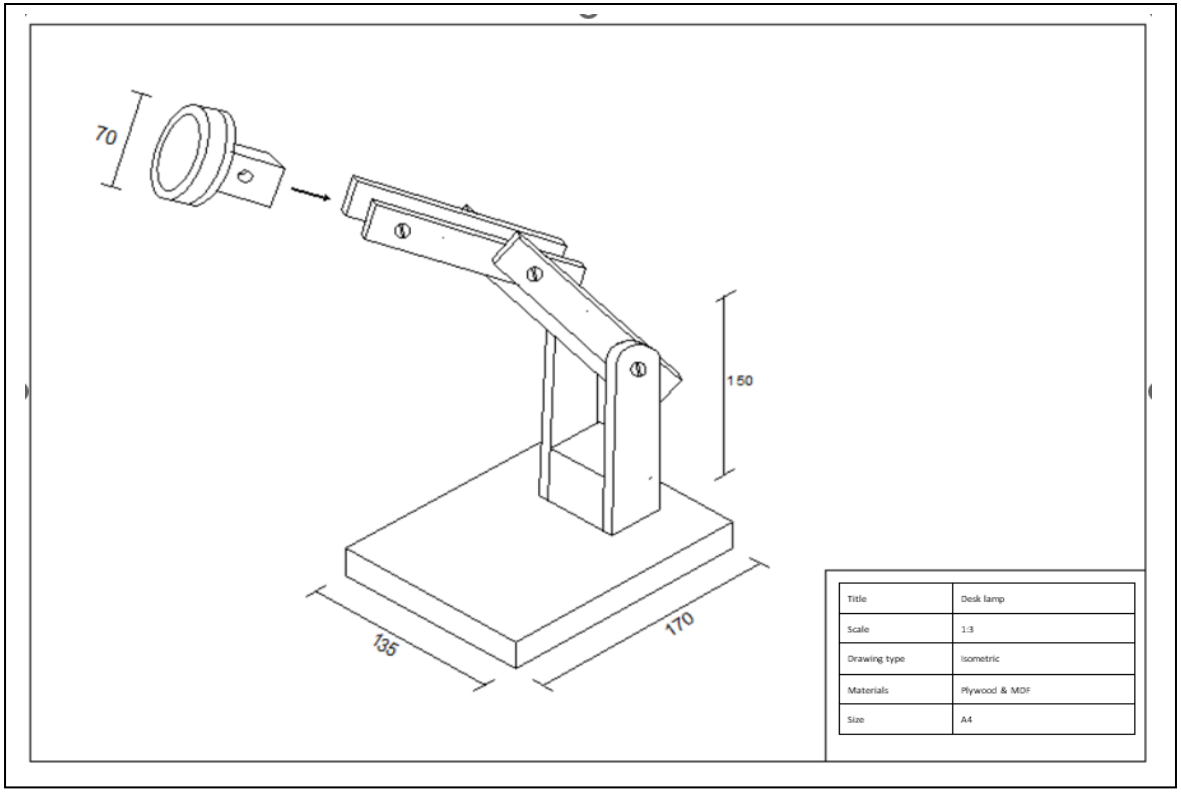


These 3 drawings are what the model is based on. I decided that the base was too small and to make it longer.
As the brief asked for an Isometric drawing so these will help with the CAD drawing I need to do.

Task 3: CAD produced engineering drawings

Evidence

- CAD software engineering drawing(s) of the LED table lamp.



Assessor comments continued

Technical terms and layout are satisfactorily used. Overall, the drawing is moderately appropriate with appreciation to relevant standards.
The learner has a reasonable recall of knowledge and understanding of how CAD drawn engineering drawings are constructed that has some detail.
However, it would have been good to see further evidence of how BS 8888 is applied to the engineering drawing.

Assessor comments

The learner has created a drawing of the free-hand sketch of the new LED table lamp included in the brief.

There is satisfactory consideration of all aspects of the brief demonstrated here. The needs of the engineering company are met in a mostly appropriate manner through the creation of a mostly appropriate drawing.

The learner has clearly shown a 3-dimensional drawing, showing the scale, the dimensions; along with the drawing type and materials used.

There is satisfactory ability to construct a drawing, along with satisfactory technical skills demonstrated.

There is a satisfactory demonstration of drawing skills using a mostly appropriate structure.

Evidence

- a plan of your engineering prototype.

Your plan **must** evidence **each** of the following areas:

- tools and equipment requirements
- health and safety measures
- quality control measures
- production plan
- time plan (including timescales and deadlines for completion of tasks).

