Edexcel GCSE

Portfolio marking guidance

Edexcel General Certificate of Secondary Education in Engineering (Double Award)

June 2003

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Contents

Introduction

GCSEs in vocational subjects

A range of GCSE (Double Award) specifications in vocational subjects has been introduced to replace and extend the range of Part One GNVQ courses at levels 1 and 2 of the National Framework of Qualifications. They can be taken as two-year courses from September 2002 and one-year courses from September 2003 for first awarding in summer 2004. This document has been prepared specifically to deal with the Edexcel GCSE in Engineering (Double Award).

Edexcel GCSE in Engineering (Double Award)

The Edexcel GCSE in Engineering (Double Award) has been designed to provide a broad educational basis for further training, further education or for moving into employment within the engineering industry. The QCA Qualification Accreditation Number for this title is 100/2062/7.

Portfolio marking guidance

This guide is designed to give guidance on how to apply the mark scheme, and to enable teachers of the Edexcel GCSE in Engineering (Double Award) to form an impression of the kind of work that may be produced as the specification is applied. Each example of work is of a style and a standard as near as possible to the requirements of the new GCSE.

The examples have been extracted from courses with similar content, and analysed to give an indication of how they relate to the levels of response in the mark scheme. Examples of the standard of work felt to contain qualities or standards indicative of high, medium and low-level mark bands are provided. Examples are not intended to be used as examples of good practice.

This publication is designed for general guidance. Full details of the course requirements can be found in the specification, guidance on internal assessment and the assessment criteria. These publications should be referred to for more definitive information. The teachers' guide will also provide more detailed guidance on dealing with assessment criteria and planning teaching programmes.

Applying the mark bands

Portfolios will be marked by the centre, and externally moderated by Edexcel. Each of the internally assessed units has a marking grid, divided into three broad mark bands, showing how to award marks in relation to the task and the assessment objectives. The marking grids indicate the required assessment outcomes as well as the quality of the outcomes needed for achievement in each of the mark bands. Mark band 1 relates to the expectations given in the grade description for grade F; mark band 2 relates to the expectations for grade C, and mark band 3 relates to the expectations for grade A. For further information on grading, see the section *Grading and aggregation* which follows this section.

In general terms, progression across the bands is characterised by:

- increasing breadth and depth of understanding
- increasing coherence, evaluation and analysis
- increasing independence and originality.

The unit marking grid shows the allocation of marks by assessment criterion and by mark band. This grid should be used to determine marks for student achievement in each unit. Students can achieve marks in different bands for each assessment objective. The total mark achieved will depend on the extent to which the student has met the assessment criteria overall.

Within each assessment criterion, it is a general principle that shortcomings in some aspects of the assessment requirements may be balanced by better performance in others. However, it is also important to note that for full marks in any particular assessment criterion, all the requirements should have been met.

Marks should not be awarded on the basis of a 'tick list' of factual content but on the overall response as it relates to the requirements stated within each mark band. Assessors should adopt a holistic approach and apply their professional judgement. In the specification, the *Guidance for teachers* section in each unit gives specific details of how marks should be allocated.

There should be no reluctance to use the full mark range and if warranted assessors should award maximum marks. Students' responses should be considered positively. A mark of 0 should only be awarded where the student's work does not meet any of the required criteria.

The grade descriptions for the Edexcel GCSE in Engineering (Double Award) refer to the levels of support and guidance required by students in carrying out investigations and tasks. All students are entitled to initial guidance in planning their work. When marking the work, assessors should apply the following guidelines:

- '**Some support and guidance**': the student has to be guided and advised throughout to ensure that progress is made. The student relies on the support of the teacher, who has to assist in most aspects of the work. This level of support restricts the student's mark to band 1, irrespective of the quality of the outcomes.
- '**Limited assistance**': the teacher supports the student initially in the choice of topic for investigation. Thereafter the teacher reacts to questions from the student and suggests a range of ideas that the student acts upon. The student frequently checks matters of detail. The teacher needs to assist in some aspects of the work. This level of support restricts the student's mark to bands 1 or 2, irrespective of the quality of the outcomes.
- '**Independently**': the teacher supports the student initially in the choice of topic for the investigation or task. Thereafter the teacher occasionally assists the student, and only when asked, but monitors progress throughout. This level of support gives access to all three mark bands.

For internal record-keeping purposes, centres may wish to make a copy of the marking grid for each student and use it to record the mark for that unit. The GCSE, GCE, GNVQ Code of Practice requires assessors to show clearly how credit has been assigned. Guidance on how this may be done will be included in the separate support material that will accompany this guide.

Grading and aggregation

The mark bands used for internal assessment do not relate to pre-determined grade boundaries. Following each examination and moderation series Edexcel will set the grade boundaries for the two internally-assessed units and the externally-assessed unit at an awarding meeting.

The raw mark boundaries will be converted to uniform marks on a scale of 0–100. The final grade for the qualification will be determined by aggregating the uniform marks for the three units. The following table gives details of the uniform mark scales (UMS) used for the units and for the qualifications.

Unit results

The minimum uniform marks required for each grade:

Unit grade	**A***	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Maximum uniform mark = 100	**90**	**80**	**70**	**60**	**50**	**40**	**30**	**20**

Candidates who do not achieve the standard required for a grade G will receive a uniform mark in the range 0–19 and be recorded as U (unclassified).

Qualification results

The minimum uniform marks required for each grade:

Qualification grade	**A*A***	**AA**	**BB**	**CC**	**DD**	**EE**	**FF**	**GG**
Maximum uniform mark = 300	**270**	**240**	**210**	**180**	**150**	**120**	**90**	**60**

Candidates who do not achieve the standard required for a grade GG will receive a uniform mark in the range 0–59 and be recorded as U (unclassified).

Exemplars and commentary

This section contains extracts from various candidates' work for the two portfolio units, 1 and 2. All criteria have been separately addressed and the examples of work shown are felt to contain qualities indicative of the medium, and in some cases the higher, mark bands. Where this occurs, the mark band 2 evidence will precede mark band 3. The work shown has been extracted from different candidates' projects.

Moderator's comments to illustrate the way in which the coursework has been assessed have been included for each criterion. An explanation of what is required of the candidate to achieve a mark at a higher level will be given.

Unit 1: Design and Graphical Communication

You need to produce a design specification and design solution for an engineered product including:

a an analysis of the brief with key features of the product or service

The Assignment

Members of a local cycling club want a speedometer that will indicate cycle speeds up to 40 miles per hour.

The club prefers a system that can be fitted to a bicycle of any size. The unit should be robust and weatherproof with easy access to a battery. The design should also offer some protection against theft.

JOHN'S WORK

In order to begin my project I need to list the key features of the design brief.

I have been asked to design a cycle speedometer suitable for members of the local cycling club for use when touring.

The speedometer should be suitable for use on a bike, and should be easy to use while the cyclist is moving. It should be capable of registering speeds up to 40 miles an hour.

The speedometer must be capable of working with any size bicycle, so I will need to research what sort of bikes the members use. Do they have different sized wheels?

The unit must be battery powered and since it should be light I will probably use a hearing aid battery.

It will need to be robust and weatherproof so I will need to make a suitable case to hold the unit and all parts must be securely fastened to the bike so that they don't drop off.

The cyclists want the speedometer to be difficult to steal and also to be easy to change the battery. This means that it must be securely fastened to the bike.

You need to produce a design specification and design solution for an engineered product including:

a an analysis of the brief with key features of the product or service

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(a) **AO1** **AO2** **6 marks**	• an analysis of the brief to identify basic client needs, with the identification of some key features of the engineering product	1 – 2	• an analysis of the brief to identify the main client needs, with a description of the main key features of the engineering product	3 – 4	• an analysis of the brief to explain the main client needs, with a justification of the main key features of the engineering product	5 – 6	**4**

MODERATOR COMMENTS

John has analysed the design brief and has described both the main client needs and the main features of the product. He has provided some description of these features, but he has considered these needs and key features individually or in pairs rather than as a whole.

John would therefore be awarded 4 marks.

In order to meet the requirements of mark band 3, John would need to consider the needs as a whole and to provide a deeper understanding of how the client needs and the key features of the product would relate to other important design features.

