BTEC

L2 Lead Examiner Report 2002

February 2020

L2 Qualification in Engineering

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Grade Boundaries

What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every candidate who took the external assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark is for a particular grade.

When our experts set the grade boundaries, they make sure that candidates receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure candidates achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to candidates if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:

http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

Component 3: Responding to an Engineering Brief

Grade	**Unclassified**	**Level 1**			**Level 2**		
		Pass	Merit	Distinction	Pass	Merit	Distinction
Boundary Mark	0	**12**	**18**	**24**	**31**	**40**	**50**

Introduction

This was the third series that the set task for component 3, Responding to an Engineering Brief, of the Tech Award in Engineering was available for candidates to take. In this series approximately 6500 candidates undertook part 1 and 2 of the set task. Of these 6500 candidates approximately 85% were in year 11.

Part 1 required candidates to carry out a practical set task before completing an extra three activities based on the task.
Part 2 consists of three activities, that targeted higher-order, planning, redesign and evaluative skills related to independent scenarios.

Part 1 required candidates to:

- Carry out a process
- Record results from the process
- Interpret the data.

Part 2 required candidates to;

- Interpret a brief for an engineered product
- Identify issues with the design provided
- Redesign a solution
- Analyse information associated with a problem
- Suggest solutions for the problems identified

Four weeks before candidates could complete their investigation for part 1 centres were provided with teacher instructions that gave information on the process for the practical activity. It was the responsibility of centres to resource and trial the practical activity before it was undertaken by candidates in the supervised period. The teacher instructions also provide guidance about the demonstration they were required to deliver to guide candidates through the practical activity. Based on the evidence observed from candidate responses, it would appear that some centres did follow the instructions they were given for the demonstration. This may have been the cause of candidates completing the investigation in a manner different to that intended.

Teachers were provided with the instructions shown below. The emboldened paragraph is of particular note.

You are required to carry out a demonstration using the instructions below for candidates to observe. Your demonstration must ensure that candidates are aware of the appropriate health and safety procedures for this practical activity. You should remind candidates they should make notes during the set up and demonstration.

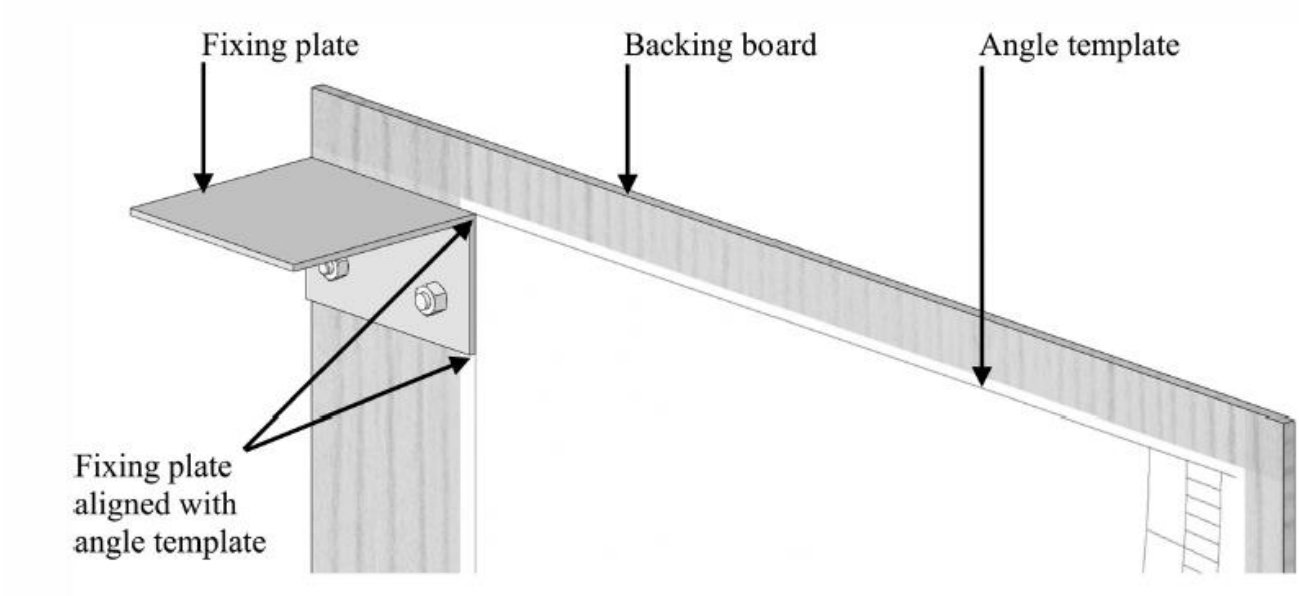
You are required to fully test each aspect of the practical activity to ensure that the chosen equipment provides valid results for your candidates. You should ensure that, when a single ruler is used, it deflects approximately 45° at maximum deflection without showing any signs of stress/fracture.

This is a practical activity to measure the angle of deflection caused by a mass at different distances from a support.

The teacher instructions then presented the following information;

Instructions for preparing the backing board

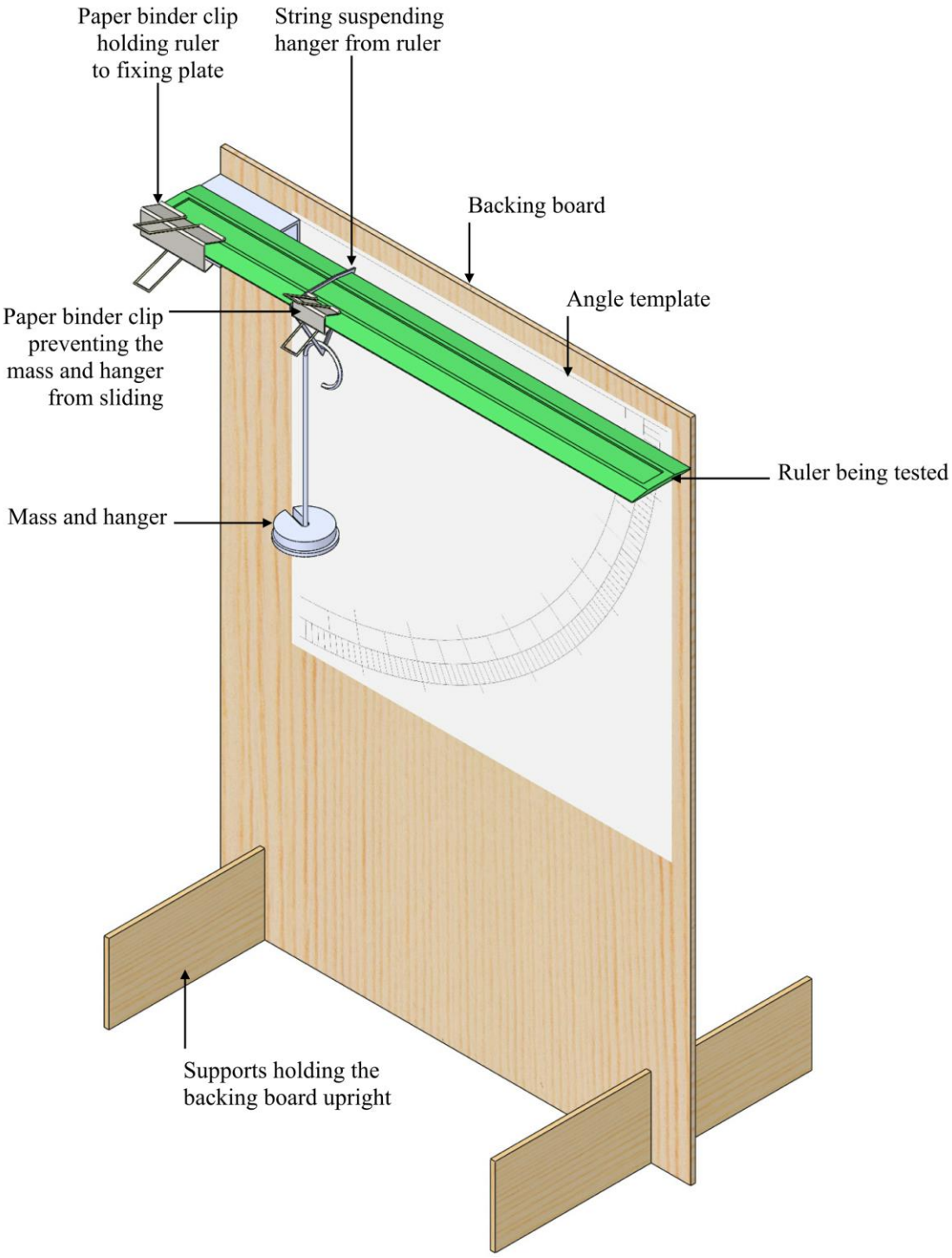
The angle template should be reproduced, using A4 paper (without scaling). This template should then be attached securely to the backing board, as shown below. The top surface of the fixing plate should be aligned horizontally with the angle template as shown below.



