



Pearson

Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCSE
In Manufacturing and Engineering (5EM03)
Paper 3F Mechanical / Automotive

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Summer 2017

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question	Answer	Mark
1(a)	<ul style="list-style-type: none"> ▪ Metal hinge ▪ Machine Vice <p><i>If 3 boxes or more crossed - no marks.</i></p> <p style="text-align: right;">(2 x 1)</p>	(2)
1(b)	<ul style="list-style-type: none"> ▪ Clutch ▪ Rear axle <p><i>If 3 boxes or more crossed - no marks.</i></p> <p style="text-align: right;">(2 x 1)</p>	(2)
(Total 4 marks)		

Question	Answer	Mark
<p>2(a) 1</p>	<ul style="list-style-type: none"> ▪ Socket set screw ▪ Cap screw ▪ Cap head ▪ Cap head screw ▪ Socket head ▪ Socket head screw ▪ Socket machine screw ▪ Allen cap screw ▪ Allen screw <p>Do not accept screw by itself Do not accept bolt by itself</p> <p><i>Accept any recognisable spelling (phonetic) of the answers above</i></p> <p style="text-align: right;">(1 x 1)</p>	
<p>2(a) 2</p>	<ul style="list-style-type: none"> ▪ Gear ▪ Spur gear ▪ Straight gear ▪ Cog <p>Do not accept bevel gear</p> <p><i>Accept any recognisable spelling (phonetic) of the answers above</i></p> <p style="text-align: right;">(1 x 1)</p>	(2)
<p>2(b) 1</p>	<p>An answer that makes reference to two of the following points:</p> <ul style="list-style-type: none"> ▪ Used for tightening/unscrewing bolts/screws/nuts (1) ▪ Used to gain access/get in difficult spaces (1) ▪ Used to give leverage (1) ▪ Different sizes available for use on different size bolt/screw heads (1) <p><i>Accept any other appropriate response</i></p> <p>e.g. a tool that is used to tighten a bolt (1) creating leverage when tightening (1)</p> <p style="text-align: right;">(1 x 2)</p>	

2(b) 2	<p>An answer that makes reference to two of the following points:</p> <ul style="list-style-type: none">▪ Drills/makes holes (1)▪ Fits securely in a chuck (1)▪ The flutes enable the swarf to be removed (1)▪ Different sizes allow different diameter holes to be produced (1)▪ The point on the bit follows a centre punch mark (1) <p><i>Accept any other appropriate response</i></p> <p>e.g. The drill bit fits into a chuck (1) to make a round hole in a metal piece (1)</p> <p style="text-align: right;">(1 x 2)</p>	
(Total 6 marks)		

Question	Answer	Mark
<p>3</p>	<p>Key terms linked to a key area</p> <p><i>No mark awarded where 2 or more lines are drawn from a term. Lines do not have to be straight but term and key area must be clearly linked.</i></p> <p style="text-align: right;">(7 x 1)</p>	<p>(7)</p>
<p>(Total 7 marks)</p>		

Question	Answer	Mark
<p>4(a)(i)</p>	<p>Appropriate two products, such as:</p> <ul style="list-style-type: none"> ▪ tube cutters ▪ low voltage circuit testers ▪ sheet steel nibblers ▪ triple leg reversible pullers ▪ ignition spark tester ▪ twist drill set ▪ bike rack for car ▪ side lever grease guns ▪ bench pillar drill ▪ lazy tong riveter ▪ hydraulic cylinder ▪ foot pump ▪ trolley jack ▪ fire extinguisher ▪ motorbike ▪ bbq ▪ filing cabinet ▪ car ▪ gearbox ▪ toolbox <p>A brand name of a specific product is acceptable</p> <p><i>This list is not exhaustive, accept any product from the mechanical/automotive sector that use finishing processes in their manufacture.</i></p> <p style="text-align: right;">(2 x 1)</p>	<p style="text-align: right;">(2)</p>

