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# General Certificate of Secondary Education **Engineering (Double Award)**

48501

Mark scheme

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4850

June 2013

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Version/Stage: Final

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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 1

Question	Part	Sub Part	Marking Guidance	Mark	Comments
1	a	i	<p>Select from answers such as:</p> <p>Deck</p> <ul style="list-style-type: none"> <li>• Plywood</li> <li>• Laminated timber</li> <li>• Maple</li> <li>• Fibre Glass (GRP)</li> <li>• Or any other suitable materials</li> </ul> <p>Wheel</p> <ul style="list-style-type: none"> <li>• Polyurethane</li> <li>• Steel skate wheel [early boards]</li> <li>• Nylon</li> <li>• Or any other suitable materials</li> </ul> <p>Truck</p> <ul style="list-style-type: none"> <li>• Aluminium</li> <li>• Aluminium alloy</li> <li>• Steel axles</li> <li>• Or any other suitable materials</li> </ul>	3	<p>Do NOT accept Veneer except when a specifically named material (e.g. Maple Veneer)</p> <p>Do NOT accept generic materials (wood/Plastic/metal)</p>
1	a	ii	<p>Select from descriptions such as:</p> <p>Property of deck material should be:</p> <ul style="list-style-type: none"> <li>• flexible</li> <li>• tough</li> <li>• non slip</li> <li>• springy</li> </ul>	6	<p>Many of these properties are shared. Therefore description statements should be judged on their individual merits and some repetition <b>not</b></p>

		<ul style="list-style-type: none"> <li>• light weight</li> </ul> <p>(1 mark for each – Max 2 marks)</p> <p>Property of wheel material should be:</p> <ul style="list-style-type: none"> <li>• hard wearing</li> <li>• impact absorbing</li> <li>• surface gripping</li> <li>• mouldable resilient</li> <li>• abrasion resistant</li> </ul> <p>(1 mark for each – Max 2 marks)</p> <p>Property of truck material should be:</p> <ul style="list-style-type: none"> <li>• strong (if placed in context)</li> <li>• lightweight</li> <li>• corrosion resistant</li> <li>• rigid</li> <li>• suitable for casting</li> </ul> <p>(1 mark for each – Max 2 marks)</p>		<p>automatically penalised.</p> <p>Award 1 mark per stated property up to 2 marks. Or, where 1 property is stated and then justified apply 1 mark for property and 1 for justification.</p>
1	b	<p>An appropriate answer should contain features such as:</p> <ul style="list-style-type: none"> <li>• bolt/set screw/CSK/machine screw</li> <li>• nut</li> <li>• locking device ... spring washer/nyloc etc.</li> <li>• counter boring/countersinking</li> <li>• appropriate labelling of added parts</li> <li>• suitable material for the components as response e.g. Stainless Steel. Accept Low Carbon Steel if includes appropriate finish.</li> </ul> <p>1 mark per point up to max</p>	5	<p>Wood screws or self-tappers are not an acceptable solution. Where materials are listed, do not accept Copper/Brass or polymer screws</p>

1	c	<p>To be awarded according to the following bands:</p> <p>7-8 marks –Candidate has covered all three stages of the casting process in detail  Preparation  pouring  finishing  (with good use of technical language)</p> <p>4-6 – Does not cover all three stages but with some use of technical language.  Or may cover all three stages but lacks sufficient detail</p> <p>1-3 – Part of the process covered with unclear description.</p>	8	<p>Comments on preparation could relate to – Pattern design and production, features of the mould inc. materials used.</p> <p>Comments on Pouring could relate to heating the pour material, reference to runner/riser, cooling, safety (PPE).</p> <p>Comments on finishing could relate to – Breaking out, fettling, surface finish, removal of sprues/runners/excess material.</p>
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1	d	<p>Up to 3 marks available for technical content such as:</p> <p>What the rider intends to do with the board.</p> <p>Is it for points such as:</p> <ul style="list-style-type: none"> <li>• competition or pleasure use?</li> <li>• what surfaces will it run on?</li> <li>• will it be jumped excessively?</li> <li>• does it need to be light and fast or heavy and robust?</li> <li>• price range?</li> <li>• dimensions?</li> <li>• weight?</li> <li>• Target user</li> <li>• or any other relevant factor.</li> </ul> <p style="text-align: right;">1 mark per relevant point made up to max of 3</p> <p><b>Plus</b></p> <p>Up to 3 marks available for command of English</p> <ul style="list-style-type: none"> <li>• some comments offered (1 mark)</li> <li>• Logically structured answer, possibly some punctuation and grammar inaccuracies. (2 marks)</li> <li>• Well explained, technically correct and well punctuated in good flowing English. (3 marks)</li> </ul>	6	
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## Question 2