You need to produce a design specification and design solution for an engineered product including:

b details of the product criteria and production constraints

JOHN'S WORK

Technical Design Specification

Performance

- measure bicycle speeds of 0 – 40 mph
- must fit to any size of bike
- display unit to be easily removed to safeguard against theft
- resist rain and splashing
- must be battery powered and battery must be easily accessible
- capable of being dropped
- display speeds in mph and km/h
- battery to have a good life

Ergonomics

- large buttons that are easy to use
- large easy to read display must that can be easily read by the rider
- no sharp edges on any component
- should be light weight

Cost

No more than £10.00

Aesthetics

- Range of colours available
- Shape of main body display, curvy edges
- Size – must be a suitable size to fit on the bike
- Company/college/cycle club logo to be displayed on large components – main body mountings etc

Quantity

Be able to be made in a batch of 50 using appropriate methods of batch production.

You need to produce a design specification and design solution for an engineered product including:

b details of the product criteria and production constraints

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(b) **AO1** **AO2** **6 marks**	• a design specification that describes basic details of the product criteria and of the production constraints	1 – 2	• a design specification that describes some of the main details of the product and of the production constraints	3 – 4	• a design specification that describes the main details of the product and of the production constraints	5 – 6	**4**

MODERATOR COMMENTS

John has produced a good specification that describes the main details of the product. He has identified the main production constraints as 'the need for batches of 50, and a maximum cost of £10'.

John has begun to describe some of the details. However these descriptions lack depth and in order to meet the requirements of mark band 3, a more detailed description of at least one of the features would be required. He has not given reasons for decisions made about the product such as why it must be suitable for manufacture in batches of 50, or why the price should not exceed £10. There are also other production constraints applicable to the product.

Therefore John's work meets the requirements of mark band 2 and he would be awarded 4 marks.

You need to produce a design specification and design solution for an engineered product including:

b details of the product criteria and production constraints

The Assignment

Members of a local cycling club want a speedometer that will indicate cycle speeds up to 40 miles per hour.

The club prefers a system that can be fitted to a bicycle of any size. The unit should be robust and weatherproof with easy access to a battery. The design should also offer some protection against theft.

PETER'S WORK

Technical Design Specification

PERFORMANCE

- measure bicycle speeds of 0 – 40 mph
- must fit to any type and size of bike
- display unit to be easily removed (without the use of tools) to safeguard against theft
- resist rain and splashing
- must be battery powered and battery must be easily accessible
- have an illuminated display
- capable of being dropped from a height of 150 mm
- display speeds in mph and km/h
- battery to last a minimum of 8 amp hours

ERGONOMICS

- large buttons that are easy to use and tactile feedback
- large easy to read display must be able to adjust angle of display to suit rider
- no sharp edges on any component
- should be light weight and weigh no more than 80 grams in total

COST

No more than £10.00

AESTHETICS

- Range of colours available
- Shape of main body display, curvy edges
- Size – no more than 100 x 100 mm
- Company/college/cycle club logo to be displayed on large components – main body mountings etc

QUANTITY

Be able to be made in a batch of 50 using appropriate methods of batch production.

You need to produce a design specification and design solution for an engineered product including:

b details of the product criteria and production constraints

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(b) **AO1** **AO2** **6 marks**	• a design specification that describes basic details of the product criteria and of the production constraints	1 – 2	• a design specification that describes some of the main details of the product and of the production constraints	3 – 4	• a design specification that describes the main details of the product and of the production constraints	5 – 6	**5**

