



GCSE ENGINEERING 8852/W

Unit 1 Written Paper

Mark scheme

June 2020

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

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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.

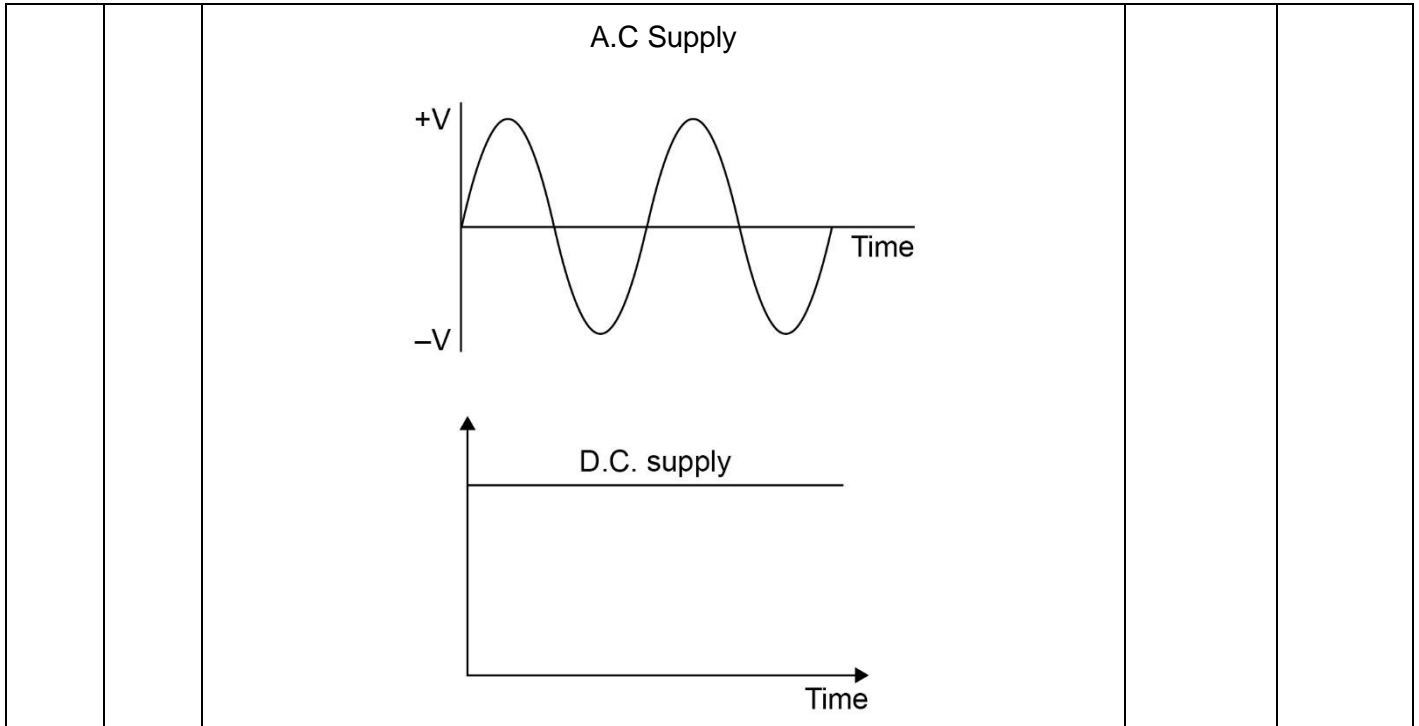
Qu	Part	Marking Guidance	Total marks	AO
1	1	<p>1 mark for AO1a (knowledge).</p> <p>Correct answer: B Hardness</p>	1 mark	AO1a
1	2	<p>2 marks for AO1a (knowledge).</p> <p>Correct answers: B Epoxy C Melamine</p> <p>Award 1 mark for each correct answer.</p> <p>However, if a candidate shades more than 2 circles, deduct 1 of the marks for each additional shaded circle.</p>	2 marks	AO1a
1	3	<p>1 mark for AO1b (understanding).</p> <p>Correct answer: D Plywood</p>	1 mark	AO1b
1	4	<p>1 mark for AO1b (understanding).</p> <p>Correct answer: A Drag</p>	1 mark	AO1b
1	5	<p>1 mark for AO1a (knowledge).</p> <p>Correct answer: A Capacitor</p>	1 mark	AO1a
1	6	<p>1 mark for AO1b (understanding).</p> <p>Correct answer: D Sintering</p>	1 mark	AO1b
1	7	<p>3 marks for AO1b (understanding).</p> <p>Award 1 mark for each correct response.</p> <p>The tray has been made using a press forming process. The moulds used in the process are usually made from high carbon steel because the mould material needs to be very hard.</p>	3 marks	AO1b