Question	Answer	Mark
<p>4(a)(ii)</p>	<p>Appropriate two processes, such as:</p> <ul style="list-style-type: none"> ▪ Electroplating/Plating ▪ Galvanizing ▪ Painting ▪ Powder coating ▪ Knurling ▪ Anodizing ▪ Sheradising ▪ Polishing/Buffering ▪ Blackodising/Hot blackening ▪ Sand/Shot blasting ▪ Fettling ▪ Barrelling/Tumbling <p><i>Accept any other appropriate response</i></p> <p style="text-align: right;">(2 x 1)</p>	<p style="text-align: center;">(2)</p>
<p>4(a)(iii)</p>	<ul style="list-style-type: none"> ▪ Electroplating/plating - is a process that uses electric current to reduce dissolved metal cations (1) so that they form a coherent metal coating on an electrode (1) ▪ Galvanizing - is the process of applying a protective zinc coating to steel or iron (1) to prevent rusting (1) ▪ Painting - is any liquid, liquefiable or mastic composition that is applied to a surface (1) and converts to a solid protective film (1) ▪ Powder coating - for metal painting and finishes that uses equipment that electrostatically charges the paint (1) so it adheres to any metal surface (1) ▪ Knurling - is a manufacturing process, typically conducted on a lathe (1), whereby a pattern of straight, angled or crossed lines is cut or rolled into the material (1) ▪ Anodizing - is an electrolytic passivation process (1) used to increase the thickness of the natural oxide layer on the surface of metal parts (1) ▪ Sheradising - is a process of galvanization (1) of ferrous metal surfaces (1) 	<p style="text-align: center;">(2)</p>

Question	Answer	Mark
	<ul style="list-style-type: none"> ▪ Polishing/Buffering - is the process of creating a smooth and shiny surface (1) by rubbing it or using a chemical action, leaving a surface with a significant specular reflection (1) ▪ Blackodising/Hot blackening – a high-temperature process (1) in which the product is inserted into a series of tanks containing cleaners, caustics, and coolants (1) ▪ Sand/Shot blasting - is the operation of forcibly propelling a stream of abrasive material against a surface under high pressure (1) to smooth a rough surface, roughen a smooth surface, shape a surface, or remove surface contaminants (1) ▪ Fettling – a grinding or abrasive process (1) that removes unwanted materials from the part (1) ▪ Barrelling/Tumbling – parts are placed in a barrel and spun around like a washing machine (1) which removes any sharp edges etc (1) <p><i>Accept any other appropriate response</i></p> <p style="text-align: right;">(1 x 2)</p>	

<p>4(b)</p>	<p>One mark for each technique One mark for each description</p> <p>Visual inspection (1) to check for defects and blemishes (1)</p> <p>Measurement checks (1) to compare against specific requirements, i.e. micrometer to check dimensions (1)</p> <p>Gauge checks (go/no go) (1) to check part is acceptable (1) Optical checks (1) to ascertain alignment (1)</p> <p>Functional checks (1) to check the operation of the product (1)</p> <p>Ultrasonic tests (1) to detect flaws or measure thickness (1)</p> <p>Material/component checks (1) to meet specification (1)</p> <p><i>Accept any other appropriate response No credit for repetition Low response (1) or two low responses (2), or detailed response (2) for each of the techniques.</i></p> <p style="text-align: right;">(2 x 1) (2 x 2)</p>	<p style="text-align: right;">(4)</p>
<p>(Total 10 marks)</p>		

Question	Answer	Mark
<p>5(a)</p>	<p>Accept any two responses:</p> <ul style="list-style-type: none"> ▪ To control machine processes (1) ▪ To assist in the operations of a manufacturing plant (1) ▪ To assist in planning (1) ▪ To assist in management (1) ▪ To assist in transportation (1) ▪ To assist in storage (1) ▪ To create a faster production process (1) ▪ To reduce waste (1) ▪ To reduce energy consumption (1) ▪ To improve product consistency (1) ▪ To improve product accuracy (1) <p><i>Accept any other appropriate response</i></p> <p style="text-align: right;">(2 x 1)</p>	<p style="text-align: right;">(2)</p>
<p>5(b)</p>	<p>One mark for identifying the disadvantage One mark for the description</p> <ul style="list-style-type: none"> ▪ The software itself is expensive (1) so initial costs are high (1) ▪ Can be slower than traditional methods (1) for one-off or low-volume production (1) ▪ Training costs are high (1) when staff are using software and machinery (1) ▪ Can be expensive to maintain (1), as highly skilled technicians required to carry out repairs (1) ▪ Programming errors can occur (1), creating defective batches of products (1) ▪ Consumers can look negatively (1) on this 'deskilling' of workers (1) <p><i>Accept any other appropriate response</i></p> <p style="text-align: right;">(1 x 2)</p>	<p style="text-align: right;">(2)</p>

