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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Manufacturing & Engineering (5EM03) Paper 3B: Food and Drink, Biological and Chemical

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General Marking Guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Learners 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 learner'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 learner's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the learner has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC,
  are being assessed. The strands are as follows:

  i) Ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear

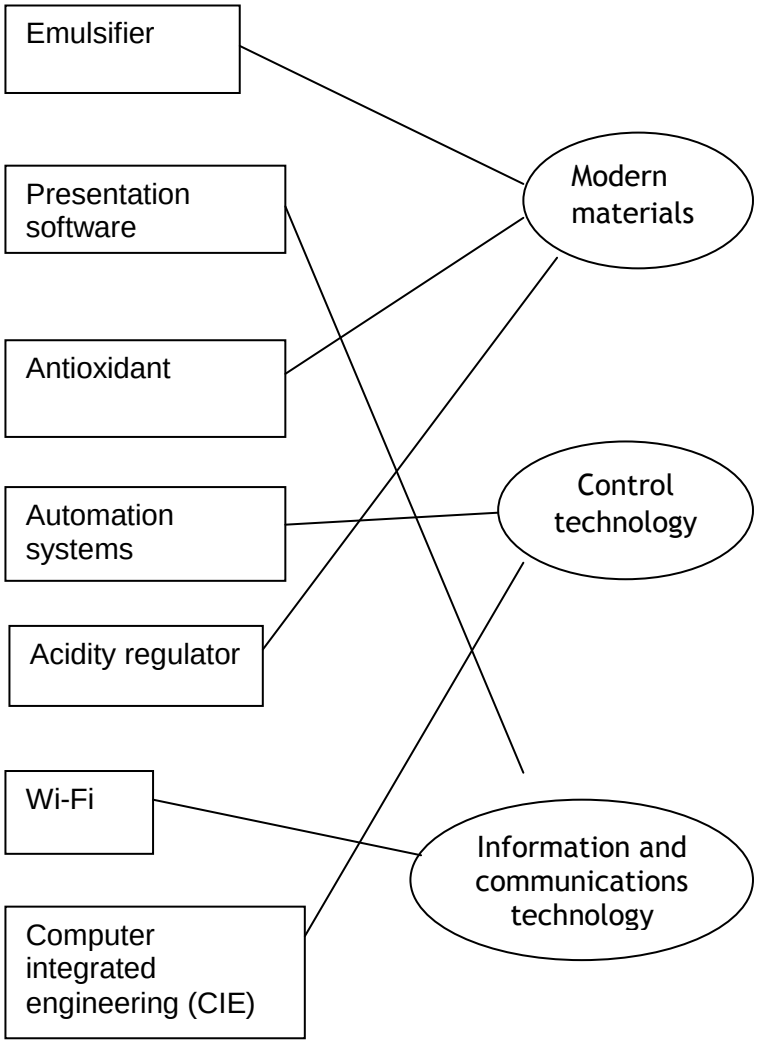
  ii) Select and use a form and style of writing appropriate to purpose and to complex subject matter

  iii) Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question	Answer	Mark
1(a)	• Swiss roll • Orange squash *If 3 boxes or more crossed - no marks.* (2 x 1)	**(2)**
1(b)	• Cough medicine • Deodorant *If 3 boxes or more crossed - no marks.* (2 x 1)	**(2)**
		(Total 4 marks)

Question	Answer	Mark
2(a) 1	• Digital scales • Scales • Electric scales • Electronic scales • Weighing scales • Measuring scales Do not accept measuring device *Accept any recognisable spelling (phonetic) of the answer above* (1 x 1)	
2(a) 2	• Docker • Roller docker • Hand docker • Pastry docker • Dough docker Accept any other appropriate response. *Accept any recognisable spelling (phonetic) of the answer above* (1 x 1)	**(2)**
2(b)	An answer that makes reference to two of the following points: • Used for accurately cutting sheeted/pinned pastry (1) • Used to cut into strips, squares, oblongs etc (1) • Used to accurately mark sheeted/pinned pastry (1) • Used to make lined patterns on pastry products, marzipan or similar (1) • To speed up the accurate cutting / marking of sheeted/pinned pastry etc (1) • To ensure the size / shape of products are consistent / are to specification (1) *Accept any other appropriate response* e.g. a piece of equipment that is used cut pastry into long strips , squares or oblongs (1) to ensure they are all the same size and shape (1) (1 x 2)	**(4)**