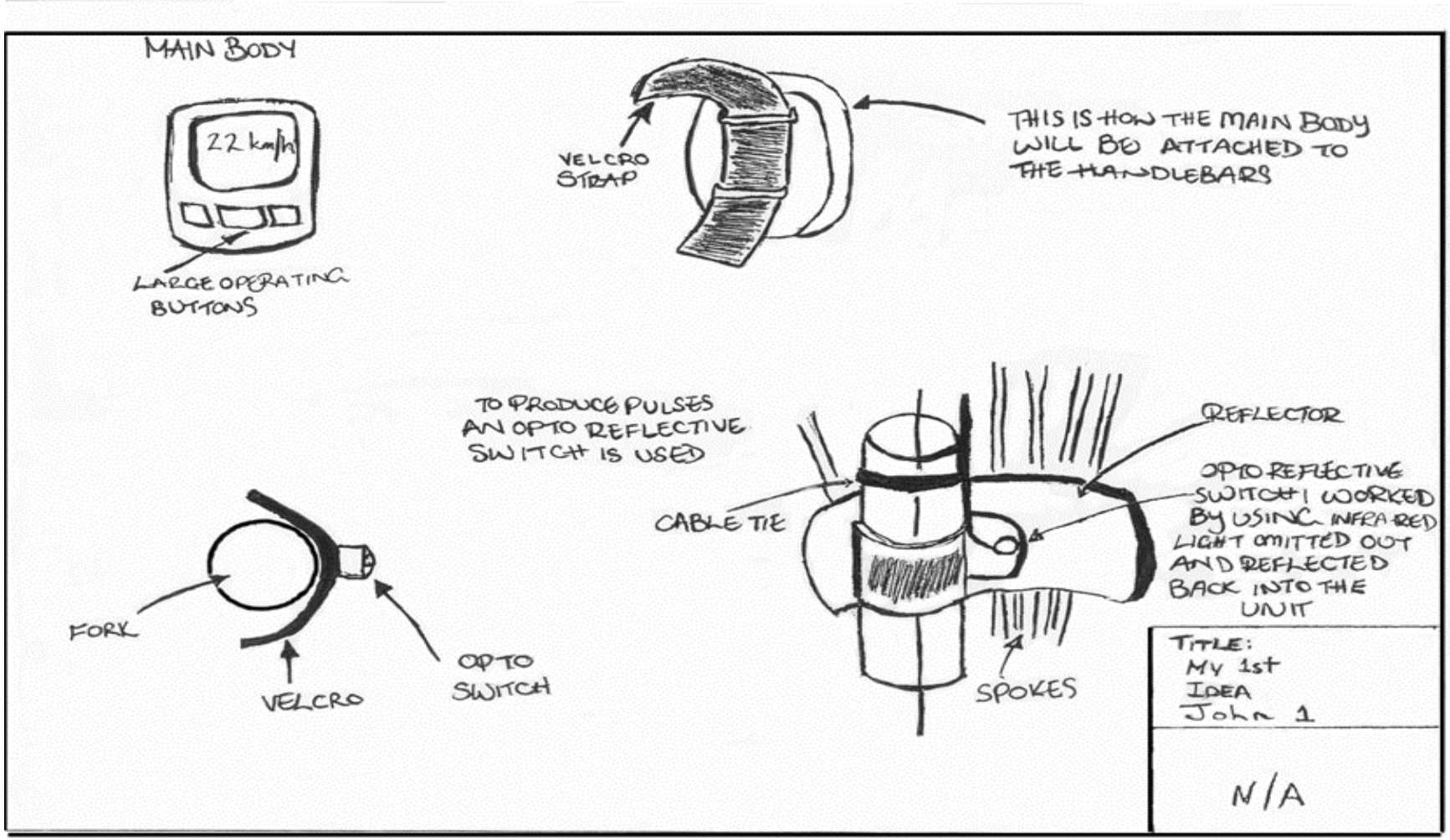
MODERATOR COMMENTS

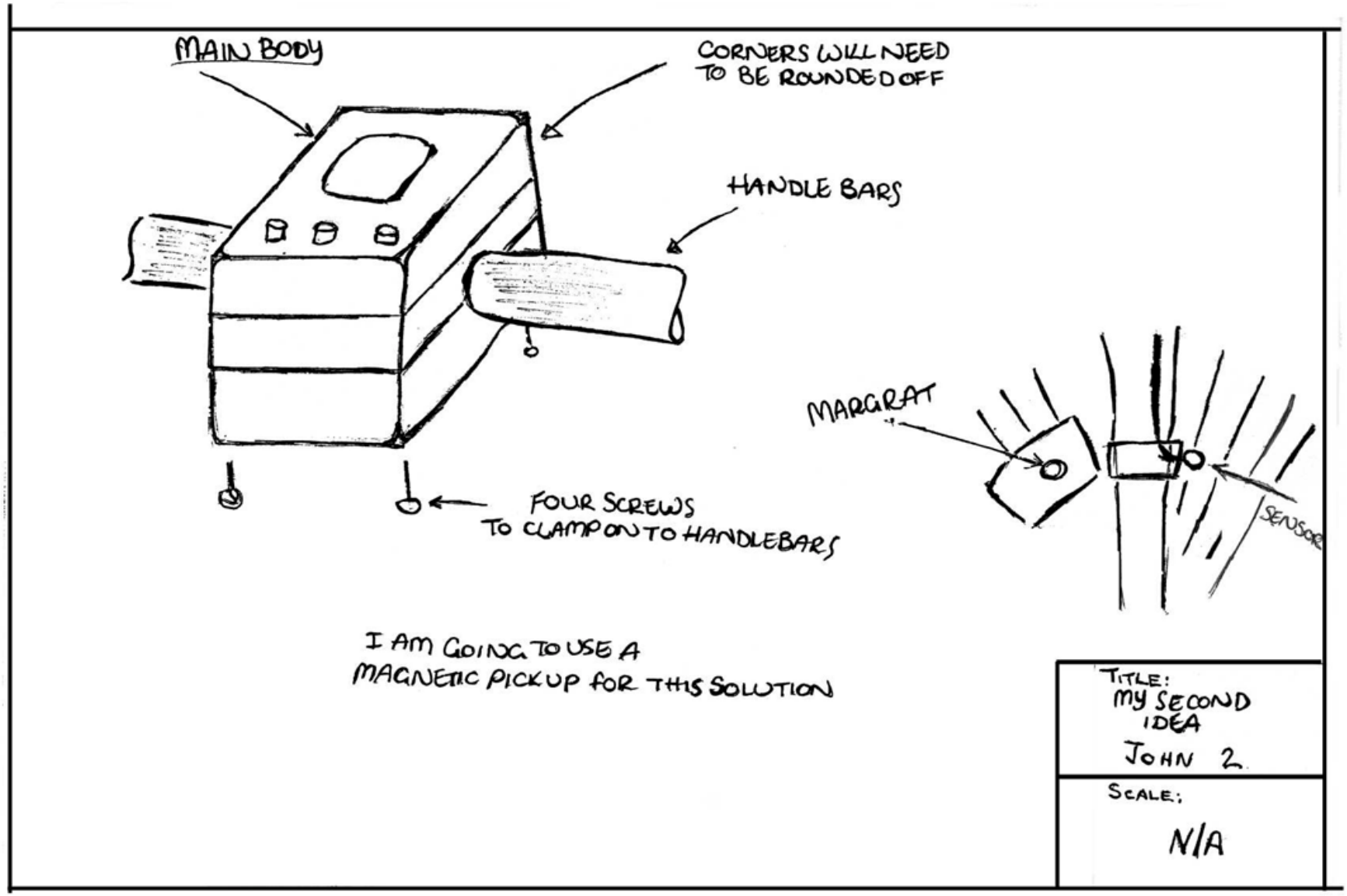
Peter's 'design specification' describes the main details of the product. From this point of view, he has produced a very good specification. The production constraints he has considered identify the need for batches of 50 to have a maximum cost of £10. Whilst other production constraints exist, these are the main ones.

Peter would therefore be awarded 5 marks, as his specification meets all the required criterion at mark bands 1 and 2 and it describes the main details of the product required by mark band 3.

You need to produce a design specification and design solution for an engineered product including:
c a range of ideas and design solutions

JOHN'S WORK




MAIN BODY
CORNERS WILL NEED TO BE ROUNDED OFF
HANDLE BARS
MARGRAT
SENSOR
FOUR SCREWS TO CLAMP ON TO HANDLEBARS
I AM GOING TO USE A MAGNETIC PICKUP FOR THIS SOLUTION
TITLE:
MY SECOND IDEA
JOHN 2.
SCALE:
N/A

You need to produce a design specification and design solution for an engineered product including:

c a range of ideas and design solutions

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(c) **AO2** **6 marks**	• the generation of basic design ideas and the development of simple design solutions	1 – 2	• the generation of alternative design ideas and the development, in some detail, of design solutions	3 – 4	• the generation of imaginative design ideas and the development of detailed and appropriate design solutions	5 – 6	**4**

MODERATOR COMMENTS

John has presented two significantly different design ideas that include some scientific principles. The solutions contain some detail but there are outstanding gaps in the development of the ideas.

In design 1, John has not shown in detail how the display could be mounted to the handlebars. There is some indication that the display would be attached to the handlebars by the Velcro tape strap. However the client brief requires that the speedo should be difficult to steal. This would not be the case with a Velcro attachment, and the design would then need to incorporate some means of disconnecting the display from the wiring harness.

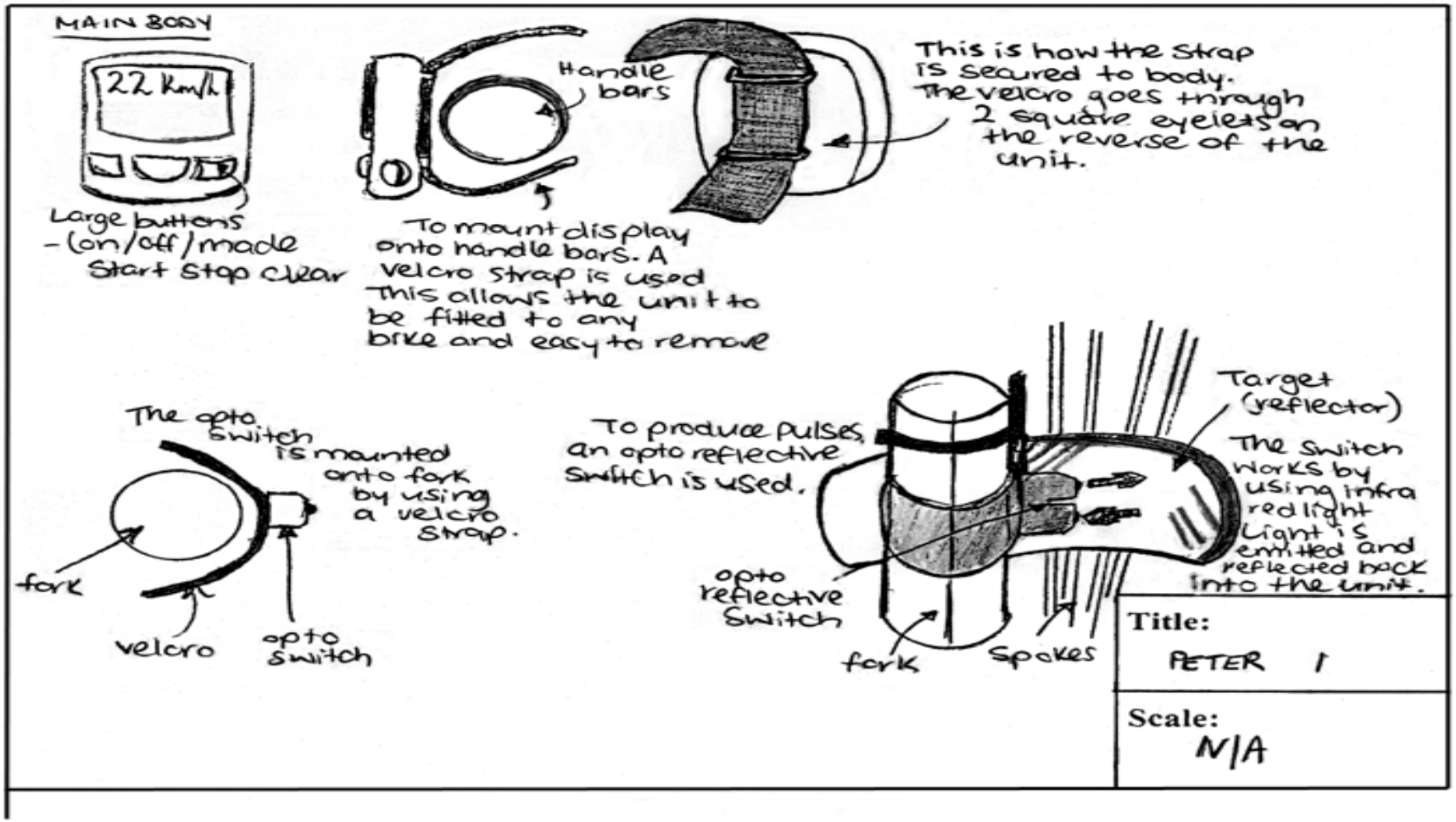
Design 2 shows how the display will be fitted to the handlebars, but there are details shown that are not clearly explained.

