L2 Lead Examiner Report

February 2019

Tech Award in Engineering

Component 3 – Responding to an Engineering Brief

21141K

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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.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner 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 learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners 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 learners 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	**13**	**19**	**26**	**33**	**43**	**53**

Introduction

This was the first series that the set task for Component 3: Responding to an Engineering Brief, of the Tech Award in Engineering was available for learners to take.

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

Part 1 required learners to:

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

Part 2 required learners 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 learners 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 learners in the supervised period. In this four-week period, prior to the activity window, only one centre raised a question about the testing process. Based on this, and the evidence observed from learner responses, it would appear that all centres were able to successfully resource and manage the testing processes for their learners.

Introduction to the Overall Performance of the Unit

In this next section examples from learners' responses will be used to illustrate features of performance that reflect how learners were able to access the marks from the highest marking bands. Examples of responses that typify learner answers that were awarded marks from the lower marking bands are also included.

It should be noted that all examples of high performance are taken from a single learner's answers. This learner was able to access full marks for both parts 1 and 2. Some parts of this learner's submissions have not been included in this report as these were not needed to illustrate the points being made. These missing sections contributed to the marks awarded.

Where examples have been used to illustrate aspects of weaker performance the examples have been chosen to demonstrate the learner has made a "good" attempt at providing a response. The intention is that this type of answer will provide more useful information than a response that is very limited in content, and hence was awarded very low marks.

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 learners for the external assessment.

It should be noted by centres that in some instance's learners appear to have run out of time to answer activity 3 in Part 2. This is suggested as the quality of content, and style of writing, changed as their responses to activities 2a, 2b and 3 progressed.

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: data recorded with limited precision and consistency, and may use inappropriate units results that may be insufficient or at inappropriate increments simple and generic observations recorded about the testing process.	The results demonstrate some understanding of testing procedures, including: data recorded with consistency and using the appropriate units but may lack precision sufficient results at appropriate increments for some of the testing process some detailed observations about the testing process but are not always relevant.	The results demonstrate a comprehensive understanding of testing procedures, including: data recorded with precision and consistency using the appropriate units sufficient results at appropriate increments throughout the testing process 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 loads placed on the load carrier.
- The units of grams (g) and Newtons (N) will be added, either to the column heading or the individual values recorded.
- The forces recorded on the Newton Meter will be different in each table.
- The forces recorded will “reasonable” for the loads being pulled.
- Descriptions will be offered about three different aspects of the testing process that the learner noted.
- Comments offered by the learner will focus on the testing process.

A learner answer that illustrates a good response

Load carrier with non-abrasive side on test surface	
Mass on load carrier: [..g.....]	Force on Newton Meter: [..N.....]
100 g	0.4 N
200 g	0.5 N
300 g	0.7 N
400 g	0.8 N
500 g	1.0 N
600 g	1.2 N
700 g	1.3 N
800 g	1.4 N

Record any other observations you made about the effect of pulling the Newton Meter other than the change in force.

When the Newton Meter was ~~fd~~ first pulled the reading initially increased before it ~~flu~~ lowered to a lower, more constant reading. The load carrier did not pull in a parrallel line ~~along~~ to the edge of the test surface. As the load carrier was repeatedly carried along it created a residue on the test surface due to the abrasion caused. When the load carrier was pulled it created a noise, this was increased when on the abrasive side. The greater the weight the more jerkey the movement of the load carrier and the greater the ~~fluctuations~~ on the Newton Meter. This jerkiness and fluctuation was increased further when on the abrasive side. When pulling the ~~&~~ newton meter it was difficult to keep it parrallel with the sides of the test surface or horizontal. The Newton Meter occasionally changed its set reading after being pulled.

Typical Characteristics of low-level response for activity 1a

- The table will not be fully populated and the masses used will change in an inconsistent pattern.
- Units will only be recorded for the mass (g)
- The forces recorded will be similar for the two tests, or will be unrealistic, for example excessively high or low for the loads being pulled.
- Comments provided will relate to how the increasing the mass on the load carrier requires an increase in force to move the load carrier. 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 learner answer that illustrates some weaknesses

Load carrier with abrasive side on test surface	
Mass on load carrier: [….g…]	Force on Newton Meter: [……N……]
100	120
200	170
300	230
400	300
500	360
600	400
700	430
800	500

A learner answer that illustrates some weaknesses

Record any other observations you made about the effect of pulling the Newton Meter other than the change in force.

More Friction occured on the rougher surface meaning more newtons were needed to pull the load across the surface.
More Force was needed to push the heavier loads across the surface.
The smoother surface needed less Newtons to be pulled across the surface.
The more load that was added to the rougher surface the harder it was to pull, resulting in more force being used.
The Non abrasive side needed roughly half as many newtons to pull across the Wood surface than the abrasive side.
The abrasive side would work better as a brake because it is a rougher surface and More Friction is created.

You should spend 15 minutes completing the tables for Activity 1a.

(Total for Activity 1a = 6 marks)

The Non abrasive, smoother surface would not be a very good break because not as many newtons are needed to pull the load. No Friction is created.