You should also justify each of the planning decisions made.

You must include your internet browsing history used for research and planning purposes.

You could use a range of the following to provide evidence for your plan:

- written report
- annotated diagrams
- digital presentation
- screen shots.

Task 4: Production plan

- Card modelling – this is needed to be able to work out the angles and sizes of each part and how it would work as a lamp
- Sketches of parts and the lamp may be needed, as the sketch provided may not work in 3D reality
- I think the base would be too small so I will need to think about what would work better
- I may choose to adjust the original design because there are limits on what we can do in the workshop.

1 – Templates of the profiles of linkage pieces to help make the actual parts will be drawn and made in card.
2 – The thicknesses and types of material will be decided after the card models have been made and experimented with.
3 – Decisions made for the best tools or processes that I could use or get help to complete if unable to use those machines myself.
4 – Health & safety rules to be followed by using PPE throughout the making process e.g. Wearing goggles on the sander, choosing the right tool for each stage.
5 – Ensure each part would be fit for purpose by making sure it was made well or finished well. Checking for quality during making.
6 – I will record the progress and processes used at each stage.
7 – I will make a note of the time needed or used for each stage I decide to do.

Timings for Practical Activities (maximum 6 hours)

- Card templates and modelling (2 x 20 minutes) = 40 minutes
- Materials selection and cutting = 40 minutes
- Sanding plywood = 40 minutes
- Cutting and drilling the spacers = 45 minutes
- Spacers and base block cutting and finishing = 50 minutes
- Drilling and sanding the holes for the linkages = 25 minutes
- Base and linkages put together (15 + 30) = 45 minutes
- LED holder making (40) and attaching (10) = 50 minutes
- Attach LED push button light = 20 minutes.

TOTAL TIME = 5 hours 55 minutes

Assessor comments

The learner has limited application of knowledge and understanding of the planning process.

There are some planning tools which have been selected and used with some success.

The prototype manufacturing features are described with some clear understanding.

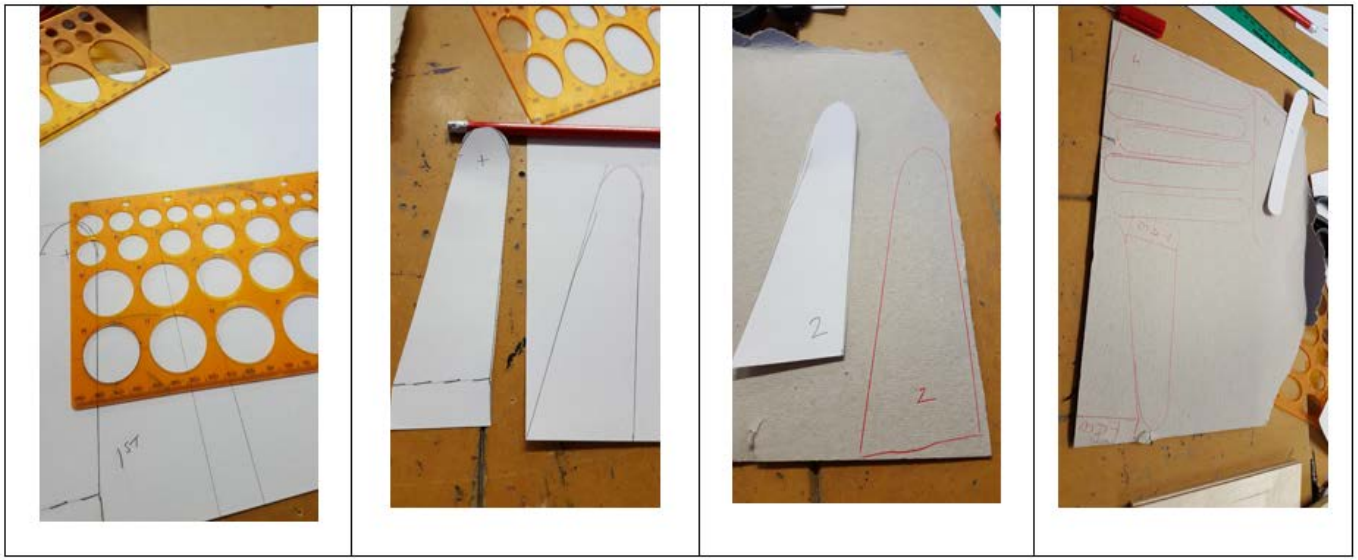
Requirements, measures, and techniques are described with some detail and understanding of their use within the production of the product.

