



GCSE ENGINEERING 8852/W

Unit 1 Written Paper

Mark scheme

June 2023

Version: 1.0 Final



Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Copyright information

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Copyright © 2023 AQA and its licensors. All rights reserved.

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Glossary for maths

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

[a, b]	Accept values between a and b inclusive.
For π	Accept values in the range [3.14, 3.142]
Their	Accept an answer from the candidate if it has been inaccurately calculated but is subsequently used in a further stage of the question.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Qu	Part	Marking Guidance	Total marks	AO
01	1	B Hardness	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
01	2	A Brass	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
01	3	B Board	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
01	4	C Malleable	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
01	5	C Process	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
01	6	B Capacitor	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
01	7	B Composite	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
01	8	<p>Award one mark for each correct response as shown in bold.</p> <p>There are two types of polymers, thermoplastics and thermosetting polymers.</p> <p>When thermoplastics are heated, they become soft and flexible, allowing them to be formed into a range of products.</p> <p>Thermoplastic products can be easily recycled at the end of their lifecycle.</p>	3 marks	AO1a

Qu	Part	Marking Guidance	Total marks	AO															
02	1	<table border="1"> <thead> <tr> <th>Level</th> <th>Marks</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>5–6</td> <td>Detailed explanation including all key stages to produce product.</td> </tr> <tr> <td>2</td> <td>3–4</td> <td>Some stages described in detail OR majority of stages covered but insufficient detail to allow correct manufacture.</td> </tr> <tr> <td>1</td> <td>1–2</td> <td>One or more basic steps/stages listed.</td> </tr> <tr> <td>0</td> <td>0</td> <td>No response or nothing worthy of credit.</td> </tr> </tbody> </table> <p>Indicative content</p> <p>Through the use of notes and sketches, award up to 6 marks for key stages as follows:</p> <p>Metal sheet cut to size, metal sheet placed between two moulds or ram and die, a press then applies pressure, the press moves downwards pushing the metal into the required shape, excess metal around shape is removed.</p> <p>Accept all other valid responses.</p>	Level	Marks	Description	3	5–6	Detailed explanation including all key stages to produce product.	2	3–4	Some stages described in detail OR majority of stages covered but insufficient detail to allow correct manufacture.	1	1–2	One or more basic steps/stages listed.	0	0	No response or nothing worthy of credit.	6 marks	AO2
Level	Marks	Description																	
3	5–6	Detailed explanation including all key stages to produce product.																	
2	3–4	Some stages described in detail OR majority of stages covered but insufficient detail to allow correct manufacture.																	
1	1–2	One or more basic steps/stages listed.																	
0	0	No response or nothing worthy of credit.																	

Qu	Part	Marking Guidance	Total marks	AO
02	2	<p>Award up to four marks for the correct answer.</p> <p>0.5 m = 500 mm (1 mark for conversion of sheet measurements from metres to mm)</p> <p>$500 \div 110 = 4.54$ (1 mark)</p> <p>$500 \div 140 = 3.57$ (1 mark)</p> <p>Rounded down to $4 \times 3 = 12$ (1 mark for correct answer)</p> <p>Also accept:</p> <p>140mm = 0.14 m 110mm = 0.11 m (Award 1 mark for conversion of plate measurements from mm to metres)</p> <p>$0.5 \div 0.14 = 3.57$ (1 mark)</p> <p>$0.5 \div 0.11 = 4.54$ (1 mark)</p> <p>Rounded down to $4 \times 3 = 12$ (1 mark for correct answer)</p>	4 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO
02	3	<p>Award up to four marks for a correct answer.</p> <p>Award marks for the method if 3.14 or 3.142 is used instead of pi symbol.</p> <p>Area = $\pi 32^2$ (1 mark)</p> <p>= their 3217 mm² (1 mark)</p> <p>$15\ 605 / \text{their } 3217 = \text{their } 4.85$ (1 mark)</p> <p>4 850 000 – 4850806.42 N/m² (Award 1 mark for conversion to N/m²)</p> <p>Accept alternative answer in Pascals.</p> <p>Also accept a correct answer in standard form 4.85×10^6</p>	4 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO
02	4	<p>Award up to four marks for a correct answer.</p> <p>$135^2 + 156^2 = a^2$ (1 mark)</p> <p>$18\,225 + 24\,336 = 42\,561$ (1 mark)</p> <p>$\sqrt{42\,561}$ (1 mark)</p> <p>$= 206.3$ mm (1 mark)</p>	4 marks	AO2