Qu	Part	Marking Guidance	Total marks	AO												
2	1	<p>5 marks for AO1a (knowledge).</p> <p>Note: 1 mark per stage available.</p> <p>Correct responses include, but are not limited to, those shown below:</p> <table border="1"> <thead> <tr> <th>Stage</th> <th>Tool/equipment</th> </tr> </thead> <tbody> <tr> <td>Cut bar to length</td> <td>Hacksaw, band saw, jigsaw, cut-off grinder (Do not accept just 'saw')</td> </tr> <tr> <td>Finish the cut edges of the bar</td> <td>File, abrasive paper, emery cloth</td> </tr> <tr> <td>Mark the position of the hole</td> <td>Centre punch and hammer, scribe (accept marker pen)</td> </tr> <tr> <td>Make 4 mm diameter hole</td> <td>Pillar drill, power drill, metal punch, 4 mm twist drill (Do not accept just 'drill')</td> </tr> <tr> <td>Bend bar to a right angle</td> <td>Vice and hammer, bench folder, folding bars, bending jig</td> </tr> </tbody> </table>	Stage	Tool/equipment	Cut bar to length	Hacksaw, band saw, jigsaw, cut-off grinder (Do not accept just 'saw')	Finish the cut edges of the bar	File, abrasive paper, emery cloth	Mark the position of the hole	Centre punch and hammer, scribe (accept marker pen)	Make 4 mm diameter hole	Pillar drill, power drill, metal punch, 4 mm twist drill (Do not accept just 'drill')	Bend bar to a right angle	Vice and hammer, bench folder, folding bars, bending jig	5 marks	AO1a
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Bend bar to a right angle	Vice and hammer, bench folder, folding bars, bending jig															
2	2	<p>1 mark for AO1a (knowledge).</p> <p>Award 1 mark for naming a specific finish appropriate for use outside.</p> <p>Accept: Paint, chrome, dip-coated, plastic dip coat, zinc, galvanised or similar.</p> <p>Do not accept anodised.</p>	1 mark	AO1a												
2	3	<p>3 marks for AO1b (understanding).</p> <p>Award 1 mark for each correct, relevant reason given.</p> <p>Reasons include:</p> <ul style="list-style-type: none"> • Prevent corrosion. • Improve the visual appeal/appearance. • Help improve resistance to scratching or damage. • Can save money as cheaper materials can be used, like steel. • Can save money in the long term as bracket will last longer. • Can help to make the bracket blend in with the surroundings. 	3 marks	AO1b												

2	4	<p>2 marks maximum for AO3 (analyse) and 2 marks maximum for AO3 (evaluate).</p> <p>Award 1 mark for each simple, correct and relevant statement given to a maximum of 2.</p> <p>Award 2 marks for each explained or justified statement.</p> <p>An example of a simple statement worth 1 mark: ‘Reduces the cost of making components’.</p> <p>An example of a justified statement worth 2 marks: ‘Reduces the cost of making components as machines can work constantly without a break’.</p> <p>Indicative content:</p> <ul style="list-style-type: none"> • Allows identical components to be manufactured (evaluation) because machines work to identical tolerances consistently (analysis). • Allows high rates of production (evaluation) as machines can operate without a break (analysis). • Allows high rates of production (evaluation) as machines can change tooling or settings faster than an operator (analysis). • Designs can be modified quickly (evaluation) as machine programs can be edited easily (analysis). • The cost of production can be lower (evaluation) as low skilled operators can use machines (analysis). • The cost of production can be lower (evaluation) as fewer workers may be needed (analysis). • Less material or time wasted (evaluation) as human error is avoided (analysis). <p>Note: Generic or very vague responses eg quick, easy, cheap are not to be credited.</p>	4 marks	AO3
2	5	<p>3 marks for AO2 (application of knowledge and understanding).</p> <p>Award: 1 mark for substitution of numbers for adjacent and opposite into formula</p> <p style="text-align: right;">$\tan A = 50/30$ (Maths mark)</p> <p>1 mark for calculation $\tan A = 1.66666$ (Maths mark)</p> <p>1 mark for correct answer 59.03° (Maths mark)</p> <p>(Accept range of 59° to 60°)</p> <p>(Note: 1 mark maximum to be awarded if a candidate offers a drawn or sketched solution with an answer of 59° to 60°).</p>	3 marks	AO2

