



MARKING SCHEME

**LEVEL 1 AND LEVEL 2 AWARD IN
ENGINEERING
9793/01**

SUMMER 2017

INTRODUCTION

This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

Question	Answer	Marks									
1. (a)	<p>1 mark for each correct answer</p> <p>Answer:</p> <table border="1"> <thead> <tr> <th>Component</th> <th>material</th> <th>classification</th> </tr> </thead> <tbody> <tr> <td>Grip</td> <td>Polyvinyl chloride (PVC)</td> <td><i>Thermoplastic</i></td> </tr> <tr> <td>shaft</td> <td>Chrome plated steel</td> <td><i>Ferrous</i></td> </tr> </tbody> </table>	Component	material	classification	Grip	Polyvinyl chloride (PVC)	<i>Thermoplastic</i>	shaft	Chrome plated steel	<i>Ferrous</i>	2
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Grip	Polyvinyl chloride (PVC)	<i>Thermoplastic</i>									
shaft	Chrome plated steel	<i>Ferrous</i>									
(b)	<p>Answer:</p> <p>Up to 2 marks available</p> <p>Property 1-elasticity (1) Property 2- water proof (1)</p> <p>Correct reference to chosen material properties such as elasticity, available in a range of colours, lightweight, durable, resistant to weather, good strength to weight ratio, stiffness as a material property and flexible.</p> <p>Or any other reasonable appropriate response.</p>	2									
(c) (i)	<p>Up to 2 marks available</p> <p>Increase the cross sectional area of the tube/increase wall thickness Accept and reference to any appropriate heat treatment process.</p> <p>Or any other reasonable appropriate response.</p>	2									
(ii)	<p>Up to 2 marks available</p> <p>The chromed layer can be decorative/ aesthetic (1), provide corrosion resistance (1), ease cleaning (1), or increase surface hardness (1).</p> <p>Or any other reasonable appropriate response.</p>	2									

Question	Answer	Marks
(d)	<p>Up to 6 mark available Indicative content</p> <p>3 marks for use of sketching</p> <p>Reference to equipment used (1) Reference to operation(1) Reference to bending(1)</p> <p>Test could include: bending the shaft material using weights and the distance measured against metal rule.</p> <p>Example answer As each individual weight is added, the shaft sample should be reviewed and comments recorded. As the sample weight reaches 1kg a reading will be taken against a metal rule.</p>	6
(e) (i)	<p>Up to 2 marks available</p> <p>Reason 1 - hard wearing and tough (1) Reason 2 - cheap to manufacture (1)</p> <p>Or any other reasonable response.</p>	2
(ii)	<p>Up to 2 marks available</p> <p>Example answer: A metal made by combining two or more metallic elements (1), especially to give greater strength or resistance to corrosion (1).</p> <p>An alloy is a metal (parent metal) combined with other substances (alloying agents), resulting in superior properties such as; strength, hardness, durability, ductility, tensile strength and toughness.</p> <p>Accept - Mix, fuse, meld, combine with an explanation.</p> <p>Or any other reasonable appropriate response.</p>	2
(f)	<p>Up to 2 marks available</p> <p>Identifying precise product requirements. A detailed description of the design and materials used to manufacture a product.</p> <p>A statement which tells the designer exactly what the product must do and what the design requirements are. This ensures that the customer and designer understand each other before designing can begin.</p> <p>Or any other reasonable appropriate response.</p>	2

Question	Answer	Marks
(g)	<p>Up to 4 marks available</p> <p>Function (1) Size(1) Mass(1) Material(1)</p> <p>Points should be related to the design of the golf club.</p> <p>Or any other reasonable appropriate response.</p>	4
Total marks question 1		24