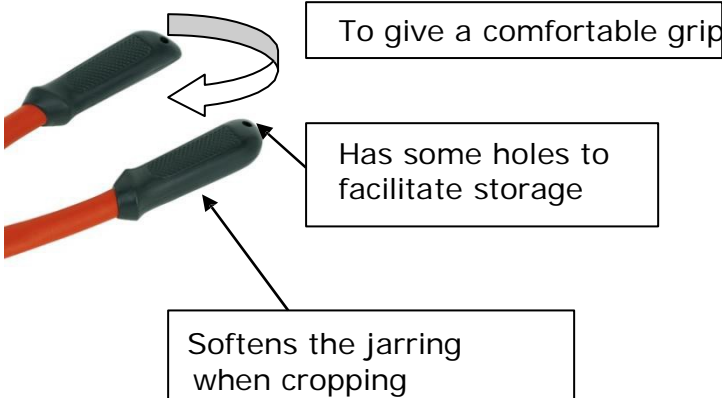
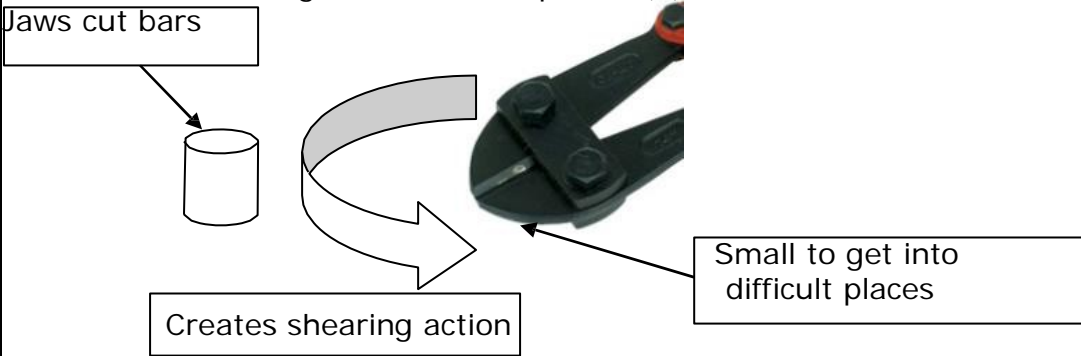
Question	Answer	Mark
<p>5(c)</p>	<p>One mark for identifying each benefit One mark for each description</p> <ul style="list-style-type: none"> ▪ PLCs control manufacturing devices i.e. laser cutters/NC/CNC machines/robots (1) to improve quality (1) ▪ PLCs give continuous operation (1) as they do not need breaks (1) ▪ PLCs can repeat actions (1) indefinitely (1) ▪ PLCs can work in hazardous environments (1), reducing dangers for workers (1) ▪ PLCs can work with fewer staff (1), reducing costs (1) <p><i>Accept any other appropriate response</i> <i>No credit for repetition</i> <i>Low response (1) or two low responses (2), or detailed response (2) for each of the benefits.</i></p> <p style="text-align: right;">(2 x 1) (2 x 2)</p>	<p>(4)</p>
<p>(Total 8 marks)</p>		