Instructions for setting up the equipment

• Attach one ruler to the fixing plate, for example using the method shown below.

• Place the suspended mass and hanger over the end of the ruler



Teachers were then required complete the following;

Instructions for demonstrating the first part of the practical activity
1. Slide the mass and hanger along the ruler to a suitable suspension point near the fixing plate.
2. Attach the method of preventing the mass and hanger from sliding.
3. Measure the distance from the right-hand edge of the fixing plate to the mass and hanger suspension point.
4. Record this distance.
5. Measure the angle of deflection of the ruler using the angle template.
6. Record the angle of deflection.
7. Remove the method of preventing the mass and hanger from sliding.
8. Move the mass and hanger to a new suspension point.
9. Repeat steps 2 to 8 as many times as required.
10. Repeat if necessary, to allow all candidates to view.

Given the instructions provided to teachers the example of a candidate's evidence on the next page should be considered.

The first paragraph relates to health and safety. However, from the teacher instructions the following was stated "Your demonstration must ensure that candidates are aware of the appropriate health and safety procedures for this practical activity." If it is normal practice at the centre for candidates to wear goggles during practical activities, then potentially it would have been appropriate to provide them for this investigation. If the staff determined that goggles were not needed, then potentially this should have been communicated to the candidates.

The final paragraph relates to the equipment not performing as required. However, from the teacher instructions the following was stated "You are required to fully test each aspect of the practical activity to ensure that the chosen equipment provides valid results for your candidates". The problems experienced by this candidate may have caused them to spend longer on the practical investigation element of the activity than intended. This would then have the consequence of less time being available for the remaining activities.

Record any other observations you made about the effect of moving the mass and hanger, other than the angle of deflection.

One important observation that I made were that no health and safety equipment was hanged ~~out~~ out, for example a crash mat, so that if the weights fall, nothing or nobody is harmed. Goggles incase anything goes wrong such as the rulers snapping. ~~of the clips~~

Another observation that I made was that the shatter resistant rulers were not brand new, they had scratch marks, ~~meaning~~ meaning they were not durable, this could have affected my results and table.

One other observation I made was the string did not stay still even when the clip was not on, the string kept moving to different numbers on the ruler which could have ruined my results table.

Introduction to the Overall Performance of the Unit

In the two previous Lead Examiner reports readers have been provided with illustrations of candidate's responses that demonstrate aspects of both high-level and low-level performance. As much of the previous content is still valid a different approach will be adopted for this series. The response of a single candidates will be considered with comments that explain how the evidence might be marked. In this way it is hoped it will support centres when assessing their own candidates work.

As in previous series each section will commence with the relevant part of the marking grid for the particular activity. The marking grid is something centres should become familiar with during the preparation of candidates for the external assessment. Where comments align horizontally these are referred to as traits. Referring to the marking grid for activity 1a there are three traits. For ease of reference these traits have been numbered.

1a

Marking Grid

Activity 1a – Results and observations (6 marks)			
Band 0	**Band 1**	**Band 2**	**Band 3**
0	**1–2**	**3–4**	**5–6**
No rewardable content.	The results demonstrate a limited understanding of testing procedures, including: 1) data recorded with limited precision and consistency, and may use inappropriate units 2) results that may be insufficient or at inappropriate increments 3) simple and generic observations recorded about the testing process.	The results demonstrate some understanding of testing procedures, including: 1) data recorded with consistency and using the appropriate units but may lack precision 2) sufficient results at appropriate increments for some of the testing process 3) some detailed observations about the testing process but are not always relevant.	The results demonstrate a comprehensive understanding of testing procedures, including: 1) data recorded with precision and consistency using the appropriate units 2) sufficient results at appropriate increments throughout the testing process 3) a range of relevant and detailed observations recorded about the testing process.

Typical Characteristics of high-level response for activity 1a

- The table will be populated with 8 equally spaced values for the distance of the mass and hanger from the fixing plate that extend over the whole length of the ruler(s).
- The units of Millimeters (mm) and Degrees (°) will be added, either to the column heading or to the individual values recorded.
- The distances between the mass and hanger from the fixing plate will be the same for both one and two rulers.
- The angle of deflection recorded will "reasonable" for the distances.
- Descriptions will be offered about three different aspects of the testing process that the candidate noted.
- Comments offered by the candidate will focus on the testing process.

Typical Characteristics of low-level response for activity 1a

- The table will not be fully populated, and the distances used will change in an inconsistent pattern, or at inappropriate increments e.g. 1mm
- The recording of the deflection angles will be incorrect.
- Units will only be recorded for the distances
- Angles will be recorded in fractions of degrees, which would not be possible using the angle template provided.
- The angles recorded will be very similar for the two tests or will be erratic.
- Comments provided will relate to how increasing the distance of the mass and hanger from the fixing plate increases the angle of deflection. This is excluded from being valid in the stem of the question.
- Comments will be repeated using different wording, but essentially describing same observation.
- Comments are offered that do not link to the testing process.

A candidate response for activity 1a

Activity 1a: Recording results and observations from your tests

Record all your results in the tables. Add the missing units to the columns on the tables.

One ruler	
Distance [cm]	Angle [Degree °]
16cm	22°
18cm	26°
20cm	29°
22cm	32°
24cm	35°
26cm	37°
28cm	39°
30cm	40°