Qu	Part	Marking Guidance			Total marks	AO
02	5	Level	Marks	Description	4 marks	AO3a
		4	7–8	Demonstrates a comprehensive knowledge of both surface finishes. Evidence of comparison using advantages and disadvantages and evaluates the suitability of both.	4 marks	AO3b
		3	5–6	Demonstrates a good level of knowledge of both surface finishes. Evidence of analysis, including several advantages and disadvantages.		
		2	3–4	Demonstrates some knowledge of painting and/or dip coating finishes. Some advantages or disadvantages of using painting and/or dip coating given.		
		1	1–2	A limited level of detail given, with very little analysis or evaluation of either surface finish.		
		0	0	No response or nothing worthy of credit.		
<p>Indicative content</p> <p>Painting</p> <p>Advantages</p> <ul style="list-style-type: none"> • Relatively quick to carry out. • Low cost. • Can increase corrosion resistance. • Improves visual appearance. • Available in a wide variety of colours and finishes. • Common equipment required. <p>Disadvantages</p> <ul style="list-style-type: none"> • Can be messy to apply. • Can chip/scratch off, not as durable. • Surface must be prepared. • Many need a number of coats. • May contain solvents which can harm the environment. <p>Dip coating</p> <p>Advantages</p> <ul style="list-style-type: none"> • Coated with a thin layer of polyethylene plastic to protect it from corrosion. • Good corrosion resistance. • Different colours are available. • Improves visual appearance, smooth and shiny. • Should only require one coat but can be reheated if necessary. • Minimal waste as excess stays in the tank 						

		<p>Disadvantages</p> <ul style="list-style-type: none"> • More labour-intensive process. • Metal must be thoroughly cleaned. • Metal must be heated so extra safety considerations. • Specialised equipment required. • Overall thickness of the plate will increase due to added layer of plastic. <p>Accept all other valid responses.</p>		
--	--	--	--	--

Qu	Part	Marking Guidance	Total marks	AO
02	6	<p>Award one mark for a suitable finish other than painting or dip coating.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Galvanising. • Electroplating/chrome plating. • Polishing/polish. • Lacquer. • Nickel plating. • Powder coating • Enamel coating • Anodizing. As no specific material is given for the housing. <p>Accept all other valid responses.</p>	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
03	1	<p>Award one mark for a correct answer.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Tidal. • Wind. • Solar. • Biomass. • Hydroelectric <p>Accept all other valid responses.</p>	1 mark	AO1a

Qu	Part	Marking Guidance			Total marks	AO
03	2	Level	Marks	Description	4 marks	AO3a
		4	7–8	Demonstrates a comprehensive knowledge of nuclear and fossil fuel energies. Evidence of comparison using advantages and disadvantages and evaluates the impact on the environment of both methods.	4 marks	AO3b
		3	5–6	Demonstrates a good level of knowledge of nuclear and fossil fuel energies. Evidence of analysis, including several advantages and disadvantages. Evidence of environmental impact.		
		2	3–4	Demonstrates some knowledge of nuclear and/or fossil fuel energies. Some advantages or disadvantages of using nuclear and/or fossil fuel energies given. Some evidence, even brief, of evaluation of environmental impact.		
		1	1–2	A limited level of detail given, with very little analysis or evaluation of environmental impact.		
		0	0	No response or nothing worthy of credit.		
<p>Indicative content</p> <p>Nuclear energy</p> <p>Advantages</p> <ul style="list-style-type: none"> • Produces low cost electricity. • Efficient. • Produces energy 24/7. • Large operating power. • Can change the demand level. • Does not contribute to global warming. <p>Disadvantages</p> <ul style="list-style-type: none"> • Uses radioactive materials. • Can cause significant damage to health and the environment. • Very expensive to build plant. • Must include many safety systems. • Extreme care needed to dispose of waste materials. • Public perception can be negative. <p>Environmental impact</p> <ul style="list-style-type: none"> • Does not emit greenhouse gases. • Large-scale accidents can be catastrophic. • Effects of hazardous materials can last many years. 						