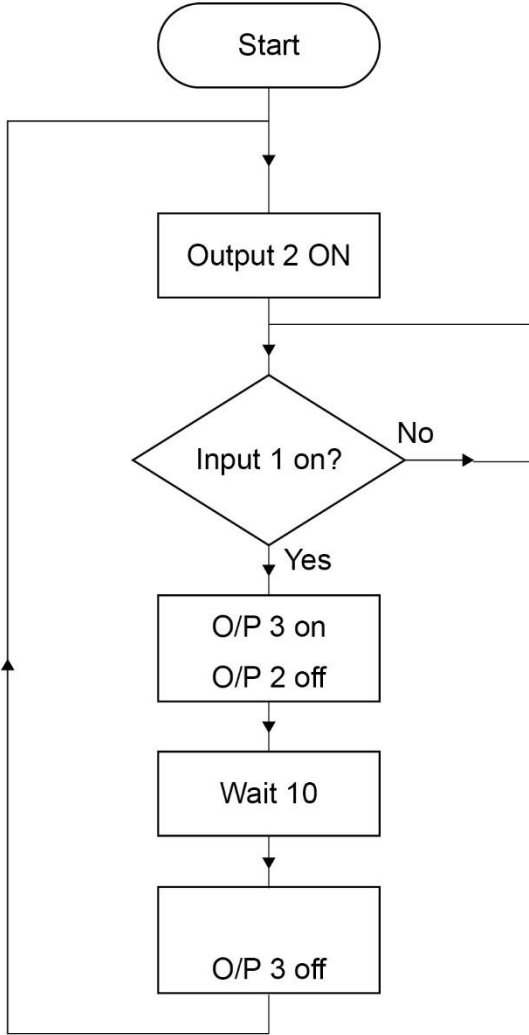
Qu	Part	Marking Guidance	Total marks	AO
3	1	<p>2 marks for AO1a (knowledge).</p> <p>Award 1 mark for each correct and relevant advantage.</p> <p>Advantages include, but are not limited to:</p> <ul style="list-style-type: none"> • A non-permanent method of fixing. • Pieces can be taken apart, or disassembled. • Fastenings give additional strength/mechanical strength. • No need to clean/flux the pieces. • No requirement to heat the pieces. • Will not cause heat distortion. <p>Note: Generic or very vague responses eg quick, easy, cheap are not to be credited.</p>	2 marks	AO1a
3	2	<p>2 marks for AO1a (knowledge).</p> <p>Award 1 mark for each correct and relevant advantage.</p> <p>Advantages include, but are not limited to:</p> <ul style="list-style-type: none"> • No requirement to drill holes. • With soldering, high temperatures are not reached or needed. • With soldering, the metal pieces are not melted. • Lighter product than using nuts/bolts. • No need to be able to access both sides of the tray. <p>Note: Generic or very vague responses eg quick, easy, cheap are not to be credited.</p>	2 marks	AO1a
3	3	<p>2 marks for AO1a (knowledge).</p> <p>Award 1 mark for each correctly named process.</p> <p>Accept: Soft soldering, brazing, welding, TIG welding, MIG welding, gas welding, oxyacetylene welding, spot-welding, fusion welding.</p>	2 marks	AO1a

Qu	Part	Marking Guidance	Total marks	AO
4	1	<p>2 marks maximum for AO3 (analyse) and 2 marks maximum for AO3 (evaluate)</p> <p>Award 1 mark for each simple, correct and relevant statement given.</p> <p>Award 2 marks for each explained or justified statement.</p> <p>Indicative content:</p> <p>Mains power supplies:</p> <ul style="list-style-type: none"> • Will not ‘run-out’ of power (analysis) and so can be used continuously (evaluation). • High power output available (analysis) so can be used to drill a wider variety of materials (evaluation). • Higher voltages available (analysis) which may generate a higher power output (evaluation). • Using mains means batteries don’t have to be purchased (analysis) which results in a lower cost in the long run (evaluation). • The drill case will not need to contain batteries (analysis) so the drill will be lighter (evaluation). • The drill does not require any batteries to be bought (analysis) which will be better for the environment in terms of recycling and disposal (evaluation). <p>Batteries:</p> <ul style="list-style-type: none"> • The drill will not need a cable or access to the mains (analysis) so the drill is more portable and can be used anywhere (evaluation). • Batteries involve lower voltages/power than using the mains (analysis) so it is safer with less risk of electrocution (evaluation). • The drill will not need a cable or lead (analysis) so there are no tripping risks and will be safer (evaluation). • A battery-powered drill can be used even if there is a power-cut (analysis) which can save time or money (evaluation). 	4 marks	AO3
4	2	<p>2 marks maximum for AO1a (knowledge) and 1 mark maximum for AO1b (understanding).</p> <p>Note: Marks can be awarded if a candidate uses notes and/or a sketch to answer the question.</p> <p>Award:</p> <ul style="list-style-type: none"> • 1 mark for DC, with current or power flowing in one direction only, or constantly (AO1a). • 1 mark for AC, with current or power changing direction, or oscillating (AO1a). • 1 mark for some further detail for AC – a reference to amplitude, frequency, more efficient means of transmission, or similar (AO1b). 	3 marks	AO1a and AO1b