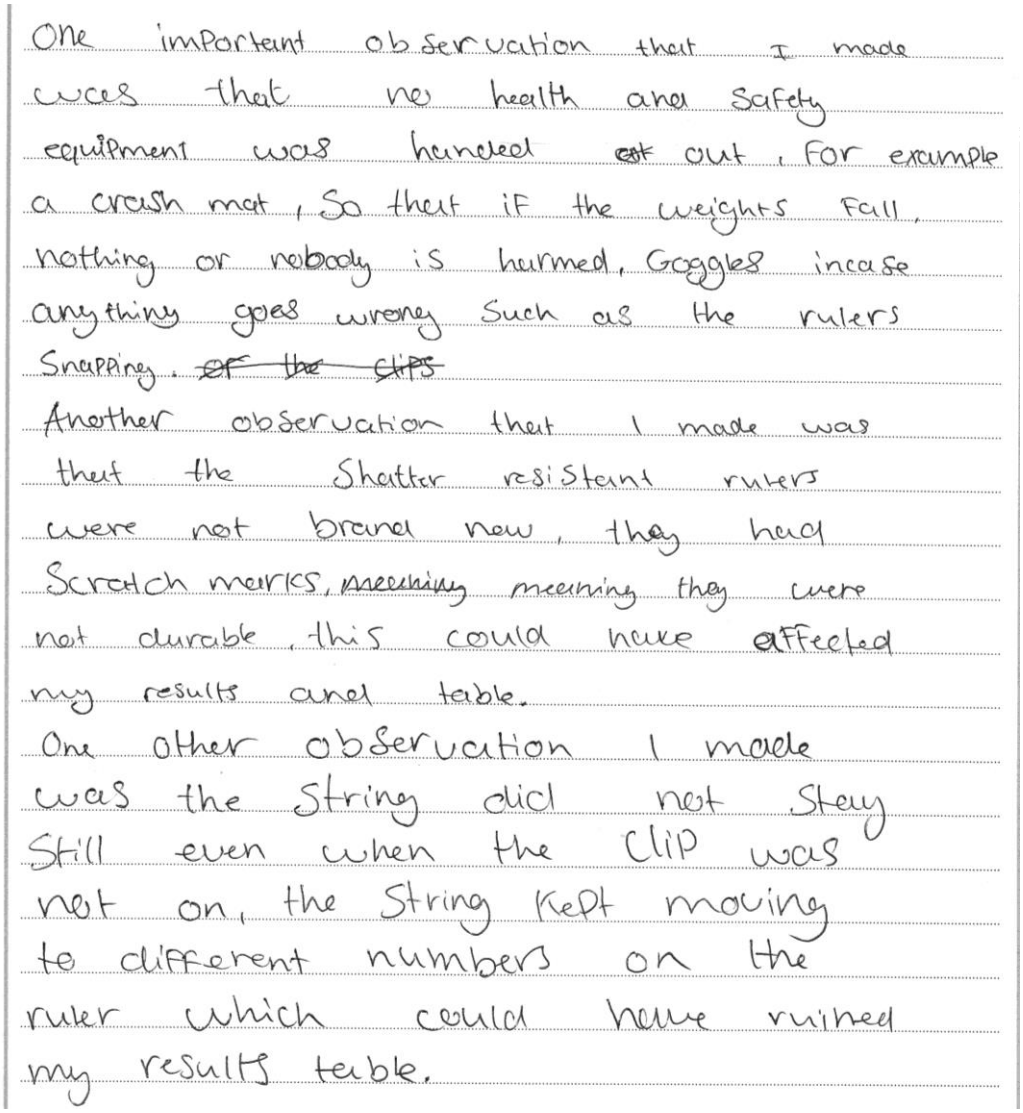
Two rulers	
Distance [cm]	Angle [Degree °]
16cm	14°
18cm	16°
20cm	19°
22cm	21°
24cm	23°
26cm	24°
28cm	26°
30cm	27°

Trait 1

The best fit description for trait 1 is “data recorded with precision and consistency using the appropriate units”. The distance the independent variable, is recorded with consistent increments and appropriate units are stated.

Trait 2

The best fit description for trait 2 is “sufficient results at appropriate increments throughout the testing process”. While it would have been more appropriate to start with distances less than 16cm the candidate has completed the table using appropriate increments of the independent variable.



One important observation that I made was that no health and safety equipment was heardeat ~~eat~~ out, for example a crash mat, so that if the weights fall, nothing or nobody is harmed, Goggles incase anything goes wrong such as the rulers Snapping. ~~of the clips~~
Another observation that I made was that the Shatter resistant rulers were not brand new, they had Scratch marks, ~~meaning~~ meaning they were not durable, this could have affected my results and table.
One other observation I made was the String did not stay still even when the clip was not on, the String kept moving to different numbers on the ruler which could have ruined my results table.

Trait 3

The best fit description for trait 3 is "a range of relevant and detailed observations recorded about the testing process". The candidate's comments are mostly specific to the investigation undertaken and each observation provides details about why the observation has been recorded. While the comment related to health and safety starts with a generic comment, the candidate has contextualised it for the specific investigation undertaken.

Overall Grading Decision for Activity 1a

Since the best fit descriptions for each of the 3 traits are in mark band 3 a mark should be awarded from mark band 3 i.e. either 5 or 6 marks.

1b

Marking Grid

Activity 1b – Processing results (8 marks)			
Band 0	**Band 1**	**Band 2**	**Band 3**
0	**1–2**	**3–5**	**6–8**
No rewardable content.	Demonstrates limited understanding of data representation techniques by plotting graphs with significant inaccuracies. Graphs include: 1) inappropriate annotations of headings and units 2) choice of scaling is inappropriate to the data and used inconsistently 3) plots of tabulated data that include significant inaccuracies 4) insufficient data plotted to represent results and to produce appropriate lines/curves.	Demonstrates some understanding of data representation techniques by plotting graphs with minor inaccuracies. Graphs include: 1) appropriate annotations of headings and units 2) choice of scaling is appropriate to the data but is not used consistently 3) plots of tabulated data that include minor inaccuracies 4) sufficient data plotted to represent results but inappropriate lines/curves produced.	Demonstrates comprehensive understanding of data representation techniques by plotting accurate graphs. Graphs include: 1) appropriate annotations of headings and units 2) choice of scaling is appropriate to the data and used consistently 3) accurate plots of tabulated data 4) sufficient data plotted to represent results and to produce appropriate lines/curves

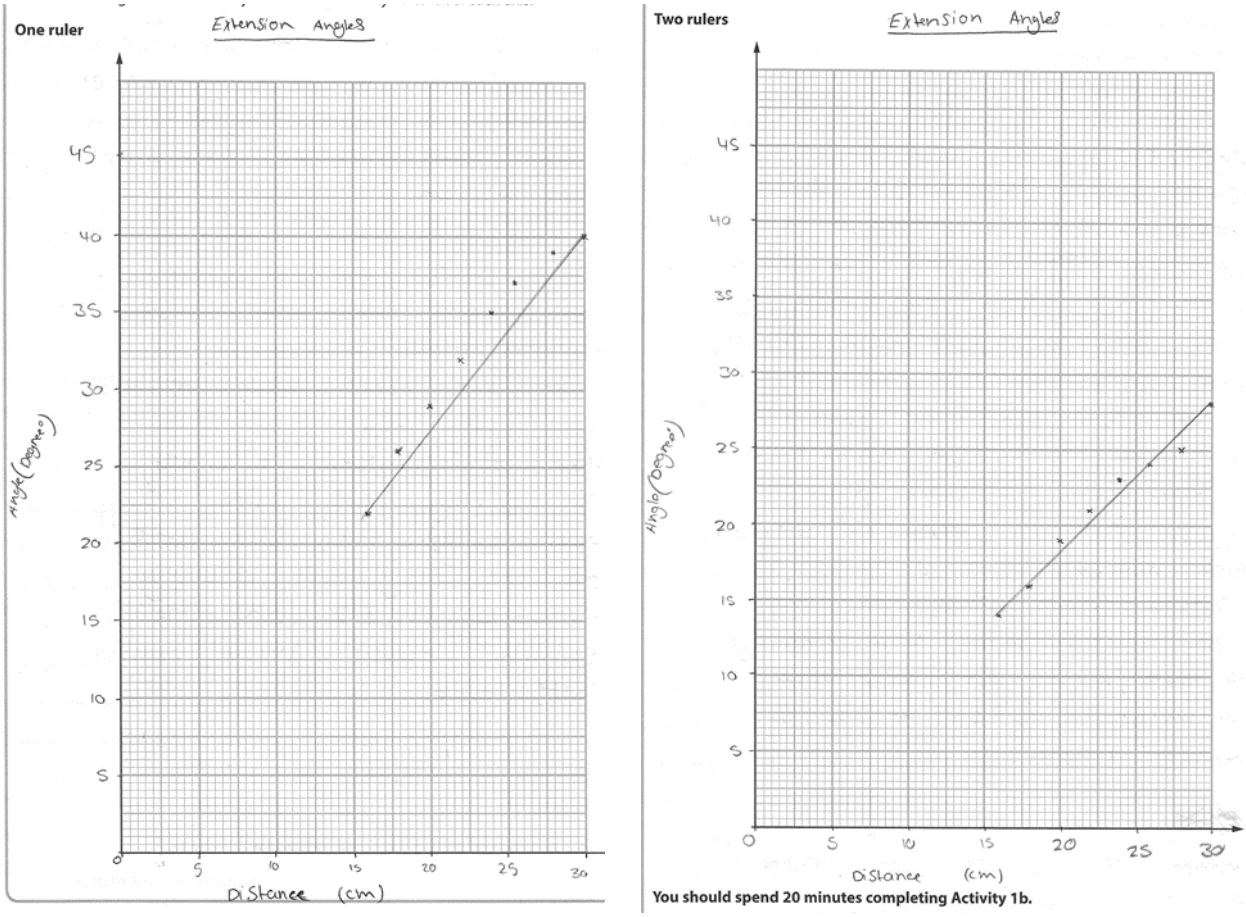
Typical Characteristics of high-level response for activity 1b

- The independent variable (distance) will be plotted on the X-axis and the dependent variable (angle) will be plotted on the Y-axis.
- Both graphs will have the axes labelled with a title and the correct units of measurement.
- Both graphs will use the majority of the space available.
- Either both graphs will use the same scales, allowing direct comparisons for activity 1c, or the graphs will use different scales so that full use of the space available is made.
- All the data recorded in the tables for 1a, will be plotted accurately.
- A line of best fit will be drawn that is appropriate to data points plotted.

