Mark Scheme (Results)

Summer 2017

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:

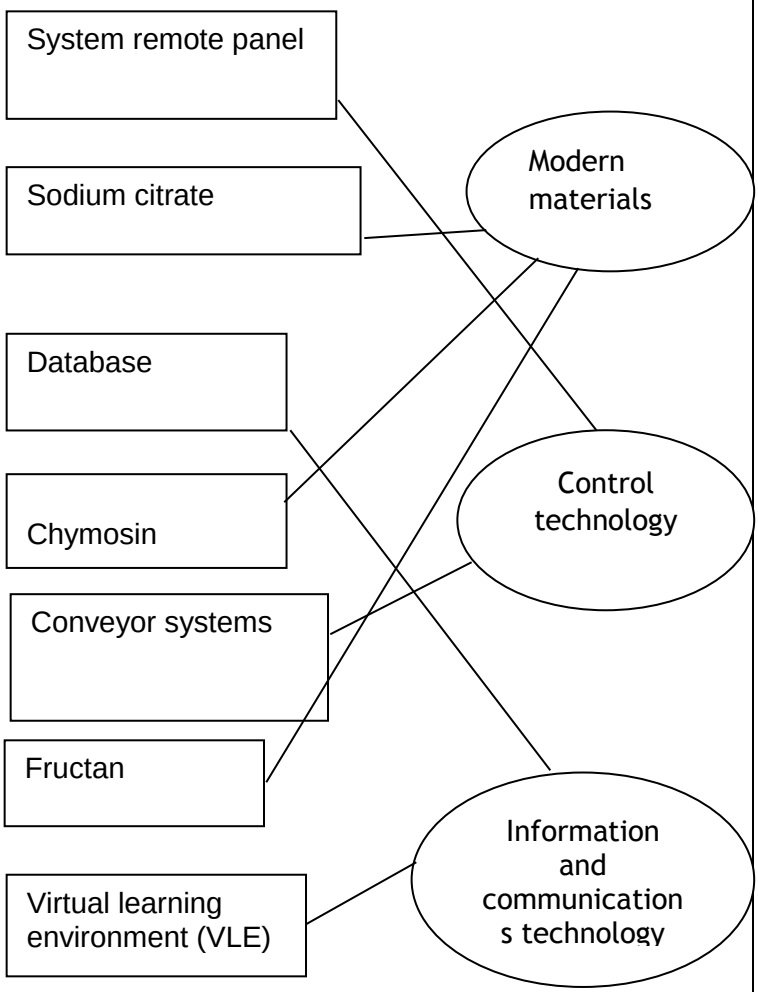
  i) Ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear

  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 Number	Answer	Mark
1(a)	• Grapefruit juice • Tea cake *If 3 boxes or more crossed - no marks.* (2 x 1)	**(2)**
1(b)	• Moisturiser • Lip balm *If 3 boxes or more crossed - no marks.* (2 x 1)	**(2)**
		(Total 4 marks)

Question Number	Answer	Mark
2(a) 1	• Hand blender • Blender • Stick blender Do not accept mixer or stirrer *Accept any recognisable spelling (phonetic) of the answers above* (1 x 1)	
2(a) 2	• Baster • Meat baster *Accept any recognisable spelling (phonetic) of the answers above* (1 x 1)	**(2)**
2(b) 1	An answer that makes reference to two of the following points: • Draining foods (1) • Removing solid foods from liquids (1) • Separating liquids from solid foods (1) • Removing extraneous matter from foods (1) • Stirring foods (1) • Portioning foods (1) • Serving foods (1) *Accept any other appropriate response* e.g. used to drain liquids from solid foods (1) when portioning ready meals (1) (1 x 2)	
2(b) 2	An answer that makes reference to two of the following points: • Slices vegetables (1) • Slices firm foods (1) • Achieves consistent thickness (1) • Aids consistent cooking times (1) • Creates decorative shapes/cuts (1) *Accept any other appropriate response* e.g. Slices raw foods such as carrots (1) to all the same thickness (1) (1 x 2)	**(4)**
		(Total 6 marks)