	<p>Fossil Fuels</p> <p>Advantages</p> <ul style="list-style-type: none"> • Reliable technology. • Energy produced as needed. • Readily available. • Relatively easy production method. <p>Disadvantages</p> <ul style="list-style-type: none"> • Non-renewable, will eventually run out. • Becoming increasingly scarce, therefore price may increase. • Environmental impact. <p>Environmental impact</p> <ul style="list-style-type: none"> • Can cause environmental damage such as pollution, smog, acid rain, greenhouse gases and global warming. • Must be mined and therefore may spoil landscapes, affect wildlife or ecosystems. <p>Accept all other valid responses.</p>		
--	--	--	--

Qu	Part	Marking Guidance	Total marks	AO												
04	1	<p>Award up to five marks for the correct tools or equipment, one mark per section.</p> <table border="1"> <thead> <tr> <th>Stage</th> <th>Tool/equipment</th> </tr> </thead> <tbody> <tr> <td>Mark out the size and the position of the holes</td> <td>Centre punch, hammer, scribe, marker pen, ruler, square, engineer's blue (Need to include a tool or equipment that can make a mark)</td> </tr> <tr> <td>Cut the metal to size</td> <td>Hack saw, bandsaw, jigsaw, tin snips, shear cutter, guillotine</td> </tr> <tr> <td>Finish the cut edges</td> <td>File, abrasive paper/cloth, wet and dry</td> </tr> <tr> <td>Make the holes</td> <td>Pillar drill, bench drill, metal punch</td> </tr> <tr> <td>Bend the metal shape to 90 degrees</td> <td>Vice and hammer, bending jig, bench folder, pan/box folder</td> </tr> </tbody> </table> <p>Accept all other valid responses.</p>	Stage	Tool/equipment	Mark out the size and the position of the holes	Centre punch, hammer, scribe, marker pen, ruler, square, engineer's blue (Need to include a tool or equipment that can make a mark)	Cut the metal to size	Hack saw, bandsaw, jigsaw, tin snips, shear cutter, guillotine	Finish the cut edges	File, abrasive paper/cloth, wet and dry	Make the holes	Pillar drill, bench drill, metal punch	Bend the metal shape to 90 degrees	Vice and hammer, bending jig, bench folder, pan/box folder	5 marks	AO1a
Stage	Tool/equipment															
Mark out the size and the position of the holes	Centre punch, hammer, scribe, marker pen, ruler, square, engineer's blue (Need to include a tool or equipment that can make a mark)															
Cut the metal to size	Hack saw, bandsaw, jigsaw, tin snips, shear cutter, guillotine															
Finish the cut edges	File, abrasive paper/cloth, wet and dry															
Make the holes	Pillar drill, bench drill, metal punch															
Bend the metal shape to 90 degrees	Vice and hammer, bending jig, bench folder, pan/box folder															

Qu	Part	Marking Guidance	Total marks	AO
04	2	<p>Award up to two marks for a correct description.</p> <p>Indicative content</p> <p>In welding, the base metal is melted so the two parts fuse. Filler wire of similar material is used to support the join. To achieve this, much higher temperatures are used than in brazing. In brazing, a dissimilar material is used as a filler. The base metal is not melted, and filler metal is used to create the join.</p> <p>Eg if electricity is used to describe welding and gas is used to describe brazing and the process is not described fully then award one mark.</p> <p>Accept all other valid responses.</p>	2 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO
04	3	<p>Award one mark for a correct answer.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Turning on a lathe. • CNC turning. • 3D printing. • Pressure die cast/ die casting. • Sintering <p>Accept all other valid responses.</p>	1 mark	AO1a