	An answer that makes reference to two of the following points: • To shred foods (1) • To make foods all the same size (1) • To reduce the size of foods (1) • To make foods easier to disperse through mixtures (1) • To make foods for decoration (1) • To make foods easier to handle (1) • To make food easier to weigh (1) *Accept any other appropriate response.* *e.g. a piece of equipment that is used to shred foods such* as cheese (1) so that it can be used for decorating products such as cheese scones (1). (1 x 2)	
		(Total 6 marks)

Question	Answer	Mark
3	Key terms linked to a key area  *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.* (7 x 1)	**(7)**
		(Total 7 marks)

Question	Answer	Mark
4(a)	Appropriate two **products** such as e.g. • Bread • Cakes • Biscuits • Pies • Toffee • Soup • Jam • Crisps • Doughnuts • Milk chocolate • A brand name of any other specific product is acceptable *This list is not exhaustive, accept any product from the food and drink, biological and chemical sectors and that uses modern materials in its manufacture.* (2 x 1)	**(2)**
4(b)(i)	• Bread – Preservatives • Cakes – Emulsifiers • Biscuits – Fructose syrup • Pies – Pre-gelatinised starch • Toffee – Glucose syrup • Soup - Modified corn flour • Jam – Pectin • Crisps – Powder flavourings • Doughnuts – Enzymes • Milk chocolate - Emulsifier *Accept any other appropriate response* (1 x1)	**(1)**

Question	Answer	Mark
4(b)(ii)	One mark for identifying each benefit One mark for each explanation • Better functional characteristics (1) usable life span (1) • Better aesthetic characteristics (1) texture (1) colour(1)/appearance(1)/flavour (1)/taste (1)/aroma (1) • Meets consumer needs(1)– appeal to target audience (1) • Better quality (1) – consistency (1) /reliability (1) • Reduced price (1) – better value for money (1) • Less waste (1) – spending reduced (1) Any other appropriate functional / aesthetic/ characteristic/ saving relating to the benefit *e.g. bread – preservatives increase the usable life of bread (1) so makes it better value for the consumer (1)* *No answer or incorrect answer to 4(b)(i) no marks for 4(b)(ii)* *Low response (1) or two low responses (2) or detailed response (2), for each of the 2 benefits* (2 x 2)	**(4)**
4(c)(i)	Must be related to the sector • Modified starches • Emulsifiers • Stabilisers • Humectants • Preservatives • Thermochromic inks Accept any other appropriate response Accept references to smart packaging materials and/or engineering applications used within the sector eg Thermo chromic inks, aroma pigments, hydro chromic inks, bio degradable inks, smart grease, smart springs, shape memory alloys Accept the same answer as given in 4(b)(i) if it is	**(1)**

Question	Answer	Mark
	a sector based smart material (1 x 1)	
4(c)(ii)	One mark for a characteristic One mark for the description • Modified starch – starches that will change the consistency of a product/ mixture (1) at different temperatures (1) • Emulsifiers – emulsifier can help make water and oil bind together (1) which can increase the softness of the product (1) • Stabilisers – stabilisers help prevent ingredients in a product from separating (1) therefore maintaining the original structure (1) • Humectants – humectants draw moisture into the product from the air surrounding it (1) helping to keep it moist for longer (1) • Preservatives – preservatives inhibit the growth of micro organisms which can spoil food (1) helping them stay edible for longer (1) • Thermochromic inks - inks that will change colour (1) when subjected to a change in temperature (1) *Accept any other appropriate response* *If no answer or incorrect answer to 4(c)(i) no marks for 4(c)(ii)* (1 x 2)	**(2)**
		(Total 10 marks)