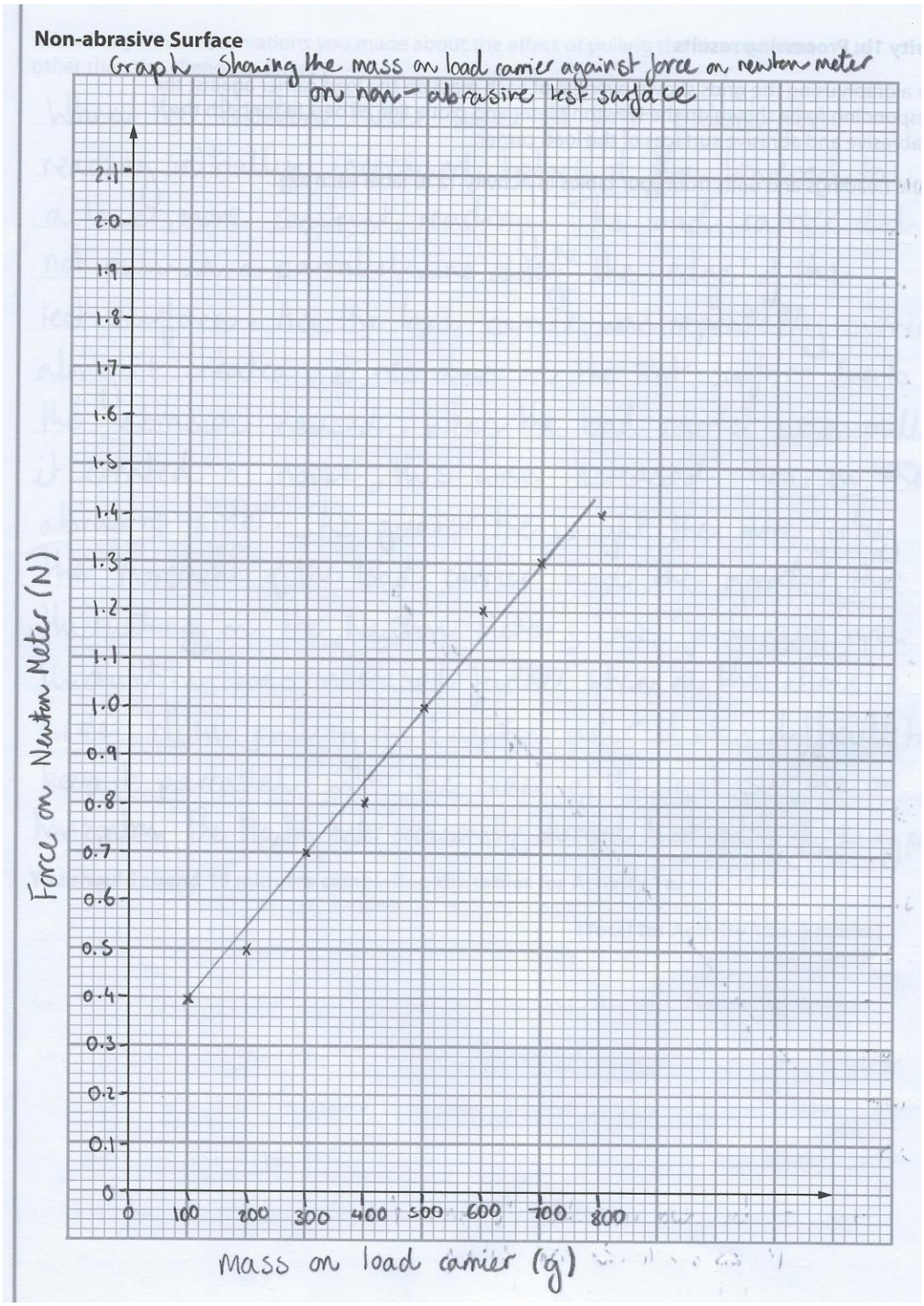
Marking Grid

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: inappropriate annotations of headings and units choice of scaling is inappropriate to the data and used inconsistently plots of tabulated data that include significant inaccuracies 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: appropriate annotations of headings and units choice of scaling is appropriate to the data but is not used consistently plots of tabulated data that include minor inaccuracies sufficient data plotted to represent results but inappropriate lines/curves produced.	Demonstrates comprehensive understanding of data representation techniques by plotting accurate graphs. Graphs include: appropriate annotations of headings and units choice of scaling is appropriate to the data and used consistently accurate plots of tabulated data sufficient data plotted to represent results and to produce appropriate lines/curves

Typical Characteristics of high-level response for activity 1b

- The independent variable (mass) will be plotted on the X-axis and the dependent variable (force) will be plotted on the Y-axis.
- Both graphs will have the axes labelled with a title and the correct units.
- 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.

A learner answer that illustrates a good response



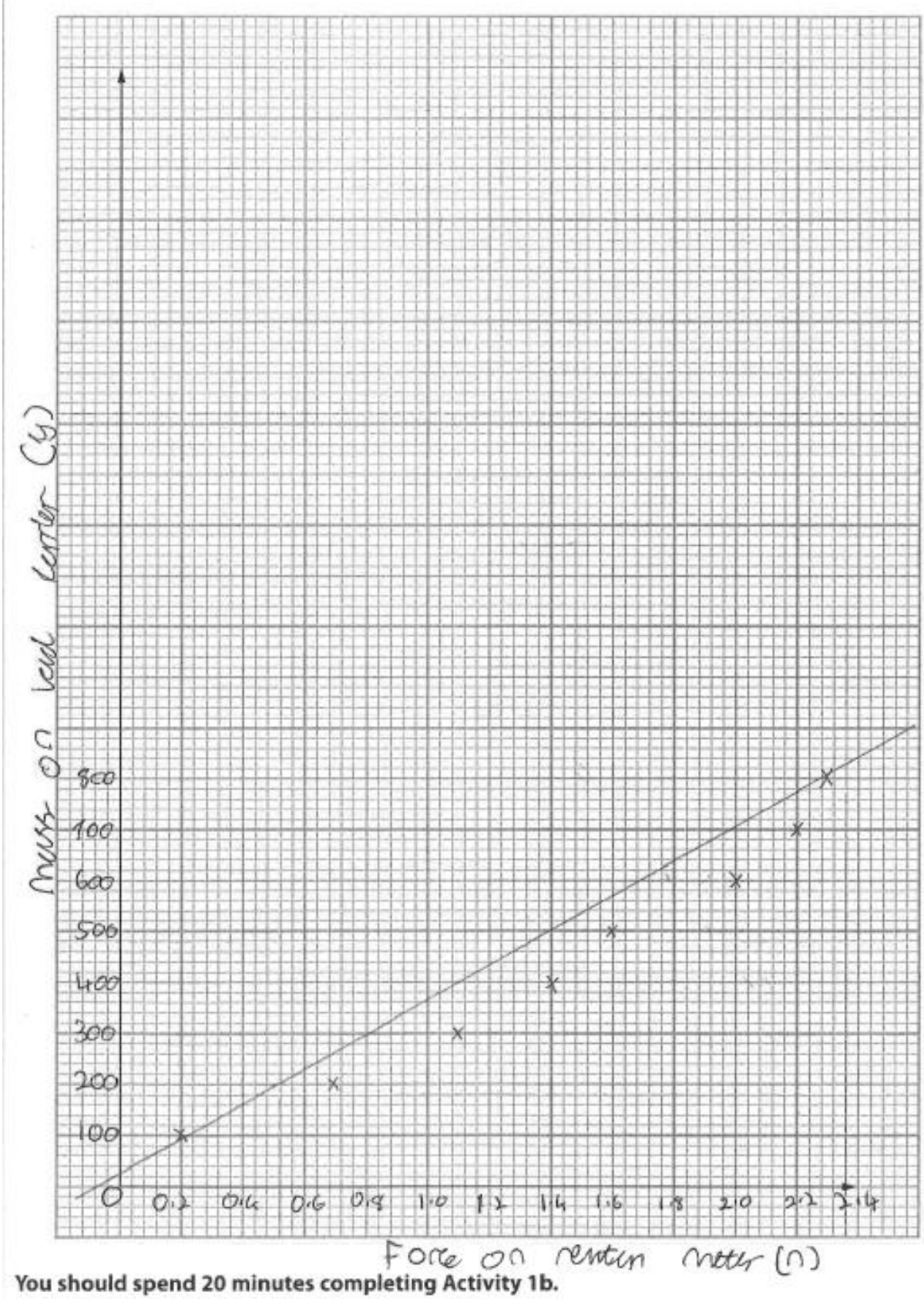
Note: The second graph had similar characteristics to this one and its inclusion in this document would offer the reader no extra information.

Typical Characteristics of low-level response for activity 1b

- The dependent variable (force) will be plotted on the X-axis and the independent variable (mass) 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 straight lines will be drawn through each data point, or a line will be drawn between the first and last data points plotted.

A learner answer that illustrates some weaknesses

Abrasive Surface



You should spend 20 minutes completing Activity 1b.

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.	Attempts to describe the patterns in the tables and graphs but is superficial or does not reflect results. Draws limited conclusions not specifically based on a comparison between patterns in the tables and graphs, with minimal reference to data.	Mostly accurate description of the patterns in the tables and graphs, with some reference to data. Draws mostly valid conclusions based on a comparison between patterns in the tables and graphs, supported by some reference to data.	Accurate description of patterns in the tables and graphs with detailed reference to data. 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 load on the carrier and the force shown on the Newton Meter will be commented on.
- The maximum and minimum data points will be referred to.
- Observations will be made about the abrasive side requiring more force to move the load carrier than the non-abrasive
- A calculation will be performed to indicate an approximate increase in force per unit of mass e.g. The force will increase by 0.4N for every 100g of load added.
- 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 (brake friction materials) and suggestions offered as to what material would be the most appropriate to use. Justification for either the abrasive, or non-abrasive materials, could be valid if supported with appropriate reasons.

A learner answer that illustrates a good response

Activity 1c: Drawing conclusions

Compare the patterns in your tables and graphs.