Qu	Part	Marking Guidance			Total marks	AO															
05	1	<table border="1"> <thead> <tr> <th>Level</th> <th>Marks</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>5–6</td> <td>Demonstrates a good level of knowledge of the impact of engineering industries. Both advantages and disadvantages discussed. Evaluates the impact on the local community and society.</td> </tr> <tr> <td>2</td> <td>3–4</td> <td>Demonstrates a good level of knowledge of the impact of engineering industries. Evidence of analysis, including some advantages and disadvantages. Some evidence, even brief, of evaluation of local community impact.</td> </tr> <tr> <td>1</td> <td>1–2</td> <td>A limited level of detail, one or two advantages or disadvantages given with very little analysis or evaluation of impact on the local community.</td> </tr> <tr> <td>0</td> <td>0</td> <td>No response or nothing worthy of credit.</td> </tr> </tbody> </table> <p>Indicative content</p> <p>Impact on society</p> <ul style="list-style-type: none"> • Improves opportunities for people in the community. • May provide skilled jobs for people. • May provide jobs across a wide range of roles and skills and in local suppliers. • Automated systems may cause job losses later on. • Increased noise and transport/traffic. <p>Impact on the economy</p> <ul style="list-style-type: none"> • May put existing engineering companies out of business. • Engineering companies add value to the local and UK economy. • The engineering projects may contribute to improved technology, infrastructure etc. <p>Accept all other valid responses.</p>			Level	Marks	Description	3	5–6	Demonstrates a good level of knowledge of the impact of engineering industries. Both advantages and disadvantages discussed. Evaluates the impact on the local community and society.	2	3–4	Demonstrates a good level of knowledge of the impact of engineering industries. Evidence of analysis, including some advantages and disadvantages. Some evidence, even brief, of evaluation of local community impact.	1	1–2	A limited level of detail, one or two advantages or disadvantages given with very little analysis or evaluation of impact on the local community.	0	0	No response or nothing worthy of credit.	6 marks	AO3a
Level	Marks	Description																			
3	5–6	Demonstrates a good level of knowledge of the impact of engineering industries. Both advantages and disadvantages discussed. Evaluates the impact on the local community and society.																			
2	3–4	Demonstrates a good level of knowledge of the impact of engineering industries. Evidence of analysis, including some advantages and disadvantages. Some evidence, even brief, of evaluation of local community impact.																			
1	1–2	A limited level of detail, one or two advantages or disadvantages given with very little analysis or evaluation of impact on the local community.																			
0	0	No response or nothing worthy of credit.																			

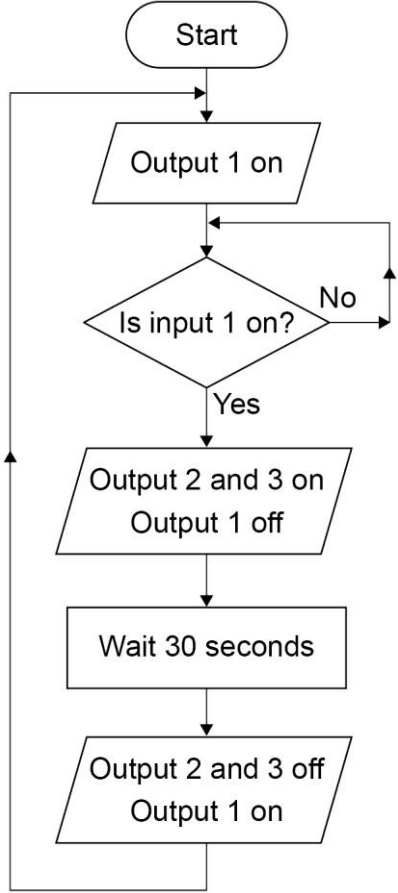
Qu	Part	Marking Guidance	Total marks	AO
05	2	Award up to two marks for the correct answer. Accept bar drawn on graph to correct height. $42 + 27 + 13 + 6 = 88$ (1 mark) $100 - 88 = 12$ Aerospace = 12% (1 mark)	2 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO
05	3	Award one mark for their 12% correctly drawn on the graph.	1 mark	AO2

Qu	Part	Marking Guidance	Total marks	AO
05	4	Award up to two marks for the correct answer. $18\,000\,000 \times 27/100$ (1 mark) $= \pounds 4\,860\,000 / \pounds 4.86$ million (1 mark)	2 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO
06	1	Award one mark for a correct answer. The transistor acts as a switch or amplifies the current.	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
06	2	Award one mark for a correct answer. Piezo sounder, loudspeaker, bell.	1 mark	AO1

