

Engineering

General Certificate of Secondary Education **A622**

Engineering Processes

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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Question Number	Specification Ref	Expected Answer	Mark	Rationale
1 (a)	A	1 mark for each correct link shown: Aerospace to tail rotor automotive to wheel hub chemical and process to paint computers communication and IT to memory card	[4]	NOTE – any 1 box having two or more lines to/from it = zero for those lines.
(b)	A	1 mark for each of two different sectors, from 3 below. 1 mark for a product from each sector eg below Electrical and Electronics <ul style="list-style-type: none"> • electric toothbrush • smoke alarm • radio-controlled car Rail and Marine <ul style="list-style-type: none"> • passenger information systems • power sources (wind, electricity, fossil fuels, human, solar) • safety features Structural and Civil <ul style="list-style-type: none"> • tunnels • artificial environment domes (eg eco-domes, arboretum, leisure, winter sports domes) • wind power generators 	[4]	Sectors must be from those stated. Accept other products appropriate to sector. Error carried forward if sectors repeated from List – Mark allowed for product if relates to sector stated.

Question Number	Specification Ref	Expected Answer	Mark	Rationale
2 (a)	M	One mark for each; goggles and apron.	[2]	The list is not exhaustive. For two marks, response must include amplification, such as how or when.
(b)	M	Two marks for each safety precaution described For example: Make sure you know where the isolating switch is before starting to work. Floor surfaces should be free of loose items and swarf and should not be slippery. Sufficient space should exist around the machine to prevent accidental contact with people going past. Ensure that: the cutter and work are correctly mounted, the guard is in position or hands not too close to machine or cutting tools correct speeds and feeds selected work is securely held on the table by means of machine vice/ angle plates. Remove swarf only by using a brush with a straight handle when the machine is electrically isolated.	[4]	
2 (c) (i)	F	Two marks for a clear description, for example: <ul style="list-style-type: none"> • Appropriate speeds and feeds • Cutting tool appropriate condition • Use of coolant Accept post machining checks, such as: <ul style="list-style-type: none"> • Running finger over surface • Use a Dial test indicator (DTI) abbreviation acceptable • Surface comparison, using known surface texture test • Using a surface texture gauge 	[2]	Award (1) for running finger over surface but only with reference to, risks (cut finger, infection). Swarf (sharp and very thin) may enter finger requiring surgical removal. It may also be hot and the cutting fluid may be hazardous. Award (1) for 'run finger over and (1) for carefully or safely

Question Number	Specification Ref	Expected Answer	Mark	Rationale
2 (c) (ii)		One mark for a reasonable definition of tolerance. For example: How much greater or smaller than the exact design measurement is acceptable or $\pm 2\text{mm}$ for a 25 mm rod Limits on acceptable size \pm amount that measurement is allowed to be out	[1]	Accept example such as $\pm 5\text{mm}$.
2 (c) (iii)		Two marks for full description. For example stating measuring or checking equipment (Vernier callipers, go-nogo gauge, ruler,jig...), how it is used/read and how result interpreted	[2]	One mark for incomplete answer (eg see if it fits, measure it, use a ruler).
3 (a)	B D(2)	One mark for each correct material (i) HIPS or PVC is a polymer (ii) cast iron or low carbon steel is a ferrous metal (iii) copper is a non-ferrous metal (iv) silicon carbide is a ceramic (v) carbon fibre is a composite (vi) low carbon steel or copper or HIPS, carbon fibre, PVC is often supplied in sheet form (vii) PVC or HIPS (or silicon carbide) is often supplied in granular form	[7]	Granular includes pellets and powders here.
(b)	B	Alloy – metallic(1) mixture (1) makes use of characteristics of each element (1) Accept metal and any other, or reasonable alternative.	[2]	Second mark may imply mixture – eg with improved properties/own properties/not easily separated/one melting point

Question Number	Specification Ref	Expected Answer	Mark	Rationale
4	L G(2)	<p>Two marks for clear description relating an appropriate new technology to the use given. For example</p> <p><u>Developing design specifications for engineered products</u></p> <p>Internet research/search engine to look up product details</p> <p>Collate data on materials/components</p> <p>Prepare parts lists</p> <p>Check specs of existing products on electronic manuals</p> <p><u>Producing engineering drawings to current industry standards</u></p> <p>Use proEngineer on computer(1) and set to Standard required/Third angle Orthographic(1) save as <filetype>.</p> <p><u>Controlling production</u></p> <p>Sensors connected to PLCs which control outputs to heaters/conveyors/dispensers...</p> <p>Barcode readers to track progress of orders</p> <p>Computerised sampling and testing/production monitoring</p> <p>Sensors are used to check dimensions and the computer controls which are passed, sent for rework or rejected.</p> <p>Computer selects a random sample and runs electrical tests on them</p>	[6]	<p>For 2 marks amplification must be given.</p> <p>Or other named industry standard.</p> <p>Accept CAD referred to more than once if supported by a different comment.</p>