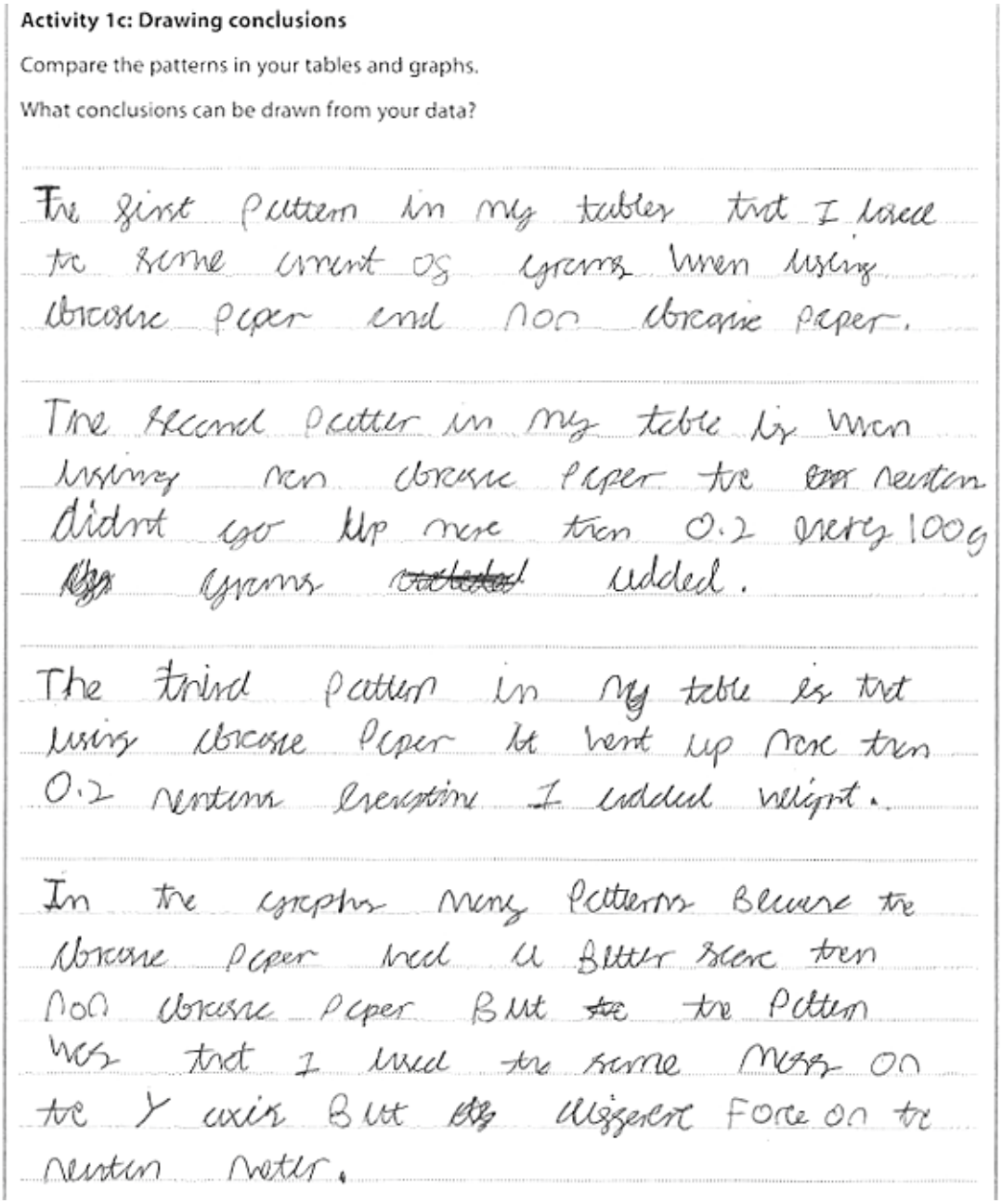
What conclusions can be drawn from your data?

Both graphs show a positive correlation between the mass on load carrier and force on Newton Meter. There is a steeper gradient on the second graph (abrasive surface) than the first graph (non-abrasive). This shows that there was a greater effect on the heavier weights used when on the abrasive side. The overall higher readings suggest that the abrasive surface would be more suitable for a friction material - or in general materials with a higher coefficient of friction - as they would have a greater impact on making a vehicle reduce its speed and it would be able to do this at a faster rate than the non-abrasive materials. However, when conducting the experiment a significantly larger amount of residue was left on the test surface when the abrasive surface was used. This shows that it eroded the test surface and suggests that the same would happen to a disc brake if it had a more abrasive surface on it. This would result in the brake disc wearing away much faster and it is even more of an issue as the disc brake has a smooth surface with a low coefficient of friction so would be damaged even more. This leads me to the conclusion that the type of friction material suitable is

Typical Characteristics of low-level response for activity 1c

- 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.

A learner answer that illustrates some weakness (repeats)



Activity 1c: Drawing conclusions

Compare the patterns in your tables and graphs.

What conclusions can be drawn from your data?

The first pattern in my tables that I have is the same amount of grams when using abrasive paper and non abrasive paper.

The second pattern in my table is when using non abrasive paper the newton didn't go up more than 0.2 every 100g ~~kg~~ grams ~~added~~ added.

The third pattern in my table is that using abrasive paper it went up more than 0.2 newtons excepting I added weight.

In the graphs many patterns because the abrasive paper had a better score than non abrasive paper But ~~the~~ the pattern was that I used the same mass on the Y axis But ~~the~~ different Force on the newton meter.

Another learner answer that illustrates some weakness (Not about patterns)

Activity 1c: Drawing conclusions

Compare the patterns in your tables and graphs.

What conclusions can be drawn from your data?

As you can see from my results, the largest shift of force, is between their being no-added weight to added-weight. When the weights were added to the load, carrier, there were many slight delays in the movement of the load carrier, I think this is because there were some small cracks and dints in the test surface which may have made it a slightly unfair test which also may have been the affected ~~rate of~~ reactant. Every single area of the test surface has been quite severely worn which could have been a cause of an unfair test, because I have carried out the test more than two times and all of them were in different positiones of the test surface which ensures that the issue was the damaged test surface. My main issue of the test was my unneccesary and rarity of my results, & with the fact that the non-abrasive side

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.	Demonstrate a limited understanding of problems with the testing method used/results obtained. Demonstrate a limited understanding of how the process of testing could be improved.	Demonstrate some understanding of problems with the testing method used/results obtained. Demonstrate some understanding of how the process of testing could be improved.	Demonstrate a comprehensive understanding of problems with the testing method used/results obtained. 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 Newton Meter that provides more accurate readings
- 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 1c

- 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 learner answer that illustrates a good response

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?