The planning contains limited justification of decisions made and the conclusions are limited in reasoning.

The learner would have benefited from creating a flow chart/Gantt chart or spreadsheet for the production plan.

Production record
1 – Card templates
20 minutes

The model needs to be accurate and match the sketch in the brief, so I drew out some parts on card first.
I used the measurements from the sketch and estimated the angle of the main part.
The model will help to decide if the sketch will work efficiently.
The card I started using was a bit thin, so I picked a thicker card for the model to check out linkage points.
This would help to decide where the holes for each arm linkage would be placed.



Assessor comments

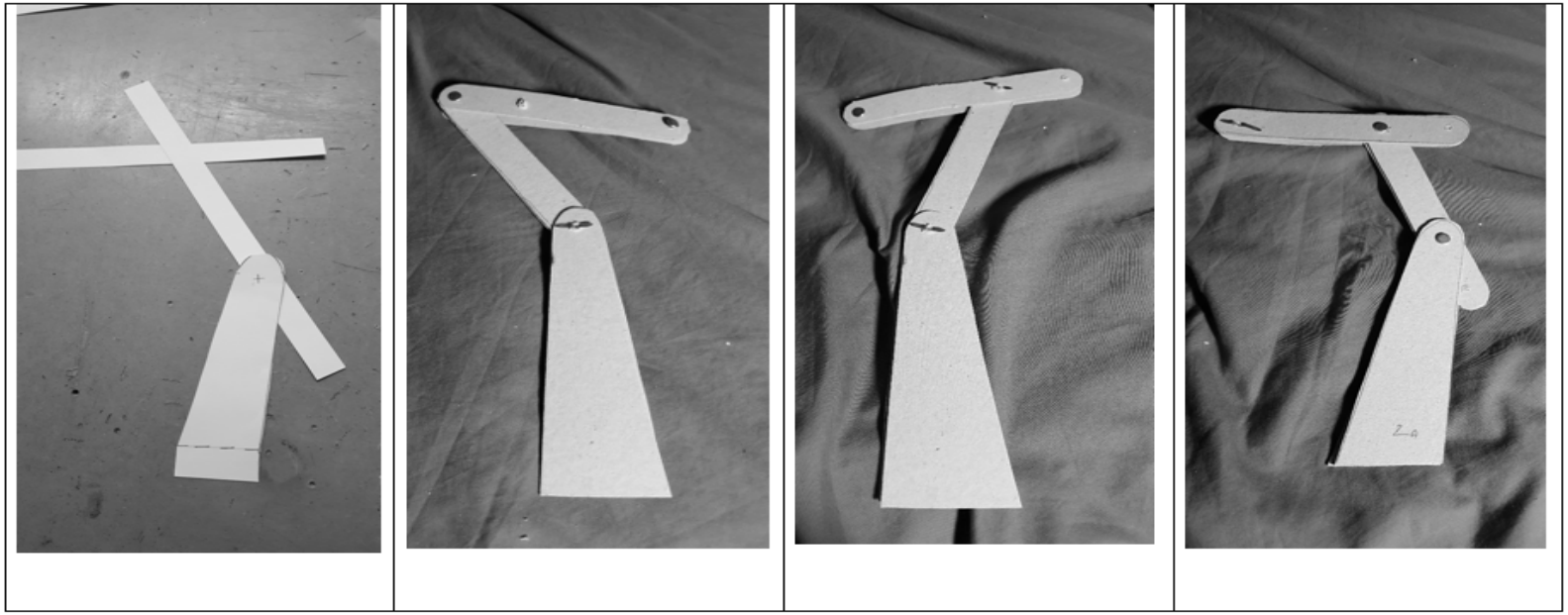
The learner has included some engineering features; however, the learner could have improved by fully justifying the use of each feature, ensuring it is relevant to the brief.

It would have been good to see clear evidence on quality control measures that should be implemented during and after the production of the LED table lamp prototype to ensure that it is produced to the highest possible standard.

Overall, there is limited reasoning and judgement made throughout each process.

2 – Card model
20 minutes

Testing out the positions for each joint before making the wooden version.
The positions of the holes in each linkage would decide whether the lamp was balanced or move enough for the user.

