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Mark Scheme (Standardisation)
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GCSE

GCSE Engineering & Manufacturing (5318/05)

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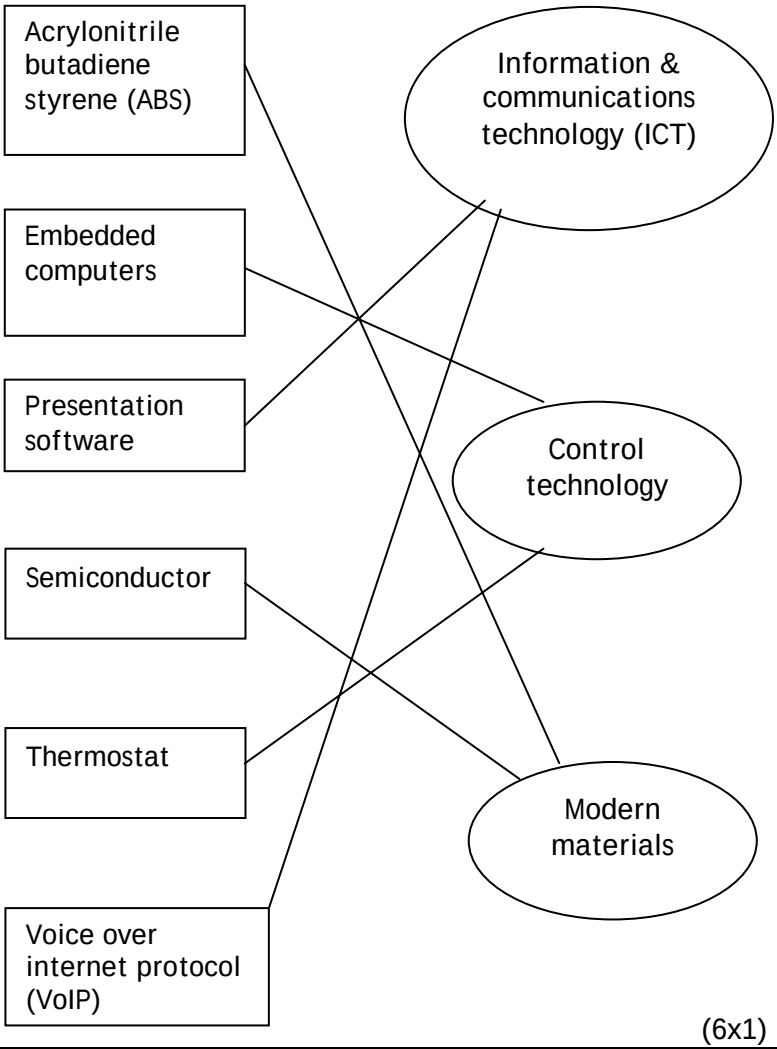
Section A

Question Number	Answer	Mark
1(a)	• Microwave cooker (1) • Games console (1) *If three boxes ticked max marks = 1 mark.* *If 4 boxes or more ticked no marks.* (1x1) (1x1)	(2)

Question Number	Answer	Mark
1(b)	• Mobile phone (1) • Set top box (1) *If three boxes ticked max marks = 1 mark.* *If 4 boxes or more ticked no marks.* (1x1) (1x1)	(2)

Question Number	Answer	Mark
2(a)	• Resistor (1) • Fixed resistor (1) Accept any answer that makes reference to a resistor, e.g. Carbon Resistor *Accept any recognisable spelling (phonetic) of the answer above.* *Do not accept ' Variable or preset resistor'* (1x1)	
	• Battery (1) • PP3 Battery (1) Accept any answer that makes reference to a battery, e.g. 'Duracell/Energizer Battery' 'Circuit Battery' '9V Battery' *Accept any recognisable spelling (phonetic) of the answers above.* *Do not accept 'Cell/s' or, 'power source' or 'car battery'* (1x1)	(2)

Question Number	Answer	Mark
2(b)	An answer that makes reference to two of the following points: • A semiconductor device giving on/off states • Used in circuits to give time delays • Used for monostable and astable applications • Used as a multivibrator circuit • Used with resistors and capacitors for time delay • Soldered onto PCB boards e.g. A popular semiconductor device (1) used to provide time delays in circuits (1) (1x1) (1x1)	
	An answer that makes reference to two of the following points: • A semiconductor device that emits light • Used as an indicator in an electronic circuit • Higher power applications such as torches • Can be used as indicators on cars • 5mm package used in circuits and panels • Can flash different colours e.g. Semiconductor light (1) which can be used as an indicator (1) (1x1) (1x1)	(4)

Question Number	Answer	Mark
3	*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.* **Term** **Key Area**  (6x1)	(6)

Question Number	Answer	Mark
4(a)(i)	Appropriate **product** such as e.g. • Digital clock (1) • Mobile phone (1) • TV (1) • Digital camera (1) • DVD player (1) • MP3 player (1) • Laptop (1) • Electric drill (1) • Soldering iron (1) • LED Headtorch (1) *Accept brand name of a specific product.* *This list is not exhaustive; accept any product associated with the electrical and electronics, process control, computer, telecommunications products.* (1x1)	(1)