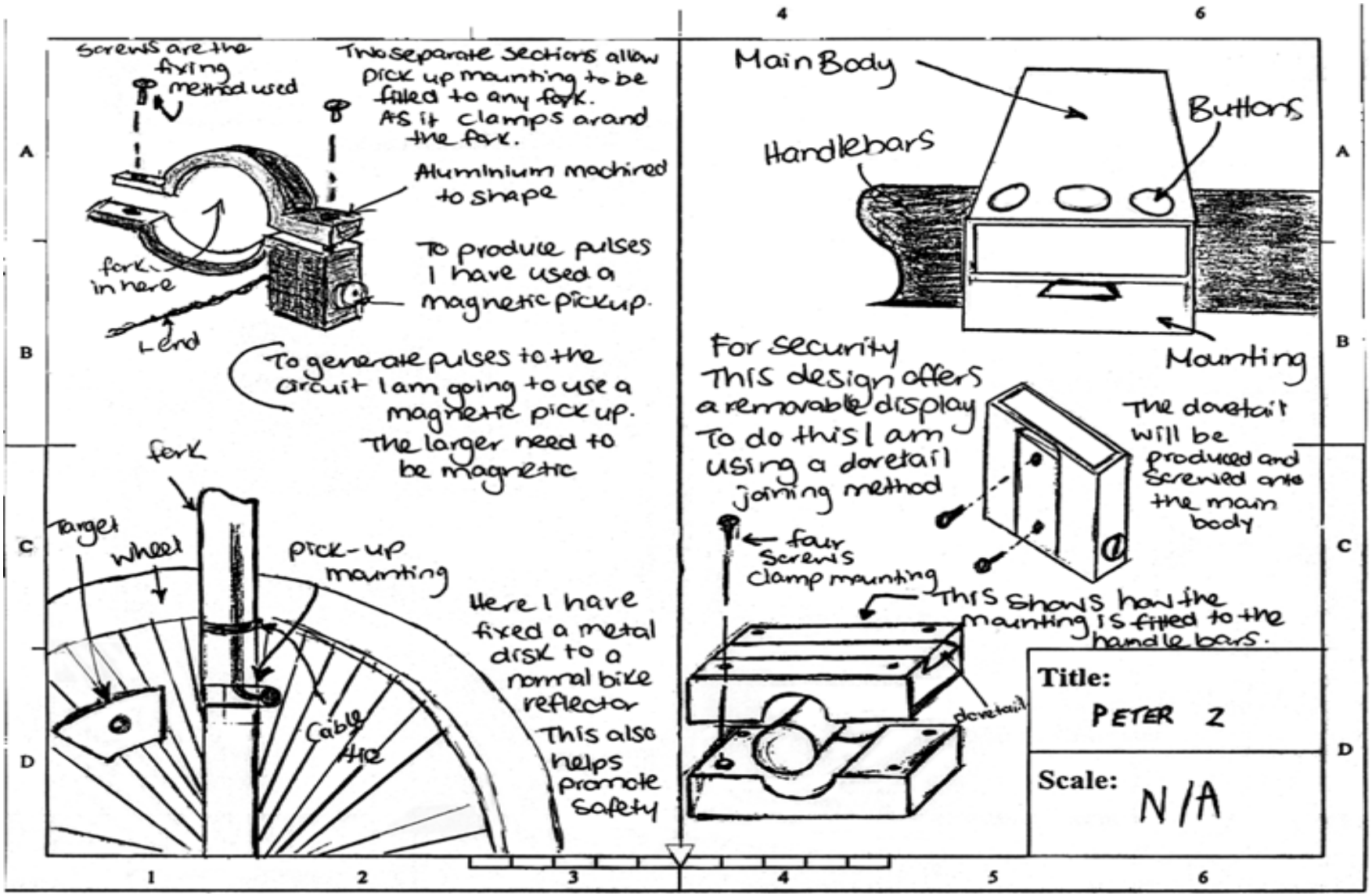
John would therefore be awarded 4 marks.

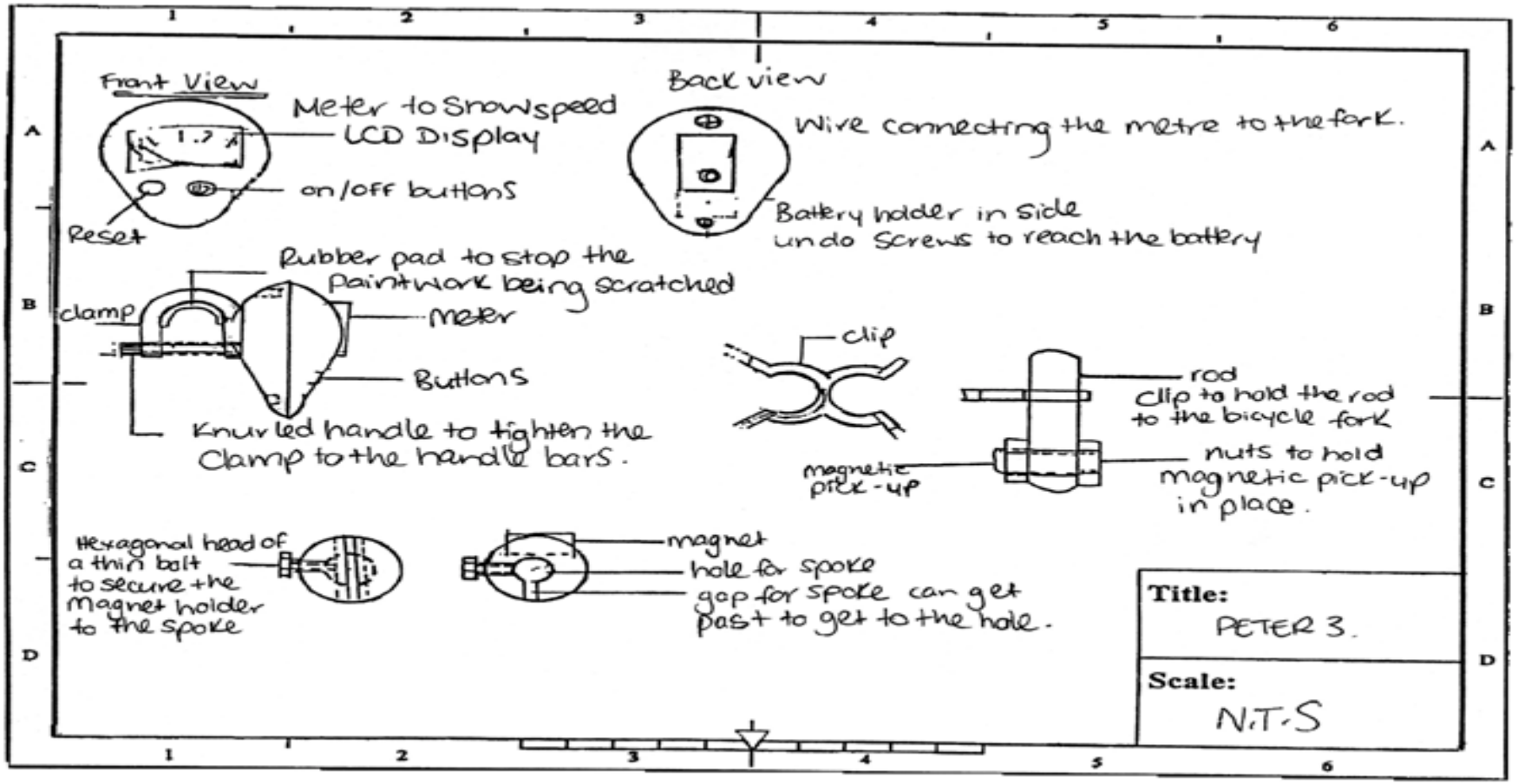
In order to improve his marks, John would need to provide more details about each of his basic ideas to ensure that they met the design brief.

You need to produce a design specification and design solution for an engineered product including:
c a range of ideas and design solutions

PETER'S WORK




Screws are the fixing method used
Two separate sections allow pick up mounting to be fitted to any fork. As it clamps arand the fork.
Aluminium machined to shape
To produce pulses I have used a magnetic pickup.
fork in here
Lead
To generate pulses to the circuit I am going to use a magnetic pick up. The larger need to be magnetic
fork
target wheel
pick-up mounting
Here I have fixed a metal disk to a normal bike reflector
This also helps promote safety
Cable tie
Main Body
Handlebars
Buttons
Mounting
For security This design offers a removable display To do this I am using a doretail joining method
The doretail will be produced and screwed onto the main body
four screws clamp mounting
This shows how the mounting is fitted to the handle bars.
dovetail
Title: PETER 2
Scale: N/A
A
B
C
D
1
2
3
4
5
6


Front View
Meter to Snowspeed
LCD Display
on/off buttons
Reset
Back view
Wire connecting the metre to the fork.
Battery holder in side
undo screws to reach the battery
Rubber pad to stop the paintwork being scratched
clamp
meter
Buttons
Knurled handle to tighten the clamp to the handle bars.
clip
rod
clip to hold the rod to the bicycle fork
magnetic pick-up
nuts to hold magnetic pick-up in place.
Hexagonal head of a thin bolt to secure the magnet holder to the spoke
magnet
hole for spoke
gap for spoke can get past to get to the hole.
Title:
PETER 3.
Scale:
N.T.S