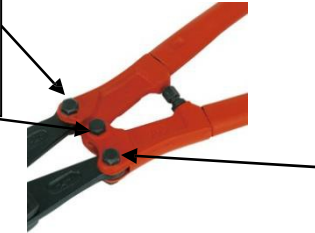
Question	Answer	Mark
<p>6(a)(i)</p>	<p>Any one of the following:</p> <ul style="list-style-type: none"> ▪ Mobile phone/infrared/bluetooth ▪ Video conferencing ▪ Voice over Internet Protocol (VoIP) ▪ Electronic point of sale (EPOS) ▪ EDI ▪ ISDN ▪ Texting ▪ Phone ▪ Walkie talkie ▪ Fax ▪ Smart phone ▪ Tablet <p><i>Accept brand names of the above</i> <i>Accept any other appropriate response</i></p> <p style="text-align: right;">(1 x 1)</p>	<p style="text-align: right;">(1)</p>
<p>6(a)(ii)</p>	<p>An answer that makes reference to two of the following points:</p> <ul style="list-style-type: none"> ▪ A method of connecting devices ▪ A local area network (LAN) ▪ Hotspots ▪ Wireless connection ▪ Access to the internet ▪ Access with router ▪ Allows you to use email ▪ Allows easy communication ▪ Enables the internet of things <p><i>Accept any other appropriate response</i></p> <p>e.g. A method of connecting devices (1) which allows easy communication (1)</p> <p style="text-align: right;">(1 x 2)</p>	<p style="text-align: right;">(2)</p>
<p>6(b)</p>	<p>One mark for identifying each reason One mark for each explanation</p> <p>The use of a dedicated computer system (1) within a larger system to perform specific functions (1)</p> <p>To monitor each process (1) as each part of the process has its own embedded system (1)</p> <p>Embedded computers are integral to process design (1) as industrial workplaces can often be harsh environments (1)</p>	<p style="text-align: right;">(6)</p>

Question	Answer	Mark
	<p>Embedded systems don't require large power supplies (1) because they integrate dedicated/miniaturised componentry (1)</p> <p>Embedded computers reduce the need for cooling (1) as they will produce a lot less heat (1)</p> <p>There is minimal ingress of moisture/dust/chemicals (1), as it can be a fan-less system (1)</p> <p>Easier maintenance (1), no need to trace component faults/instant diagnosis (1)</p> <p>Allows opportunities for effective change of function (1) as the embedded computer can be reprogrammed when required (1)</p> <p><i>Accept any other appropriate response</i> <i>No credit for repetition</i> <i>1 x 1 mark low response, 3 x 1 mark three low responses, or detailed response (2) per reason.</i></p> <p style="text-align: right;">(3 x 2)</p>	
(Total 9 marks)		

Question	Answer	Mark
7(a)	<p>One mark for identifying the benefit, up to two marks for the explanation:</p> <ul style="list-style-type: none"> ▪ Allows online questionnaires to be used (1) instant feedback (1) target market can be established (1) ▪ Demographic information can be analysed (1) existing products known to target market (1), allows matching customer requirements (1) ▪ Information about materials can be obtained (1) suitability for product (1) cost details (1) ▪ Compare existing products (1) to optimise the development of the design (1) minimising the cost of the product (1) ▪ To generate break even data (1) through the use of spreadsheets (1) to calculate cost of production (1) <p><i>Accept any other appropriate response</i></p> <p>Low response (1) or detailed statement (3)</p> <p style="text-align: right;">(1 x 3)</p>	(3)

Question	Answer	Mark
7(b)	<p>One mark for identifying the benefit, up to two marks for the explanation:</p> <ul style="list-style-type: none"> ▪ Fewer material shortages (1) by accessing stock records (1) and matching orders accordingly (1) ▪ Improved scheduling (1) by accessing orders (1) and minimising downtime (1) ▪ Efficient utilisation of staff (1) by utilising training/skills records (1) to ensure skilled staff are in the appropriate position (1) ▪ Appropriate allocation of plant/equipment (1) by accessing resources list (1) and process capability (1) ▪ Set control points for quality checks (1) access product specifications (1) to minimise product waste (1) ▪ Allows modelling of deadlines (1) use of spreadsheets (1) access to process data (1) ▪ Maximise machine efficiency (1) by ensuring correct process allocation (1) from accessing computer stored data and information (1) <p><i>Accept any other appropriate response</i></p> <p>Low response (1) or detailed statement (3)</p> <p style="text-align: right;">(1 x 3)</p>	(3)
(Total 6 marks)		
Total Marks for Section A		50