Question	Answer	Mark
5(a)(i)	*An answer that makes reference to three of the following points, including an example:* • A global network of computers (1) • A means of transferring data (1) • A means of collecting data (1) • A means of accessing data (1) • A communication tool (1) • An easy-to-use interface (1) • A system which uses TCP/IP (Transmission Control Protocol/Internet Protocol) (1) • A network that includes web pages and large files that might be digital videos, music files or computer programs (1) • A tool that can be used to send email (1) • A tool that can be used to transfer files (1) *Accept any other appropriate response* *e.g. a global network of computers (1) which allow data to be transferred internationally (1) such as images, music files and emails (1)* (3x1)	(3)
5(a)(ii)	One mark for disadvantage One mark for extension • Expected to be continually available (1) increased stress (1) • Staff time wasted (1) lowers productivity (1) • Overrates the performance of the company (1) not meeting customer expectations / loss of personal contact / less direct communication (1) • Online data can be hacked / viruses introduced (1) loss/corruption of data (1) • Presumes a certain level of IT skills (1) staff need training (1) • Replaces research skills (1) knowledge base lost / loss of innovative solutions (1) • Systems failure/power loss/loss of connection (1) causing disruption to manufacturing (1) *Accept any other appropriate response* *Disadvantage must relate to the manufacturer* (2x1)	(2)

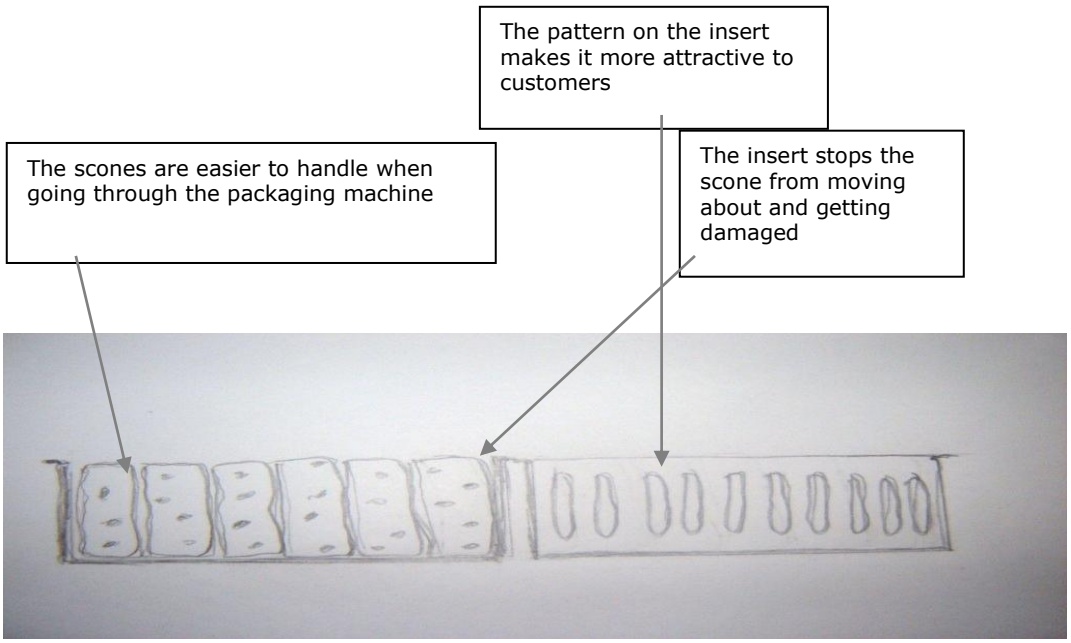
5(b)(i)	• Mobile phone/infrared/bluetooth • Video conferencing • Voice over Internet Protocol (VoIP) • Electronic point of sale (EPOS) • EDI • ISDN • Texting • Phone • Walkie talkie • Fax • Smart phone • Tablet • Near field communication (NFC) • Email • WIFI *Accept any appropriate response* *Accept Brand names of the above* (1x1)	(1)
5(b)(ii)	One mark for identifying the benefit One mark for the extension • Mobile phone/infrared/Bluetooth - flexibility (1) roaming location (1) • Video conferencing – no travel expenses (1) less time wasted in travel (1) • Voice over Internet Protocol (VoIP) - no travel expenses (1) less time wasted in travel (1) • Electronic point of sale (EPOS)/EDI – immediate transfer of information (1) no hard copies needed (1) • ISDN – more data transferred in parallel (1) quicker (1) • Texting – stored record of transaction (1) accountable (1) • Phone – immediate two way conversation (1) clarity (1) • Walkie talkie – flexibility (1) roaming location (1) • Fax – hard copy record (1) quick transfer of data (1) • Smart phone - immediate (1) access to vast amounts of information (1) • Tablet - flexibility (1) roaming location (1) • Near field communication (NFC) – fast data transfer (1) over short distances / between two devices (1) • Email – permanent record (1) for audit	