18

You need to produce a design specification and design solution for an engineered product including: c a range of ideas and design solutions

ASSESSOR'S MARKING GRID							
	Mark band 1 **At this level work must show:**	**Mark range**	**Mark band 2** **At this level work must show:**	**Mark range**	**Mark band 3** **At this level work must show:**	**Mark range**	**Mark awarded**
(c) **AO2** **6 marks**	• the generation of basic design ideas and the development of simple design solutions	1 – 2	• the generation of alternative design ideas and the development, in some detail, of design solutions	3 – 4	• the generation of imaginative design ideas and the development of detailed and appropriate design solutions	5 – 6	**6**
MODERATOR COMMENTS							
Peter has generated three design ideas. They are all different and all contain ideas for holding the speedometer on the cycle and the method of generating the signal and securing the appropriate device. His ideas have imagination and he has developed appropriate engineering solutions that are technically sound. Peter would therefore be awarded 6 marks as his evidence meets all the requirements of the criterion listed in mark band 3							

You need to produce a design specification and design solution for an engineered product including:

d evidence of how you tested and selected the final solution

The Assignment

To design and make a temperature-controlled device to keep four cans of drink $10^{O}C$ below room temperature.

Specification

To design and make a cooling device to cool a given number of cans.
The cooler must be battery powered.

Customer requirements
The following points must be met when designing the can cooler:

- *Fan must be powered by PP3 battery (or 6 AA batteries)*
- *Circuit must be designed by me*
- *Circuit and battery must be covered*
- *Cooler should be stable*
- *Should be large enough for specified number of cans*
- *Should be able to cool cans under $10^{O}C$ in two hours*
- *Mainly made from metal*
- *Not too heavy (approximate 1kg with water)*
- *Not too large on desk (20cm by 20cm by 20cm for four cans)*

SARAH'S WORK

Specific points	Design 1	Design 2	Design 3
Safety of fan	4	3	3
The container	4	2	3
Max Size	4	3	3
Temperature	2	2	2
Cost of making 1 materials	3	3	3
2 labour	3	2	3
Circuit and batteries	3	2	2
Environmental Issues	5	5	5
Total	**28**	**22**	**24**

1 Poor
2 Satisfactory
3 OK
4 Good
5 Excellent

Please note:

In this instance, the evidence shown below in the 'Evaluation of Final Design' table addresses some of criterion (d) and all of criterion (g).

This evidence is repeated on page 29 as the candidate has combined the evidence from both criteria. However, students will be expected to fully address both (d) and (g) in order to be awarded marks for each criterion.

Evaluation of Final Design

Design Brief	Specification	Final Design	Comments
Temperature Controlled	Use PP3 battery Circuit Pre designed (60/40/40mm for circuit)	Circuit is designed to use PP3 Battery. Circuit and Battery is situated in base in a sealed bag.	Although the circuit is sealed there is still a chance that the circuit and battery could get wet and short circuit.
Home or work	Use on small desk such as computer work station	At 260/150/150mm the unit would be too large for a small desk, it would have to be used on a medium size desk.	If it was used in a small office then it could be stored on the floor.
Cool up to four cans	Able to cool cans to at least 10^0C below room temperature	An experiment was carried out to prove the temperature would drop after a short time.	The effectiveness of the cooler could vary depending on what the temperature of the office is.
Aesthetics/safety	Made from metal. Circuit and battery to be covered and kept dry.	The components would mainly be made out of aluminium. Sharp edges would be filed off. Circuit would be sealed so it would not get damp.	With Circuit kept under water tray there is a higher risk of it getting damp.
Manufacture A- too techniques	Hand tools/Pillar drill/ Lathe/Milling Machine/ Heat treatment/ Brazing/Welding	Aluminium would be TIG welded. All other methods apart from milling, brazing and heat treatment would be used in making the unit.	Some methods would be used more than others.
B – cost	Availability Environment	All Materials are cheep and readily available. The cooler would not use CFC's like fridge's so deposing of it would not be a problem.	The only problem would be disposing of the battery especially if it were a rechargeable.
Desk Can Cooler	Stable base. Space efficient	Fairly large base at 260/150mm so stability would not really be a problem.	Circuit and water tray is in the bottom of the unit to lower centre of gravity making it more stable.

You need to produce a design specification and design solution for an engineered product including:

d evidence of how you tested and selected the final solution

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(d) **AO3** **6 marks**	• limited testing against the design criteria to select and outline the final design solution	1 – 2	• a range of testing against the design criteria to select and describe the final design solution	3 – 4	• objective testing against the design criteria to select and justify the final design solution	5 – 6	**4**

MODERATOR COMMENTS

Sarah has presented limited evidence of why the final solution was chosen, in the form of an evaluation table. However she has included a comprehensive evaluation of her final design. Justification was done objectively. More evidence of the range of testing used would improve the mark awarded.

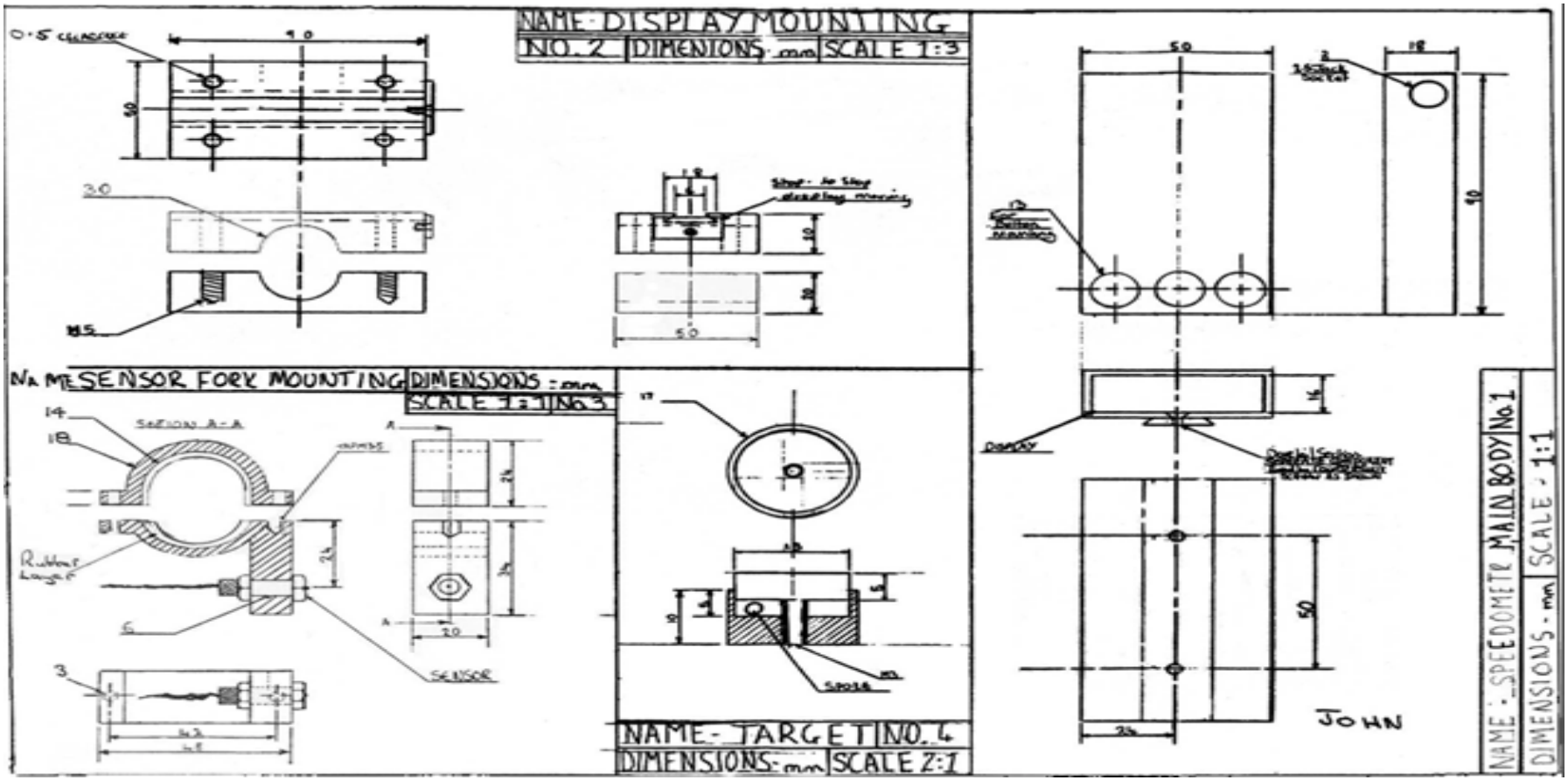
Sarah's work should be awarded a total of 4 marks as her justification for selecting her final design meets the requirements of mark band 3, whereas the limited evidence of testing each design limits that aspect to mark band 1.