Qu	Part	Marking Guidance	Total marks	AO
06	3	<p>Award up to six marks for a completed flowchart.</p> <p>Indicative content</p> <ul style="list-style-type: none"> 1 mark for completed decision box 1 mark for Outputs 2 and 3 on, Output 1 off 1 mark for Yes/no routes 1 mark for Outputs 2 and 3 off, Output 1 on 1 mark for time delay 1 mark for return loops <div style="text-align: center;">  <pre> graph TD Start([Start]) --> Output1[Output 1 on] Output1 --> Decision{Is input 1 on?} Decision -- No --> Output1 Decision -- Yes --> Output2[Output 2 and 3 on Output 1 off] Output2 --> Wait[Wait 30 seconds] Wait --> Output3[Output 2 and 3 off Output 1 on] Output3 --> Decision </pre> </div>	6 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO
06	4	<p>Award one mark for each of the following advantages, up to a maximum of two marks.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Provides an overview of the system. • Simple and easy to read. • Consistency from using standard symbols. • Software is commercially available and easy to use, eg selection of pre-drawn symbols. • The symbols can be easily edited. • The flowchart can be tested virtually if on a PC. <p>Accept all other valid responses.</p>	2 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO
06	5	<p>Award up to two marks for a correct answer and/or sketch.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • AC is alternating current that changes direction, shown graphically as a sine wave. • DC is direct current that flows in one direction only, shown graphically as a straight line. • May also show graphical drawing of current wave. <p>Accept all other valid responses.</p>	2 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO
06	6	<p>Award one mark for each of the following advantages, up to a maximum of two marks.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Using batteries makes the product portable. • Batteries can be used where there is no access to mains electricity, eg outdoors, in a car etc. • Batteries can be used when there is a limited number of sockets available. • Batteries can be placed in a pack to create a specific voltage. • Using batteries means there are no power cords/wires to trip over. <p>Accept all other valid responses.</p>	2 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO
06	7	<p>Award 1 mark for a correct type of gate: NOT, AND, OR gates</p> <p>Accept any other correct type of gate.</p>	1 mark	AO2

Qu	Part	Marking Guidance	Total marks	AO
06	8	<p>Award 1 mark for a correct function of a logic gate: NOT gate – an inverter, output signal is opposite of input signal AND gate – only produces an output signal of 1 when both input signals are 1 OR gate – produce an output signal of 1 when either input signal is 1</p>	1 mark	AO2

Qu	Part	Marking Guidance	Total marks	AO
07	1	<p>Award one mark for each correct answer.</p> <p>The motion at point A is: Linear.</p> <p>This is converted to Rotary motion at point B.</p>	2 marks	AO1a

Qu	Part	Marking Guidance	Total marks	AO
07	2	<p>Award one mark for each simple, correct statement.</p> <p>Award two marks for a statement that has been justified.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • The follower follows the shape of the cam making it rise and fall. • As the cam rotates it pushes the follower up and down to make parts move. • It transfers the rotary motion of the cam to reciprocating motion in the moving part. • The follower should move smoothly and not jam during movement. <p>Accept all other valid responses.</p>	2 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO
07	3	<p>Award one mark for each of the following reasons, up to a maximum of two marks.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • To avoid break downs/unexpected stoppage. • To keep the machine clean and in working order • To make sure the machinery is safe to use. • To avoid corrosion/deterioration. • To check for wear and tear. <p>Accept any other valid responses.</p>	2 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO
07	4	<p>Award one mark for each correct, simple statement (max 2 marks). Award two marks for a statement that has been justified.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Lubricating helps to prevent wear between parts. • Reduces friction between parts. • Prevents overheating of parts which may make them jam or seize. • Provides some protection against corrosion. • Ensures the longer life span of parts, reducing the need to replace them. • Saves money as parts will last longer. • Reduces sound. <p>Accept all other valid responses.</p>	4 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO
07	5	<p>Award up to two marks for the correct answer.</p> <p>$40 \div 300$ (1 mark)</p> <p>$= 0.13$ (1 mark)</p>	2 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO
07	6	<p>Bearing. Accept ball bearing/roller bearing or ball race.</p> <p>Accept all other valid responses.</p>	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
07	7	<p>To control motion and reduce friction between moving parts.</p> <p>Accept all other valid responses.</p>	1 mark	AO1b

