

Engineering

General Certificate of Secondary Education **4868**

Unit 3: Application of Technology

Mark Scheme for June 2010

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Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Question			Expected Answer	Mark	Additional guidance
1	(a)		<p>One mark for each correct link shown:</p> <p>Crane linked to Mechanical (1)</p> <p>Games console electrical and electronic (1)</p> <p>Container ship marine (1)</p> <p>Satellite navigation system telecommunications (1)</p>	[4]	
	(b)		<p>Responses MUST relate to one of the products given in part (a)</p> <p>One mark for an example of technology used in the product</p> <p>One mark for a benefit of using the stated technology in the product 3 x (1+1)</p> <p>For example:</p> <p><u>Crane</u> – steel alloy – greater strength</p> <p>Sensors, safer/ warns when becoming unstable</p> <p>Hydraulics, ease of lifting</p> <p><u>Games console</u> – wireless technology – allows users freedom from wires</p> <p><u>Container ship/satnav</u> – gps -navigation benefits</p>	[6]	ECF for benefit if technology is incorrect but benefit is correctly referenced.
	(c)		<p>One mark for one of the following:</p> <p>Aeronautical, automotive, civil, computer, construction or process control, chemical. (1+1)</p>	[2]	

Question			Expected Answer	Mark	Additional guidance
2			<p>Annotate ✓ where marks are awarded. Total of 12 marks for sketches and notes showing an engineered product NOT A CAMERA. 4 marks for each of the following relating to the product shown in sketches and notes: Look for Structure and then Technologies and then Materials/Components. (not repeated from camera)</p> <p>Structure – maximum 4 (4) One mark can be awarded for sketch showing overall structure.</p> <p>Then additional marks for each structural feature identified, one more for explaining how a structural feature meets its purpose/reflects the technology used.</p> <p>Technology – maximum 4 (4) One mark for each named example of technology up to 4 marks. Alternatively additional mark for detail on how/why the correct technology(s) identified is used.</p> <p>Materials/components – maximum 4 (4) One mark for each named example of a material or component up to 4 marks. Alternatively additional mark for detail on how/why the correct material/component identified is used.</p>	[12]	<p>NOTE 1: be flexible. Some items could fall into more than one category – one mark only for each point, but allocate to advantage</p> <p>Annotate with ticks to show where marks awarded and Annotate REP all points repeated from the camera example. ie:</p> <p>electronic flash for light/night pictures, lens, lightweight, pressed Al, case, Lithium ion battery, compartment, USB port for fast transfer of pictures, DC jack in, for battery charging, LCD colour screen to view pictures, Infra-red remote receiver. view finder Accept transfer/import of data/video/music/ ring tones as expansion of 'connection to PC for the USB port' (which is a repeat and so not rewarded).</p> <p>NOTE 2: Some centres tutor candidates so many candidates responses will appear similar</p> <p>Do not reward generic materials e.g. plastic, metal but accept trade names, for example Perspex</p>

Question	Expected Answer	Mark	Additional guidance
3	<p>For each engineering process selected: Process 1 (see table below for examples) One mark for each of two correctly named tools/pieces of equipment. Two marks for describing safe working practice (2) Two marks for describing how to ensure quality (2) Process 2 As process 1 (2+2+2) Accept generic PPE if not in safety (1 mark only) Electrical safety in general 1 mark Visual checks (and of what)</p>	<p>[6] [6]</p>	<p>The table is intended to support rather than restrict. Look for creditable points across the response</p> <p>For safety allow reference to behaviour once (1 only)</p>
<p>PCB Etching Etching tank, tongs, Avoid contact with chemicals/spills Timing set correctly, fresh solution</p> <p>Powder coating Brazing Hearth, Fluidiser, Hooks, Tongs, Oven Avoid hot part contacting people/flammables. Ventilation Clean part carefully, ensure temp of metal not too high/low, avoid contact when wet, clean environment to cure/dry</p> <p>Riveting Rivet set, snap, ball pein/engineers hammer, file, pop-riveting pliers Clamp when drilling, remove swarf Correct size drill and rivets, cut length to correct size, apply even pressure. Drill second side as rivets put in.</p> <p>Soldering, Soldering iron, stand, damp sponge Work in well ventilated area (fume extract) Check flow, keep tip clean, trim legs.</p> <p>Turning Lathe, gouge, chisel, scraper, callipers check guards are in position, the work is securely held before switching on. Switch off when adjusting stand correctly Correct speed for piece, stand correctly, concentrate at all times. Work steadily and evenly.</p> <p>Welding Torch, gas cylinders, rods, transformer Check where fire extinguishers/exits are, Good ventilation, Adult supervision, check for leaks, flashback arrestors, flame-traps, cylinders upright, lift heavy equipment correctly, keep grease away from oxygen, Avoid hot parts contacting people/flammables/ gas cylinders. Protect from others eyes Ensure earth clamp in place. Adjust the flame carefully, even motion.</p>			<p>Do not accept materials, fluxes, chemicals, and finishing products.</p>