You need to produce a design specification and design solution for an engineered product including:

e evidence of how you selected and used engineering drawing techniques

f engineering drawings and technical details

JOHN'S WORK



You need to produce a design specification and design solution for an engineered product including:

e evidence of how you selected and used engineering drawing techniques

f engineering drawings and technical details

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(e) **AO1** **AO2** **6 marks**	• the selection and use of a limited range of engineering drawing techniques to communicate the final solution	1 – 2	• the selection and use of a range of engineering drawing techniques to communicate, in some detail, the final solution	3 – 4	• the selection and use of an effective range of engineering drawing techniques to communicate, in detail, the final solution	5 – 6	**4**

MODERATOR COMMENTS

There is no evidence to suggest how much help was given to John when he selected which drawing techniques to use. Although the use of orthographic drawings is appropriate for the components shown, either a circuit diagram or an exploded diagram of the speedometer would have complemented the range of techniques used. The speedometer could basically be made from the drawings, as they are effective and presented in sufficient detail. John's work should be awarded 4 marks. Whilst both aspects of mark band 1 have been met, additional evidence such as a Witness Statement would be helpful evidence of John's ability to select and use drawing techniques.

(f) **AO1** **AO2** **AO3** **6 marks**	• engineering drawings that have limited compliance with sector-specific standards and conventions, and that use some common standard symbols	1 – 2	• engineering drawings that comply, in some detail, with sector-specific standards and conventions, describing the purpose of the components and features used	3 – 4	• appropriate engineering drawings that comply, in detail, with sector-specific standards and conventions, explaining the purpose of the components and features used	5 – 6	**4**

MODERATOR COMMENTS

John's drawings show a good level of skill and have been well presented. The drawings comply with some sector-specific standards and conventions showing a few obvious mistakes. Annotation shows the purpose of most of the features.

John's work should be awarded 4 marks.

You need to produce a design specification and design solution for an engineered product including:

e evidence of how you selected and used engineering drawing techniques

PETER'S WORK

The drawings I am going to use

1 To present my ideas to the cycling club

I will present the cycling club with sketches of my final design solution because I am not sure that they would understand orthographic projections.

I will also make a prototype model so that they can see what the speedo is going to look like fitted to a bike.

2 To show the makers how to make the speedo

I will produce orthographic projections of the Display Mounting components. These will need to show all the details necessary to make the components.

I do not think that a circuit diagram for the speedo is necessary since there are only two wires needed to connect the sensor to the main display.

I will use a ready made computer and display circuit and so I do not need a circuit diagram for this.

You need to produce a design specification and design solution for an engineered product including:

e evidence of how you selected and used engineering drawing techniques

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(e) **AO1** **AO2** **6 marks**	• the selection and use of a limited range of engineering drawing techniques to communicate the final solution	1 – 2	• the selection and use of a range of engineering drawing techniques to communicate, in some detail, the final solution	3 – 4	• the selection and use of an effective range of engineering drawing techniques to communicate, in detail, the final solution	5 – 6	**5**