Qu	Part	Marking Guidance	Total marks	AO
08	1	<p>One mark for AO1a and two marks maximum for AO2.</p> <p>Award: 1 mark for formula: Strain = change in length/original length, or $\epsilon = \delta l/l$</p> <p>1 mark for substitution: 2.5/300 (1 Maths mark)</p> <p>1 mark for correct answer: 0.0083 (1 Maths mark)</p>	<p>1 mark</p> <p>2 marks</p>	<p>AO1a</p> <p>AO2</p>

Qu	Part	Marking Guidance	Total marks	AO
08	2	<p>Award up to two marks for the correct answer.</p> <p>1 mark for correct substitution of values: 2.2/0.019</p> <p>1 mark for their correct answer rounded to: 1 dp Answer: 115.8 N/mm²</p>	2 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO
08	3	<p>Award one mark for correct answer.</p> <p>Correct answer: Tensile strength.</p>	1 mark	AO1a

Qu	Part	Marking Guidance	Total marks	AO
08	4	<p>Award one mark for each point similar to the indicative content below, up to a maximum of two marks.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Tensile strength tests attempt to stretch or pull a material apart. • The cable is subjected to a pulling force until it fails. • Increasing loads are applied to the cable. • The test will show the maximum amount of tension the cable can take before it fails. • The cable could be tested in a tensile strength machine. <p>Accept all other valid responses.</p>	2 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO
08	5	<p>Award one mark for each of the following functions, up to a maximum of two marks.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • To reduce effort when lifting loads (mechanical advantage). • To transfer power within a system. • Change the direction of the effort. <p>Accept all other valid responses.</p>	2 marks	AO1b

Qu	Part	Marking Guidance			Total marks	AO
09	1	Level	Marks	Description	4 marks 4 marks	AO3a AO3b
		4	7–8	Demonstrates a comprehensive knowledge of rapid prototyping method. Evidence of analysis including a range of advantages and disadvantages.		
		3	5–6	Demonstrates a good level of knowledge of rapid prototyping method. Evidence of analysis, including several advantages and disadvantages.		
		2	3–4	Some advantages or disadvantages of using rapid prototyping method given. Some evidence, even brief, of analysis.		
		1	1–2	A limited level of detail given, with very little analysis.		
		0	0	No response or nothing worthy of credit.		
<p>Indicative content</p> <p>Advantages</p> <ul style="list-style-type: none"> • Cost effective for one-off or bespoke solutions. • Prototypes can be modelled more quickly than using conventional machining operations (no marks for repeating ‘rapid prototyping’, must be justified). • Possible to create complex shapes with reduced section area/thickness leading to efficient design. • Ability to create complex shapes in one piece. • Components can be made with internal features. • Easy to modify/make alterations. • Repeatable process. • Component is made in one operation. • Less waste. <p>Disadvantages</p> <ul style="list-style-type: none"> • Can have high set-up costs. • Requires specialist training/software. • CAD skills required. • Limited range of materials can be used. • Most common material is plastic which has environmental issues. • May not be possible to make the component in final materials. • Size restrictions. • Harmful emissions. • Manufacturing job losses. • Energy consumption. <p>Accept all other valid responses.</p>						

Qu	Part	Marking Guidance	Total marks	AO
09	2	<p>Award one mark for a method and one mark for an explanation. Max four marks.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Use of measuring equipment eg: vernier calipers, micrometers, depth gauges etc to check dimensions and tolerances. • Use of a go/no gauge to check against upper and lower tolerances. • Visual check to ensure the component looks as it should. • Weight check to ensure the component is the correct weight. • Assembly check to make sure the component goes together as it should. <p>Accept all other valid responses.</p>	2 marks	AO1 1a
			2 marks	AO1 1b

Qu	Part	Marking Guidance	Total marks	AO
09	3	<p>Award up to three marks for a correct answer</p> $2\% = 150 \times 0.02$ $= 3 \text{ (1 mark)}$ <p>Minimum = 147 mm (1 mark) Maximum = 153 mm (1 mark)</p>	3 marks	AO2