Question			Expected Answer	Mark	Additional guidance
			Note: Accept Aluminium Alloy but not rubber for all questions that require a modern material		
4	(a)		One mark for an example of a product that uses a modern material to reduce its weight. One mark for naming the material used. (1+1)	[2]	If product and material are transposed reward accordingly.
	(b)		One mark for one example of a product that uses a modern material to make it easier to use. One mark for naming the material used. (1+1)	[2]	If no product given do not reward material.
	(c)		One mark for an example of a product that uses a modern material to make it safer for the end user. One mark for naming the material used. (1+1)	[2]	Products can be rewarded if no material is given provided a modern material could potentially deliver that improvement.
	(d)		One mark for an example of a product that uses a modern material to make it safer for the workforce making it. One mark for naming the material used. (1+1)	[2]	
	(e)		For three marks the explanation should include reference to a product, a specific smart material (1) and its properties (1) that bring about a stated benefit (1). Nitinol shape memory alloy wire conducts electricity and also shrinks back to size when a specific temperature is reached so it can cut off the power to a kettle immediately when it boils. A DVD drive uses smart grease to make the tray slide in smoothly. Smart grease gets thicker when pressure is applied so it resists a larger pushing force more than a gentle one. Racing Bicycle uses carbon fibre to give the same strength with lighter weight frame. Lighter weight same strength A forehead thermometer/ bathwater temp indicator uses liquid crystals enclosed in a tough plastic film. This indicates the temperature without using poisonous mercury/child unfriendly electronic devices/moving parts.	[3]	

Question			Expected Answer	Mark	Additional guidance
	(f)		<p>Three marks for a clear explanation of how reducing the weight of a product has affected its impact on the environment</p> <p>For example: three marks for a link between reducing product weight and environmental impact with an example of a product.</p> <p>‘Specific car model now weighs less which reduces its fuel consumption and therefore emissions’</p> <p>Carbon fibre used in racing cars is more difficult to reuse/recycle than aluminium alloy.</p>	[3]	<p>This is the challenging part of the question.</p> <p>Two for limited response:</p> <p>For example:</p> <p>‘lighter products need less fuel to deliver them’</p> <p>One for simple statement/single word:</p> <p>For example:</p> <p>‘You can get more on a lorry’</p> <p>‘saves fuel’</p>

Question			Expected Answer	Mark	Additional guidance
5	(a)		One mark for each of two costs when CAD is introduced: NOT EQUIPMENT COSTS Eg staff training, installation, planning, setting up equipment (1+1)	[2]	
	(b)	(i)	Two marks for each of two benefits of CAD (accept generic), for example: Drawings can be easily modified Files can be exported to a CAM system saving storage space for files files can be shared with third parties (2+2)	[4]	Not faster or more accurate.
		(ii)	Two marks for a benefit specific to the end user, for example Efficient designs reduce cost/improve performance Safer products – tested for strength etc by program Customised products available at reasonable cost Improved products on sale quicker	[2]	One mark for reference to quality.
	(c)	(i)	Two marks for each of two generic benefits of using CAM What and how or why: For example in terms of consistency, precision, reduced setting up time between products/ tooling time. Improve productivity (24-7 working) Workforce reduction Single mark for simple stating a benefit, eg 'cheaper' without qualification (2+2)	[4]	
		(ii)	Two marks for a realistic reason CAM used in one-off production (accept generic) Direct from CAD - Shorter time to set up, prepare and process, precision to design, Reference to quicker production time Using existing equipment/time available on machine To see whether a product can be made using CAM	[2]	