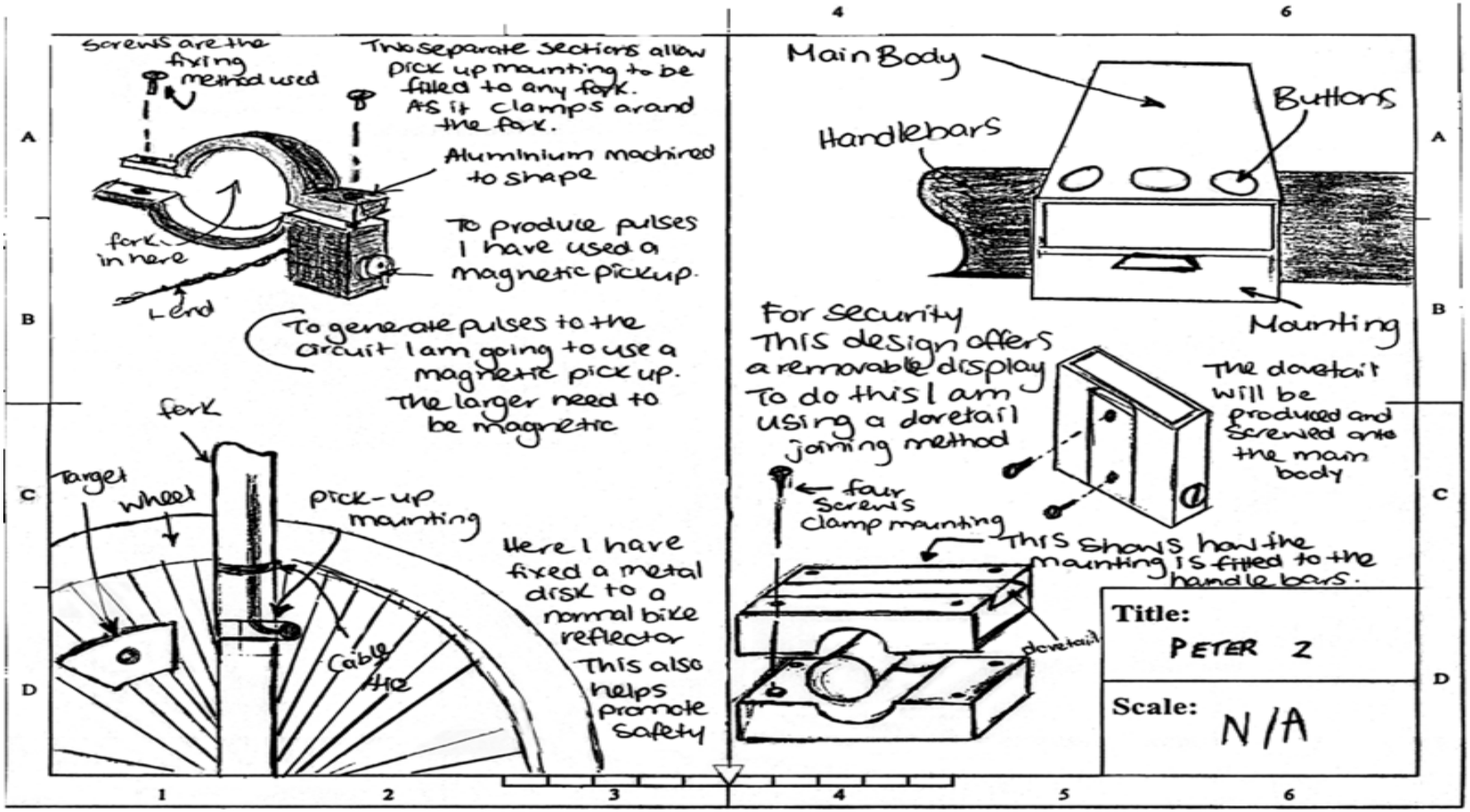
MODERATOR COMMENTS

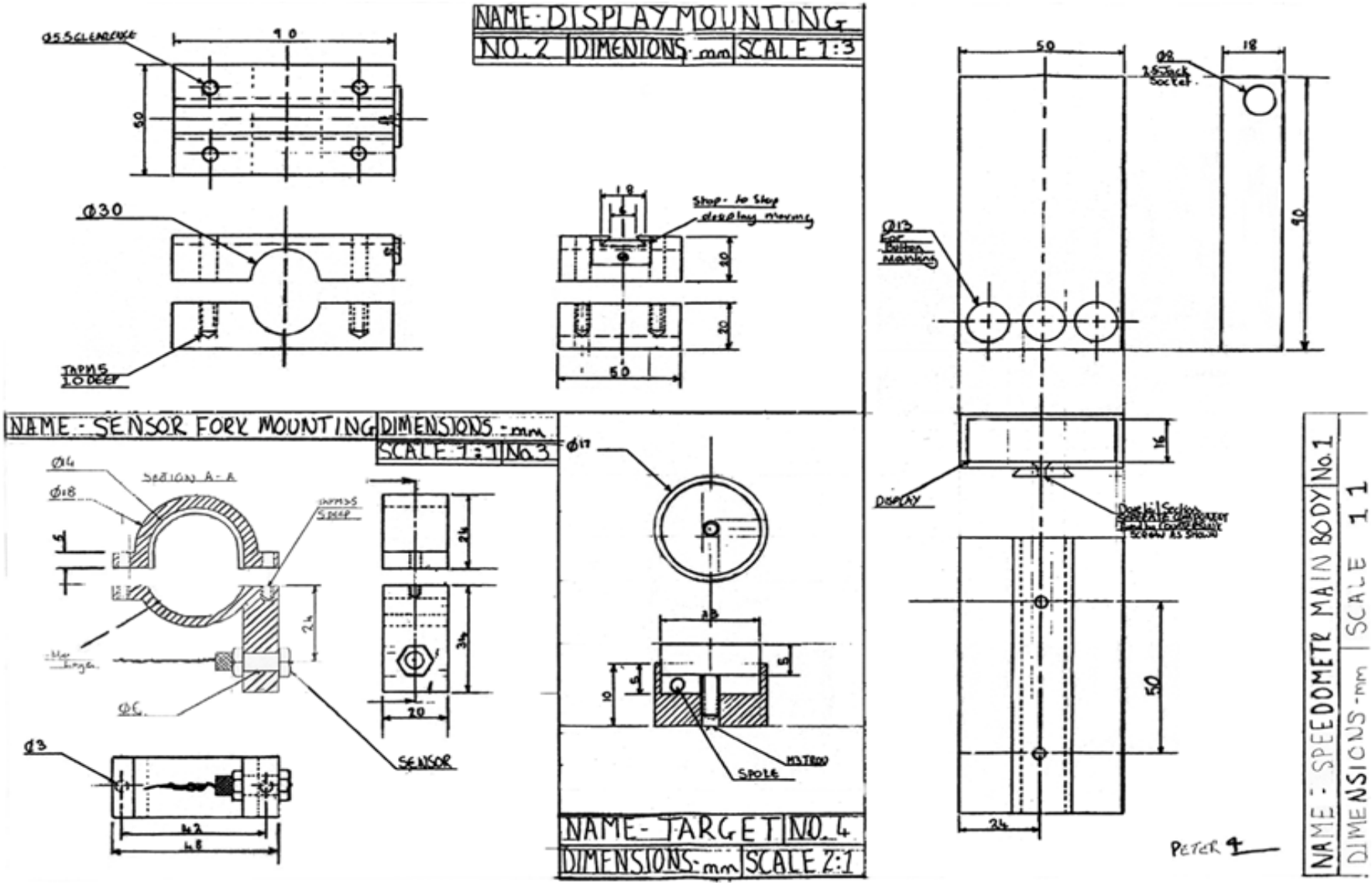
Peter has provided some evidence of why he selected the different drawing techniques. The use of orthographic drawings is appropriate for the components shown. There is little evidence of how the speedometer will work and therefore either a circuit diagram or an exploded diagram of the speedometer would have complemented the range of techniques used. However the speedometer could basically be made from the drawings, as they are effective and presented in sufficient detail. Peter's work should be awarded 5 marks. Whilst both aspects of mark band 1 have been met, additional evidence such as a Witness Statement would be helpful evidence of Peter's ability to select and use drawing techniques since it is not directly evident why Peter chose the range of drawings.

You need to produce a design specification and design solution for an engineered product including:

f engineering drawings and technical details

PETER'S WORK




NAME - DISPLAY MOUNTING
NO. 2 | DIMENIONS - mm | SCALE 1:3
Ø5.5 CLEARANCE
90
50
Ø30
TAPPED 10 DEEP
18
Stop - to stop sliding moving
10
20
50
NAME - SENSOR FORK MOUNTING | DIMENSIONS - mm
SCALE 1:1 | NO 3
Ø4
Ø18
SECTION A-A
TAPPED 5 DEEP
24
34
20
Ø6
SENSOR
Ø3
42
48
Ø17
28
10
5
SPOKE
NAME - TARGET | NO. 4
DIMENSIONS - mm | SCALE 2:1
50
Ø8
18
Ø12
DISPLAY
16
50
24
PETER
NAME - SPEEDOMETR MAIN BODY | No. 1
DIMENSIONS - mm | SCALE 1 1

You need to produce a design specification and design solution for an engineered product including:

f engineering drawings and technical details

ASSESSOR'S MARKING GRID							
	Mark band 1 **At this level work must show:**	**Mark range**	**Mark band 2** **At this level work must show:**	**Mark range**	**Mark band 3** **At this level work must show:**	**Mark range**	**Mark awarded**
(f) **AO1** **AO2** **AO3** **6 marks**	• engineering drawings that have limited compliance with sector-specific standards and conventions, and that use some common standard symbols	1 – 2	• engineering drawings that comply, in some detail, with sector-specific standards and conventions, describing the purpose of the components and features used	3 – 4	• appropriate engineering drawings that comply, in detail, with sector-specific standards and conventions, explaining the purpose of the components and features used	5 – 6	**5**
MODERATOR COMMENTS							
Peter's drawings show a high level of skill and have been presented in a professional manner. Standards and conventions are used. His drawings comply with industrial standards for this unit. Annotation shows the purpose of features. Had the inclusion of a circuit diagram or exploded diagram been in evidence, further opportunities would exist for a fuller range of techniques, standards and conventions to be used with more description of components and features. This improvement would maximise the marks awarded for this criterion, otherwise Peter's work should be awarded 5 marks.							

You need to produce a design specification and design solution for an engineered product including:

g evidence of how the solution meets the criteria with suggested modifications to improve its fitness for purpose.

Please note:

In this instance, the evidence shown below in the 'Evaluation of Final Design' table addresses some of criterion (d) and all of criterion (g).

This evidence is repeated on page 20 as the candidate has combined the evidence from both criteria. However, students will be expected to fully address both (d) and (g) in order to be awarded marks for each criterion.

SARAH'S WORK

Evaluation of Final Design

Design Brief	Specification	Final Design	Comments
Temperature Controlled	Use PP3 battery Circuit Pre designed (60/40/40mm for circuit)	Circuit is designed to use PP3 Battery. Circuit and Battery is situated in base in a sealed bag.	Although the circuit is sealed there is still a chance that the circuit and battery could get wet and short circuit.
Home or work	Use on small desk such as computer work station	At 260/150/150mm the unit would be too large for a small desk, it would have to be used on a medium size desk.	If it was used in a small office then it could be stored on the floor.
Cool up to four cans	Able to cool cans to at least 10^0C below room temperature	An experiment was carried out to prove the temperature would drop after a short time.	The effectiveness of the cooler could vary depending on what the temperature of the office is.
Aesthetics/safety	Made from metal. Circuit and battery to be covered and kept dry.	The components would mainly be made out of aluminium. Sharp edges would be filed off. Circuit would be sealed so it would not get damp.	With Circuit kept under water tray there is a higher risk of it getting damp.
Manufacture A- too techniques	Hand tools/Pillar drill/ Lathe/ Milling Machine/ Heat treatment/ Brazing/Welding	Aluminium would be TIG welded. All other methods apart from milling, brazing and heat treatment would be used in making the unit.	Some methods would be used more than others.
B – cost	Availability Environment	All Materials are cheep and readily available. The cooler would not use CFC's like fridge's so deposing of it would not be a problem.	The only problem would be disposing of the battery especially if it were a rechargeable.
Desk Can Cooler	Stable base. Space efficient	Fairly large base at 260/150mm so stability would not really be a problem.	Circuit and water tray is in the bottom of the unit to lower centre of gravity making it more stable.

You need to produce a design specification and design solution for an engineered product including:

g evidence of how the solution meets the criteria with suggested modifications to improve its fitness for purpose.

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(g) **AO3** **6 marks**	• limited description of how the final design solution meets the brief and specification, with an identification of some relevant modifications	1 – 2	• description, in some detail, of how the final design solution meets the brief and specification, describing relevant modifications	3 – 4	• an explanation, in some detail, of how the final design solution meets the brief and specification, explaining relevant modifications	5 – 6	**3**

MODERATOR COMMENTS

Sarah's evaluation of her final design gives comments against the main key features of the specification. She identifies areas of weakness in her solution with limited reference to any modifications required.

Sarah's work should be awarded 3 marks. Had modifications to address the identified weaknesses been suggested, more marks would have been awarded.

