



Cambridge National

Engineering

Unit **R109**: Engineering materials, processes and production

Level 1/2 Cambridge National Award/Certificate in Engineering
Manufacturing

Mark Scheme for January 2018

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



All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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These are the annotations, (including abbreviations), including those used in scoris, which are used when Marking

Annotation	Meaning of annotation
	Blank page
	Vague
	Tick
	Noted but no credit given
	Unclear
	Repeat
	Benefit of doubt
	Cross
	Development
	Example/Reference
	Knowledge
	Level 1
	Level 2
	Level 3

Question		Answer / Indicative Content	Mark	Guidance
1	(a)	<p>One mark for each correct example given for the stated material type. No mark for stating the material type.</p> <p>Examples: Alloys - Brass; bronze; duralumin; steel; cast iron; solder Composite materials - Carbon fibre; GRP; concrete; MDF; Plywood Ferrous metals - Iron; steel (any); HSS; stainless steel; cast iron Non – ferrous metals - Copper; aluminium; lead; tin; Titanium; zinc Smart materials - Shape memory alloy (SMA); Thermochromic material Quantum tunnelling composite (QTC) 3 x (1+1)</p>	6	<p>Accept other appropriate examples</p> <p>Allow repeated use if appropriate.</p> <p>e.g. Brass as Alloy <i>and</i> Non-ferrous metal Stainless steel as Ferrous metal <i>and</i> Alloy</p>
	(b)	(i)		
		<p>Up to three marks for a reasoned explanation</p> <p>Example: Thermoplastics are more easily moulded (1) and shaped as they can be softened by heat (1) but thermosetting plastics cannot be re-softened after being formed into shape(1) (3x1)</p>	3	<p>Accept other valid explanations including reference to ease of recycling, but NOT 'reshaped' etc after manufacture.</p> <p>Justified response with comparison needed for full marks</p> <p>Allow two marks for one point fully justified or two unjustified points</p>
		(ii)		
		<p>Saucepan handles; electrical fittings; GRP Boat hulls; carbon fibre cycle frames; kettle</p>	1	<p>Accept other appropriate example</p>

Question		Answer / Indicative Content	Mark	Guidance
2	(a)	Tungsten carbide; glass; ceramic bearing material (Zirconium dioxide; Silicon nitride)	1	Accept other appropriate examples e.g. porcelain; marble
	(b)	Up to two marks for each of three valid descriptions Examples; Ductility – The ability of a material to be drawn into lengths (1) without breaking (1) Elasticity – The ability of a material to return to its original length / shape (1) after being stretched / bent (1) Resistivity – The ability of a material to resist the passage (1) of electricity or heat (1) 3 x (1+1)	6	Allow other suitably descriptive responses Justified response needed for second mark
	(c)	One mark for naming and up to two further marks for describing a destructive test Examples: Tensile testing (1) is carried out by gripping and stretching a test piece (1) and recording the load it breaks at (1) Impact testing (1) is done by swinging a heavy block onto a notched test piece (1) and seeing how much energy is absorbed in breaking (1) the test piece 1 + (2x1)	3	Allow any other valid destructive test e.g. Brinell/Rockwell/Vickers hardness testing

Question		Answer / Indicative Content	Mark	Guidance	
3	(a)	<p>One mark for each correctly named tool</p> <p>1 – Junior/Mini hacksaw 2 – Centre punch/dot punch 3 – (Hand/Flat) File 4 – Hacksaw 5 – (Engineer's) Try square 6 – Tap wrench / holder</p> <p style="text-align: right;">(6x1)</p>	6		
	(b)	(i)	<p>Up to three marks for an appropriate description of a <i>workable</i> method</p> <p>Example: Drill and countersink holes for the rivets (1) Put rivet through holes and cut to length (1) Form countersunk head on end of rivet (1)</p> <p style="text-align: right;">(3x1)</p>	3	
		(ii)	<p>Self-tapping screws; adhesives / glueing; threaded fasteners / nuts and bolts / screws</p>	1	
4	(a)	<p>One mark for each of three appropriate finishing processes</p> <p>Examples: Painting; plastic / powder coating; galvanising ; blueing / oil blackening; electroplating</p> <p style="text-align: right;">(3x1)</p>	3	Not polishing	
	(b)	<p>One mark for each relevant stage given</p> <p>Examples: 1. Potential risk is identified (1) 2. Evaluated to see how serious it might be (1) 3. Measures are put in place to minimise / remove the risk (1)</p> <p style="text-align: right;">(3x1)</p>	3	<p>Response must be process related not product referenced.</p> <p>Accept other suitably descriptive wording of relevant stages.</p>	