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	a		<p>Notes indicating points such as:</p> <ul style="list-style-type: none"> <li>• forming patterns</li> <li>• adhesives</li> <li>• cross-plying</li> <li>• clamping</li> <li>• vacuum bagging</li> <li>• use of cauls</li> <li>• other technically correct alternatives acceptable.</li> </ul> <p style="text-align: right;">1 mark per relevant point made up to max</p>	2	
2	b		<p><b>Modification of properties</b>                      Use of additional materials such as:</p> <ul style="list-style-type: none"> <li>• Fibreglass</li> <li>• Kevlar</li> <li>• Bamboo</li> <li>• Carbon fibre</li> <li>• Aluminium</li> <li>• Acrylic</li> <li>• Abrasive materials inc. Gripper tape</li> <li>• Stainless steel</li> <li>• Nylon</li> </ul> <p style="text-align: right;">1 mark per relevant material up to max of 2 marks</p> <p><b>Each material backed up with a suitable explanation such as:</b></p> <ul style="list-style-type: none"> <li>• The inclusion of Fibreglass / Kevlar / Carbon fibre / Aluminium would greatly increase the strength / durability / weight of the deck.</li> <li>• The inclusion of Acrylic will add to the aesthetic visual quality of the deck. Light transfer or illumination effects.</li> </ul>	6	

		<ul style="list-style-type: none"> <li>• The inclusion of Bamboo / Nylon will increase the flexibility of the deck to aid control and absorb landing impact.</li> <li>• The use of stainless steel on the underside of the board to be used as grinding strips/provide additional stiffness/rigidity.</li> </ul> <p>Good explanation offered per material 2 marks Simplistic or one word answer 1 mark.</p> <p style="text-align: right;">(4 marks)</p>		
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### Question 3

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	a		<p>(A) Integrated circuit/555 Timer/micro-controller/PIC/Micro Chip/Controller            (B) Capacitor (electrolytic)            (C) Motor            (D) Variable resistor</p>	4	
3	b	i	<p>Add relevant components to the drawing such as:</p> <ul style="list-style-type: none"> <li>• Motor</li> <li>• Motor pulley / cog wheel</li> <li>• Drive wheel pulley / cog wheel</li> <li>• Drive belt / chain</li> <li>• A suitable gear train</li> <li>• Worm and wheel</li> <li>• Any functional combination</li> </ul> <p>1 mark available for correct labelling of components 1 mark per relevant point up to max</p>	3	
3	b	ii	<p>Explanation relevant to solution offered covering such points as:</p> <ul style="list-style-type: none"> <li>• Good weight distribution</li> <li>• Length of drive system required</li> <li>• Type of drive system employed</li> <li>• Protection of motor</li> <li>• Maintenance access</li> <li>• Not impeding the deck/user</li> </ul> <p>1 mark per relevant point made up to max</p>	3	
3	b	iii	<p>Description of <b>operation</b> referring to points such as:</p> <ul style="list-style-type: none"> <li>• Acceleration (max 2 marks for a detailed response which may include method of control. 1 mark for input device only such as on/off switch)</li> </ul>	5	

			<ul style="list-style-type: none"> <li>• Braking (max 2 marks for a detailed response which may include a method of safety cut-off if the user falls off. 1 mark for simple on/off mechanism.)</li> <li>• 1 mark for appropriate technical terms/ labelling</li> </ul>		
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### Question 4