Question	Answer	Marks
2. (a)	<p>Up to 2 marks available</p> <p>Most drones do not operate using fossil fuels (1) meaning that they do not produce the high levels of CO₂ ,polluting the environment and depleting oil based fuels(1).</p> <p>Drones also offer a more environmentally friendly means of delivering products in both urban settings and rural areas. Flying in straight lines to the destination (1). Reducing road traffic (1).</p> <p>Example: A single, battery-powered drone traveling to bring your order versus large emissions/ polluting (1) delivery truck is a vast improvement when it comes to emissions and energy efficiency(1).</p> <p>Or any other reasonable appropriate response.</p>	2
(b)	<p>Up to 4 marks available</p> <p>Indicative content</p> <p>Unable to carry heavy items. (1)</p> <p>Package/ delivery theft(1). Hacking navigation / control systems (1). Drones being hit from the air (1).</p> <p>Unable to fly in adverse weather (1).</p> <p>Drones are small and can't carry large quantities (1). To deliver everything delivery companies will require large number of drones, increasing the inevitability they'd collide with each other (1).</p> <p>Or any other reasonable appropriate response.</p>	4
(c)	<p>Up to 4 marks available</p> <p>Development 1 power - New battery technologies (1) reduced size (1), increased power (1), longer battery life(1) lithium alloy etc.</p> <p>Development 2 navigation- use of global positioning systems (GPS) (1), Wi-Fi technology connectivity –wireless (1).</p> <p>Or any other reasonable appropriate response.</p>	4

Question	Answer	Marks
(d) (i)	<p>Up to 2 marks available</p> <p>Indicative content</p> <p>Use of CNC lathe (1) for turning propeller drive shaft (1) Use of CNC miller (1) for milling slots to locate components(1) Use of Laser Cutter (1) for cutting or engraving components (1) Use of CNC drill (1) to produce holes in the circuit board (1) Use of rapid prototyping machine(1) to model blades(1)</p> <p>Any appropriate CAM machine</p> <p>Or any other reasonable appropriate response.</p>	2
(ii)	<p>Up to 2 marks available</p> <p>One mark for identifying each benefit</p> <p>More consistent products (1) lower purchase price (1) Shorter order times (1) Better quality/accurate product (1) Customer satisfaction (1)</p> <p>Or any other reasonable appropriate response</p>	2
(iii)	<p>Up to 2 marks available</p> <p>Conversion from 2D to 3D (1) for modelling (1) Quicker development time (1) through Simulation Easy to make modifications/edit/change (1) no paper hard copies (1)/computer data (1) Lower initial development costs (1) concurrent design processes (1) Easy storage of data/information and retrieval (1) interaction with databases (1)</p> <p>Accurately drawn (1) entry of accurate data or sizes (co–ordinates) (1)</p> <p>Or any other reasonable appropriate response</p>	2
Total marks question 2		16

Question	Answer	Marks
3. (a)	Up to 4 marks available Jacobs chuck / 3 jaw chuck / key chuck / chuck (1) clamp drill bit (1) Tap (1) Cutting internal threads (1)	4
(b)	Up to 2 marks available Lathe (1) turning (1) Accept any appropriate answers with reference to a process. Injection moulding, 3D printing, rotary head milling.	2
(c)	Up to 2 marks available Quickly fabricate/manufacture (1) a scale model (1) of a physical part/assembly using three dimensional CAD data (2). Manufactures models cheaply (1) Allows for quicker product development time(1) Or any other reasonable appropriate response.	2
(d)	Up to 2 marks available Feature 1 : drill guard (1) Feature 2: drill press vice, (1) finger claps (1) any suitable work holding device. Safety devices only.	2
(e) (i)	Up to 2 marks available Metric thread 12mm diameter (1), 1.25 pitch (1)	2
(ii)	Up to 2 marks available A section view is a view used on a drawing to show an area or hidden part (1) of an object by cutting away or removing some of that object (1). The cut line is called a “cutting plane” (1). Or any other reasonable appropriate response.	2

Question	Answer	Marks
(iii)	Up to 2 marks available Minimum size / allowance $52 - 0.75 = 51.25$ (1) Maximum size / allowance $52.0 + 0.75 = 52.75$ (1)	2
(iv)	Up to 4 marks available Hole length $27 - 10 = 17$ (1) Hole area $\pi \times 5 \times 5 = 78.5$ (1) Area x length $78.5 \times 17 = 1334.5$ (1) Volume 1334.5 mm^3 (1)	4
Total marks question 3		(20)