Question	Answer	Mark
<p>8(a)</p>	<p>An answer that makes reference to any of the following points:</p> <ul style="list-style-type: none"> ▪ To give a comfortable grip (1) ▪ To protect user in case of accidental shock (1) ▪ To prevent damage to the end of the handle (1) ▪ To soften the vibration/jarring on the users hand (1) ▪ To facilitate storage (1)  <p><i>Accept any other appropriate response</i> <i>Must have notes and sketches (notes or sketches only, maximum 2 marks)</i></p> <p><i>1 x 1 mark low response, or up to 3 marks for detailed response</i></p> <p style="text-align: right;">(1 x 3)</p>	<p>(3)</p>
<p>8(b)</p>	<p>An answer that makes reference to any of the following points:</p> <ul style="list-style-type: none"> ▪ To cut whatever is being cropped (1) ▪ To create a shearing action (1) ▪ To minimise the effort needed (1) ▪ To remain sharp (1) ▪ To be able to get into difficult places (1) 	<p>(3)</p>

Question	Answer	Mark
	<p><i>Accept any other appropriate response</i> <i>Must have notes and sketches (notes or sketches only, maximum 2 marks)</i></p> <p><i>1 x 1 mark low response, or up to 3 marks for detailed response</i></p> <p style="text-align: right;">(1 x 3)</p>	
<p>8(c)</p>	<p>An answer that makes reference to any of the following points:</p> <ul style="list-style-type: none"> ▪ To provide the connection between the handle and the end of the jaw section (1) ▪ Provides an amplification/efficiency of the lever action (1) ▪ Acts as a fulcrum (1) ▪ To minimise effort (1) ▪ To provide a fixing for the jaws/bolts (1) ▪ To balance the bolt croppers weight (1) ▪ To position the stop (1) <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; width: 25%;"> <p>It gives a second application of the fulcrum to add shearing efficiency</p> </div>  <div style="border: 1px solid black; padding: 5px; width: 25%;"> <p>This allows the bolts to be used to connect the handle to the end of the jaws</p> </div> </div> <p><i>Do not accept links the handle to the jaw/links the jaw to the handle</i></p> <p><i>Accept any other appropriate response</i> <i>Must have notes and sketches (notes or sketches only, maximum 2 marks)</i></p> <p><i>1 x 1 mark low response, or up to 3 marks for detailed response</i></p> <p style="text-align: right;">(1 x 3)</p>	<p>(3)</p>
<p>(Total 9 marks)</p>		

Question	Answer	Mark
9(a)(i)1	<ul style="list-style-type: none"> ▪ Processing and production ▪ Production and processing ▪ Production processing ▪ Production ▪ Processing <p><i>Accept any recognisable spelling (phonetic) of the answers above</i></p> <p style="text-align: right;">(1 x 1)</p>	
9(a)(i)2	<ul style="list-style-type: none"> ▪ Assembly and finishing ▪ Finishing and assembly ▪ Assembly ▪ Finishing <p><i>Accept any recognisable spelling (phonetic) of the answers above</i></p> <p style="text-align: right;">(1 x 1)</p>	(2)
9(a)(ii)	<ul style="list-style-type: none"> ▪ Design ▪ Stage 1/stage one ▪ One/1 ▪ First/ First stage <p style="text-align: right;">(1 x 1)</p>	(1)
9(b)	<p>An answer that makes reference to any of the following:</p> <ul style="list-style-type: none"> ▪ Gathering consumer opinion (1) ▪ Calculating product costs (1) ▪ Developing a marketing plan (1) ▪ Using market research (1) ▪ Developing a competitive edge (1) ▪ Advertising the bolt croppers (1) ▪ Promoting the bolt croppers (1) ▪ Carrying out questionnaires/surveys (1) ▪ Pricing for the target market (1) ▪ Using trade/electronic (internet, email) media (1) ▪ Identifying gaps in the market (1) <p><i>Accept any other appropriate response</i></p> <p style="text-align: right;">(3 x 1)</p>	(3)
9(c)	<p>Appropriate descriptions including three of the following points (statements must be applicable to the bolt croppers):</p> <ul style="list-style-type: none"> ▪ Bolt croppers boxed (1) ▪ Boxes packed onto pallets (1) ▪ Boxed items sent to retailers (1) ▪ Bar coding applied to boxed sets of products (1) 	

