OCR
Oxford Cambridge and RSA

Cambridge National

Engineering

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

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

Mark Scheme for June 2017

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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

Annotation	Meaning of annotation
BP	Blank page
VG	Vague
	Tick
SEEN	Noted but no credit given
	Unclear
REP	Repeat
BOD	Benefit of doubt
	Cross
DEV	Development
EG	Example/Reference
K	Knowledge
L1	Level 1
L2	Level 2
L3	Level 3

Question			Answer / Indicative Content	Mark	Guidance
1	(a)	(i)	**Ferrous metals -** cast iron; high speed steel; stainless steel (2x1)	2	All materials must be from the list provided
		(ii)	**Composite materials -** carbon fibre; GRP (2x1)	2	
		(iii)	**Thermosetting plastic -** polyester resin; urea-formaldehyde	1	
		(iv)	**Non-ferrous alloys** - brass; bronze (2x1)	2	
	(b)		One mark for each of three valid reasons Examples: Thermoplastics are: generally easier to form into complex shapes/manufacture available in a wide range of colours generally more suited to mass production methods self-finishing / don't need surface finishing corrosion resistant electrically insulating (3x1)	3	Accept other viable responses Three simplistic correct responses 2 marks Two simplistic correct responses 1 mark NOT easier to recycle / remould / reheat
2	(a)	(i)	Ductile Conductive Malleable / flexible /easy to bend Corrosion resistance Non magnetic (2x1)	2	
		(ii)	Up to three marks for a reasoned explanation		

Question			Answer / Indicative Content	Mark	Guidance
			Examples: Copper is quite a heavy metal (1) and this would make the cables sag between the pylons (1) so they may touch the ground and be dangerous (1). The cables would sag(1) because copper is heavy (1), so there would have to be more pylons and closer together(1). The power lines system would cost more (1) because copper is expensive (1) and also more pylons would need to be made (1). (3x1)	**3**	Do not accept reference to heat
	(b)		Powder Sheet Granular Liquid (2x1)	**2**	Do not accept gas
	(c)		One mark for an example, and up to two marks for a suitable explanation. Example: Testing where the product is not damaged (1) and can therefore be finished and sold (1), such as using X-rays to detect cracks (1) 1 +(2x1)	**3**	Justified explanation required for full marks
3	**(a)**		**Stage 2** – assemble the two parts **Stage 3 –** apply flux to the area of the joint **Stage 4 –** heat the joint **Stage 5 –**melt brazing rod into the joint **Stage 6 –** leave to cool		Accept other *workable* solution e.g. Accept reference to self-fluxing rods / granular spelter

Question			Answer / Indicative Content	Mark	Guidance
			(5x1)	**5**	
	(b)	**(i)**	Riveting Use of threaded fasteners Cyanoacrylate / super glue Epoxy resin adhesive (2x1)	**2**	Not simply 'glue / adhesive' Accept high strength double-sided tape
		(ii)	Up to three marks for a clear description of the chosen method. Examples: Riveting – drill correct size holes in the two parts (1) assemble the parts with rivets in place(1) cut rivets to length and hammer to make joint (1) Super glue – remove any surface defects and make the joint areas perfectly clean(1) apply small amount of adhesive and avoid touching the joint (1) assemble the parts and clamp lightly (1) (3x1)	**3**	A clear and viable method required for full marks Accept reference to pop riveting Ecf if inappropriate method but well described eg 'glueing' NOTE: method described must not involve heat.
4	**(a)**		**Stage 1** Facing (off) **Stage 2** Knurling **Stage 3** **(**Plain / parallel) turning (down) **Stage 4** Taper turning **Stage 5** Parting (off) (5x1)	**5**	Accept tapering / coning
	(b)	**(i)**	Up to three marks for an adequate description, which should include reference to: Carburising – heat to red hot and soak in carburising powder Heat to red hot Quench – in oil or water (3x1)	**3**	Method described must be viable Reference to all three stages required for full marks.

Question			Answer / Indicative Content	Mark	Guidance
		(ii)	Hardening Annealing Tempering Normalising Nitriding (2x1)	2	Processes must relate to heat treatment Accept any other valid heat treatment process
5	(a)		Up to two marks for each of two benefits Examples: The machines are more versatile (1) and can carry out many different operations (1) Production time can be reduced (1) as parts do not need to be changed from one machine to another (1) The machines would take up less space (1) than a number of different machines (1) 2 x (2x1)	4	Accept other relevant / feasible responses Justified response needed for full marks Do not accept references to workforce
	(b)		Cutting Welding Engraving Measurement Alignment Sintering (2x1)	2	Accept specific reference to use in quality control
	(c)		Up to four marks for a detailed explanation Example: The product is designed using CAD software (1) and a 3D image is produced (1) Computer software 'slices' 3D image into thin layers (1) the 3D printer then builds up the solid model / prototype (1) (4x1)	4	Detailed explanation required for full marks Reference to slicing / layers required for full marks

Question			Answer / Indicative Content	Mark	Guidance
6	(a)		One mark for the technology used and a further mark for its use Examples: Use of email / video conferencing to share ideas The Internet (1) can be used to search for existing examples of products or materials to use (1). CAD software (1) can be used to produce design drawings and 3D images (1). 2 x (1+1)	4	Simplistic responses e.g. Using CAD / the Internet – 1 mark only

Question			Answer	Marks	Guidance	
					Content	Levels of response
	(b)*		Up to six marks for a discussion or detailed explanation of the business benefits of global manufacturing.		Responses may include reference to: Financial incentives from governments of countries to set-up manufacturing facilities. Lower manufacturing costs from cheaper labour. Closeness to raw materials. Ease of manufacturing remotely using digital communication. Potential of benefits from varying exchange rates. Ease of international travel / communication. Closeness to developing markets. International standardisation of processes.	**Level 3 (5–6 marks)** Detailed discussion showing a clear understanding of the business benefits of global manufacturing. 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. **Level 2 (3–4 marks)** Adequate discussion showing an understanding of the business benefits of global manufacturing. 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

Question			Answer	Marks	Guidance	
					Content	Levels of response
				6		and grammar. **Level 1 (1–2 marks)** Basic discussion showing limited understanding of the business benefits of global manufacturing. 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. 0 = a response that is irrelevant and/or not worthy of a mark. Annotate with 'Seen' at end of response.

			Total mark for paper	**60**	

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