Question	Part	Sub Part	Marking Guidance	Mark	Comments																								
4	a	i	<ul style="list-style-type: none"> <li>Use of Projection lines (1 mark)</li> <li>Use of Rabbat line (1 mark)</li> <li>Producing a plan view (1 mark)</li> <li>Plan view drawn in the correct position (1 mark) (max 3)</li> </ul>	3																									
4	a	ii	<ul style="list-style-type: none"> <li>Insert one dimension (1 mark)</li> <li>Use of appropriate dimension standards (2 marks)</li> </ul>	3	Dimension standards such as leader lines, arrow heads, dimension written above the line, diameter symbol																								
4	a	iii	<ul style="list-style-type: none"> <li>Add hidden detail to denote the hook and where the handle penetrates the tool in the plan. (1 mark)</li> </ul>	1	Such as tolerances, centre lines, diameter symbol.																								
4	b		<table border="1"> <thead> <tr> <th>Order</th> <th>Operation</th> <th>Tools and Equipment</th> <th>Description of task carried out.</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Cut out the blank for the tool.</td> <td>Stamping press and die.</td> <td>Outline of tool and required hole cut out in one action. <b>C</b></td> </tr> <tr> <td>2</td> <td>De-burr the blank</td> <td>Angle grinder fitted with a flexible abrasive flap wheel.</td> <td>Rough edges produced during forming are removed. <b>A</b></td> </tr> <tr> <td>3</td> <td>Hardening</td> <td>Gas / air or oxy-acetylene torch &amp; water bath. <b>D</b></td> <td>Heat hooked end of tool until red, hot and quench.</td> </tr> <tr> <td>4</td> <td>De-scaling</td> <td>File emery cloth polishing wheel. <b>E</b></td> <td>Remove layer of oxide formed by heating and create a shiny surface.</td> </tr> <tr> <td>5</td> <td>Tempering</td> <td>A controllable heat Source.</td> <td>Heat hooked end to a specific temperature and quench. <b>B</b></td> </tr> </tbody> </table>	Order	Operation	Tools and Equipment	Description of task carried out.	1	Cut out the blank for the tool.	Stamping press and die.	Outline of tool and required hole cut out in one action. <b>C</b>	2	De-burr the blank	Angle grinder fitted with a flexible abrasive flap wheel.	Rough edges produced during forming are removed. <b>A</b>	3	Hardening	Gas / air or oxy-acetylene torch & water bath. <b>D</b>	Heat hooked end of tool until red, hot and quench.	4	De-scaling	File emery cloth polishing wheel. <b>E</b>	Remove layer of oxide formed by heating and create a shiny surface.	5	Tempering	A controllable heat Source.	Heat hooked end to a specific temperature and quench. <b>B</b>	5	The code letter or the written descriptor are equally acceptable answers.
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### Question 5

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5			<p>Select two from the list of new technologies such as:</p> <ul style="list-style-type: none"> <li>• CNC machining processes</li> <li>• Computer Aided Design</li> <li>• Automated Production</li> <li>• Computer Aided Manufacture (when a specific application is given ie Laser Cutter)</li> <li>• Robotics (when a specific application is given i.e. 6-axis spray robot)</li> <li>• Or any other suitable process</li> </ul> <p style="text-align: right;">1 mark for each relevant answer max 2</p> <p>Each chosen example backed up with an appropriate description of the benefit gained such as:</p> <ul style="list-style-type: none"> <li>• A CNC machining system attached to a router or spindle drum sander could trim outlines and edge finish the decks. <span style="float: right;">(1 mark)</span></li> <li>• CAD system could be used for testing the performance of materials and components at the design stage, without the need to build prototypes for initial testing. <span style="float: right;">(2 marks)</span></li> <li>• Or other appropriate answer <span style="float: right;">Simplistic answer 1 mark</span></li> </ul>	6	1 mark awarded for the benefit of the technology, a further mark for justification of the benefit.

### Question 6

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6			<p>Select two from the list of Artwork techniques such as:</p> <ul style="list-style-type: none"> <li>• Transfers/stickers</li> <li>• Stencils</li> <li>• Screen printing</li> <li>• Laser engraving</li> <li>• Inlay</li> <li>• Spray painting/airbrush</li> <li>• Or similar</li> </ul> <p style="text-align: right;">1 mark per relevant answer max 2</p> <p>Each chosen technique backed up with a description of the chosen process such as:</p> <ul style="list-style-type: none"> <li>• An entire art work design could be applied in the production stage of the deck by including a design transfer in with the laminates prior to bonding. (2 marks)</li> <li>• An artwork design could be quickly and accurately applied by spraying on a background coat of paint and adding detail by over spraying through stencils cut to specific designs. (2 marks)</li> <li>• Use a spray gun (1 mark)</li> </ul> <p style="text-align: right;">Simplistic answer 1 mark</p>	6	