4	3	<p>2 marks for AO1a (knowledge)</p> <p>Component A: Accept switch, SPST, Single Pole Single Throw. Component B: Battery (don't accept cell).</p>	2 marks	AO1a
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4	4	<p>2 marks for AO1b (understanding)</p> <p>Award 1 mark for each correct statement – up to 2 marks.</p> <p>Indicative content:</p> <p>Allow:</p> <ul style="list-style-type: none"> • One circuit to switch-on another circuit. • Turns the bulb on when switch A is closed. • Separates or isolates two different circuits. <p>Note: a response such as: 'Allows low voltage circuits to control high voltage circuits' would merit 2 marks as it suggests one circuit switching-on another, and has further detail.</p>	2 marks	AO1b
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4	5	<p>6 marks for AO2 (application of knowledge and understanding).</p> <p>Completing a flowchart for an alarm system – up to 6 marks.</p> <p>Award:</p> <ul style="list-style-type: none"> • 1 mark for input decision. (Written in the diamond box; accept input on/input 1 on/is input on?) • 1 mark for correct yes/no routes drawn on flowchart • 1 mark for green LED off and red LED on. (Accept reference to output pins/terms including high, low, 1, 0 or on, off). • 1 mark for wait/delay of 10 seconds. • 1 mark for red LED off and green LED on. • 1 mark for return or loop line back to a correct place in the program. <p>Loops need separating and given 1 mark each.</p> <p>Example of correct answer:</p>  <pre> graph TD Start([Start]) --> Output2[Output 2 ON] Output2 --> Input1{Input 1 on?} Input1 -- No --> Output2 Input1 -- Yes --> OP3[O/P 3 on O/P 2 off] OP3 --> Wait[Wait 10] Wait --> OP3off[O/P 3 off] OP3off --> Input1 </pre>	6 marks	AO2
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4	6	<p>6 marks for AO3 (evaluate)</p> <p>Award 1 mark for each simple, correct and relevant statement given to a maximum of 3.</p> <p>Award 2 marks for each statement that has been explained or justified further.</p> <p>An example of a simple statement worth 1 mark:</p> <p>‘See if circuit works before manufacture.’</p> <p>An example of a justified statement worth 2 marks:</p> <p>‘See if circuit works before manufacture which will save time and money as components and boards are not wasted.’</p> <p>Indicative content:</p> <ul style="list-style-type: none"> • See if the circuit works before manufacture. • Can change the values of components to test performance. • Can check and alter the physical size of the circuit. • Saves money and prevents waste. • Can use the simulation to gauge customer feedback. • Actual components not needed to test the circuit. • No soldering needed. • Gives access to a larger range of components than may be physically stocked by a designer. <p>Note: Give credit for responses that mention that CAD does not always provide totally reliable circuit simulation.</p>	6 marks	AO3
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Qu	Part	Marking Guidance	Total marks	AO														
5	1	<p>2 marks maximum for AO1a (knowledge) and 2 marks maximum for AO1b (understanding).</p> <p>Award one mark for each correct hazard and a second mark for an associated and relevant precaution.</p> <table border="1" data-bbox="344 611 1182 1245"> <thead> <tr> <th data-bbox="344 611 762 701">Hazards include</th> <th data-bbox="762 611 1182 701">Precautions</th> </tr> </thead> <tbody> <tr> <td data-bbox="344 701 762 790">Trapping hands/fingers</td> <td data-bbox="762 701 1182 790">Use of machine guards</td> </tr> <tr> <td data-bbox="344 790 762 880">Getting hair caught in machine</td> <td data-bbox="762 790 1182 880">Tie hair back/wear cap</td> </tr> <tr> <td data-bbox="344 880 762 969">Getting material in eyes</td> <td data-bbox="762 880 1182 969">Wear goggles/glasses</td> </tr> <tr> <td data-bbox="344 969 762 1059">Damage to hearing</td> <td data-bbox="762 969 1182 1059">Use ear-defenders/ear plugs</td> </tr> <tr> <td data-bbox="344 1059 762 1149">Dropping components/fixtures onto feet</td> <td data-bbox="762 1059 1182 1149">Wear sturdy footwear/ use of lifting equipment</td> </tr> <tr> <td data-bbox="344 1149 762 1238">Cuts on sharp edges</td> <td data-bbox="762 1149 1182 1238">Wear gloves/deburr parts</td> </tr> </tbody> </table> <p>Note: This list is not exhaustive and other reasonable responses are to be credited.</p>	Hazards include	Precautions	Trapping hands/fingers	Use of machine guards	Getting hair caught in machine	Tie hair back/wear cap	Getting material in eyes	Wear goggles/glasses	Damage to hearing	Use ear-defenders/ear plugs	Dropping components/fixtures onto feet	Wear sturdy footwear/ use of lifting equipment	Cuts on sharp edges	Wear gloves/deburr parts	4 marks	AO1a and AO1b