Question Number	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 Number	Answer	Mark
4(a)(i)	Appropriate two **products**, such as: • Sultana scones • Chocolate bars • Jam Doughnuts • Apple pies • Cakes • Pastries • Biscuits A brand name of a specific product is acceptable *This list is not exhaustive, accept any product from the food sector.* (2 x 1)	**(2)**

4(a)(ii)	Appropriate two **processes**, such as: • Glazing • Coating • Dusting/Dredging • Enrobing • Spreading • Piping *Accept any other appropriate response* (2 x 1)	**(2)**

Question Number	Answer	Mark
4(a)(iii)	• Glazing - is a process used to apply a thin and even coating of egg / soft/wet icing to a un-cooked or cooked product (1) usually with a brush or spray (1) • Coating – is a process to apply a decorative medium such a buttercream to cover the top and sides of a product such as a cake (1) often applied with a pallete knife and smoothed with a scraper (1) • Dusting/Dredging – is a process to cover a food product with an even cover of powder such as icing sugar/flour (1) usually applied with a dredger or sieve (1) • Enrobing – Is a process to cover a product by passing it through a curtain of semi-fluid material such as chocolate/fondant/icing (1) using automated equipment which keep the temperature consistent (1) • Spreading – is a process to apply a consistent thickness of toppings such as creams/chocolate/caramel to a product(1) often applied with knife/scraper/piping bag to form a decorative pattern(1) • Piping – is process used to apply icings/creams/toppings with a piping bag fitted with form shaping tube(1) to form a distinctive border/edging (1) *Accept any other appropriate response* (1 x 2)	**(2)**
4(b)	One mark for each technique One mark for each description Visual inspection (1) to check for defects/physical damage (1) Dimensional checks (1) to check measurements using equipment such as rulers/gauges/templates (1) Weight checks (1) using manual scales/in-line weighing systems (1) Temperature checks (1) using hand/integrated thermometers/gauges (1) Flavour checks (1) using organoleptic testing to ensure consistency (1) Colour checks (1) using photographs/charts/electronic measurements (1) Microbiological checks (1) using rapid/traditional methods to ensure the product is safe (1) Shelf life tests (1) checking the durability of the product over varying times and conditions (1) Scanning (1) for foreign bodies using in- line x-ray machines (1)	**(4)**

Question Number	Answer	Mark
	Label/coding checks (1) to ensure products are correctly labelled and traceability is in place (1) *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* (2 x 1) (2 x 2)	
		(Total 10 marks)

Question Number	Answer	Mark
5(a)	Accept any two responses: • 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) *Accept any other appropriate response* (2 x 1)	**(2)**
5(b)	One mark for identifying the disadvantage One mark for the description • 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)	**(2)**

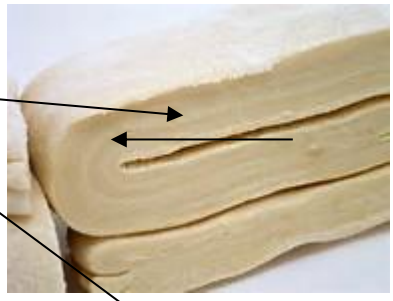
Question Number	Answer	Mark
	• Consumers can look negatively (1) on this 'deskilling' of workers (1) *Accept any other appropriate response* (1 x 2)	
5(c)	One mark for identifying each benefit One mark for each description • PLCs control manufacturing devices i.e. robots (1) to improve quality (1) • 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) *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 benefits* (2 x 1) (2 x 2)	**(4)**
		(Total 8 marks)

