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# GCSE ENGINEERING

48501  
Mark scheme

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4850  
June 2014

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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 Assessment Writer.

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](http://aqa.org.uk)

Question	Part	Sub Part	Marking Guidance	Mark	Comment
1	a		<p><b>In the spaces below, correctly describe the function of each labelled part:</b></p> <p><b>Crank/Pedal assembly:</b> Answers such as:</p> <ul style="list-style-type: none"> <li>• Move the bike forward/provide drive</li> <li>• Transfer of motion</li> <li>• To convert power from the pedals to the chain</li> <li>• To provide a means of housing a range of sprocket sizes</li> <li>• Crank arms provide leverage to reduce effort required</li> <li>• Gives a connection between the pedals and the drive/rear wheel</li> <li>• Is positioned so as to allow the user to apply force using their body weight through the pedals</li> </ul> <p><b>[1 mark per point made Max 2]</b></p> <p><b>Handle Bars:</b> Answers such as:</p> <ul style="list-style-type: none"> <li>• Allows the user to steer the bike</li> <li>• To house the grips</li> <li>• To accommodate the gear shifters</li> <li>• To house the brake levers</li> <li>• Gives the user support/balance whilst riding the bike</li> </ul> <p><b>[1 mark per point made Max 2]</b></p> <p><b>Brake System:</b> Answers such as:</p> <ul style="list-style-type: none"> <li>• Allows the user to apply pressure to the brake lever.</li> <li>• Stop/slow down the bike</li> <li>• Transfers pressure from the lever to the caliper</li> <li>• Both front and rear brakes to allow greater stability when braking in different situations</li> </ul>	6	

Question	Part	Sub Part	Marking Guidance	Mark	Comment
			<ul style="list-style-type: none"> <li>Creates tension in a cable in order to apply friction to brake pads.</li> </ul> <p><b>[1 mark per point made Max 2]</b></p>		
1	b	i	<p><b>Name a suitable <b>specific</b> material for one of the following</b></p> <p><b>Wheel rims</b>  <b>Wheel spokes</b>  <b>Wheel hubs</b></p> <p>Answers such as:</p> <ul style="list-style-type: none"> <li>Aluminium</li> <li>Aluminium alloy</li> <li>Composite such as carbon fibre or carbon Kevlar</li> <li>Thermoset Polymers</li> <li>Steel or steel alloys</li> <li>Titanium</li> </ul> <p><b>[1 mark]</b></p>	1	No generic terms such as metal, composite or plastic.
1	b	ii	<p><b>Explain why the material you have chosen in part Q1(b)(i) would be suitable for a bicycle wheel.</b></p> <p>Explanation including two points such as:</p> <ul style="list-style-type: none"> <li>Can be fabricated/formed into complex shapes</li> <li>Correct reference to chosen material properties such as lightweight/durable/resistant to weather</li> <li>A range of finishes can be applied</li> <li>Good strength/stiffness as a material property</li> </ul> <p><b>[1 mark per point made Max 2]</b></p>	2	
1	b	iii	<p><b>Identify a suitable material for the handlebar grips.</b></p> <p>Answers such as:</p> <ul style="list-style-type: none"> <li>Rubber (synthetic or natural)</li> </ul>	1	Don't accept Nylon, Thermoset or thermoplastic or generic materials.

Question	Part	Sub Part	Marking Guidance	Mark	Comment
			<ul style="list-style-type: none"> <li>• Neoprene</li> <li>• Elastomer</li> <li>• Polymer</li> <li>• Polyurethane tape</li> <li>• Silicon</li> </ul> <b>[1 mark]</b>		Don't accept 'grip tape' or 'Foam'
1	b	iv	<p><b>Explain why the material chosen in Q1(b)(iii) would be suitable for the handlebar grips.</b></p> <p><b>Accept suitable responses within the context of the material stated</b> Explanation including two points such as:</p> <ul style="list-style-type: none"> <li>• Easily moulded/shaped</li> <li>• Durable</li> <li>• Comfort</li> <li>• Grip</li> <li>• Resistant to moisture/sweat</li> <li>• Can be personalised/coloured</li> <li>• Mention of ergonomics or anthropometrics</li> </ul> <b>[1 mark per point made Max 2]</b>	<p>2</p> <p><b>6 MARKS</b></p>	
1	c		<p><b>Modern bicycle frames are increasingly manufactured using composite materials. Explain the advantages/disadvantages of using composites over traditional materials.</b> <b>Quality of Written Communication will be assessed in your answer.</b></p> <p>Up to 3 marks available for technical content such as:</p> <p>advantages</p> <ul style="list-style-type: none"> <li>• Lightweight</li> </ul>	6	