	purposes / attaching documents (1) • WIFI – convenient access (1) in a wide variety of locations (1) Other advantages may be seen in light of: Speed, accuracy, information retrieval, meets consumer demands, quicker, increased sales, reduced stock levels, reduced business costs, reduced lead times, calculation of sales, storage space reduced or any other appropriate response. *Advantages must relate to the retailer* *No answer or incorrect answer to 5(b)(i) no marks for 5(b)(ii)* (1x2)	(2)
		(Total 8 marks)

Question	Answer	Mark
6(a)(i)	• Lifting heavy goods (1) • Transfer of goods around factory (1) • Bundling (1) • Assembling products (1) • Packaging products (1) • Loading machines (1) • Loading lorries (1) • Placing products in outer packaging (1) • Collation of orders (1) *Accept any other appropriate response.* (1x1)	(1)
6(a)(ii)	One mark for each disadvantage One mark for each extension • High set-up costs (1) – purchasing of equipment (1) • High training costs (1) – new skills required (1) • Long set-up time (1) – time needed for new practices to be implemented (1) • Extra space needed (1) – older style factories may not be set up appropriately (1) • Reputation may suffer (1) – due to making staff redundant (1) • They require regular maintenance (1) from specialist technicians (1) • Incorrect programming (1) leads to repetitive mistakes (1) • Increased energy usage (1) leading to high emissions (1) *Accept any other appropriate response.* (2x2)	(4)
6(b)	One mark for identifying feature One mark for extension • Uses closed-loop processes (1) based on real time inputs (1) • A manufacturing system is linked together (1) using a CAD/CAM interface (1) • Using computers/PLCs/microcontrollers to control an entire production process (1) with constant exchange of information (1) • The whole process is controlled (1) by	(4)

Question	Answer	Mark
	embedding computers in the system (1) • An integrated system using computers (1) to monitor and control the manufacturing processes (1) • Suppliers can be integrated into the system (1) facilitating just-in-time techniques (1) *Accept any other appropriate response.* (2x2)	
		(Total 9 marks)

Question	Answer	Mark
7(a)	An answer that makes reference to any of the following points: • Know how many units are to be produced (1) • Plan stock levels (1) • Quantity of materials / components required for each unit (1) • Can order in time (1) • Quantity of materials / components already in stock (1) • Can amend new materials orders (1) • Cost of materials / components (1) • Can budget accordingly (1) • Supplier of materials / components (1) • Ease supplier relations (1) *Accept any other appropriate response* e.g. *The manufacturer would need to know how many units are required (1) to be able to plan stock levels* *(1) and inform suppliers earlier in the chain (1). This allows the manufacturer to budget accordingly (1).* *4 x 1 marks for 4 low responses, or up to 4 marks for a* *detailed response* (1 x 4)	**(4)**
7(b)	One mark for each benefit One mark for each extension • Accurate information (1) – updated regularly (1) • Fast access to data (1) – search/sort/query (1) • Effective goods tracking (1) – barcoding/EPOS (1) • Fast distribution (1) – fast delivery details (1) • Detailed information (1) – high storage space (1) • Improved planning (1) – short lead times (1) • Forecasting (1) – collects volumes of data/modelling (1) • Cost of control (1) – better scheduling (1) • Waste control (1) – process monitoring/control (1) • Reduced stock holding(1) – tracks trends/JIT (1) *Accept any other appropriate response* (1x2)	**(2)**
		(Total 6 marks)
	Total Marks for Section A	**50**