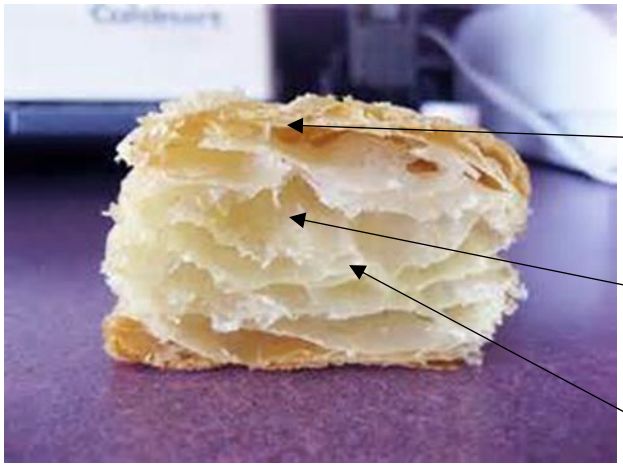
Question Number	Answer	Mark
6(a)(i)	Any one of the following: • Mobile phone/infrared/bluetooth • Video conferencing • Voice over Internet Protocol (VoIP) • Electronic point of sale (EPOS) • EDI • ISDN • Texting • Phone • Walkie talkie • Fax • Smart phone • Tablet *Accept brand names of the above* *Accept any other appropriate response* (1 x 1)	**(1)**
6(a)(ii)	An answer that makes reference to **two** of the following points: • 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 *Accept any other appropriate response* e.g. A method of connecting devices (1) which allows for easy communication (1) (1 x 2)	**(2)**
6(b)	One mark for identifying each reason One mark for each explanation The use of a dedicated computer system (1) within a larger system to perform specific functions (1) To monitor each process (1) as each part of the process has its own embedded system (1) Embedded computers are integral to process design (1) as industrial workplaces can often be harsh environments (1)	**(6)**

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

Question Number	Answer	Mark
7(a)	One mark for identifying the benefit, up to two marks for the explanation: • 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) *Accept any other appropriate response* Low response (1) or detailed statement (3) (1 x 3)	**(3)**

Question Number	Answer	Mark
7(b)	One mark for identifying the benefit, up to two marks for the explanation: • Fewer materials / ingredients 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) *Accept any other appropriate response* *Low response (1) or detailed statement (3)* (1 x 3)	**(3)**
		(Total 6 marks)
	Total Marks for Section A	**50**

Question Number	Answer	Mark
8(a)	An answer that makes reference to any of the following points: • To develop / hydrate the gluten (1) • To moisten the starch (1) • To control/adjust pastry mix consistency (1) • To help control pastry mix temperature (1) • To help disperse other ingredients through the pastry mix (1) • To create steam during baking to assist 'lift'/'rise' (1) **LINE DRAWING REQUIRED** Controls the consistency of the pastry  Develops the gluten Helps disperse ingredients in the mix *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* (1 x 3)	**(3)**
8(b)	An answer that makes reference to any of the following points: • To provide proteins/gluten (1) • To provide starch (1) • To provide structure to the pastry (1) • To contribute to layering/lamination (1) • To absorb water (1) • Influences texture of pastry (1) • Influences the 'lift'/volume of pastry (1) • Influences eating attributes(1)	**(3)**

Question Number	Answer	Mark
	LINE DRAWIING REQUIRED  *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* (1 x 3)	
8(c)	An answer that makes reference to any of the following points: • Assists with layering/lamination (1) • Influences 'lift' /volume (1) • Contributes to texture ie crispness/shortness/softness (1) • Contributes to taste/flavour (1) • Contributes to palatability/eating qualities (1) • Adds colour (1) *Accept any other appropriate response* *1 x 1 mark low response, or up to 3 marks for detailed response* (1 x 3)	**(3)**
		(Total 9 marks)

Question Number	Answer	Mark
9(a)(i)1	• Processing and production • Production and processing • Production processing • Production • Processing *Accept any recognisable spelling (phonetic) of the answers above* (1 x 1)	
9(a)(i)2	• Assembly and finishing • Finishing and assembly • Assembly • Finishing *Accept any recognisable spelling (phonetic) of the answers above* (1 x 1)	**(2)**
9(a)(ii)	• Design • Stage 1/stage one • One/1 • First/ First stage (1 x 1)	**(1)**
9(b)	An answer that makes reference to any of the following: • Gathering consumer opinion (1) • Calculating product costs (1) • Developing a marketing plan (1) • Using market research (1) • Developing a competitive edge (1) • Advertising the frozen puff pastry sheets (1) • Promoting the frozen puff pastry sheets (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) *Accept any other appropriate response* (3 x 1)	**(3)**
9(c)	Appropriate descriptions including three of the following points (statements must be applicable to the frozen puff pastry sheets): • Frozen puff pastry sheets are wrapped / boxed (1)	