Question	Part	Sub Part	Marking Guidance	Mark	Comment
			<ul style="list-style-type: none"> <li>• High strength to weight ratio</li> <li>• Composites can be moulded/laid-up into complex shapes</li> <li>• Composites can be constructed to allow maximum strength in certain planes/axis (compression/tension)</li> <li>• Decorative/aesthetically pleasing</li> <li>• Self-finishing</li> </ul> <p>disadvantages</p> <ul style="list-style-type: none"> <li>• Time consuming to manufacture</li> <li>• Expensive</li> <li>• Higher level of skill required to manufacture</li> <li>• More difficult to repair if damaged</li> <li>• Cannot be recycled</li> </ul> <p><b>[MUST discuss both adv <u>and</u> DisAdv. 1 mark per point up to a maximum 2 marks from adv and 2 marks from disadv. Max 3]</b></p> <p><b>plus</b></p> <p><b>Up to 3 marks available for command of English.</b></p> <ul style="list-style-type: none"> <li>• <b>Some attempt made (1)</b></li> <li>• <b>Logical, structured answer possibly with some punctuation and grammar inaccuracies. (2)</b></li> </ul> <p><b>Technically correct and well punctuated in good flowing English (3)</b></p>		

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2			<p><b>Figure 2 shows a bicycle which is electrically powered. Using notes and sketches in the space below, describe how an electrically powered bike is controlled.</b></p> <p>Sketches and notes detailing information such as –</p> <ul style="list-style-type: none"> <li>• Method of control ie. Lever, slide switch, button</li> <li>• Acceleration</li> <li>• Braking</li> <li>• Speed control</li> <li>• Use of battery</li> <li>• Motor/method of drive</li> <li>• Steering</li> <li>• braking</li> </ul> <p><b>(0-2) basic sketch showing method of control with simple labelling of components</b>  <b>(3-4) sketch showing feasible solution accompanied by explanatory notes</b>  <b>(5-6) detailed, clear sketches of a realistic solution with notes which adequately explain the candidates idea with full system shown</b></p> <p><b><u>[If no mention of electrical system then max 4 marks]</u></b></p>	6	Do not award marks for reference to an engine

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	a		<p><b>The table below shows equipment which may typically be used in an Engineering workshop. Complete the table.</b></p> <p>Accept the following:</p> <p>Equipment Name -</p> <ul style="list-style-type: none"> <li>• Allow any term including 'vernier'</li> <li>• Screw tap/Tap (first/taper/2nd or plug)</li> </ul> <p>Equipment Use –</p> <ul style="list-style-type: none"> <li>• Any form of measuring or measurement</li> <li>• Cutting an internal thread</li> </ul> <p><b>[1 mark for each MAX 4 marks]</b></p>	4	Do not allow 'caliper' or 'digital caliper'
3	b	i	<p><b>Name three risks to health when using a Centre Lathe. For each one suggest a suitable protective measure. Accept the following:</b></p> <p>2 marks available for each hazard and relevant protective measure.</p> <p>Answers such as:</p> <p>Hazards:</p> <ul style="list-style-type: none"> <li>• Swarf/debris flying out/away from the work piece</li> <li>• Sharp edges/trapping hands/fingers</li> <li>• Loose hair/clothing/jewellery</li> <li>• Chuck key flying from the chuck</li> <li>• Work piece coming loose</li> <li>• Coolant/cutting fluid</li> </ul> <p>Other relevant hazards</p>	6	