Unit 2: Engineered Products

You need to make an engineered product including evidence of:
a how you used a product specification and interpreted engineering drawings
b information about details of resources and processing requirements

SONIA'S WORK

The Automatic Sprinkler Project

My project is to make an automatic water sprinkler. I have been given some drawings to work to. I plan to make the Water Sprinkler in the following order:

1. Cast and fettle the base	2. Prepare the base on the lathe
3. Make the Head	4. Make the bearing
5. Make the shaft	6. Make the adaptor
7. Make the arms (2)	8. Make the end sleeves
9. Assemble the sprinkler unit	10. Make the probe
11. Make the PCB circuit	12. Make the Control Box
13. Assemble the Controller	

My Notes

Sand Casting

We were provided with a pattern. This is a wooden model of the cast we are going to make.

Making the mould

Have the drag ready to start and make sure that the wooden object is in the middle of it. You must place parting dust down, so that the sand doesn't stick to the ground or wooden object.

Next sieve the sand all over the mould, until it is covered. Then place more sand over the mould. This time we just sieve it through our fingers.

When the box is about half full you get a rammer and squash down the sand as much as you can until the sand is really compacted. You do this until the sand is full to the top of the drag. Then you use a strickle and trowel to level out the sand.

Turn the drag over and place the cope on top. Use more parting dust so that the two don't stick together.

Put a riser in the middle of the wooden mould, so you can pour molten metal in.

Now sieve more sand and compact the sand until it is level at the top.

Carefully take out the riser and runner.

Carefully take off the cope.

Cut holes in the sand from a larger hole to the mould for drainage.

Carefully tap the wooden mould out and place the cope back on top of the drag.

Now the metal can be poured in through the runner and when the mould is full the extra metal will flow up into the riser along with some air.

When the mould has cooled, the drag and cope are taken off and all the burnt sand should be removed.

Then cut away all the bits of waste metal.

Planning Sheet							
Name: Sonia		Date:		Tutor:			
Name of Part: Sprinkler Base							
STAGE NO.	PROCESS (What I will do)	MATERIALS	TOOLS & EQUIPMENT	MACHINERY	HEALTH & SAFETY	QUALITY CHECKS	TIME
1	Prepare mould for casting	Wooden Mould, casting box, casting sand, runner, riser, parting dust	Rammer, strickle, trowel		Do not spill sand, Wear goggles, Take care when compacting sand. Make sure that sand is dry.	Check that sand is properly compacted.	45 mins
2	Melt the aluminium	Aluminium	Ladle,	Hearth	Teacher is to do this task. Protective footwear	Make sure that all of the aluminium is melted	10 mins
3	Pour the molten aluminium		Ladle		Teacher is to do this task. Protective footwear	Make sure that mould is full (metal coming out of the riser.	2 mins
4	Cool						
5	Next lesson – Take out casting and clean away sand and waste metal		Hammer, Chisel, brush, file,		Make sure that mould is cool.		30 mins
6	Level top of spigot	Casting	TDI, left hand facing tool	Lathe, 4 jaw chuck	Wear a visor, check for loose clothing etc, Is chuck key out	Use TDI to make sure that casting is straight in chuck	5mins
7	Trim up side of spigot		TDI, left hand facing tool	Lathe, 4 jaw chuck	Wear a visor, check for loose clothing etc, Is chuck key out	Only take off a small amount all round spigot. Leave 13 mm at bottom.	3 min
8	Drill hole in centre of spigot		M18 drill	Lathe, 3 jaw chuck	Wear a visor, check for loose clothing etc, Is chuck key out	Drill leaving 10 mm from bottom	10 min
9	Tap hole in spigot		M18 tap, tap wrench			Make sure tap is straight in hole	10 min
10	Cut spigot to correct length		TDI, left hand facing tool	Lathe, 4 jaw chuck	Wear a visor, check for loose clothing etc, Is chuck key out	Only take off a small amount all round spigot. Leave 13 mm at bottom.	3 min

Planning Sheet							
Name: Sonia		Date: 8/11/0X		Tutor: Mr. M D			
Name of Part: Brass Head							
STAGE NO.	PROCESS (What I will do)	MATERIALS	TOOLS & EQUIPMENT	MACHINERY	HEALTH & SAFETY	QUALITY CHECKS	TIME
1	Cut to length	Brass rod	Hacksaw, vice, steel rule		Watch knuckles on vice	Check that right length and that ends are square	8 mins
2	Drill one hole		7.5 mm drill	Pillar drill and vice	Wear a visor, make sure that every thing is tight, guards in place	Is it square. Is it 5 mm deep	5 mins
3	Drill hole straight through		Drill	Pillar drill, vice	Wear a visor, make sure that every thing is tight, guards in place	Is it square	3 mins
Name of Part: Bearing							
STAGE NO.	PROCESS (What I will do)	MATERIALS	TOOLS & EQUIPMENT	MACHINERY	HEALTH & SAFETY	QUALITY CHECKS	TIME
1	Cut to length	Nylon Rod	Saw			Is it right length	2 mins
2	Drill 8 mm hole		8 mm drill	Lathe, 3 jaw chuck	Wear a visor, check for loose clothing etc, Is chuck key out		4 mins
3	Face one end		Left hand facing tool	Lathe, 3 jaw chuck	Wear a visor, check for loose clothing etc, Is chuck key out	5 mm long 20mm diam	8 mins
4	Face other end		Left hand facing tool	Lathe, 3 jaw chuck	Wear a visor, check for loose clothing etc, Is chuck key out	10 mm long 25mm diam	8 mins
5	Cut threads		Dye and dye holder			Make sure that everything is square	5 mins
6	Drill 12mm diam hole		12 mm diam drill	Lathe, 3 jaw chuck		Drill 10 mm deep	3 mins

Witness Statement

Candidate name: *Sonia Kay*

Unit title: *Unit 2 Engineered Products*	Candidate number: *0101*

Activity context:
Outline of the activity and its purpose. This may be written by the candidate prior to the observation.

Using and discussing information shown in the 'Water Sprinkler Drawings'

Assessment evidence:
Refer to the assessment grids reproduced from the specification.

Use of a product specification and interpretation of engineering drawings.
Assessment Evidence:
(a) how you used a product specification and interpreted engineering drawings
(b) information about details of resources and processing requirements.

Observation notes:
Specific comments on candidate performance that demonstrates achievement of the assessment evidence.

Sonia produced a simple list of materials and processes that she could use for most of the relevant parts of the Water Sprinkler. She carried out some detailed research and was able to make reasonable contributions to discussions with me about the materials and methods to be used.

Sonia received limited guidance to interpret the drawing, but she lacked confidence to make decisions without first talking the various options through with me.

Sonia began to lose interest during the planning stage and her plans were never completed.

Witness name: *Mike Shaw*	Witness signature: *M SHAW*
Job role: *Teacher*	Date: *12/11/0X*
Assessor name: *John Miller*	Assessor signature: *J MILLER*
	Date: *13/11/0X*

You need to make an engineered product including evidence of:

a how you used a product specification and interpreted engineering drawings

b information about details of resources and processing requirements

ASSESSOR'S MARKING GRID

	Mark band 1 At this level work must show:	Mark range	Mark band 2 At this level work must show:	Mark range	Mark band 3 At this level work must show:	Mark range	Mark awarded
(a) **AO1** **AO2** **6 marks**	• use of some information in a product specification and interpretation of basic details in engineering drawings and/or diagrams	1 – 2	• use of the main information in a product specification and interpretation of the main details in engineering drawings and/or diagrams	3 – 4	• confident use of the main information in a product specification and competent interpretation of the main details of engineering drawings and/or diagrams	5 – 6	**4**

MODERATOR COMMENTS

Sonia was presented with a set of drawings for a water sprinkler. In selecting materials, parts and components, tools and equipment, she has demonstrated how she used and interpreted engineering drawings. Some of the detail contained in her planning document lacks accuracy and the plans are not complete and this was noted in the 'Witness Statement'.
Sonia's work is well presented. However, the Witness Statement identifies that she needed some guidance and reassurance during the interpretation of the drawings. Sonia's work should be awarded 4 marks.

(b) **AO2** **AO3** **6 marks**	• a production plan that identifies basic details of resources and processing requirements	1 – 2	• a production plan that describes some details of the resources and processing requirements	3 – 4	• a production plan that explains the main details of the resources and processing requirements	5 – 6	**4**

MODERATOR COMMENTS

Sonia has produced a series of plans and when read in conjunction with her notes relating to the project, these identify details of resources and processing requirements required to make the Water Sprinkler. Sonia has only provided plans for some of the main manufacturing activities. She has begun to evaluate the order in which to make the components and has produced an outline of the sequence of operations. However she has not produced a schedule for the manufacturing operations. By studying the production plan and notes, a third party with relevant experience could manufacture the Water Sprinkler.
Sonia should be awarded 4 marks