Question	Answer	Mark
8(a)	An answer that makes reference to any of the following points: • To protect the product from damage (1) • Reduced wasted product (1) • Easier handling at packaging/dispatch/warehousing stage (1) • Easier handling at point of sale (1) • Keeps the product clean (1) • Increases shelf/usable/freshness life (1) • Easier to count stock (1) • Customer attracted to product (1) • Easier home storage (1)  *Accept any other appropriate response.* *Must have notes and sketches (notes or sketches only maximum 2 marks)* *1 x 1 mark low response, or up to 3 marks for detailed response* (3 x 1)	**(3)**

8(b)	An answer that makes reference to any of the following points: • The gluten/protein content provides structure (1) • The starch content provides softness (1) • Contributes to taste (1) • Contributes to the texture (1) • Gives bulk to the product (1) • Facilitates gas retention (1) • Provides colour (1) • Provides nutrition (1) • Provides fibre (1) *Accept any other appropriate response.* *1 x 1 mark low response, or up to 3 marks for detailed response* (3 x 1)	**(3)**
8(c)	An answer that makes reference to any of the following points: • Provides gas (CO^2 /carbon dioxide) (1) • To create gas (1) • To create gas at the right time (1) • To create gas at the right temperature (1) • To create the correct amount of gas (1) • Aerates the product (1) • Increase the size/volume (1) • Makes the crumb structure open (1) • Improves the eating qualities (1) • Makes the scones less dense /lighter (1) • Contributes to softness (1) • Contributes to taste (1) • Contributes to appearance (1) • Allows for lower weight to volume ratios (1) *Accept any appropriate response.* *1 x 1 mark low response, or up to 3 marks for detailed response* (3 x 1)	**(3)**
		(Total 9 marks)

Question	Answer	Mark
9(a)(i)1	• Marketing (1 x 1)	
9(a)(i)2	• Processing and production • Production and processing • Processing • Production (1 x 1)	**(2)**
9(a)(ii)	• Production planning • Stage 3/Three • Three/3 • Planning *Do not accept 'production' on its own.* (1 x 1)	**(1)**
9(b)	Any three of the following points: • Development of the design brief (1) • Carry out taste tests (1) • Design specification for the mass produced packs of sultana scones (1) • Listing design criteria (1) • Listing performance requirements (1) • Use of internet/websites to investigate existing designs (1) • Sketches are produced by hand (1) • Initial design ideas are produced (1) • Development of design ideas (1) • Modelling ideas using ICT (1) • Using CAD software (1) • Prototyping/sampling before manufacture (1) • Sourcing materials/supplies/consumables (1) • Costing resource requirements (1) • Communicating with client/customer/focus groups (1) • Design modification (1) *Accept any other appropriate response* Accept references to 'packaging' (3 x 1)	**(3)**

Question	Answer	Mark
9(c)	Appropriate descriptions including three of the following points (statements must be applicable to packs of sultana scones): • Gathering together of manufactured parts (1) • Selecting correct packaging materials/equipment (1) • Scones placed in inserts / overwrapped (1) • Package boxed/sealed (1) • Labelling the packaging (1) • Bar coding/product code applied to boxed sets of products (1) • Boxes packed onto pallets (1) • Pallets/products transferred to storage/dispatch (1) • Final quality checks (1) • Packing/shipping lists (1) • Planning route for delivery (1) • Box items sent to retailers (1) • Details sent to finance department for invoicing requirements (1) • Stock control (1) *Accept any other appropriate response but must be related to the manufacture of packs of scones.* *e.g.* At this stage the sultana scones would be put into inserts and overwrapped (1) and put into boxes (1), and then sent to the customer (1). The details of the delivery would then be sent to the customer to ask for the money that they owe (1). *Up to 3 marks* *1 x 1 mark low response, 3 x 1 mark 3 low responses or up to 3 for detailed response* (3 x 1)	**(3)**
		(Total 9 marks)