Question Number	Specification Ref	Expected Answer	Mark	Rationale
5 (a)	E	Two marks for a description of a correct example each process: <u>Shaping</u> moulding/beating/forging (1) with type or method(1) <u>Finishing</u> sanding, polishing, oiling, coating, painting (1) + method or type (1)	[4]	For both marks, amplification is needed.
(b)		Two marks for each of two benefits to the workforce described. One mark for a generic response (eg safer, easier) <u>Machining</u> – reduced risk(1) from specific(1), makes more consistent parts for fitting (1), avoids having to move work(1) between processes/machines (1) <u>Robotic welding</u> – as above (not repeated) – may need revisiting at standardisation <u>Surface mount technology</u> – avoids repeated close work (1) which can strain eyes/muscles (1), minimises exposure to solder/fumes (1) damaging to health (1).	[4]	

Question Number	Specification Ref	Expected Answer	Mark	Rationale
6	C	<p>Two marks for each correct detailed response. Accept function or description of use in a product which makes the function clear:</p> <p>Cam Change rotary (1) to reciprocating motion (1) or Makes sure the bobbin in a sewing machine is evenly wound. Expect opening valves in a car engine</p> <p>Capacitor Stores (1) charge (1) in a circuit note – accept storage of voltage, current. Power, energy, etc.</p> <p>Fuse Protects a circuit (1) by breaking contact when current flow too high (1) or Prevents damage when there is a short circuit/if water gets in</p> <p>Machine screw temporary and secure fixing(1) of metal parts(1)</p> <p>Single acting cylinder Allows air to move piston (1) one way(1) return by spring/gravity (1)</p> <p>Non-return valve Only allows air/water (1) through one way only (1)</p>	[3 x 2]	Do not accept references to Computer aided Manufacture CAM.

Question Number	Syllabus Ref	Expected Answer	Mark	Rationale
7		The table shows a comparison of six materials that could be used in an engineered product.		
(a)		F	[1]	
(b)		Give <u>two</u> reasons why material E would be a good choice for one off manual production. One mark for each of two correct reasons: Easy to use Safe to use	[2]	

Question Number	Specification Ref	Expected Answer	Mark	Rationale
(c)		<p>Explain <u>one</u> other factor that might be considered when selecting the most suitable material to use in an engineered product.</p> <p>1 mark for a factor and up to 2 further marks for explanation. For example:</p> <p>Form of supply – suitable for existing equipment Familiar to work force – training not needed Strength to weight ratio or other physical property – may be important factor</p> <p>Recyclable – sustainable – effect on environment – etc. which is another interpretation of this question. Reliability of material Wear resistance Easily re-used</p>	[3]	<p>'Just in Time' – not acceptable because it is not specified that the factor should be about the material.</p> <p>Some had selected one other factor from the table headings,</p>

Question Number	Specification Ref	Expected Answer	Mark	Rationale
8		<p>Discuss the implications of introducing systems and control technology into the workplace.</p> <p>Six marks for discussion giving three relevant points, stating why two are relevant and giving an example, or for a critical evaluation of the impact of systems and control technology on H&S.</p> <p>Examples of points</p> <ul style="list-style-type: none"> The use of S&CT (mechanical controls) has enabled automation – humans not so closely involved High investment cost, reduced running costs Enables good repetition of quality of product Reduction in workforce/employee costs, strikes, holidays, illness, boredom, etc Training may be needed in use and H&S Enables monitoring and adjustment of working conditions Detects hazardous conditions (leaks, spills) and can raise alarm/take action automatically <p>Identification and expansion of any of the above. List is not exhaustive. Some will list advantages and disadvantages.</p> <p>QWC</p> <p>Level 1 (0-2 marks) Basic discussion showing some understanding of the impact of systems and control technology on production. 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>Level 2 (3-4 marks) Adequate discussion showing an understanding of the impact of systems and control technology on production. 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>	[6]	Responses like 'so that children are safe to use the machines' may refer to schools – as the 'workplace'.

Question Number	Specification Ref	Expected Answer	Mark	Rationale
		Level 3 (5-6 marks) Thorough analysis, showing a clear understanding of the impact of systems and control technology on production. 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.		
		Paper Total	[60]	

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