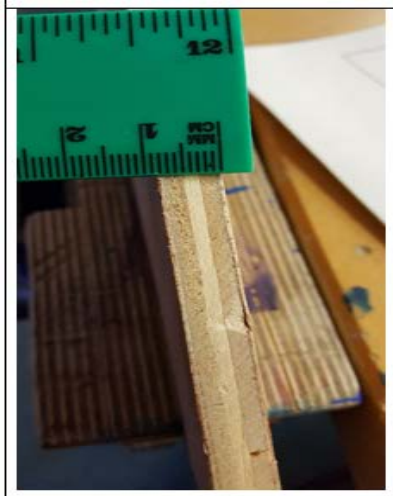


3 – Plywood and materials selection
10 minutes

Plywood is a strong and stable material.
Deciding on the thicknesses of plywood to use.
I chose the 5mm plywood as it is lighter but still strong. There would be two sides to each arm anyway so it would work fine.

4 – Cutting the plywood
30 minutes

The plywood was marked out using the templates and then cut on a bandsaw as using a hand saw or scroll saw was not as accurate or tidy.
Qualified staff did this task.




5 – Sanding the Plywood
40 minutes

I used a belt sander and some sandpaper to round or smooth the edges of the plywood base arms to take off the rough edges and also to tidy the edges of the lamp arms. Goggles were worn when using the belt sander.

6 – Cutting and drilling the spacers

45 minutes

The spacers will keep the arms separated and allow the bolts to be tightened so the lamp arm can be adjusted.

I used a coping saw and tenon saw to cut the dowels for the spacers. I cut lengths of about 6cm for each of the three pieces. I estimated this was more than would be needed when I started to put the arms together using the bolts and wing nuts. I used a machine vice to hold the dowel firm when I drilled a hole through the dowel. The dowl was marked first to find the centre using a steel rule. I used a 5.5 mm drill bit which should make a large enough hole for the M5 bolts I will be using.

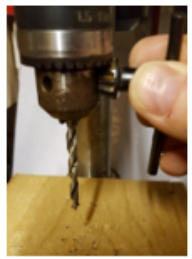
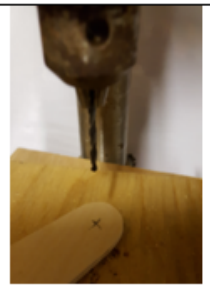
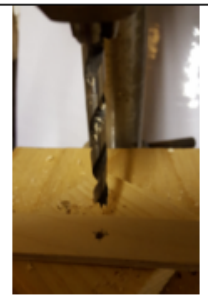
H&S – Goggles were worn on the drill.

7 – The spacers & base block

Cutting the spacers to the right length/Base block making and finishing.

50 minutes

8 – Drilling holes in each lamp linkage and sanding them smooth
25 minutes

 First dowel was too big for the arms but could maybe be used on the base as a support between each piece if needed. This was a hard wood.	 Second collection of dowels were 20mm diameter which matches the width of the arms made. These should be perfect once cut to the right length.	 Cutting the base block using a Tenon saw.	 Sizing up the base block and ensuring it is the same as the base arms of the lamp.
 Locking a bit into the chuck with the chuck key	 Lining up the linkage with the drill bit	 Different drill bit sizes used	 5.5mm dowel bit used to drill final hole for bolts in the linkages

9 – Lamp construction

MDF base marked up and attached = **15 minutes/**Linkages attached with spacers and M5 bolts = **30 minutes**.

LED Lamp holder/last linkage

Lamp holder making = **40 minutes/**Lamp holder attaching = **10 minutes**.

LED Lamp holder/last linkage

Lamp holder making = **30 minutes/**Lamp holder attaching = **10 minutes**.

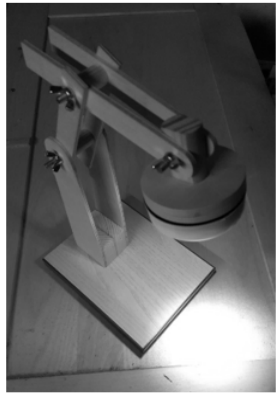
Task 5: Functioning prototype manufacture

Evidence

- your functioning prototype
- evidence of production processes, skills, and techniques
- evidence of prototype testing.

You could use a range of the following formats to provide evidence of your production process:

- digital presentation
- written report
- annotated screenshots
- annotated images.



The prototype model works as a light.

It uses a cheap and easily replaced push LED light fitting.
3 x AAA are needed for the LED light to work.
It pivots at three points as like the original sketch.

See Production plan & record for processes and tools used.