Question	Answer	Mark
	<ul style="list-style-type: none"> ▪ Details sent to finance department for invoicing requirements (1) ▪ Planning route for delivery (1) ▪ Selecting correct packaging materials/equipment (1) ▪ Sealing packaging (1) ▪ Packing/shipping lists (1) ▪ Labelling (1) ▪ Gathering together of manufactured parts (1) ▪ Final quality control checks (1) ▪ Stock control (1) <p><i>Any other appropriate response but must be related to the manufacture of the bolt croppers</i></p> <p>e.g. At this stage the bolt croppers would be put into boxes (1) and then sent to the customer (1). The details of this would then be sent to the finance department (1).</p> <p><i>Up to 3 marks 1 x 1 mark low response, 3 x 1 mark 3 low responses, or up to 3 marks for a detailed response</i></p> <p style="text-align: right;">(1 x 3)</p>	(3)
(Total 9 marks)		

Question	Answer	Mark
<p>10(a)</p>	<ul style="list-style-type: none"> ▪ Rubber ▪ Polypropylene ▪ HDPE ▪ Polyethylene <p>Do not accept plastic on its own</p> <p><i>Accept any other appropriate response</i></p> <p style="text-align: right;">(1 x 1)</p>	<p style="text-align: center;">(1)</p>
<p>10(b)(i)</p>	<p>Any three of the following:</p> <ul style="list-style-type: none"> ▪ Drilling ▪ Milling ▪ Screw cutting ▪ Cutting ▪ Turning/Tapping ▪ Injection moulding/Plastic dipping ▪ Casting/Die casting ▪ Heat treatment/Hardening/Tempering/Annealing/Case hardening ▪ Powder coating/Painting ▪ Blacking ▪ Heavy duty crimping ▪ Presswork/Deforming <p><i>Accept any other appropriate response</i></p> <p><i>Accept any recognisable spelling (phonetic) of the answers above</i></p> <p style="text-align: right;">(3 x 1)</p>	<p style="text-align: center;">(3)</p>

Question	Answer	Mark
<p>10(b)(ii)</p>	<p>An explanation that makes reference to three of the following points:</p> <ul style="list-style-type: none"> ▪ can remove material from hard metal ▪ gives a very accurate finish ▪ produces a very good surface texture ▪ quick method / fast production rate when produced in batches ▪ can be mass produced easily ▪ unit costs are very low for medium to high volume production runs ▪ highly automated process ▪ reliable process ▪ minimal waste ▪ not labour intensive ▪ products have consistent quality <p><i>Accept any other appropriate response</i></p> <p>e.g. Grinding can produce a very good surface texture on the cutting edge (1) on the material that is very hard (1) with a consistent quality (1)</p> <p><i>3 x 1 mark for 3 low responses, or up to 3 marks for a detailed response</i></p> <p style="text-align: right;">(1 x 3)</p>	<p>(3)</p>
<p>10(c)</p>	<p>An explanation that makes reference to three of the following points:</p> <ul style="list-style-type: none"> ▪ Improved aesthetics ▪ Better ergonomics ▪ Better functionality/strength ▪ Longer lasting/durable ▪ More consistent product ▪ More accurate product ▪ More reliable product ▪ Safer product ▪ Lower costs ▪ Increased efficiency ▪ Lower purchase price ▪ Allows for product guarantee ▪ Allows for increased range/variation of product ▪ Lighter product ▪ Appropriate-sized product 	<p>(3)</p>

Question	Answer	Mark
	<p><i>Accept any other appropriate response</i></p> <p>e.g. Modern materials have better functional characteristics (1), are more durable (1) and allow for greater consumer choice (1)</p> <p><i>3 x 1 mark for 3 low responses, or up to 3 marks for a detailed response</i></p> <p style="text-align: right;">(1 x 3)</p>	
(Total 10 marks)		