Typical Characteristics of low-level response for activity 1b

- The dependent variable (angle) will be plotted on the X-axis and the independent variable (distance) will be plotted on the Y-axis.
- The graphs will not have the axes labelled with neither a title or the units.
- The graphs will be drawn such that they are limited to using the lower left corner of the space available.
- The graphs will not use consistent spacing for the scales, e.g. the major divisions will be labelled with values that do not increase in a regular linear manner.
- Some of the data recorded in the tables for 1a, will be plotted but there will be inaccuracies.
- Either multiple straight lines will be drawn through each data point, or a line will be drawn between the first and last data points plotted.

A candidate response for activity 1b



Trait 1

The best fit description for trait 1 is “appropriate annotations of headings and units”. Both graphs have the independent variable, distance, on the X axis. Both axes are labelled with headings (titles) and units of measurement.

Trait 2

The best fit description for trait 2 is “choice of scaling is appropriate to the data and used consistently”. As the candidate has recorded data from 16cm there is no data below this value. Potentially this could prevent a decision to allocate band 3 for the trait as the choice of scaling could be considered weak. However, the description for mark band 2 is “choice of scaling is appropriate to the data but is not used consistently” is a poorer fit, as the scales are consistent, therefore mark band 3 is the most appropriate.

Trait 3

The best fit description for trait 3 is “accurate plots of tabulated data”. The candidate has accurately plotted each of the data pairs obtained from activity 1a.

Trait 4

The best fit description for trait 4 is “sufficient data plotted to represent results but inappropriate lines/curves produced”. The candidate has produced a line of best fit by joining the first and last data points in each graph. This has resulted the line of best fit for the one ruler graph being too low. While the line of best fit drawn for the two rulers graph has also used this method it is a much closer fit, but this may just be fortuitus.

Overall Grading Decision for Activity 1b

Since three of the four traits have been allocated mark band 3 an overall best fit would be to allocate a mark from mark band 3, i.e. 6 to 8 marks. Given that trait 4 was judged to be in mark band 2 it would not be appropriate to award the maximum mark available for the activity. Therefore, a mark of 6 or 7 should be awarded.

1c

Marking Grid

Activity 1c – Conclusions (8 marks)			
Band 0	**Band 1**	**Band 2**	**Band 3**
0	**1–2**	**3–5**	**6–8**
No rewardable content.	1) Attempts to describe the patterns in the tables and graphs but is superficial or does not reflect results. 2) Draws limited conclusions not specifically based on a comparison between patterns in the tables and graphs, with minimal reference to data.	1) Mostly accurate description of the patterns in the tables and graphs, with some reference to data. 2) Draws mostly valid conclusions based on a comparison between patterns in the tables and graphs, supported by some reference to data.	1) Accurate description of patterns in the tables and graphs with detailed reference to data. 2) Draws valid conclusions based on a comparison between patterns in the tables and graphs, supported by detailed reference to data.

Typical Characteristics of high-level response for activity 1c

- Comments will focus on the patterns shown in the tables and graphs.
- A positive correlation between the distance of the mass from the fixing plate and the angle of deflection will be commented on.
- The maximum and minimum data points will be referred to.
- Conclusions will be made that as the mass moves away from the fixing plate the angle of deflection increases and that two rulers deflect less than one.
- A calculation will be performed to indicate an approximate increase in angle per increase in distance e.g. The angle will increase by 3◦ for every extra 2cm increase of distance.
- Comments will be made related to the gradients of both lines
- Observations will be offered about how close the data points lie to the line of best fit
- Reasons for any anomalous data points will be suggested.
- Evidence from the tables / graphs will be linked back to the scenario (cantilever beams) and suggestions offered two rulers would offer more support than one.

Typical Characteristics of low-level response for activity 1c

- Comments that provide an overview of the results will not be provided.
- Comments offered will not relate to the patterns in the tables or graphs.
- Where comments are offered about patterns in the tables or graphs, they will be repeated with different wording and provide no new information.
- Comments will be offered about patterns in the tables or graphs that are not actually present.

A candidate response for activity 1c

Activity 1c: Drawing conclusions

Compare the patterns in your tables and graphs.

What conclusions can be drawn from your data?

The ~~Sim~~ Patterns in my tables are that in Ruler 2 ~~1~~, the last two Angles I measured were 26° and 27°. And in Ruler 1, the last two angles I measured were 39° and 40°, the Pattern is that the last two measurements I record are only 1 number away From each other.

AlSo the Second and third angle I measured were 3 numbers away From each other, which in both tables is the highest amount ~~ever~~ in difference in each number.

Another Pattern was that in my graphs there was around Five anomaly's in each graph, meaning that maybe there was a mistake in the test or in the measurements I made.

My ~~[illegible]~~ conclusion is that the more the Distance, the more the Plastic rulers bend.

AlSo with ~~1~~ one Ruler, it bends more than with two rulers meaning that ~~with two~~ ~~2~~ two rulers ~~can't~~ can handle more more weight without bending ~~that~~ than with one ruler.

In graph ~~three~~ one, my line of best Fit is higher than in graph one, meaning that ruler one bends more than ruler two does.

The first two paragraphs of the candidate's response refer to comparisons of patterns in the data from the tables so are relevant to trait 1. However, the comments do not reference the graphs.

The third paragraph refers to patterns in the graphs, but is not valid. The "anomalies" are due to a poor line of best fit. This again relates to trait 1.

The fourth paragraph offers two valid conclusions;
"The more the distance the more the plastic rulers bend" and
"One ruler bends more than with two rulers".

The final paragraph is another valid observation that indicates the line of best fit is higher in graph one, combined with another conclusion "meaning that the one ruler bends more".

In order to access mark band 3 for traits 1 and 2 the candidate would need to provide "detailed reference to data". There is insufficient evidence to allocate these marks bands.

In order for the mark band 1 to be allocated the candidates evidence would need to have only superficially described patterns in the tables and graphs and draw limited conclusions. The candidate has provided better evidence than this.

Trait 1
The best fit description for trait 1 is therefore "Mostly accurate description of the patterns in the tables and graphs, with some reference to data".

Trait 2
The best fit description for trait 2 is therefore "Draws mostly valid conclusions based on a comparison between patterns in the tables and graphs, supported by some reference to data".

<u>Overall Grading Decision for Activity 1c</u>
Since both traits have been allocated mark band 2 an overall best fit would be to allocate a mark from mark band 2, i.e. 3 to 5 marks.

1d

Marking Grid

Activity 1d – Evaluation (8 marks)			
Band 0	**Band 1**	**Band 2**	**Band 3**
0	**1–2**	**3–5**	**6–8**
No rewardable content.	1) Demonstrate a limited understanding of problems with the testing method used/results obtained. 1) Demonstrate a limited understanding of how the process of testing could be improved.	1) Demonstrate some understanding of problems with the testing method used/results obtained. 1) Demonstrate some understanding of how the process of testing could be improved.	1) Demonstrate a comprehensive understanding of problems with the testing method used/results obtained. 2) Demonstrate a comprehensive understanding of how the process of testing could be improved.