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5	2	<p>4 marks maximum for AO1b (understanding) and 4 marks maximum for AO2 (application of knowledge and understanding)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Level</th> <th style="text-align: center;">Mark</th> <th style="text-align: center;">Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">7–8</td> <td>Clear explanation including key processes to mill the slot.</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">5–6</td> <td>Majority of processes covered including most key processes to mill the slot. Some areas lacking detail.</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">3–4</td> <td>Some processes described in basic detail/list form OR majority of processes covered but insufficient detail to allow correct or complete manufacture.</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1–2</td> <td>One or more basic processes/steps or tools listed.</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td>Nothing of relevance or no response.</td> </tr> </tbody> </table> <p>Through the use of notes and/or sketches candidates should be awarded marks based on covering the key stages as follows:</p> <ul style="list-style-type: none"> • Securely holding material in place – vice or clamps. • Selection/fitting of slotting tool. • Sharpness of tool. • Setting tool height. • Setting of feeds and speeds (manual or software). • Tool rotation. • Material removed. • Movement to cut a slot. • Offsets/datums. • Use of coolant. • Explanation of the milling processes. • Unclamp/remove block from machine. • Deburr block or slot. <p>Note: Candidates may respond by describing either horizontal, vertical, manual or CNC milling. Do not award credit for PPE.</p>	Level	Mark	Description	4	7–8	Clear explanation including key processes to mill the slot.	3	5–6	Majority of processes covered including most key processes to mill the slot. Some areas lacking detail.	2	3–4	Some processes described in basic detail/list form OR majority of processes covered but insufficient detail to allow correct or complete manufacture.	1	1–2	One or more basic processes/steps or tools listed.	0	0	Nothing of relevance or no response.	8 marks	AO1b and AO2
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Qu	Part	Marking Guidance	Total marks	AO
6	1	<p>1 mark maximum for AO1a (knowledge) and 2 marks maximum for AO2 (application of knowledge and understanding).</p> <p>Award: 1 mark for writing the formula: Mechanical Advantage = load/effort, or $MA = F_b/F_a$</p> <p>1 mark for evidence of transposition of formula: Effort = load/MA or $125/3$ (Maths mark)</p> <p>1 mark for answer: 41.67N (units needed) (Maths mark)</p> <p>Accept range 41.6 to 41.7</p>	3 marks	AO1a and AO2
6	2	<p>1 mark maximum for AO1a (knowledge) and 3 marks maximum for AO2 (application of knowledge and understanding).</p> <p>Award: 1 mark for formula: Stress = force/cross-sectional area, or $\sigma = F/A$</p> <p>1 mark for calculating: force = $70 \times 9.81 = 686.7$ (Maths mark)</p> <p>1 mark for calculating: csa = 706.95 (accept range 706.5 to 707.1) (Maths mark)</p> <p>1 mark for answer: 0.97 (accept range 0.97 to 0.972) (Maths mark)</p>	4 marks	AO1a and AO2
6	3	<p>1 mark maximum for AO1a (knowledge) and 2 marks maximum for AO2 (application of knowledge and understanding).</p> <p>Award: 1 mark for formula: Strain = change in length/original length, or $\epsilon = \delta/l$</p> <p>1 mark for substitution: 3/200 (Maths mark)</p> <p>1 mark for correct answer: 0.015 (Maths mark)</p>	3 marks	AO1a and AO2