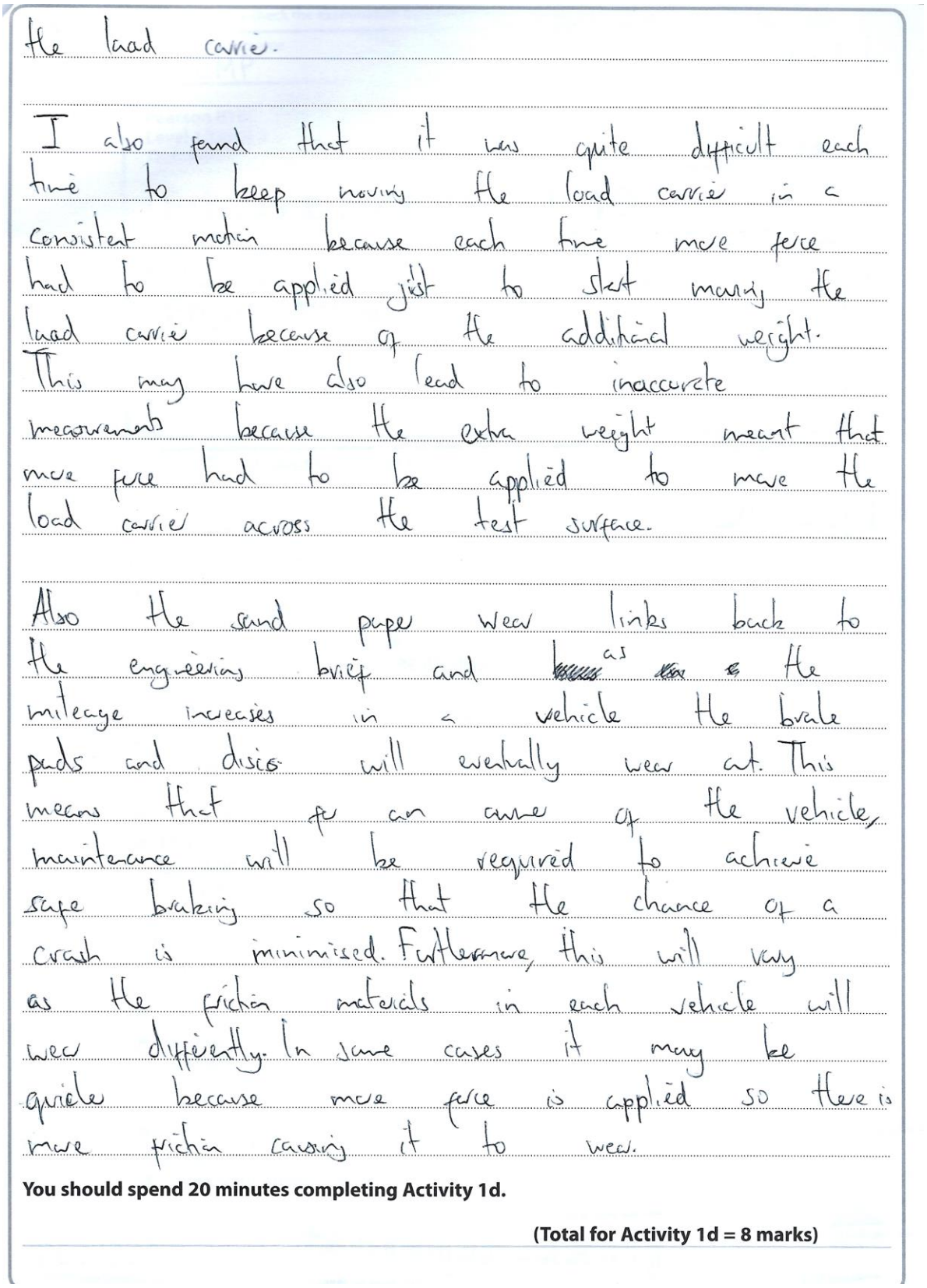
If you carried out the test again, what would you do differently?

When setting up the test, many problems occured. It was very difficult to hold the Newton Meter parallel to the edges of the testing surface and to even know if it was parallel or not. Also, the width of the Newton Meter was greater than the height of the load carrier, making it extremely difficult to hold it parallel to the surface. It was also difficult to place the weights exactly in the middle of the load carrier. There was ambiguity on where the load carrier should start and finish and it was difficult to make sure they were moved exactly the same distance each time.

Carrying out the experiment left many issues, for example the residue from the eroded test surface that had to keep being cleaned. As the weights were not set up exactly in the middle, the load carrier moved diagonally which could affect the results. It was also difficult to keep the load carrier moving at a constant speed and whilst it was moving to keep it parallel.

Recording the results was problematic, too. The result of inertia meant that the immediate reading jumped up before it when back down. This fluctuation

A learner answer that illustrates some weakness



the load carrier.

I also found that it was quite difficult each time to keep moving the load carrier in a consistent motion because each time more force had to be applied just to start moving the load carrier because of the additional weight. This may have also lead to inaccurate measurements because the extra weight meant that more force had to be applied to move the load carrier across the test surface.

Also the sand paper wear links back to the engineering brief and as the mileage increases in a vehicle the brake pads and discs will eventually wear out. This means that for an owner of the vehicle, maintenance will be required to achieve safe braking so that the chance of a crash is minimised. Furthermore, this will vary as the friction materials in each vehicle will wear differently. In some cases it may be quicker because more force is applied so there is more friction causing it to wear.

You should spend 20 minutes completing Activity 1d.

(Total for Activity 1d = 8 marks)

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: Identifies issues with the existing design that are not entirely relevant Demonstrates limited understanding of issues in relation to the brief.	Produce a reasoned evaluation of the existing product that: Identifies mostly relevant issues with the existing design Demonstrates some understanding of issues in relation to the brief.	Produce a developed and reasoned evaluation of the existing product that: Identifies relevant issues with the existing design 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 the engineering brief and the methods and materials suggested for the manufacture. For example;
    - Milling rectangular section to make 1000 stands will cause excessive waste and excessive time.
    - The 10mm diameter holes will not support the 4mm diameter screwdriver.
    - The 15mm tall stand will not support the screwdriver.
- Generic problems will also be identified with the proposed design solution that do not take into account the engineering brief and the methods and materials suggested for the manufacture. For example, the design has sharp edges which could cut the user.

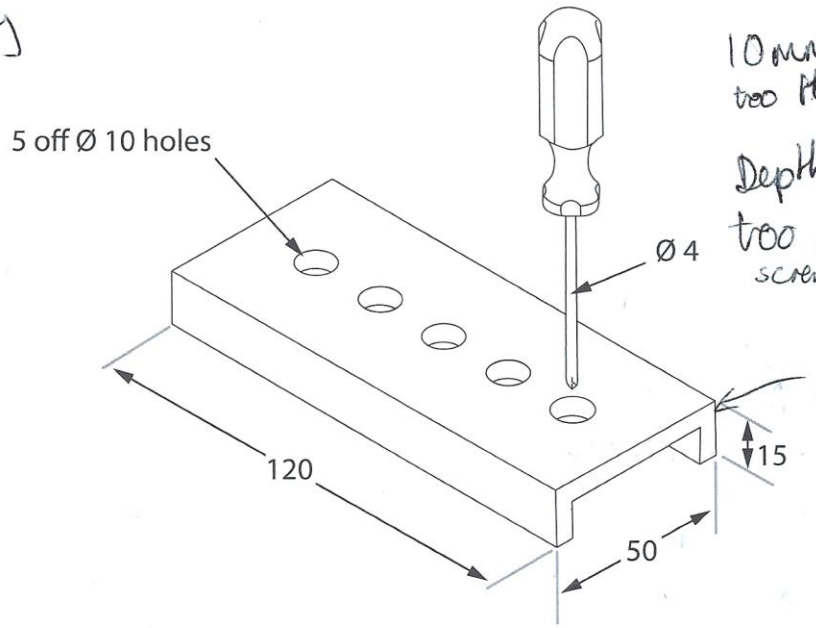
A learner answer that illustrates a good response

Set task information

Engineering Brief

A customer wants to place an order for 1000 stands to hold screwdrivers. The screwdrivers will be placed into the 10mm diameter holes. A technician at your company designs and makes the stand shown below as a possible solution. The stand is made from medium carbon steel which is supplied as a rectangular section that is 15mm thick.

unnecessary material



10mm diameter too [illegible] wide

Depth of hole too shallow for screwdriver

sharp corners

To make the stand, the technician:

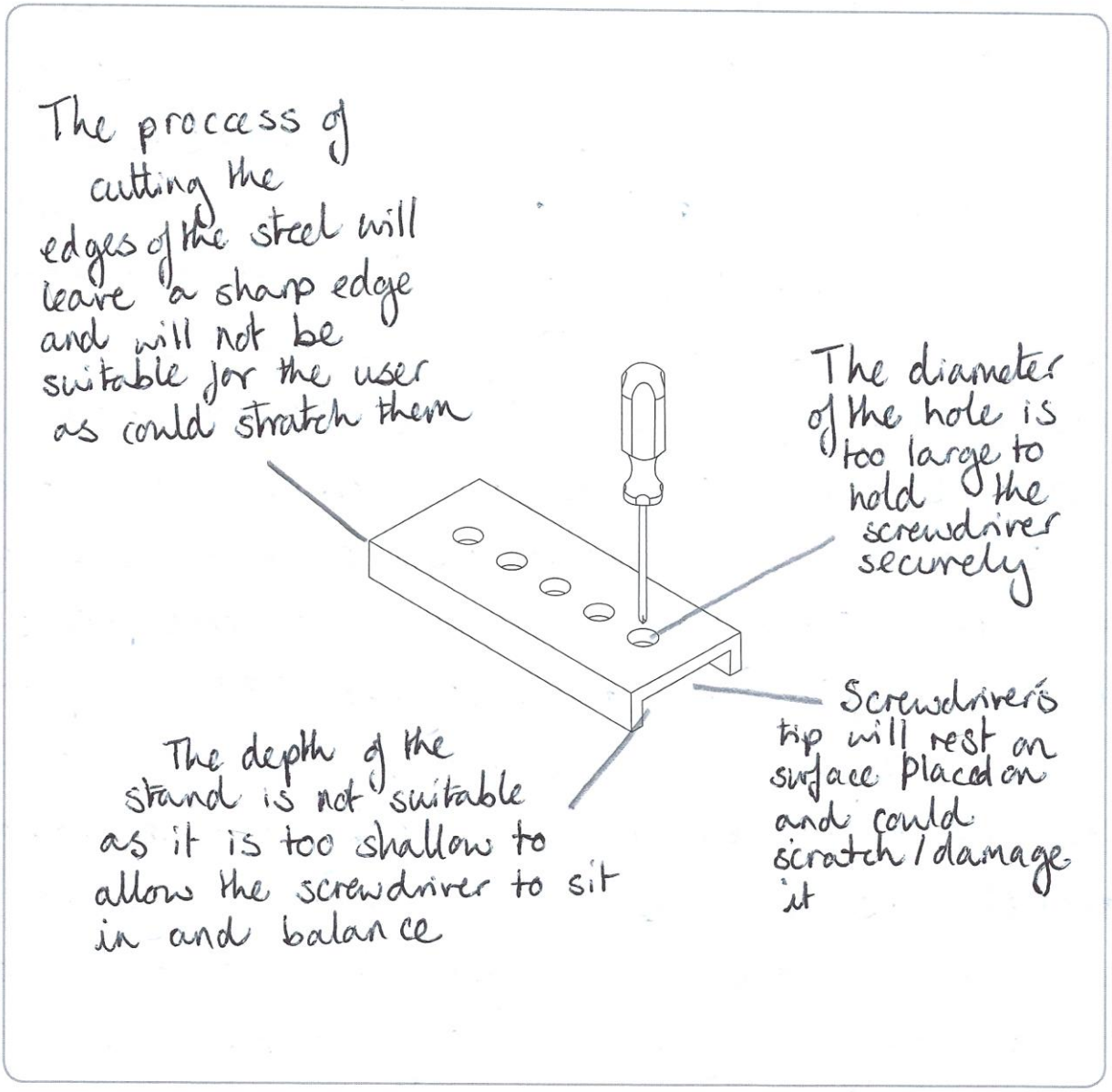
- marked out the length, the position of the holes and the slot at the bottom
- cut the steel to length
- cut the slot underneath using a milling machine
- drilled the 10mm holes using a pillar drill

Method not suitable for 1000

inaccurate as done by person

drill wear away often, have to use lots of drills

machine more accurate & worth investment for bulk

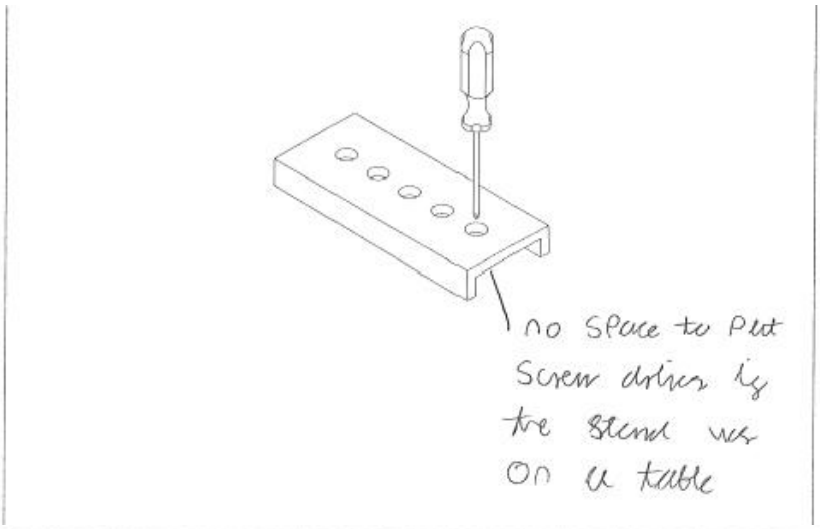

The process of cutting the edges of the steel will leave a sharp edge and will not be suitable for the user as could stratch them
The diameter of the hole is too large to hold the screwdriver securely
Screwdriver's tip will rest on surface placed on and could scratch / damage it
The depth of the stand is not suitable as it is too shallow to allow the screwdriver to sit in and balance

The method of making the product is an issue as it would be too time consuming and unrealistic as the product needs to be made in bulk. This means that steps such as marking out the holes and individually drilling each of them is unsuitable. On top of this, having it made by hand means that it would be less accurate, especially due to fatigue and time constrictions considering that 1000 need to be made. The use of medium carbon steel is also unnecessary. This is because using a metal will require sanding the edges so they are not as sharp and putting a finish onto it afterwards. This all requires extra time for these processes and extra investment for these materials. As well as this, medium carbon steel is more expensive than other metals however is not needed as the stand is being put under virtually no strain or environmental factors that would require more durability. The fact that the design has no tolerance for size means it is even more unsuitable to be made by hand and also unrealistic as over time tools will wear away. The use of medium carbon steel could also result in the drills wearing away when drilling holes as it is relatively strong.

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.

A learner answer that illustrates some weakness



The screwdriver stand doesn't have many holes to Put Screw drivers in the stand. If the Person ~~who~~ who Bought these Models wanted to use them when they were ~~on~~ on a table or in a tool Box it wouldn't work Because ~~there~~ there is no Space to put the end of the Screwdriver in so it would Be Pointless. Would Be Better if the holes was a range of Sizes So then all Sizes of Screwdrivers ~~could~~ could fit in the holder. Not mean Space to Drill the stand into the wall Because there is no Screw Space ~~left~~ So it will Be difficult to Place on a ~~wall~~ wall. another issue is that it is made out of medium carbon Steel So if all the holes ~~were~~ were filled the holder might Bend or Snap Because of the weight.