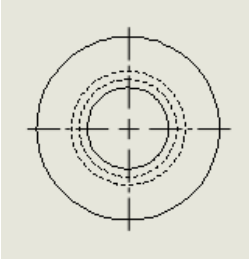


		<p>Protective measures:</p> <ul style="list-style-type: none"> <li>• Wear safety goggles/correct PPE</li> <li>• Ensure that the Lathe safety guard is in place</li> <li>• Tie Long hair back/remove jewellery</li> <li>• Ensure that safety checks are carried out before starting the lathe</li> <li>• Double check tightening of the work piece before and periodically during machining</li> </ul> <p>Other relevant protective measures</p> <p><b>[1 mark for each correct hazard and 1 mark for associated protective measure. Up to 6 Marks]</b></p>		
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Question	Part	Sub Part	Marking Guidance	Mark	Comments												
4	a		<p><b>Using standard conventions, add two dimensions to the drawing below.</b></p> <p>Correct dimensions (125, 12, 3 or 6).  <b>[1 mark for each Max 2]</b></p> <p>1 mark for each of the following (Max 2)</p> <ul style="list-style-type: none"> <li>• Leader lines</li> <li>• Solid arrow heads</li> <li>• Dimension centered above line</li> <li>• Diameter symbol</li> </ul> <p><b>[1 mark for each. Max 4 marks]</b></p>	4													
4	b		<p><b>The table below lists 6 major operations to manufacture a brake lever. Complete the table by inserting the identification letter in the correct box. Choose from letters A to K</b>  <b>Accept words and/or letters where correct</b>  <b>[1 Mark for each correct answer MAX 10 marks]</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Order</th> <th>Operation</th> <th>Tools/Equipment</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Make the pattern</td> <td>Coping/tenon saw, marking and measuring equipment, Rasp, glass paper L</td> <td style="text-align: center;">E</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Cast the blank lever</td> <td style="text-align: center;">D</td> <td style="text-align: center;">H</td> </tr> </tbody> </table>	Order	Operation	Tools/Equipment	Description	1	Make the pattern	Coping/tenon saw, marking and measuring equipment, Rasp, glass paper L	E	2	Cast the blank lever	D	H	10	
Order	Operation	Tools/Equipment	Description														
1	Make the pattern	Coping/tenon saw, marking and measuring equipment, Rasp, glass paper L	E														
2	Cast the blank lever	D	H														

			<b>3</b>	Machine the lever to correct size and tolerances	<b>G</b>	<b>A</b>		
			<b>4</b>	Make holes for brake cable and ventilation	<b>I</b>	<b>Secure workpiece in vice and drill holes M</b>		
			<b>5</b>	Deburr holes	<b>B</b>	<b>J</b>		
			<b>6</b>	Finish surface	<b>C</b>	<b>f</b>		

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	a		<p>Draw the section view, AA as shown in figure 7 below.</p> <div style="text-align: center;"> </div> <ul style="list-style-type: none"> <li>• 1 mark for each of the following:</li> <li>• Correct shape</li> <li>• Show cross hatching</li> <li>• Labelling Section A-A</li> <li>• Drawn in correct position/orientation</li> </ul> <p><b>[3 marks Max]</b></p>	3	

<p><b>5</b></p>	<p><b>b</b></p>	<p><b>Draw the Plan view of figure 8.</b></p> <ul style="list-style-type: none"> <li>• Correct circular shape/position</li> <li>• Hidden detail represented by dashed lines(2 circles as in example below)</li> <li>• Solid edges shown by solid lines</li> <li>• Centre lines</li> </ul>  <p><b>[4 marks max]</b></p>	<p><b>4</b></p> <p><b>[TOTAL 7 MARKS]</b></p>	
<p><b>6</b></p>	<p><b>a</b></p>	<p><b>Explain why steel is hardened.</b></p> <p>Accept answers such as:</p> <ul style="list-style-type: none"> <li>• Increases the wear resistance</li> <li>• Increases abrasion resistance/less easy to scratch</li> <li>• Greater durability</li> <li>• More suited to a range of applications</li> <li>• Increases usefulness for given applications</li> <li>• Relatively low cost material can be used in place of more expensive ones</li> </ul> <p><b>[1 mark per correct statement. 2 marks Max] Metals can be treated in order to change their material properties.</b></p>	<p><b>2</b></p>	