		Note: Do not award 3 rd mark if candidate includes units (eg 0.015 mm).		
6	4	<p>1 mark maximum for AO1a (knowledge) and 3 marks maximum for AO2 (application of knowledge and understanding).</p> <p>Award:</p> <p>1 mark for correct formula: Young's modulus = stress/strain, or $E = \sigma/\epsilon$</p> <p>1 mark for correct substitution of values: 1.8/0.017 (Maths mark)</p> <p>1 mark for correct answer rounded to: 1 d.p Answer: 105.9 (Maths mark)</p> <p>1 mark for correct use of units: N/mm^2</p>	4 marks	AO1a and AO2

Qu	Part	Marking Guidance	Total marks	AO
7	1	<p>2 marks for AO1b (understanding).</p> <p>Award 1 mark for each correct response.</p> <p>The system converts rotary motion into reciprocating motion.</p>	2 marks	AO1b
7	2	<p>4 marks for AO3 (analyse).</p> <p>Award 1 mark for each simple, correct and relevant statement given (maximum two marks).</p> <p>Award 2 marks for each statement that has been explained or justified further.</p> <p>An example of a simple statement worth 1 mark: ‘Reduces wear in an engine’.</p> <p>An example of a justified statement worth 2 marks: ‘Reduces wear in an engine as the oil stops contact between components’.</p> <p>Indicative content:</p> <ul style="list-style-type: none"> • Helps to prevent wear. • Reduces friction between moving parts. • Prevents over-heating of parts. • Ensures a longer life-span of parts. • Prevents components seizing. • Saves money in the long-run. • Reduces the need to replace worn parts. • Helps to prevent corrosion. 	4 marks	AO3