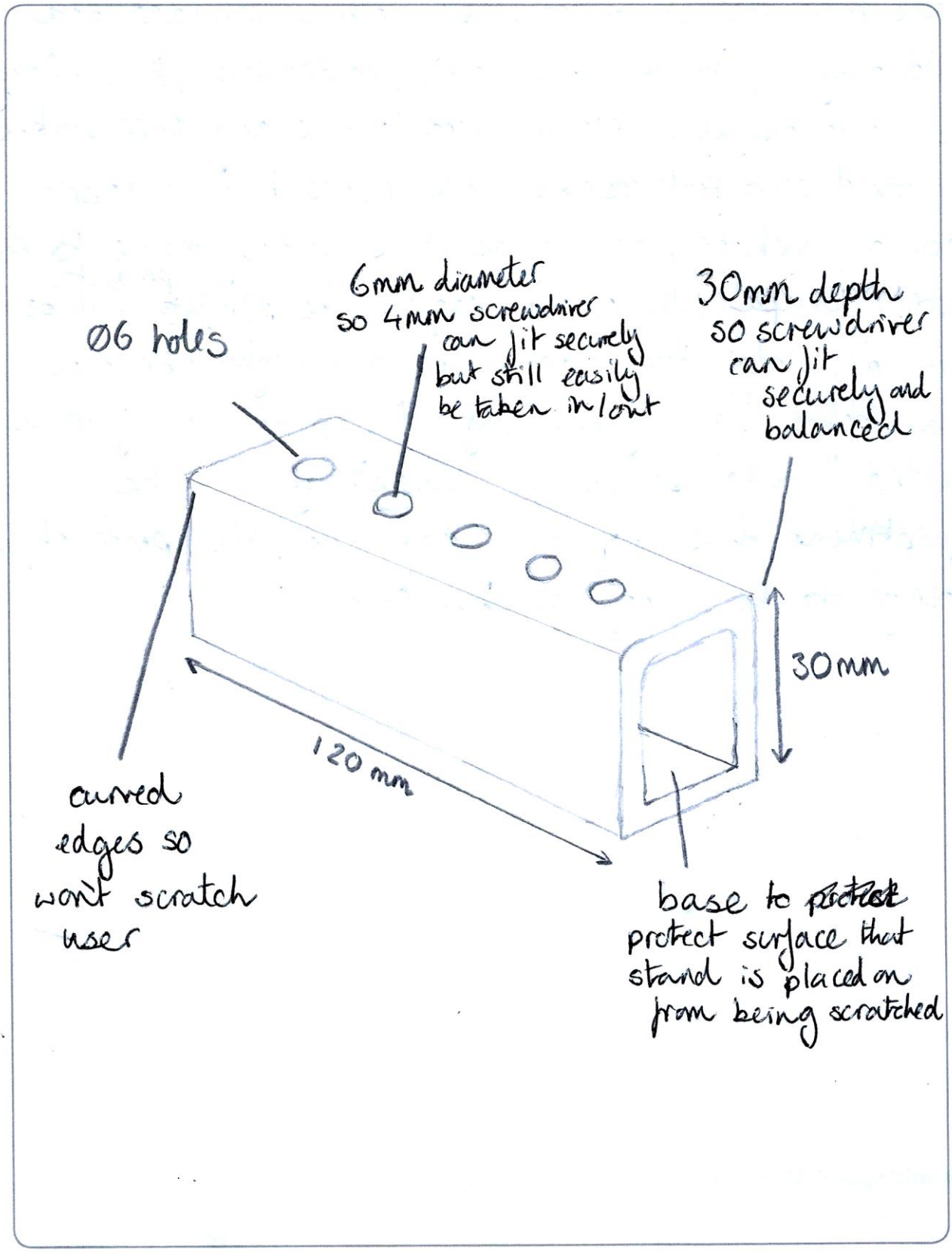
Marking Grid

Activity 2b – Redesign (10 marks)			
Band 0	**Band 1**	**Band 2**	**Band 3**
0	**1–3**	**4–7**	**8–10**
No rewardable content.	Basic ideas that partially address the brief and offer minimal improvement on the original. Limited justification for the chosen design solution. Limited justification for the chosen processes.	Ideas that address the brief and offer partial improvement on the original. A reasoned justification for the chosen design solution. A reasoned justification for the chosen processes.	Ideas that fully address the brief and show an improved design approach to the original. A developed and reasoned justification for the chosen design solution. 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 solutions that;
    - Reduce the size of the 10mm diameter holes so they will better support the 4mm diameter screwdriver. Notes will explain this feature.
    - The stand will be made taller such that it better supports the screwdriver, or be redesigned so that it can be attached to a wall. Notes will explain this feature.
    - Other design features will be added to improve the performance of the design, for example a different arrangement of the holes
- A more efficient method of manufacture will be suggested, for example injection moulding. The advantages of the proposed new process above the existing method will be explained. The method will be appropriate to the suggested material the stand will be made from.

A learner answer that illustrates a good response



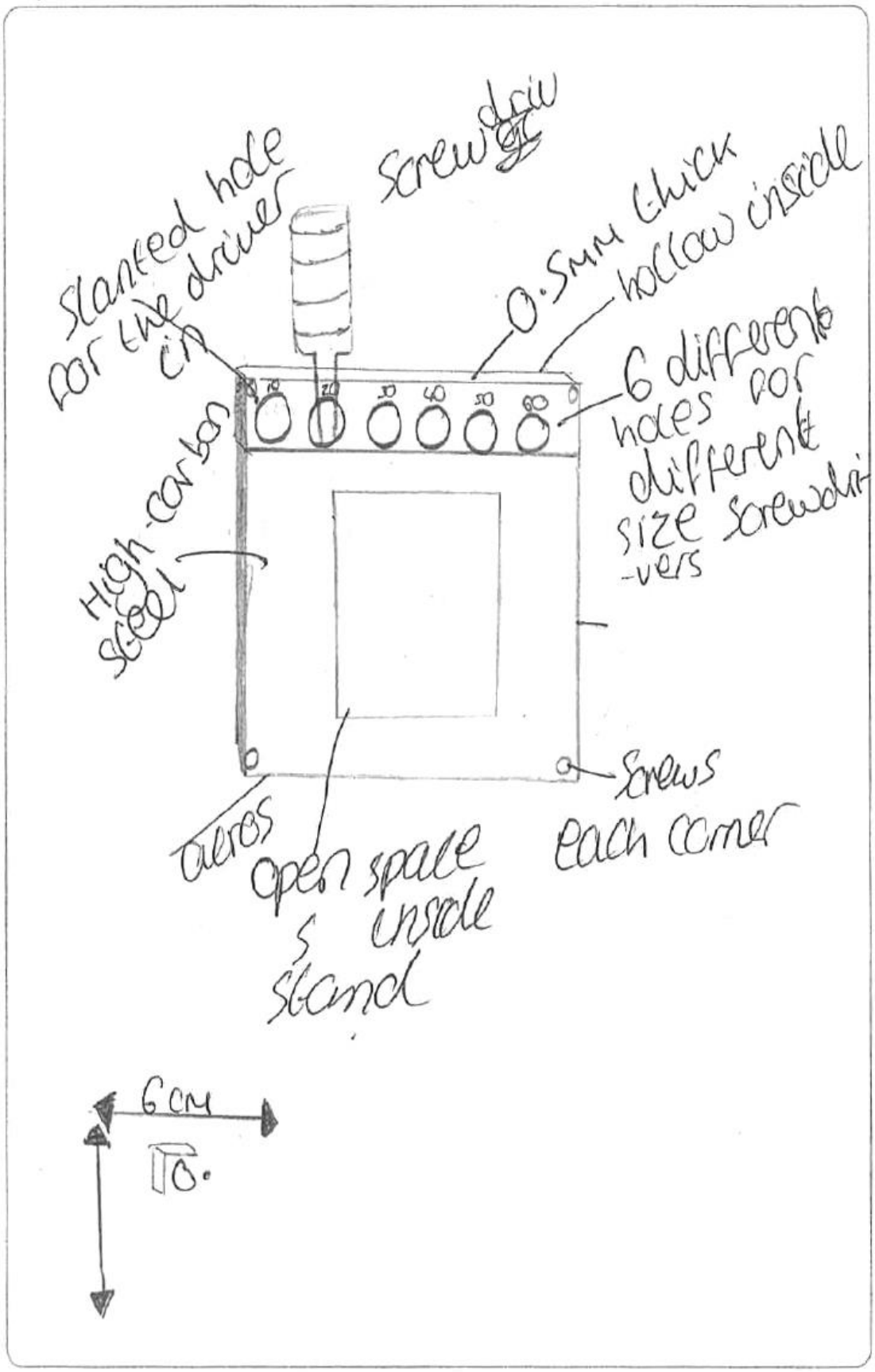
Justify why your design idea is an improvement on the existing screwdriver stand and explain which processes you would use to make your design idea.