Question Number	Answer	Mark
	• Boxes packed onto pallets (1) • Boxed/cartoned items sent to retailers (1) • Bar coding applied to boxed products (1) • 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) • Final quality control checks (1) • Stock control (1) *Any other appropriate response but must be related to the manufacture of frozen puff pastry sheets* e.g. At this stage the packs of frozen puff pastry sheets 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). *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* (1 x 3)	**(3)**
		(Total 9 marks)

Question Number	Answer	Mark
10(a)	• Mono and Diglycerides of fatty acids • E471 • Lecithin • E322 Do not accept fatty acids on its own *Accept any other appropriate response* (1 x 1)	**(1)**
10(b)(i)	Any three of the following: • Mixing • Batching/weighing pastry mix • Billeting • Extruding • Size/thickness reduction/sheeting • Rolling/pinning • Chilling/refrigerating • Cutting/guillotining • Blast/tunnel/gyro freezing *Accept any other appropriate response* Do not accept freezing on its own. *Accept any recognisable spelling (phonetic) of the answers above* (3 x 1)	**(3)**

Question Number	Answer	Mark
10(b)(ii)	An explanation that makes reference to three of the following points: • Creates accurate layering of the pastry margarine and dough • Controls size/thickness • Controls rate of size reduction • Reliable process • Minimal waste • Products have consistent quality • Can be automated • Safer process • Aids cost control • Quick method/fast production rate when set up • Unit costs are very low for high volume production runs • Not labour intensive *Accept any other appropriate response* e.g. Lamination can be automated (1) which results in minimal waste (1) and produces a consistent quality product (1) *3 x 1 mark for 3 low responses, or up to 3 marks for a detailed response* (1 x 3)	**(3)**
10(c)	An explanation that makes reference to three of the following points: • Improved aesthetics • Better functionality • Longer lasting/ improved shelf life • 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 *Accept any other appropriate response* e.g. Modern materials have better functional characteristics (1), are more durable (1) and allow for greater consumer choice (1)	**(3)**

Question Number	Answer	Mark
	3 x 1 mark for 3 low responses, or up to 3 marks for a detailed response (1 x 3)	
		(Total 10 marks)

Question Number	Answer	Mark
11(a)	An answer that makes reference to any of the following: • 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) *Accept any other appropriate response* (1 x 2)	**(2)**
11(b)(i)	One mark for each example One mark for each description • Robots (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 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 frozen puff pastry sheets to another stage of production/storage (1) *Accept any other appropriate response* *No credit for repetition* *1 x 1 mark low response, 3 x 1 mark 3 low responses, or detailed response (2) per example* (3 x 2)	**(6)**
11(b)(ii)	One mark for the disadvantage One mark for the explanation • 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)	**(2)**

Question Number	Answer	Mark
	• More training required (1) to be able to operate the equipment (1) *Accept any other appropriate response* (1 x 2)	
11(b)(iii)	One mark for the benefit One mark for the explanation • 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 production (1) • Product guarantee (1) as confidence in the automation process (1) • Customer satisfaction (1) because of consistent products (1) Accept any appropriate response. (1 x 2)	**(2)**
		(Total 12 marks)

Question Number	Answer	Mark
12(a)(i)	An answer that makes reference to two of the following points: • 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) *Accept any other appropriate response* (2 x 1)	**(2)**
12(a)(ii)	One mark for identifying each effect One mark for each explanation • 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) *Accept any other appropriate response* *Do not accept cheaper, faster, quicker without an explanation* *No credit for repetition* *Low response (1) or two low responses (2), or detailed response (2) for each of the effects* (2 x 1) (2 x 2)	**(4)**
12(b)	One mark for identifying each advantage One mark for each explanation • 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)	**(4)**

Question Number	Answer	Mark
	• Transportation reduced (1) saving of fossil fuels/less emissions (1) • Use of alternative energies (1) reducing energy requirements (1) *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 advantages* (2 x 1) (2 x 2)	
		(Total 10 marks)

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

Question Number	Answer	Mark
	response (2) for each impact (2 x 1) (2 x 2)	
		(Total 4 marks)

Question Number	Answer	Mark
14 **QWC i, ii, iii**	**Indicative content** • 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 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.	**(6)**
		(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.

Level	Mark	Descriptor
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**