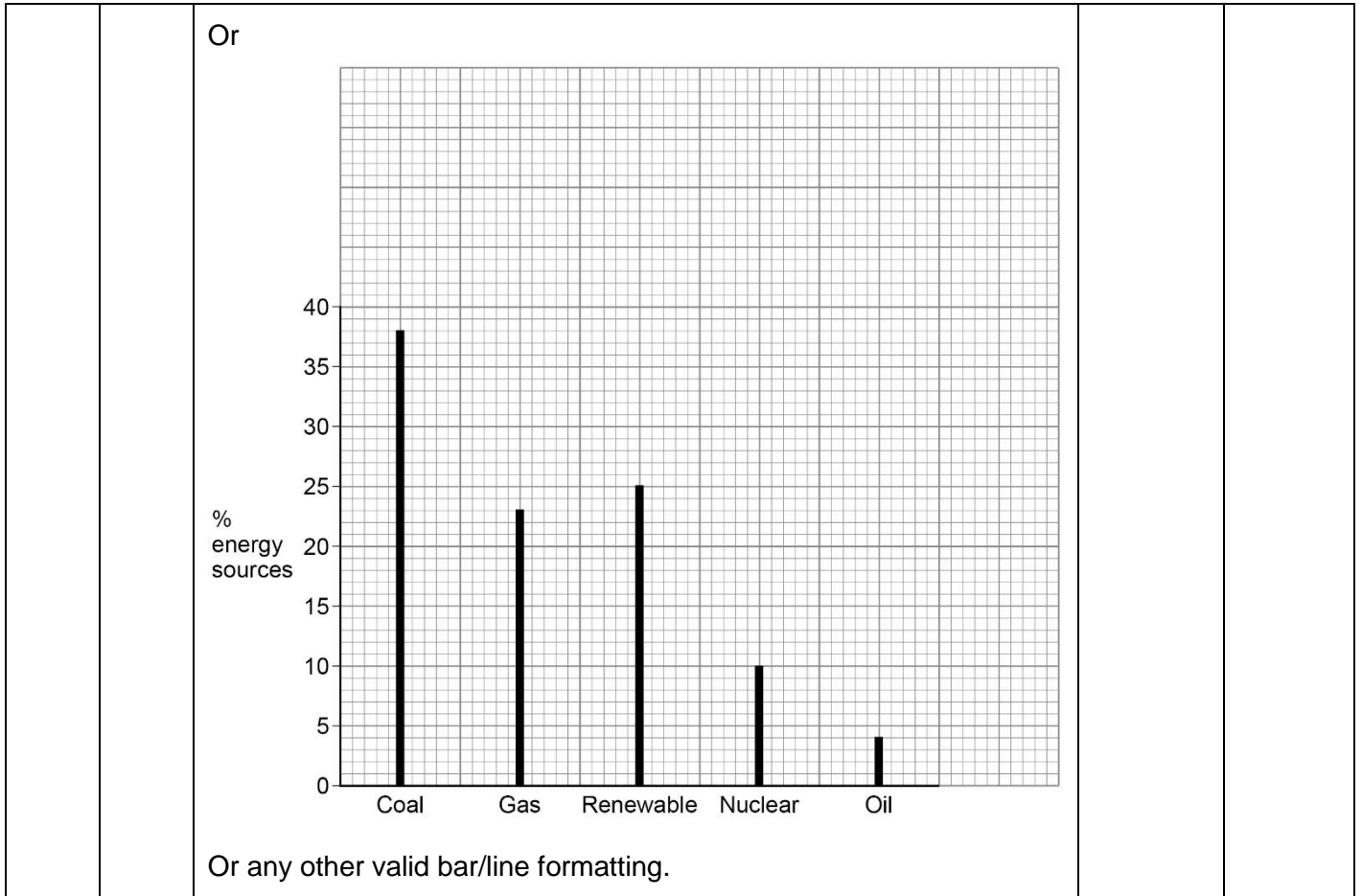
7	3	<p>1 mark maximum for AO1a (knowledge) and 1 mark maximum for AO1b (understanding).</p> <p>Award 1 mark for each simple, correct and relevant statement given.</p> <p>Award 2 marks for a statement that has been explained or justified further.</p> <p>An example of a simple statement worth 1 mark: 'Controls the valves in an engine'.</p> <p>An example of a justified statement worth 2 marks: 'Controls the valves in an engine by pushing the valves open'.</p> <p>Indicative content:</p> <ul style="list-style-type: none"> • Control the valves. • Open and close the valves. • Help to control the amount of fuel entering a cylinder. • Control the valve timing in an engine. 	2 marks	AO1a and AO1b
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7	4	<p>3 marks maximum for AO3 (analyse) and 6 marks maximum for AO3 (evaluate).</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Level</th> <th style="text-align: center;">Mark</th> <th style="text-align: left;">Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">7–9</td> <td>Demonstrates a comprehensive knowledge of the impact of using both fossil fuels and batteries. Evidence of analysis, including several advantages and disadvantages of using both technologies, and has made reference to both environmental issues and the impact on the user of the car.</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">4–6</td> <td>Demonstrates a good knowledge of the impact of using either fossil fuels and/or batteries. Evidence of analysis, including some advantages and disadvantages of using either technology, and has made a brief reference to both environmental issues and the impact on the user of the car.</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1–3</td> <td>A limited level of detail given. Only advantages or disadvantages of using one technology given, with very little analysis or evaluation, or both technologies discussed very briefly.</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td>Nothing of relevance or no response.</td> </tr> </tbody> </table> <p>Candidate responses may include (but are not limited to) factors such as:</p> <p>Environmental impact:</p> <ul style="list-style-type: none"> • Fossil fuels are a finite resource (1 analysis) which is environmentally damaging in the long term, and will lead to higher prices for the user (2 evaluation). • Fossil fuels create harmful substances when burnt (1 analysis) which can enter a person’s body resulting in health problems (1 evaluation). • There may be environmental effects when being mined or sourced (1 analysis), which can lead to pollution and be visually damaging (2 evaluation). • Batteries don’t generate harmful substances when used in a car (1 analysis) which can help to avoid health issues and damage to the environment (2 evaluation). • Batteries still require some initial source of power to charge them (1 analysis) so there may still be environmental effects through mining/sourcing and power generation (2 evaluation). • Electric cars are quieter than petrol engines (1 analysis) which can be a pleasant benefit to pedestrians, but can be dangerous for road users as they can’t hear these cars (2 evaluation). • Batteries will need to be replaced/disposed of eventually (1 analysis), causing problems regarding re-cycling and safe disposal of chemicals and materials (2 evaluation). 	Level	Mark	Description	3	7–9	Demonstrates a comprehensive knowledge of the impact of using both fossil fuels and batteries. Evidence of analysis, including several advantages and disadvantages of using both technologies, and has made reference to both environmental issues and the impact on the user of the car.	2	4–6	Demonstrates a good knowledge of the impact of using either fossil fuels and/or batteries. Evidence of analysis, including some advantages and disadvantages of using either technology, and has made a brief reference to both environmental issues and the impact on the user of the car.	1	1–3	A limited level of detail given. Only advantages or disadvantages of using one technology given, with very little analysis or evaluation, or both technologies discussed very briefly.	0	0	Nothing of relevance or no response.	9 marks	AO3
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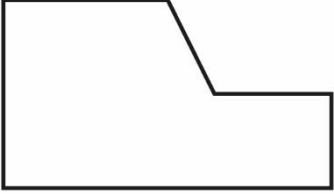