Typical Characteristics of high-level response for activity 1d

- Any problems commented on in activity 1a will be carried forward, with solutions being offered.
- Comments will be offered about several different problems encountered during the testing process.
- For each of the comments offered reasons will be provided that relate to the causes of the problems.
- Specific solutions will be suggested that would overcome the observed problems e.g. use a stronger clip to stop the mass sliding along the ruler.
- Generic solutions will also be offered that could improve most testing processes e.g. repeat the tests to obtain average readings.

Typical Characteristics of low-level response for activity 1d

- Comments will be offered about a single problem encountered, often repeated using different wording.
- Reasons for the problems will not be commented on.
- Only generic improvements to testing processes will be commented on.
- Comments will be offered on aspects of the testing process that did not demonstrate problems.

A candidate response for activity 1d

Activity 1d: Evaluation

Think about the testing process you have just carried out.

What problems did you encounter with setting up the test, carrying out the test and recording results?

If you carried out the test again, what would you do differently?

One main Problem was that we were not given any Safety equipment such as a crash mat and goggles which are very important.. Another Problem that I encountered was the durability of the apparatus I was given. The two Shatter resistant rulers were worn out ~~and~~ and was also bent. Another Problem was that the String did not Stay in Place even after I Put the Clip on it to adjust it, ~~a~~ the String kept Sliding down ~~and~~ away From the number I adjusted it on. The other Slight Problem with this testing Process was that the clip Put on the ruler to adjust the String could have affected my results as it could have added on Slight weight, ~~to~~ to the ruler.

lastly, the weight hanging was not stable and kept moving even though I adjusted it.
IF I was to carry out this test again, I would make sure that I am using the right safety equipment which are goggles and a crash mat to make sure no harm is done.
Another adjustment I would make is the durability of the apparatus, making sure everything is new and functioning well.
Finally, the last thing I would adjust is the string tied ~~to~~ to the ruler as it kept sliding off. I would make sure that the string is tightly tied to the ruler or a new way of hooking the weight on.
I would also double checked my data and measurements to be accurate.

You should spend 20 minutes completing Activity 1d.

(Total for Activity 1d = 8 marks)

The first section of the candidate's response relates to health and safety and as such is a generic observation of a problem that could apply to any examination series. The second page provides an improvement to this perceived problem, the use of safety equipment.
In the second section the candidate comments that the rulers were worn out and bent. Since a bent ruler would affect the results of the investigation it is a specific and valid comment. However, this is a cause of a problem, and does not demonstrate understanding of the problem e.g. a bent ruler would change the angle recorded. Comments about the "durability" of equipment are generic and could apply to any examination series.
In the third section the candidate makes valid comments about the string sliding down the ruler. Again, this is a valid cause of a problem, but does not demonstrate an understanding of the problem e.g. problems correlating position of weight and angle of deflection. A valid solution to this problem is proposed on the second page.
In the final paragraph of the first page the candidate suggests that the weight of the clip may have affected the results. As this weight was constant across all measurements taken it is not a valid observation.
The first paragraph of the second page is another valid problem, movement of the weight, but again does not demonstrate an understanding of how this movement would affect the investigation.
The comments related to the "durability" do offer a solution, "making sure everything is new" but this is generic and could apply to any practical investigation.
The final comment offered by the candidate, to "double check" is valid but again is generic and could apply to any practical investigation.

Trait 1
For the reasons given above the candidate has not met the requirements for mark band 3. The best fit description for trait 1 is therefore "Demonstrate some understanding of problems with the testing method used/results obtained"

Trait 2
As most of the candidate's suggestions for improvements about how the testing could be improved are for generic problems there is insufficient evidence to allocate mark band 3. The best fit description for trait 2 is therefore "Demonstrate some understanding of how the process of testing could be improved"

<u>Overall Grading Decision for Activity 1d</u>
Since both traits have been allocated mark band 2 an overall best fit would be to allocate a mark from mark band 2, i.e. 3 to 5 marks.

2a

Marking Grid

Activity 2a – Evaluation (8 marks)			
Band 0	**Band 1**	**Band 2**	**Band 3**
0	**1–2**	**3–5**	**6–8**
No rewardable content.	Produce a superficial evaluation of the existing product that: 1) identifies issues with the existing design that are not entirely relevant 2) demonstrates limited understanding of issues in relation to the brief.	Produce a reasoned evaluation of the existing product that: 1) identifies mostly relevant issues with the existing design 2) demonstrates some understanding of issues in relation to the brief.	Produce a developed and reasoned evaluation of the existing product that: 1) identifies relevant issues with the existing design 2) demonstrates comprehensive understanding of issues in relation to the brief.

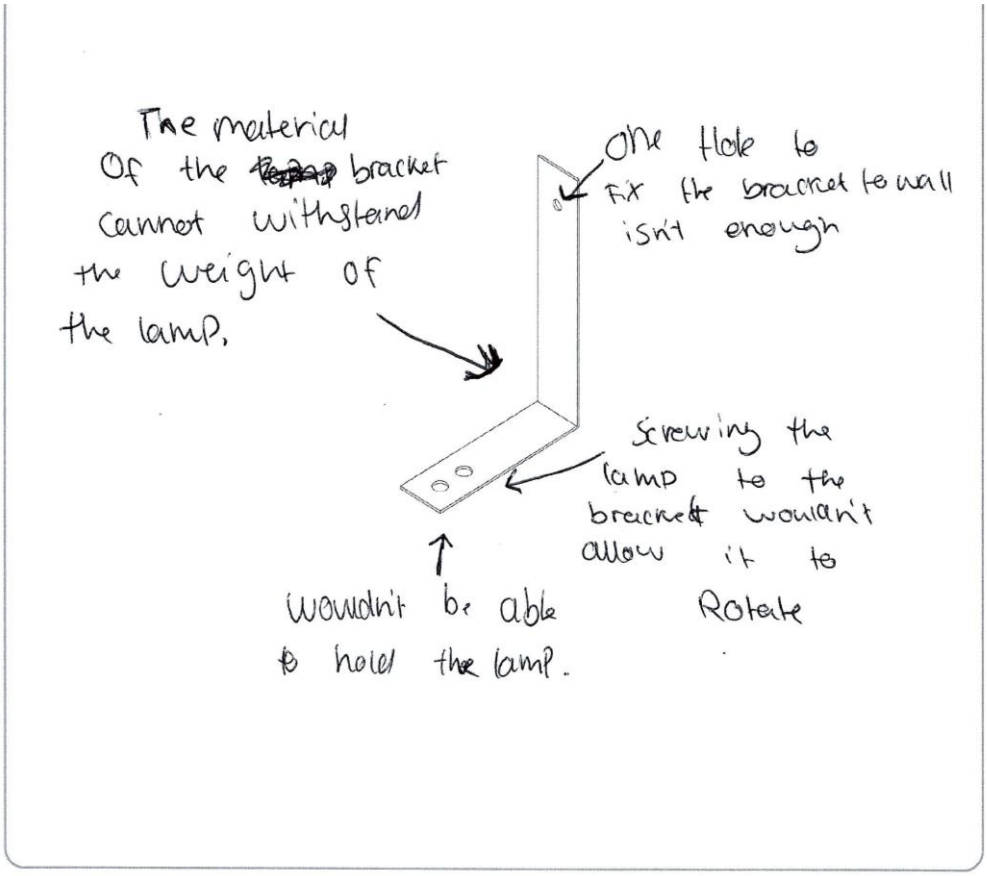
Typical Characteristics of high-level response for activity 2a

- Information contained within the engineering brief, proposed design solution and method of manufacture will be taken into account.
- Problems will be identified with the proposed design solution that take into account all information provided. For example;
    - The lamp would not rotate
    - The bracket would rotate on the wall
    - The material the bracket is made from would corrode when placed outside
    - The manufacturing method might result in inconsistencies.
- Generic problems will also be identified with the proposed design solution that do not take into account the engineering brief.
    - The bracket has sharp edges
    - The bend is too sharp
    - Details about holes sizes and other dimensions are not provided.
- Each of the points annotated on the drawing will be expanded on in the text space.
- Candidates will demonstrate sound knowledge of material properties and manufacturing processes.
- Information will be communicated clearly.
- Full use will be made of the available space.