The materials used were –

- Plywood
- MDF(base)
- Softwood dowels (2 sizes)
- Steel bolts and wing nuts (M5)
- Wood screws (3 sizes)
- Softwood – probably pine
- PVA wood glue.

Assessor comments

The learner has a reasonable consideration of some aspects of the brief and some of the needs of the engineering company are met in a sound manner.

The learner has created a reasonable functioning prototype of the LED table lamp, which meets some of the requirements of the machine, such as identifying which materials have been used. However, it would have been good to see evidence of the scale and dimensions, in accordance with the drawings.

Assessor comments continued

They have evidenced some of the tools and equipment used, albeit with limited justification as to why these are necessary. It would have been good to see a detailed justification of the tools used.

There is limited evidence of the skills and techniques used. There is also limited evidence of any prototype testing. It would be advantageous if the student fully explains and the testing that takes place. Overall, the technical skills evidenced are reasonable.

Task 6: Summative evaluation

Evidence

- how your prototype met the brief
- how you could improve your prototype, in relation to the brief.

You must provide:

- your evaluation.

You could use the following formats to provide evidence of your evaluation:

- annotated screenshots
- written report.

1 – How my product met the brief	Functionality • The prototype is able to move with the same number of joints as the original sketch • The LED light can be held in multiple positions and angles as needed • The LED push button light is easy to switch on or off • The base is weighted or heavier than another material might have been • Changing the batteries is fiddly as the front of the light needs to be removed and does not always stay on – there is a need to find a better fitting for the LED light part.
	Suitability • The sizes of most parts are the same as the original idea, so it is portable and not difficult to pick up or adjust • The brief does not say the LED lamp has to be mains, so the battery LED light is fine for this lamp • The battery allows the lamp to be used anywhere without the need for cables and direct power.
	Other • The prototype matches the shape and function of the original sketch well • It is probably more stable than the sketch would have been if it was made to exactly the same sizes.

Assessor comments

The learner has provided a reasonable summary on how the product met the brief and has done so in bullet points under three headings.

These demonstrate that they have an understanding on what the brief demanded and how this has been translated into the final product.

However, these are underdeveloped and the evaluative points are generally without expansion.

The learner has then provided explanations on how the lamp could be improved. Again, these are bullet pointed and of a reasonable standard, albeit underdeveloped.

2 – Improvements I could make to the lamp prototype	Functionality • The light source could move right or left as well as up and down – this would make it even more versatile • The base of the light could also be movable, maybe be on a wheel so it can be easily turned around to another direction • The LED light needs to be held when switching on or off so maybe an easier switch or alternative LED light source could be used.	**Assessor comments** Finally, the learner has provided information on testing undertaken under three headings: namely positive, negatives and suggested changes to the finished product. Once again these are bullet pointed and although reasonable are underdeveloped.
	Suitability • It could be painted or have a different finish to the plain wood surface I used to make the protype • Unless it has a durable finish on the product it would probably not sell • A waterproof and wipeable paint or other sort of finish could be put on the surface.	
	Other • The lamp could have been made from a stronger and longer lasting material. I liked the wood look, but it maybe is not the strongest option • I could use a low voltage LED light fitting with cables and adaptor – this would make sure that the lamp would have regular power that didn't run out like a battery.	

<table>
<tr>
<td rowspan="2">3 - Prototype testing</td>
<td> 
  </td>
<td>POSITIVES

• The lamp arms move easily and can be held in position well with the wingnuts
• The plywood is strong enough that it does not bend much when the arms are moved
• The MDF base is thick and heavy enough to make the lamp stable
• The position of the lamp arms are towards the back of the base so that it is more balanced when the lamp is pulled forward
• The model is a close match to the original sketch provided so should also match the design wanted.</td>
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<tr>
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<td>NEGATIVES

• The ends of each arm are not rounded and would look better if they had been made curved
• It is quite fiddly to adjust the wing nuts and a better method of adjustment could be used, but not sure what that would be
• The lamp does not have a finish on it – It could be painted or varnished to make it last longer or stop it getting dirty
• The base material does not have the same surface texture as the plywood so is not the same aesthetically.</td>
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</table>

SUGGESTED CHANGES TO THE FINISHED PRODUCT

- The lamp could be painted or varnished
- Use a thicker or stronger material such as metal
- Make the base smaller but add a solid weight inside the base so it does not need to be the size I made it
- Use some type of clip fasteners to allow easier adjustment at the joints
- Use a low voltage LED lamp to allow for longer use without the need to change batteries.