This design is an improvement because it is now made of ABS instead of medium carbon steel. Having ABS means that the stand can be injection moulded and would only require that one step, saving lots of time. Doing this would also eliminate the need to hire any other workers so would save that cost. It also means that it doesn't need a finish or sanding as it is already made to the correct shape with curved edges. The product will be more accurate, too, so will be to a higher standard than before. Having the product injection moulded would be worth investing in the equipment due to the fact that the product is going to be made in bulk.

Typical Characteristics of low-level response for activity 2b

- A drawing will be provided but it will be difficult to interpret, sizes will not be indicated.
- The size of the holes and height of the stand will not be improved.
- No manufacturing method will be indicated
- A change of material will be suggested, but this will not be appropriate to the product.

A learner answer that illustrates some weakness



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

The design I have drawn is unique to the first stand. My new stand is going to be fitted onto the wall with the four screws, one in the corners. The stand has six different holes and they are all different sizes to fit the right screw drivers in. The holes are at the top of the stand and so the screwdrivers have enough room to fit. On the front of the stand there is an open area to see inside the stand. This area could also be useful to get the screwdrivers out. My design is made from high carbon steel. I chose this material because it is strong and doesn't warp a lot. I have chosen for it to be on the wall so it is out of the way and easy to access when ever you need to.

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.	Provides a limited interpretation of the resource material with minimal reference to the data. Attempts to identify some issues associated with the problem but these may not be relevant. Demonstrates a limited understanding of the causes of the issues. Suggestions, if present, are not valid or supported and may not link to the issues or potential causes.	Provides a partially valid interpretation of the resource material with some reference to the data but this will lack detail. Identifies some relevant issues associated with the problem. Demonstrates some understanding of the causes of the issues but may lack detail. Gives partially valid suggestions about how the issues could be resolved with an attempt to make logical links to the potential causes.	Provides a mostly valid interpretation of the resource material with some detailed reference to the data. Identifies some issues associated with the problem. Demonstrates some detailed understanding of the causes of the issues. Gives mostly valid suggestions about how the issues could be resolved by making some logical links with the potential causes.	Provides a valid interpretation of the resource material with detailed reference to the data. Comprehensively identifies relevant issues associated with the problem. Demonstrates a comprehensive and detailed understanding of the causes of the issues. 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

- The increase in the time to manufacture components after block 15 will be noted.
- The increased rate of change in time taken from block 25 will be noted.
- The decrease in diameter from block 15 will be noted.
- The potential anomaly for block 35 will be noted.
- The fact that all holes are within tolerance, other than block 35 will be noted.
- Valid reasons that could cause the patterns noted in the data above will be offered e.g. drill bit wear, operator fatigue, potential errors with measurements.
- A consequence of the increased time, decreased diameter, potential anomalous measurement will be provided for the organisation, e.g. increased costs, production delays.
- Valid suggestions about how to eliminate the causes of the changes in time / diameter and the potential anomaly will be offered e.g. different speeds/ feed rates, coolant, better quality drill bits, improved operator skill, go no/go gauges to measure hole diameter.

A learner answer that illustrates a good response

Activity 3: Drawing conclusions

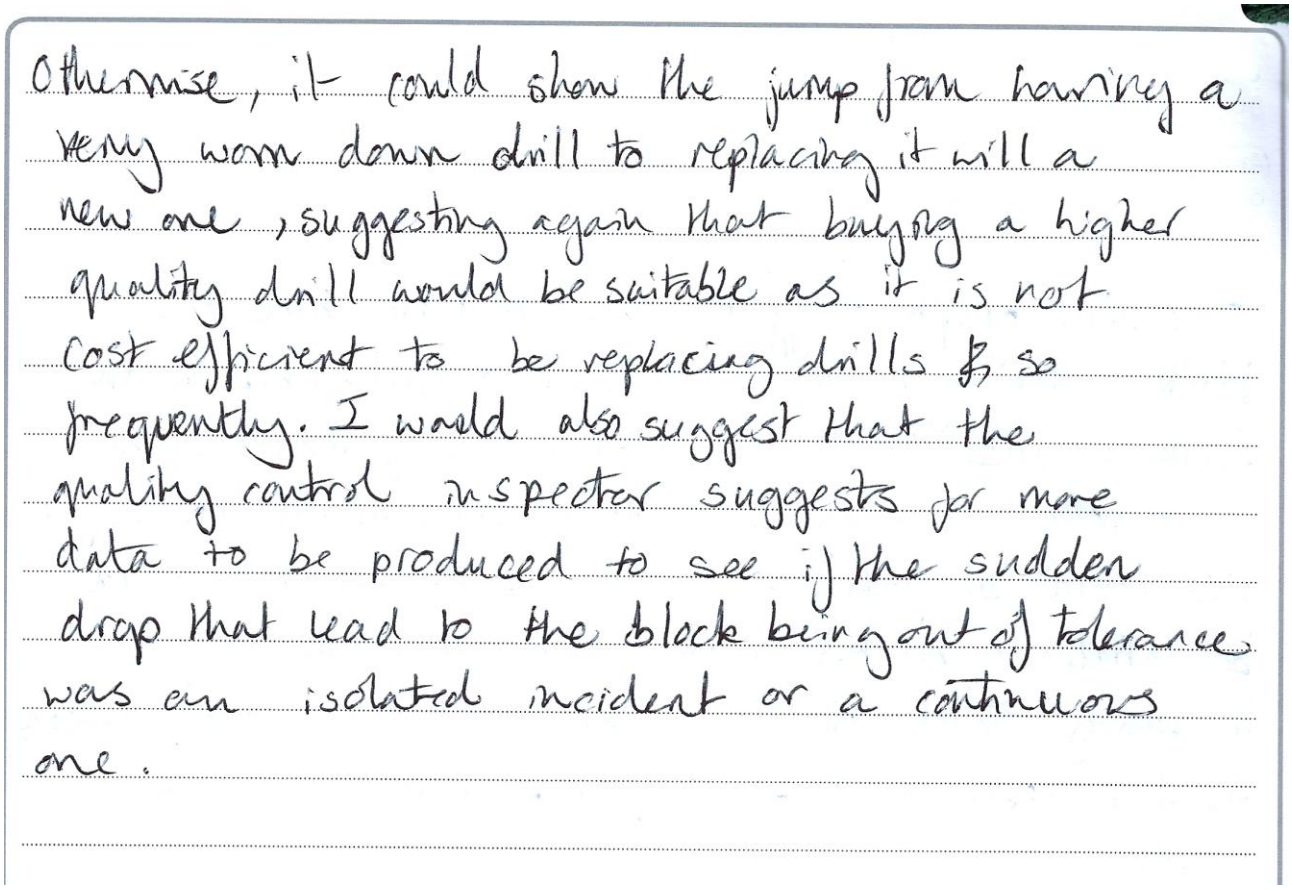
Analyse the information in the line graph and table to explain the issues that have occurred during the production of the component.