Typical Characteristics of low-level response for activity 2a

- Only the information contained within the proposed design solution will be taken into account.
- Only generic problems, such as the safety of sharp edges, will be commented on.
- Information will not be communicated clearly or will lack detail.
- The candidate will not make full use of the space available.

A candidate response for activity 2a



One issue with the design of the mounting bracket is that the material it is made out of would not stand the weight of the lamp as it is not a strong material, leading it to break and ~~may could~~ become a hazard.
Another issue is that the mounting bracket is fixed onto the wall with just one small screw, this wouldn't be able to hold the weight of the lamp and will also keep swinging, which ~~yet~~ yet again can be dangerous.
One other ~~Pr~~ issue was that securing the lamp onto the bracket would not allow it to rotate (as the customer demands are)
One last issue was that the bracket would not be able to hold the lamp without anything holding the bracket from the bottom ~~keeping it to~~ securing it in place.

The top left annotation on the drawing indicates that the bracket will not "withstand" the weight of the lamp. This comment is invalid and illustrates a potential lack of awareness of material properties.

The top right comment is valid, as it identifies the weakness associated with a single screw, but it does not demonstrate an understanding as it does not explain why one hole is not enough.

The bottom right comment is valid, and gives a reason, therefore demonstrating some understanding.

The bottom left comment may repeat the top left one, or it may be linked to the design rather than the material. But, regardless of the context, it is not valid.

The first and last paragraphs of the written answer are not valid, for the reasons given above.

The second paragraph extends the annotation and now explains why the single screw would not be sufficient. This adds understanding to the candidate's response.

The third paragraph expands on the annotation comment.

Trait 1
As the candidate only identified two valid problems with the proposed design, they have not provided the level of detail required to justify a mark being awarded from band 3. Therefore, the best fit description for trait 1 is "identifies mostly relevant issues with the existing design"

Trait 2
A candidate's ability to access marks for trait 2 is very closely link to the evidence they produce for trait 1. A candidate is unlikely to be able to demonstrate understanding of an issue if they have not identified it. The best fit description for trait 2 is therefore "demonstrates some understanding of issues in relation to the brief"

Overall Grading Decision for Activity 2a
Since both traits have been allocated mark band 2 an overall best fit would be to allocate a mark from mark band 2, i.e. 3 to 5 marks.

2b

Marking Grid

Activity 2b – Redesign (10 marks)			
Band 0	**Band 1**	**Band 2**	**Band 3**
0	**1–3**	**4–7**	**8–10**
No rewardable content.	1) Basic ideas that partially address the brief and offer minimal improvement on the original. 2) Limited justification for the chosen design solution. 3) Limited justification for the chosen processes.	1) Ideas that address the brief and offer partial improvement on the original. 2) A reasoned justification for the chosen design solution. 3) A reasoned justification for the chosen processes.	1) Ideas that fully address the brief and show an improved design approach to the original. 2) A developed and reasoned justification for the chosen design solution. 3) A developed and reasoned justification for the chosen design solution.

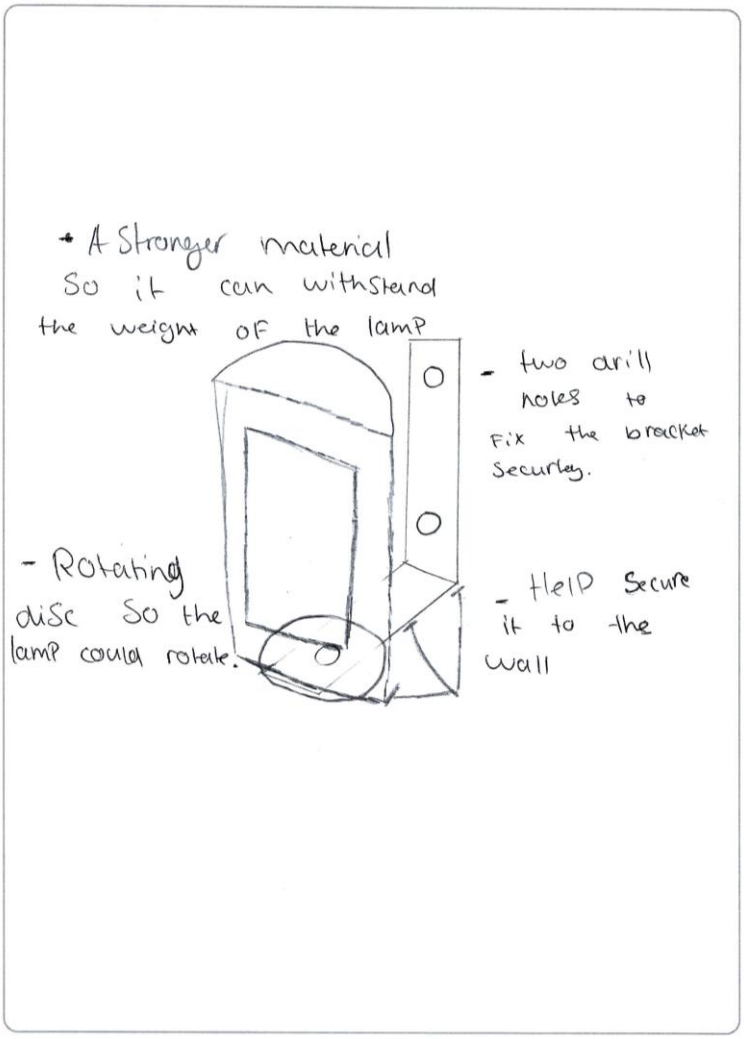
Typical Characteristics of high-level response for activity 2b

- An annotated drawing will be provided that presents information clearly, probably using different views.
- The drawing will indicate the sizes of keys features of the design solution.
- The idea will include some solutions that;
    - Allow the lamp to rotate
    - Prevent the bracket swinging on the wall.
    - Uses a material, or finish, that will prevent corrosion.
    - Resolves inconsistencies with the manufacturing process.
- Written information will be communicated clearly.
- Full use will be made of the available space.

Typical Characteristics of low-level response for activity 2b

- A drawing will be provided but it will be difficult to interpret
- Proposed changes to the design may not be effective or do not offer an improvement.
- A change of material and or process will be suggested, but this will not be appropriate to the product.
- Sharp edges will be rounded off.

A candidate response for activity 2b



Justify why your design idea is an improvement on the existing mounting bracket and explain which processes you would use to make your design idea.

My design idea is an improvement as I have taken all the issues with the previous design an improved them.

My first improvement was that the material changed from mild steel to iron as iron can withstand more weight and pressure than mild steel can.

Another big improvement was that instead of one drill hole fixing the bracket to the wall. I added another drill hole to hold it in place without it moving around.

One other big improvement was that I added a rotating disc so that the lamp could rotate 90° without any problems.

And finally, I secured the bottom of the mounting bracket with a holder to ~~and~~ help with the weight.

You should spend 30 minutes completing Activity 2b.

(Total for Activity 2b = 10 marks)

The top left annotation on the drawing indicates that the improved bracket design is now stronger so it can withstand the weight of the lamp. As this was not a problem with the original design, this is not a valid response.

The top right comment is valid, and provides a reasoned justification for the change “to fix the bracket securely”

The bottom right comment on the drawing does not clearly convey the candidate’s suggestion and is therefore not valid.