Question			Expected Answer	Mark	Additional guidance
6	(a)		Three marks for a clear explanation of how control technology contributes to each advantage stated Ideally: making a relevant point, evidence/example and relating to the advantage.		Example required for full marks
		(i)	Improved reproducibility Once programmed, robots repeat the same actions. Human performance tends to vary through tiredness/distractions. Robots can monitor and adjust themselves (as wear occurs for example), or monitor process and adjust their settings to maintain quality.	[3]	Needs reference to programming for full marks
		(ii)	Increased rate of production Because robots can operate for expended periods without stopping so more can be made in the time. Robots can often carry out varied sequences of operations faster than humans, and faster than automated machinery needing components to be transported between operations.	[3]	Reduced start up time award one mark,
		(iii)	Reduced waste Because there are fewer rejects (1) due to improved accuracy and consistency (1), materials are not wasted (1).	[3]	
	(b)		Three marks for a clear explanation why robotics not used. Point, evidence/example, logical link. For example There are some tasks that are not suited to robotics, where space is limited such as in populating pcbs some components must be manually inserted. For simple repeated tasks such as bottling water, an automated production line gives all the above benefits. It does not need the flexibility of robotic equipment.	[3]	Not simple 'cost', justification is needed.

Question			Expected Answer	Mark	Additional guidance
7	(a)		<p>One mark for one of: gear train, machine screw or spring. (1)</p> <p>Two marks for correct description of main function of component (2)</p> <p>One mark for an example of the component in use. (1)</p> <p>One mark for one of: capacitor, diode, or resistor. (1)</p> <p>Two marks for correct description of main function of component (2)</p> <p>One mark for an example of the component in use. (1)</p>	[8]	One mark only for function if LED is referenced
	(b)		One mark for filter or reservoir. (1)	[1]	
	(c)		<p>Three marks for a clear explanation: (3)</p> <p>Making a point, evidence/example, relating</p> <p>They are `readily available from a range of suppliers so can hold less stock/change if problems.</p> <p>Standardising across their product ranges again reduces stock needed/ left at end of run – can be used elsewhere.</p> <p>Bought-in components saves cost of making in-house</p>	[3]	

Question			Expected Answer	Mark	Additional guidance
8	(a)		<p>The impact of automated production on engineered product quality</p> <p>Six marks for discussion following the guidance, ie:</p> <p>One mark for each of 3 relevant issues (to product quality or automated production) (3)</p> <p>Two marks for explaining each of two of the issues (why relevant) (2)</p> <p>One mark for a specific supporting example (must link both aspects) (1)</p> <p>Or</p> <p>Similar breadth and depth of response</p> <p>Expected responses will focus on how automation gives consistency/accuracy so as long as machines are set up precisely, all products will be within tolerance/tolerances can be tighter (improving average quality or overall quality).</p>	[6]	<p>While relevant points may relate to either product quality or automated production, the explanation must draw both together.</p> <p>Accept points on automated checking of equipment, products, materials etc.</p>
	(b)		<p>Note: this part builds on 8a, accept cross references.</p> <p>Six marks for discussion following the guidance, ie:</p> <p>One mark for each of 3 relevant issues (3)</p> <p>Two marks for explaining each of two of the issues (why relevant) (2)</p> <p>One mark for a specific supporting example (must link both aspects) (1)</p> <p>Or</p> <p>Similar breadth and depth of response</p> <p>Expected responses will focus on the cost of equipment and setting up against potential future increase in profits through reduced numbers of rejected/returned/faulty products or premium quality of products.</p>	[6]	<p>While relevant points may relate to finance, introducing technology or quality, the explanation must draw both together.</p>

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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