Question	Answer	Mark
10(a)	• Potassium sorbate • E202 • Calcium propionate • Calcium propanoate • E282 *Accept any other appropriate response.* *Accept any recognisable spelling (phonetic) of the answers above*	**(1)**
10(b)(i)	Any three of the following: • Weighing /measuring ingredients • Cleaning ingredients ie sultanas • Conditioning ingredients • Transfer of mixtures to sheeter hoppers • Dusting • Sheeting/rolling/pinning • Cutting to shape • Trim edge removal • Trim/off- cut reclaim/re-work • Recovery/resting • Tray up/oven transfer • Baking • Pre-bake /post bake glazing • Cooling (rack or automated/controlled) *Accept any other appropriate response* *Accept any recognisable spelling (phonetic) of the answers above.* (3x1)	**(3)**

Question	Answer	Mark
10(b)(ii)	An explanation that makes reference to three of the following points: • Quick method / fast production rate • Reliable process • Minimal waste • Can be mass produced easily • Products have consistent quality • Neat and quality finish produced • Combines all ingredients to a single mass • Evenly disperses ingredients • Creates a smooth/even mixture • Develops gluten • Hydrates starch • Easier to monitor and control • Efficient use of energy • Low cost per unit *Accept any other appropriate response* *e.g. Automated mixing can be done quickly (1) dispersing all ingredients evenly (1) which helps to create a consistent product (1).* *3 x 1 marks for 3 responses, or up to 3 marks for a detailed response* *Allow 1 mark for any combination of the following without explanation:* *faster/quicker/cheaper/easier/accurate/consistent* (3x1)	**(3)**
10(c)	An explanation that makes reference to three of the following points: • Reduce the risk of contamination • To keep the scones clean • To maximise usable/shelf life/fresh • To protect the scones from damage • Low permeability to air/bacteria/moisture/oil • Good strength • Lightweight material • Can be printed on • Can be coated • Can be sealed • Can be made into reels • Can be used on packaging machines *Accept any other appropriate response*	**(3)**

Question	Answer	Mark
	e.g. Reels of cellophane can be used on automated packaging machines (1), it reduces the risk of contamination (1) and helps give the scones a longer shelf life (1). (3x1)	
		(Total 10 marks)

Question	Answer	Mark
11(a)(i)	Two of the following: • Automated re-ordering (1) • Automated stock records (1) • Automated delivery of materials to production (1) • Monitors/controls materials usage (1) • Provides cost information/data (1) • Monitors quality (1) • Automatic quantity checks (1) • Automatic movement (1) *Accept any other appropriate response* *Do not accept assembling or finishing product on its own* (2 x 1)	(2)
11(a)(ii)	One mark for each type One mark for each extension • PLCs (1) to control processes in production (1) • Use of conveyor systems (1) to move the scones from one process to the next (1) • Embedded computers (1) to perform dedicated functions (1) • Machine monitoring (1) to control quality and accuracy (1) • To improve safety (1) in hazardous conditions by using robots (1) • Use of CAM (1) to monitor whole process performance (1) *Do not accept CAD or CNC on their own* *Accept any other appropriate response* *Low response (1) or two low responses (2) or detailed* *response (2) per example* (2 x 2)	(4)

11(b)	One mark for each benefit One mark for each extension • Reduced customer complaints (1) better/consistent quality (1) • Repeatability of specification (1) due to no human involvement (1) • Reduced costs (1) as less staff are required (1) • Faster production rates (1) due to 24/7 operation (1) • Dangerous operations can be carried out (1) without risk or injury to workers (1) • Less waste produced (1) due to carefully controlled production (1) • Better process control (1) due to in-process monitoring (1) • Less energy consumed (1) due to reduction in wasted activity (1) *Accept any other appropriate response* *2 x 1 marks for 2 responses each, or 2 marks for a detailed response* *Allow 1 mark for any combination of the following without explanation:* *faster/quicker/cheaper/easier/accurate/consistent* (3 x 2)	(6)
		(Total 12 marks)