Question		Answer / Indicative Content	Mark	Guidance
	(c)	One mark for each correctly named part A – Saddle / Apron B – Top /compound slide C – Tool post / tool holder D – Cross slide (4x1)	4	

Question		Answer	Marks	Guidance	
				Content	Levels of response
5	(a)*	Up to six marks for a discussion or detailed explanation of the factors to consider before changing from production using manually controlled machines to production using CNC machines	6	Response might include reference to: The cost of new machines. Re-training of staff to use new technologies / machines. Redundancies in the workforce. Potential changes to workshop layout. Whether the increased output is justified by sales. Long term cost effective benefits. Disposal of old machinery. Improved working conditions for staff. Increased reliability/consistency of CNC machines	<p>Level 3 (5–6 marks) Detailed discussion showing a clear understanding of the factors to consider before changing from production using manually controlled machines to production using CNC machines</p> <p>Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar.</p> <p>Level 2 (3–4 marks) Adequate discussion showing an understanding of the factors to consider before changing from production using manually controlled machines to production using CNC machines</p> <p>There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, punctuation and grammar.</p>

Question			Answer	Marks	Guidance	
					Content	Levels of response
						<p>Level 1 (1–2 marks) Basic discussion showing limited understanding of the factors to consider before changing from production using manually controlled machines to production using CNC machines</p> <p>There will be little or no use of specialist terms. Answers may be ambiguous or disorganised. Errors of spelling, punctuation and grammar may be intrusive.</p> <p>0 = a response that is irrelevant and/or not worthy of a mark.</p> <p>Annotate with 'Seen' at end of response.</p>

Question		Answer / Indicative Content	Mark	Guidance
5	(b)	<p>Up to three marks for an adequate description Examples: When the product has been designed using CAD (1) it is sent to a CNC milling machine or router (1) where a prototype is produced (1) CNC milling machines (1) can be used to produce prototypes quickly (1) and changes can easily be made on the CAD software (1)</p> <p style="text-align: right;">(3x1)</p>	3	<p>Ref to use of CAD needed for full marks</p> <p>Allow up to two marks for one partially detailed point</p>
	(c)	<p>Examples: Selective Laser Sintering / SLS Stereolithography / SLA Direct Metal Laser Sintering (DMLS) Fused Deposition Modelling (FDM) 3D printing electron beam melting</p>	1	

Question		Answer / Indicative Content	Mark	Guidance
6	(a)	<p>Up to two marks for each of three justified benefits</p> <p>Examples: Automatic machines make products more quickly / work 24/7(1) increasing the overall output (1) Once set up, automatic machines make products more cheaply(1) and increase profits (1) Automation means that fewer workers are needed (1) which saves the company money (1) Improvement in quality and consistency (1) as no human error is involved (1) Safer working environment (1) means less accidents/danger to workers(1)</p> <p style="text-align: right;">3 x (1+1)</p>	6	<p>Accept other appropriate benefits</p> <p>Benefits must be justified for full marks</p>
	(b)	<p>Up to four marks for a reasoned explanation</p> <p>Example: JIT means that parts are delivered when they are needed to the place where they will be used (1) This means that the company don't have to store parts (1) and can use the space saved for production (1). One drawback is that if the delivery fails to arrive in time, production has to stop (1)</p> <p style="text-align: right;">(4x1)</p>	4	<p>Accept other appropriate benefits/drawbacks</p> <p>Clear and justified response covering benefits <i>and</i> drawbacks required for full marks</p> <p>Maximum 3 marks for listed unjustified points</p>

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

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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