The bottom left comments while not clear in itself, when combined with the drawing provides an indication of how the rotation problem may be solved, but again it lacks detail.

The first paragraph of the written answer does not contain any content that is worthy of credit.

The second paragraph of the written answer is not valid and demonstrates a lack of understanding of material properties.

The third paragraph is valid and offers a reasoned justification for the proposed design change.

The fourth paragraph demonstrates the candidate’s intention for the “rotating disc” but does not provide details of how this would function. While the details of how the proposal would work are limited there is a reasoned justification “so that the lamp could rotate 90° without any problems”

The final paragraph does not provide details that help explain the annotation of the drawing. As the intention is to solve a problem that does not exist the reasoned justification “to help with the weight” is not valid.

Trait 1
As the candidate has only provided valid two improvements with the proposed design, they have not provided the level of detail required to justify a mark being awarded from band 3. Therefore, the best fit description for trait 1 is “Ideas that address the brief and offer partial improvement on the original”

Trait 2
As in activity 2a a candidate’s ability to access marks for trait 2 is very closely link to the evidence they produce for trait 1. A candidate is unlikely to be able to demonstrate a reasoned justification for a design solution if they have not offered one. The best fit description for trait 2 is therefore “A reasoned justification for the chosen design solution”

Trait 3
This trait relates the processes chosen to manufacture the proposed design. In order to access mark band candidates must provide “Limited justification for the chosen processes”. Within the candidate’s answer there are no chosen processes, and hence there cannot be an associated justification. Therefore, the best fit mark band for trait 3 is “No rewardable content”

Overall Grading Decision for Activity 2b
Since two of the three traits have been allocated mark band 2 an overall best fit would be to allocate a mark from mark band 2, i.e. 4 to 7 marks. Given that trait 3 was judged to be in mark band 0 it would not be appropriate to award the maximum mark available for the activity. Therefore, a mark of between 4 and 6 should be awarded.

3
Marking Grid

Activity 3 – Drawing conclusions (12 marks)				
Band 0	**Band 1**	**Band 2**	**Band 3**	**Band 4**
0	**1–3**	**4–6**	**7–9**	**10-12**
No rewardable content.	1) Provides a limited interpretation of the resource material with minimal reference to the data. 2) Attempts to identify some issues associated with the problem but these may not be relevant. 3) Demonstrates a limited understanding of the causes of the issues. 4) Suggestions, if present, are not valid or supported and may not link to the issues or potential causes.	1) Provides a partially valid interpretation of the resource material with some reference to the data but this will lack detail. 2) Identifies some relevant issues associated with the problem. 3) Demonstrates some understanding of the causes of the issues but may lack detail. 4) Gives partially valid suggestions about how the issues could be resolved with an attempt to make logical links to the potential causes.	1) Provides a mostly valid interpretation of the resource material with some detailed reference to the data. 2) Identifies some issues associated with the problem. 3) Demonstrates some detailed understanding of the causes of the issues. 4) Gives mostly valid suggestions about how the issues could be resolved by making some logical links with the potential causes.	1) Provides a valid interpretation of the resource material with detailed reference to the data. 2) Comprehensively identifies relevant issues associated with the problem. 3) Demonstrates a comprehensive and detailed understanding of the causes of the issues. 4) Gives valid suggestions about how the issues could be resolved by making logical links with the potential causes throughout.

Typical Characteristics of high-level response for activity 3

Candidates will identify at least some points from each of the 4 traits below.

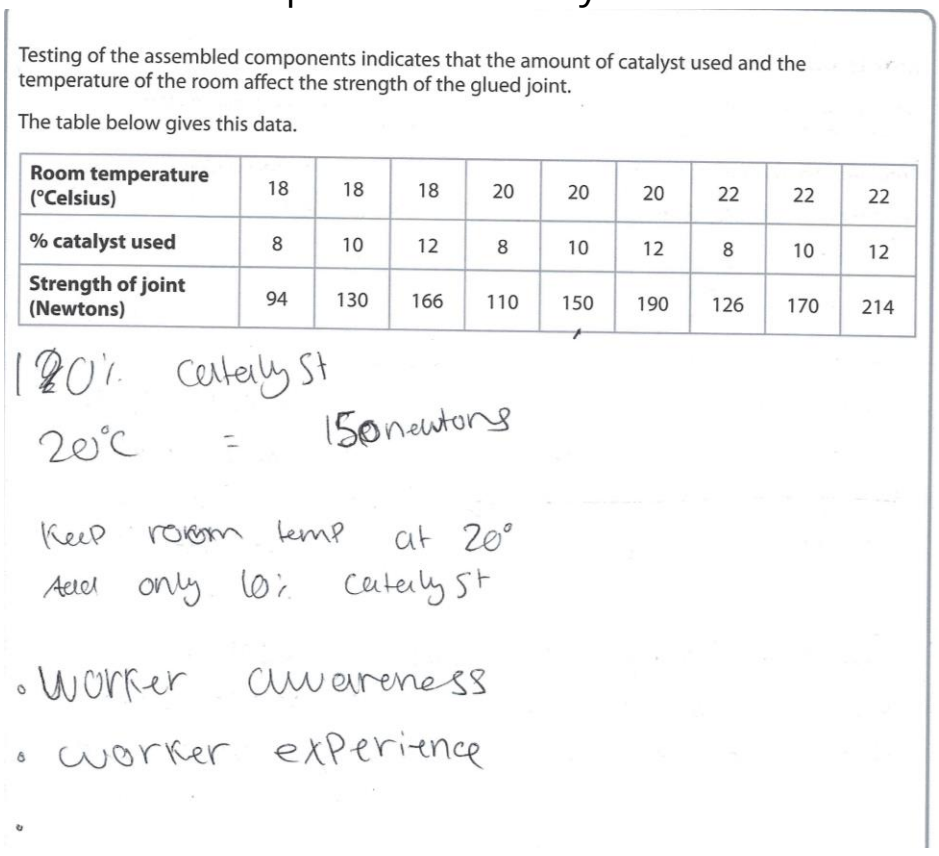
- Information contained in all elements of the resource materials will be made use of.
- For trait 1 candidates will identify the following problems
    - Only a temperature of 20° and 10% catalyst provides the required strength.
    - Separation forces above, or below, 150N are incorrect.
    - An increase in temperature, and / or catalyst, increases the separation force, and vice versa.
    - The manual assembly processes could lead to inconsistency.
- For trait 2 candidates will identify the consequences of the problems
    - H&S risks due to chemicals being used
    - Assemblies that are out of tolerance will;
        - Have to be remade
        - Will waste materials
        - Will delay production
        - Will increase costs
        - May damage reputation of producer
- For trait 3 candidates will identify the causes of the problems;
    - The balance of temperature against catalyst
    - Inconsistent assembly techniques related to;
        - Misalignment of components
        - Inconsistent application of adhesive
        - Inconsistent mixing of adhesive
        - Inconsistent pressure applied during assembly
- For trait 4 candidates will identify solutions to the problems
    - Maintain temperature at 20° and catalyst at 10%
    - Adjust balance of temperature and catalyst
    - Automate the assembly process
    - Provide the engineer with equipment e.g. jigs, to improve the assembly process.

Typical Characteristics of low-level response for activity 3

Candidates will

- Not make full use of the space available, potentially this may be due to spending too long on activities 2a and 2b.
- Make limited use of the information provided
- Suggest generic causes for the problems e.g. operator fatigue, machine wear.
- Suggest generic solutions to problems e.g. buy better machines, repair the machines, give the operator longer rest periods.
- Repeat answers that were valid from the previous examinations, or the Sample Assessment Material (SAM), which were not be relevant for this activity.
- Identify problems, but not offer solutions.
- Not identify consequences associated with the problems.
- Suggest changes to the design, material or manufacturing process.

A candidate response for activity 3



Testing of the assembled components indicates that the amount of catalyst used and the temperature of the room affect the strength of the glued joint.

The table below gives this data.