Question	Answer	Mark
<p>11(a)</p>	<p>An answer that makes reference to any of the following:</p> <ul style="list-style-type: none"> ▪ The use of systems (1) to control machinery / processes (1) ▪ The use of control systems (1) to replace human operators (1) ▪ The ability of a process (1) to operate without the need for human sensory input (1) ▪ Mechanical devices that are operated electronically (1) and function automatically (1) <p><i>Accept any other appropriate response</i></p> <p style="text-align: right;">(1 x 2)</p>	<p>(2)</p>
<p>11(b)(i)</p>	<p>One mark for each example One mark for each description</p> <ul style="list-style-type: none"> ▪ Robots/pick and place (1) to assemble products (1) ▪ Use of conveyor systems (1) to move the product from one process to the next (1) ▪ Flexible manufacturing system/embedded computers (1) to perform dedicated functions at each step of assembly/production (1) ▪ Machine monitoring (1) to control quality and accuracy (1) ▪ To improve safety (1) in hazardous conditions by using robots (1) ▪ PLCs (1) to control processes in production (1) ▪ Remotely operated vehicles (1) moving bolt cropper components to another stage of production/storage (1) <p><i>Accept any other appropriate response No credit for repetition</i></p> <p><i>1 x 1 mark low response, 3 x 1 mark 3 low responses, or detailed response (2) per example</i></p> <p style="text-align: right;">(3 x 2)</p>	<p>(6)</p>

<p>11 (b) (ii)</p>	<p>One mark for the disadvantage One mark for the explanation</p> <ul style="list-style-type: none"> ▪ Increased capital cost (1) due to purchase of equipment (1) ▪ Increased noise (1) due to more machines being used (1) ▪ Increased energy usage (1) as increased power requirements of the machines (1) ▪ Increased maintenance costs (1) as more equipment to monitor and maintain (1) ▪ More training required (1) to be able to operate the equipment (1) <p><i>Accept any other appropriate response</i> (1 x 2)</p>	<p style="text-align: right;">(2)</p>
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Question	Answer	Mark
<p>11 (b) (iii)</p>	<p>One mark for the benefit One mark for the explanation</p> <ul style="list-style-type: none"> ▪ Consistent product (1) as controlled better (1) ▪ Product reliability (1) as more likely to be produced to specification (1) ▪ Reduced delivery time (1) as manufacturer can vary product to suit demand (1) ▪ Lower prices (1) as less waste and quicker assembly (1) ▪ Product guarantee (1) as confidence in the automation process (1) ▪ Customer satisfaction (1) because of consistent products (1) <p>Accept any appropriate response. (1 x 2)</p>	<p style="text-align: right;">(2)</p>
<p>(Total 12 marks)</p>		

Question	Answer	Mark
12(a)(i)	<p>An answer that makes reference to two of the following points:</p> <ul style="list-style-type: none"> ▪ Reduced noise (1) ▪ Quieter machines (1) ▪ Cleaner workplace (1) ▪ Fewer hazards (1) ▪ Modern technology can replace workers in hazardous areas (1) ▪ Healthier environment (1) ▪ Atmosphere cleaned (1) ▪ Less vibration (1) ▪ Less risk of accident/injury (1) <p><i>Accept any other appropriate response</i></p> <p style="text-align: right;">(2 x 1)</p>	(2)
12(a)(ii)	<p>One mark for identifying each effect One mark for each explanation</p> <ul style="list-style-type: none"> ▪ Continuous operation (1) reducing time (1) ▪ Modern machines (1) faster production (1) ▪ Reduced costs (1) by automating processes (1) ▪ Access to data (1) allows constant monitoring (1) ▪ Eliminating worker waste (1) improves use of time (1) ▪ Less waste produced (1) due to carefully controlled production (1) <p><i>Accept any other appropriate response</i></p> <p><i>Do not accept cheaper, faster, quicker without an explanation</i> <i>No credit for repetition</i></p> <p><i>Low response (1) or two low responses (2), or detailed response (2) for each of the effects</i></p> <p style="text-align: right;">(2 x 1) (2 x 2)</p>	(4)