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

The line graph ~~suggests~~ shows that over time the block is taking progressively longer to drill. This is an issue because it shows that the performance of the engineering is lowering its standard over time. A reason for this could be fatigue. A way to resolve this could be introducing breaks for the engineers. ~~Another way could be having multi-skilled workers that can switch between.~~ Another reason could be laziness or boredom. To resolve this issue the quality control inspector could suggest to have a mainter at each station to ensure that work is being produced to a correct speed.

The table shows that the diameter of the hole is decreasing over time. This could be because of the drill being used wearing away over time. This is especially a possibility as aluminium alloy is being used which is a very strong metal. To resolve this the inspector could suggest to invest in a higher quality drill that will not wear away quickly. The sudden drop at block 35 could show a mistake that was random, suggesting that it is because the engineer is fatigued. If this was the case then breaks could be introduced.

11


Otherwise, it could show the jump from having a very worn down drill to replacing it will a new one, suggesting again that buying a higher quality drill would be suitable as it is not cost efficient to be replacing drills so frequently. I would also suggest that the quality control inspector suggests for more data to be produced to see if the sudden drop that lead to the block being out of tolerance was an isolated incident or a continuous one.

Typical Characteristics of low-level response for activity 3

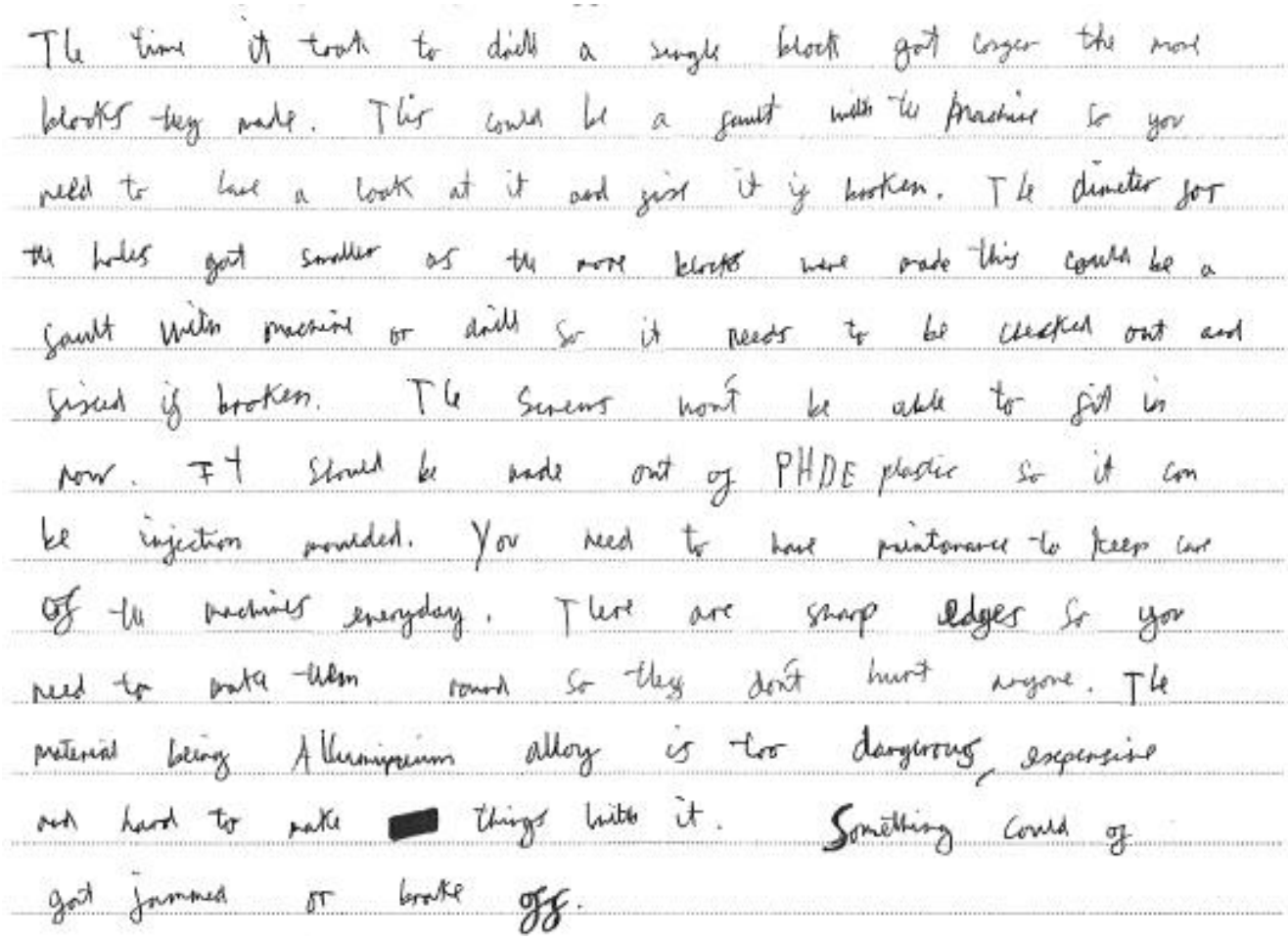
- Either the increase in time, or the change in diameter will be commented on.
- Generic causes for the changes will be offered e.g. operator fatigue, machine breakage.
- Generic solutions to problems will be offered e.g. buy better machines, repair the machines, correct software problems, give the operator longer rest periods.

A learner answer that illustrates some weakness

The first three blocks that had a measure of the diameter 5 took around 90 seconds to drill, as the diameter decreased the time taken to drill increased. Block number 50 took the longest at 140seconds. The issues occured during the production of this component is that the thinner the diameter got the more time needed to be taken to drill, this is due to having to take more care to get the diameter of the space block accurate.

To resolve this issue the quality control inspector should suggest to keep the diameter of all space blocks the same so that it takes less time to drill them. This is due to the 50th block taking over two minutes to drill. He could also suggest to try different materials to see which one would be best used for a space block design.

A different learner answer that illustrates some weakness


The time it took to drill a single block got longer the more blocks they made. This could be a sign that the machine is you need to have a look at it and see if it is broken. The diameter of the holes got smaller as the more blocks were made this could be a sign that with machine or drill so it needs to be checked out and fixed if broken. The screws won't be able to fit in now. It should be made out of PHDE plastic so it can be injection moulded. You need to have maintenance to keep on of the machines everyday. There are sharp edges so you need to make them round so they don't hurt anyone. The material being Aluminium alloy is too dangerous, expensive and hard to make [redacted] things with it. Something could of got jammed or broke off.

A different learner answer that illustrates some weakness

The issues could have been a machien fault or error in the programming or a man made error. ~~ts~~ To Solve the error, I would Suggest that Some one would analise the coding in the machine to see if they are any faults with it, but I would also Suggest that Some one Should also check all the parts on the machine too See if they are loose and need tightening and to see if everything is in the correct place. Anothe thing that I would Suggest is to check the part of the machine that cuts the diamiter of the holes as there is a clear problem with the Size of the holes from the data. Once the programming has been checked, I would Suggest to do another batch to see if the Sizing and the timming has improved, if it hasnt I would then Suggest looking at the machines again but then also at the people controling the machines to See if the fault is because of them and how

Summary

Based on their performance on this paper, future learners 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.
- Do 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 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 suggest a more appropriate manufacturing method.
- For activity 3 make use of all the information provided.

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