6	b	i	<p><b>Give one disadvantage of hardening steel.</b></p> <p>Accept answer such as:</p> <ul style="list-style-type: none"><li>• Material becomes brittle</li><li>• Labour intensive</li><li>• Harder to shape/bend or form</li></ul> <p><b>[1 mark for a correct statement. 1 mark Max]</b></p>	1	
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Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	b	ii	<p>Describe the process of case hardening low carbon steel.</p> <p>Answers should include such as:</p> <ul style="list-style-type: none"> <li>• Material is heated using a gas torch/oven</li> <li>• Material becomes cherry red in colour</li> <li>• Material is added/introduced to a Carbon rich environment/carbon is added</li> <li>• Material reheated/dwell time</li> <li>• Above steps repeated as necessary to ensure correct level of hardness</li> <li>• Material is finally quenched/rapidly cooled</li> <li>• Testing</li> </ul> <p>[1 mark for each correct statement. MAX 3 marks of process described does not include some form of carbon addition. 5 marks Max]</p>	<p>5</p> <p>[TOTAL 8 MARKS]</p>	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
7			<p><b>Due to advances in modern technology, electrically assisted bicycles have become more popular.</b></p> <p><b>Describe the environmental effects of using electrically assisted bicycles.</b></p> <p><b>Accept the following:</b></p> <ul style="list-style-type: none"> <li>• <b>Less traffic/congestion due to increased use of bicycles in Cities/Towns</b></li> <li>• <b>More pollution through manufacture processes</b></li> <li>• <b>Increased number of components linked to use of resources</b></li> <li>• <b>Use of fossil fuels to generate electricity</b></li> <li>• <b>Less CO2 emissions from traffic</b></li> <li>• <b>Less pollution as an alternative to cars</b></li> <li>• <b>Production of electricity contributes to global warming/CO2 emissions</b></li> <li>• <b>Use of energy when charging</b></li> <li>• <b>Recyclability issues related to battery disposal</b></li> <li>• <b>Negative effects on the environment from battery manufacture</b></li> <li>• <b>Invasion of open space within Towns/Cities in order to store/re-charge</b></li> </ul> <p><b>[1 mark for each statement/discussion point. Accept other valid points related to Environment. Max 3]</b></p>	<p><b>3</b></p> <p><b>[TOTAL 3 MARKS]</b></p>	



Question	Part	Sub Part	Marking Guidance	Mark	Comments
8	a		<p>A client asks a designer to design a bicycle car rack. Suggest three pieces of information the designer needs before he can begin work.</p> <p>1 mark per point such as:</p> <p>Preferred:</p> <ul style="list-style-type: none"> <li>• Construction material</li> <li>• Colour</li> <li>• Finish</li> <li>• Range of dimensions i.e. Vehicle size/range suitable for</li> <li>• Price</li> <li>• Storage capacity</li> <li>• Method of attachment</li> <li>• Weight of bike rack</li> </ul> <p>[1 mark per point made Max 3]</p>	3	Don't accept 'Aesthetics' – need to be more specific.

<p><b>8</b></p>	<p><b>b</b></p>	<p><b>Using the three pieces of information you have given in part 8(a), add details below to produce an initial specification for the bicycle car rack.</b></p> <p><b>Full marks for answers containing information such as:</b></p> <ul style="list-style-type: none"> <li>• <b>Suitable specification point for a bike rack</b></li> <li>• <b>Development of client information</b></li> <li>• <b>Inclusion of further relevant detail</b></li> <li>• <b>Clear intentions stated</b></li> </ul> <p><b>[Award marks even if not related to previous item. 2 marks per specification point Max 6]</b></p>	<p><b>6</b></p> <p><b>[total 9 marks]</b></p>	<p><b>[TOTAL FOR SECTION B 48 MARKS]</b></p> <p><b>[total marks for paper 75]</b></p>
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