<p>12(b)</p>	<p>One mark for identifying each advantage One mark for each explanation</p> <ul style="list-style-type: none"> ▪ Modern machines use less energy (1) so reducing CO2 emissions (1) ▪ Smaller products (1) less use of natural resources (1) ▪ Less waste/reworking of materials (1) less materials used/processing (1) ▪ Transportation reduced (1) saving of fossil fuels/less emissions (1) ▪ Use of alternative energies (1) reducing energy requirements (1) <p><i>Accept any other appropriate response No credit for repetition</i></p> <p><i>Low response (1) or two low responses (2), or detailed response (2) for each of the advantages</i></p> <p style="text-align: right;">(2 x 1) (2 x 2)</p>	<p style="text-align: center;">(4)</p>
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(Total 10 marks)

Question	Answer	Mark
<p>13</p>	<p>One mark for identifying each impact One mark for each explanation</p> <p>Real time stock taking (1) reduces waste of stock (1)</p> <p>Simplified sourcing (1) Improved cost control (1)</p> <p>Use of barcodes (1) improved material traceability (1)</p> <p>Direct links to supplier and other departments (1) allowing immediate updating of material lists (1)</p> <p>Allows more frequent ordering (1) meaning less storage space required (1)</p> <p>Accurate modelling of material usage (1) ensures less stock out (1)</p> <p>Identifies potential obsolescence (1) avoids over ordering (1)</p> <p>Search facilities using databases/spreadsheets (1) allow sourcing/ordering of alternative materials (1)</p> <p><i>Accept any other appropriate response</i></p> <p><i>Do not accept cheaper, faster, quicker without an explanation</i></p> <p><i>No credit for repetition</i></p> <p><i>Low response (1) or two low responses (2), or detailed response (2) for each impact</i></p> <p style="text-align: right;">(2 x 1) (2 x 2)</p>	<p style="text-align: center;">(4)</p>

(Total 4 marks)

Question	Answer	Mark
<p>14</p> <p>QWC i, ii, iii</p>	<p>Indicative content</p> <ul style="list-style-type: none"> ▪ Use of energy management systems ▪ Intelligent lighting ▪ Use of low energy devices ▪ Energy consumption alarms ▪ Minimising over production ▪ Start up and shut down scheduling ▪ Generating own sources of energy ▪ Lean manufacturing techniques ▪ Efficient production planning ▪ Minimise high/low temp operations ▪ Pre-heating ▪ Use of heat exchangers/heat pumps/heat sinks ▪ Improved insulation ▪ Energy recovery systems ▪ Retrofit PLCs ▪ Reduce transportation/movement ▪ Improve staff awareness <p>e.g. manufacturers can use peak and demand monitor devices which will suggest better consumption methods that can be automatically actioned. They will be able to control their energy use by careful strategies such as intelligent lighting and the fitting of low energy devices. Manufacturers could use their own sources of supply such as solar panels/wind turbines or use heat pumps to service some energy needs. Other areas of energy control can be achieved by careful planning and use of insulation.</p>	<p style="text-align: right;">(6)</p>
(Total 6 marks)		

Level	Mark	Descriptor
	0	No material deserving of reward
1	1–2	The learner identifies at least two methods of monitoring/controlling energy consumption or gives a brief description of one method. The learner shows limited knowledge of monitoring/controlling energy consumption. The learner uses everyday language and the response lacks clarity and organisation. Spelling, punctuation and the rules of grammar are used with limited accuracy.
2	3–4	The learner gives a brief description of two methods of monitoring/controlling energy consumption or a detailed description of one method. The learner shows good knowledge of monitoring/controlling energy consumption. The learner uses some manufacturing/technological terms and shows some focus and organisation. Spelling, punctuation and the rules of grammar are used with some accuracy. Some spelling errors may still be found.
3	5–6	The learner gives a detailed explanation of at least two methods of monitoring/controlling energy consumption. The learner shows a developed knowledge of monitoring/controlling energy consumption. The learner uses a range of appropriate manufacturing/technological terms and shows good focus and organisation. Spelling, punctuation and the rules of grammar are used with considerable accuracy.
		(Total 6 marks)
Total Marks for Section B		60
Total Marks for the whole paper for Sections A & B		110