Question	Answer	Mark
12(a)(i)	An answer that makes reference to two of the following points: • A system for reducing waste (1) • Maximises customer value (1) • A responsive system (1) • Eliminating processes that do not add value (1) • Focuses processes and production (1) • Organising a 'flow' system of processes (1) • A system which allows processes to be flexible (1) *Accept any other appropriate response* *e.g. lean manufacturing is a responsive system (1) which allows a company to minimise waste (1)* (2 x 1)	**(2)**

12(a)(ii)	One mark for identifying the advantage One mark for explanation • More consistent/accurate products (1) - fewer returns (1) • Lower purchase price (1) – increased sales (1) • Shorter ordering times (1) – improved response for customer (1) • Automated ordering (1) – in-demand products available (1) • Fewer customer complaints (1) - more repeat sales (1) • Ability to order bespoke/varied products (1) – improved customer satisfaction (1) • Better communication with manufacturer (1) – less likelihood of delivery errors (1) • Receipt and movement of goods inward improved (1) – simplified tracking procedures (1) • Increased number of customer referrals (1) resulting in a larger customer base (1) *Do not accept 'easier', or 'faster/quicker' without explanation* *Low response (1) or two low responses (2) or detailed* *response (2), for each of the advantages* (2 x 2)	**(4)**
12(b)(i)	Two of the following: • May reduce carbon emissions (1) • May result in operational efficiencies / less energy / saves fossil fuels (1) • Likelihood of reduced waste going to landfill (1) • Could produce healthier environment (1) • May improve quality (1) *Accept any other appropriate response* (2 x 1)	**(2)**

12(b)(ii)	One mark for identifying the benefit, one mark for extension Explain **one** benefit that this change could have on the workforce. • Healthier working environment (1) because it is cleaner (1) • Requirement to learn/use specialist techniques such as fishbone diagrams and SPC (1) contributing to worker development • Bonus payments/incentives (1) may be performance related (1) • Development of communication skills (1) as team working important (1) • Improved promotion prospects for those in post (1) as skills in demand (1) • More direct communication (1) as fewer layers of management (1) • More job security (1) as manufacturing likely to be more efficient (1) • Higher motivation (1) workers will not become tired of monotonous/repetitive jobs (1) *Accept any other appropriate response* (1 x 2)	**(2)**
		(Total 10 marks)

Question	Answer	Mark
13	An answer that makes reference to any of the following points: • Use suitable forms of supply to reduce waste • Reworking non-compliant products to save materials • Burn packaging materials to reclaim heat/heat water • Recover energy from the processing of materials through exhaust systems/heat exchangers • Waste food being reprocessed to make other products • Surplus products being reprocessed to make by products • Recycling materials so less waste materials go to landfill • Source local materials to reduce transportation costs • Using alternative forms of energy (1) to reduce the consumption of fossil fuels *Accept any other appropriate response* *Up to 4 low responses (4) or detailed response (up to 4)* (1 x 4)	**(4)**
		(Total 4 marks)

Question	Answer	Mark
14 **QWC i, ii, iii**	**Indicative content** **Indicative content** Discussion may address the following issues: • *Impact* ▪ Increased level of accuracy • *Development* ▪ Greater levels of automation allow for greater levels of control ▪ Reduction in human errors ▪ Higher level of precision from machines ▪ Automatic sensors / quality control checks ensuring the quality of the product • *Impact* ▪ Reduced wastage • *Development* ▪ Automation allows for earlier detection of faulty goods ▪ Automation allows for automatic removal of goods not up to quality • *Impact* ▪ Move away from highly skilled manual jobs / crafts • *Development* ▪ Automation may be less efficient when making items of a bespoke standard or skill level and when carrying out one off quality checks *Accept any other appropriate response*	**(6)**
		(Total 6 marks)

Level	Mark	Descriptor
	0	No material deserving of reward
1	**1-2**	The learner identifies at least two impacts that automation has on the quality of products or gives a brief description of one impact, and shows some understanding of the topic. 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 at least two impacts that automation has on the quality of products or a detailed description of one impact. 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 impacts that automation has on the quality of products. 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 Section A & B	**110**