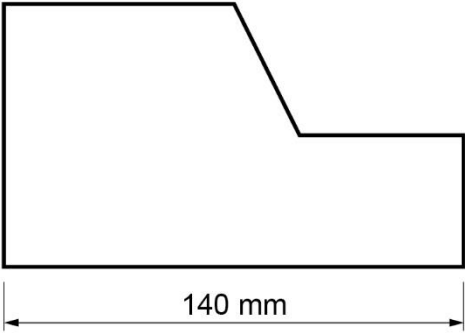
	<p>Ease of use:</p> <ul style="list-style-type: none"> • Petrol stations more numerous than re-charging points (1 analysis), so less danger of running out of a power source (1 evaluation). • Batteries need constant re-charging (1 analysis) which results in inconvenience for a driver, and can waste a lot of time (2 evaluation). • Limited range for battery-powered cars (1 analysis) which may mean getting stranded, and means making more stops to re-charge (2 evaluation). • Filling a car with petrol is much quicker than charging a battery (1 analysis), so less time wasted when stopped and leads to shorter overall journey times (2 evaluation). • Batteries can be charged-up at home (1 analysis), which will save time and money, and be more convenient for a driver (2 evaluation). 		
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Qu	Part	Marking Guidance	Total marks	AO
8	1	<p>3 marks for AO3 (analyse).</p> <p>Award 1 mark for each simple, correct and relevant statement given.</p> <p>Indicative content:</p> <ul style="list-style-type: none"> • CRF is very strong. • Very rigid material. • A light material. • Low weight to volume, low density. • Can be moulded/formed into complex shapes. • Can have a variety of surface finishes applied. • Aesthetically pleasing to look at. • No joints needed for frame members. • Corrosion resistant <p>Note: Generic or very vague responses eg quick, easy, cheap are not to be credited.</p>	3 marks	AO3
8	2	<p>4 marks for AO2 (application of knowledge and understanding).</p> <p>Award 1 mark for the correct answer: £54.74 (Maths mark)</p> <p>Award 1 mark for evidence of calculation of labour: $12.6 \times 40/60 = 8.40$ (Maths mark)</p> <p>Award 1 mark for evidence of calculation of cost of spokes: $0.58 \times 28 = 16.24$ (Maths mark)</p> <p>Award 1 mark for evidence of collection of data from the table: Shown through the working eg the spoke calculation or addition of the other costs. (Maths mark)</p>	4 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO												
9	1	<p>2 marks for AO2 (application of knowledge and understanding).</p> <p>Award 1 mark for rounding to 1 d.p.: 332.4 (Maths mark)</p> <p>Award 1 mark for calculation: $25\,570 \times .013 = 332.41$ (Maths mark)</p>	2 marks	AO2												
9	2	<p>4 marks for AO2 (application of knowledge and understanding).</p> <p>Award:</p> <ul style="list-style-type: none"> • 1 mark for labelling vertical axis (Maths mark). • 1 mark for numbering vertical axis (Maths mark). • 1 mark for accurately drawing bars or lines on the grid (Maths mark). • 1 mark for labelling each bar or line (Maths mark). <p>Accept:</p> <table border="1"> <caption>Energy Sources Data</caption> <thead> <tr> <th>Energy Source</th> <th>Percentage (%)</th> </tr> </thead> <tbody> <tr> <td>Coal</td> <td>38</td> </tr> <tr> <td>Gas</td> <td>23</td> </tr> <tr> <td>Renewable</td> <td>25</td> </tr> <tr> <td>Nuclear</td> <td>10</td> </tr> <tr> <td>Oil</td> <td>4</td> </tr> </tbody> </table>	Energy Source	Percentage (%)	Coal	38	Gas	23	Renewable	25	Nuclear	10	Oil	4	4 marks	AO2
Energy Source	Percentage (%)															
Coal	38															
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Qu	Part	Marking Guidance	Total marks	AO
10	1	<p>1 mark for AO1a (knowledge).</p> <p>Correct answer:</p> <p>A $R_t = R_1 + R_2$</p>	1 mark	AO1a
10	2	<p>2 marks for AO2 (application of knowledge and understanding)</p> <p>Award 1 mark for correct answer:</p> <p>18 (Maths mark)</p> <p>Credit if units not shown. Accept R, ohms or Ω.</p> <p>Award 1 mark for showing evidence of changing subject of equation:</p> <p>$A = 100 - 82$, or $A = R_t - 82$ (Maths mark)</p>	2 marks	AO2

Qu	Part	Marking Guidance	Total marks	AO
11		<p>1 mark maximum for AO1a (knowledge) and 5 marks maximum for AO2 (application of knowledge and understanding).</p> <p>Award:</p> <ul style="list-style-type: none"> • 1 mark for plan view same length as front view and in line. • 1 mark for both detail lines in correct place:   <ul style="list-style-type: none"> • 1 mark for side view same height as front view and in line. • 1 mark for detail line in correct place:  <ul style="list-style-type: none"> • 1 mark for dimension line drawn with regard to convention:  <ul style="list-style-type: none"> • 1 mark for correctly labelling both views as 'plan view' and 'side view'. 	6 marks	AO1a and AO2

		(Accept plan elevation and side elevation) (AO1a).		
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