Room temperature (°Celsius)	18	18	18	20	20	20	22	22	22
% catalyst used	8	10	12	8	10	12	8	10	12
Strength of joint (Newtons)	94	130	166	110	150	190	126	170	214

120% catalyst

20°C = 150 newtons

Keep room temp at 20°

And only 10% catalyst

- worker awareness
- worker experience
-

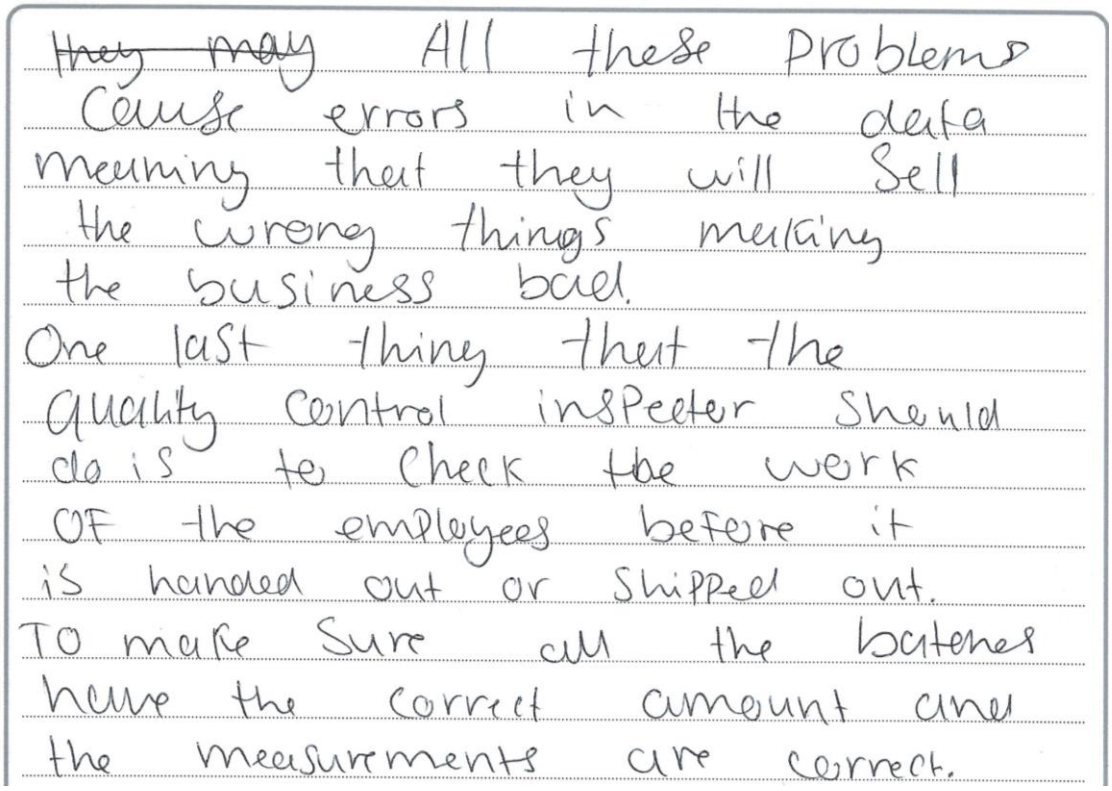
Activity 3: Drawing conclusions

Analyse the information in the drawing, manufacturing process and table to explain the issues that have occurred during the assembly of the component.

Consider what the impact of these issues will have for the engineering organisation.

What should the quality control inspector suggest to resolve the issues?

One thing the quality control inspector should do is keep the room temperature at 20°C and the amount of catalyst used 10%. as this is the only formula that ~~turns out to be~~ the Strength of the joint turns out to be 150 newtons.
Another thing the quality control inspector should do is to make sure that the engineer is fully awake and aware of what is going on as they might be tired, they may make some mistakes ruining the data. For this they should take breaks and make sure that they're able to work.
The ~~inspector~~ quality control inspector should also train the employees so no error is made and that they're experienced enough for the job. As


They may All these problems
Cause errors in the data
meaning that they will sell
the wrong things making
the business bad.
One last thing that the
quality control inspector should
do is to check the work
of the employees before it
is handed out or shipped out.
To make sure all the batches
have the correct amount and
the measurments are correct.

On the first page of the candidate's response they have identified a relevant column of the data table that indicates the correct variable value required to provide the 150N separation force.

They have also offered a valid solution, of maintaining these variables.

The candidate has listed worker awareness / experience but does not offer any details related to these points.

The first paragraph of the written response repeats the annotations from the first page, but does not add any detail.

The second paragraph, about worker fatigue, is generic. As there is no data to support within the information provided the comment is not valid, or credit worthy.

The final paragraph on the first page of the candidate's response is partially valid but is a generic response.

The first paragraph of the second page attempts to identify an issue with the problems but is limited to indicating "making the business bad", which does not indicate how this would be "bad".

The final paragraph is again a generic response of increasing the number of quality control checks completed.

Trait 1
The candidate has only made use of a single column from the data table and has referred to these figures. They have made some use of the information related to the manufacturing process, but this is only by implication. Therefore, the best fit description for trait 1 is "Provides a partially valid interpretation of the resource material with some reference to the data but this will lack detail".

Trait 2
The only evidence related to issues with the problems is to identify that it would be "bad". Therefore, the best fit description for trait 2 is "attempts to identify some issues associated with the problem but these may not be relevant"

Trait 3
While the candidate has identified specific values that provide the desired outcome there are no detailed comments related to the causes of the incorrect outcomes. Therefore, the best fit description for trait 3 is "Demonstrates some understanding of the causes of the issues but may lack detail"

Trait 4
The candidate has offered a single valid solution to the problems, to keep the temperature and percentage of catalyst at 20° and 10%. However, this suggestion does not have an explicit link to the causes of the problem as required for mark bands 3 and 4. Therefore, the best fit description for trait 4 is "Gives partially valid suggestions about how the issues could be resolved with an attempt to make logical links to the potential causes"

Overall Grading Decision for Activity 3
Since three of the four traits have been allocated mark band 2 an overall best fit would be to allocate a mark from mark band 2, i.e. 4 to 6 marks. Given that trait 2 was judged to be in mark band 1 it would not be appropriate to award the maximum mark available for the activity. Therefore, a mark of 4 or 5 should be awarded.

Summary

Based on their performance on this paper, future candidates should:

- Ensure they note problems, or potential problems, that may arise during the testing process. This will then provide content for activities 1a and 1d.
- Ensure they record appropriate units for the variables recorded in the tables for activity 1a
- Ensure the graphs drawn for 1b are accurately drawn to an appropriate scale, with correctly orientated and labelled axes and include an appropriate line, or curve, of best fit.
- For activity 1c, comment on data displayed in the tables (from 1a) and the graphs (from 1b). They should not comment on the testing process.
- For activity 1c relate the data from the tables and graphs to the set task information engineering brief.
- Identify problems encountered during the testing for activity 1d and do not comment on the aspects of the test that they performed well, or aspects that did not cause problems.
- Not relate the problems identified in 1d back to the set task information engineering brief.
- Plan to use their time effectively for part 2, such that all activities can be addressed in appropriate detail.
- For activities 2a and 2b demonstrate accurate knowledge related to materials and processes.
- For activity 2a annotate the diagram provided.
- For activity 2a, use the information provided in the engineering brief, proposed design solution and method of manufacture to identify issues that are specific to the information provided. The majority of their submission should be linked to this specific information.
- For activity 2b, clearly communicate the redesign proposal using different views, dimensions and annotation / notes.
- For activity 2b either suggest a more appropriate manufacturing method, or justify the continued use to the existing process.
- For activity 3 make use of all the information provided.
- For activity 3 comment on
    - Problems shown in the information provided (Trait 1)
    - Consequences of the problems (Trait 2)
    - Causes of the problems (Trait 3)
    - Solutions to the problems. (Trait 4)