Question Number	Answer	Mark
4(a)(ii)	Appropriate explanation of what the product does, may include reference to features and function Examples: • Mobile phone - long range portable device (1) used for mobile communication(1) • TV - telecommunication system (1) for broadcasting and receiving moving pictures and sound over a distance • Digital camera - To take pictures (1) and store them on disk (1) *If product given in 4(a)(i) is not from this sector but is from one of the other engineering/manufacturing sectors then allow follow through, up to one mark.* *No answer to 4(a)(i) no mark for 4(a)(ii)* (2x1)	(2)

Question Number	Answer	Mark
4(b)(i)	• design (1) marketing (1) production planning (1) materials – supply and control (1) processing/production (1) assembly/finishing (1) packaging/dispatch (1) *If product given in 4(a) (i) is not from this sector but is from one of the other engineering/manufacturing sectors then allow follow through.* *No answer to 4(a)(i) no marks for 4(b)(i)* *Accept a process that is within any of the stages (e.g using CAD, or using CAM) or (e.g. handling customer information) or (e.g. controlling packaging processes) must be appropriate to the product stated in 4(a)(i)* (1x1)	(1)

Question Number	Answer	Mark
4(b)(ii)	One mark for identifying advantage One mark for why Appropriate advantage to the manufacturer e.g. **Design, marketing, production planning, materials – supply and control, processing/production, assembly/finishing, packaging/dispatch** **design** • better designs (1) – can link other information into the process (1), or best designs can be maximised by simulation (1) • faster (1) – many CAD features such as copy, array can be used (1) or if mistakes made they can be quickly rectified (1) **marketing** • accurate information (1) – less mistakes made in capturing data (1) • better/accessible knowledge base (1) – easy data entry/data analysed easy (1) **production planning** • speed (1) – faster than human application (1) **materials – supply and control** • buy best available materials (1) – use of internet (1) • waste control (1) – by monitoring processes and quality control of processes (1) **processing/production** Answer could relate to the application of CAM and control technology such as:– • energy conservation (1) – by control of energy into process (1) • waste control (1) – by monitoring processes and quality control of processes(1) • competitiveness (1) – faster rates of production/application of CAM techniques (1) • product consistency (1) – by control of processes (1) • cost control (1) – by less waste/faulty parts (1) • efficiency (1) – by less waste/faulty parts (1) • speed (1) – faster than human application (1)	

	assembly/finishing Answer could relate to the application of CAM and control technology such as:– • energy conservation (1) – by control of energy into process (1) • waste control (1) – by monitoring processes and quality control of processes (1) • product consistency (1) – by control of processes (1) • cost control (1) – by less waste/faulty parts (1) • efficiency (1) – by less waste/faulty parts (1) • speed (1) – faster than human application (1) **packaging/dispatch** Answer could relate to the application of CAM and control technology such as:– • packaging consistency (1) – by control of processes (1) • cost control (1) – by less waste/faulty parts (1) • efficiency (1) – by less waste/faulty parts (1) • speed (1) – faster than human application (1) • energy conservation (1) – by control of energy into process (1) • waste control (1) – by monitoring processes and quality control of processes (1) *Low response (1) or two low responses (2) or detailed response (2)* *If the answer in part 4(b)(i) is not a manufacturing stage allow follow through up to 2 marks.* *No answer to 4(b)(i) no marks for 4(b)(ii)* (1x1) (1x1)	(2)

Question Number	Answer	Mark
4(c)(i)	• polymer / plastic (although plastic is not technically correct accept the term plastic) (1) • adhesive (1) • coating (1) • metal (1) • composite (1) • shape memory alloy (1) • ceramic (1) • Other appropriate modern material – a material currently used for the given application (1) *Accept brand name of a specific material* *If product given in 4(a)(i) is not from this sector but is from one of the other engineering/manufacturing sectors then allow follow through.* *No answer to 4(a)(i) no marks for 4(c)(i)* (1x1)	(1)

Question Number	Answer	Mark
4(c)(ii)	One mark for identifying an improved characteristic One mark for how • Functional characteristics – weight (1) / size (1) / shelf life (1) / protection (1) / rigidity (1) • Mechanical characteristics – strength (1) / durability (1) • Aesthetic characteristics – surface finish (1) / texture (1) / colour (1)/ appearance (1) • Reduced weight (1) – better strength to weight ratio (1) • Reduced cost (1) – quicker to manufacture / assemble (1) • Better appearance (1) – brighter (1) / attractive finish (1) • Any other appropriate functional / mechanical / aesthetic characteristic relating to the improvement (1) *If answer in part 4(a)(i) is inappropriate but the material given in 4(c)(i) is appropriate allow follow through up to 2 marks. If no answer is given in part 4(a)(i) but the answer to part 4(c)(ii) relates to the material stated in part 4(c)(i) allow follow through up to 1 mark. If no answer or incorrect answer given in part 4(c)(i) no marks awarded for 4(c)(ii)* (1x1) (1x1)	(2)

Question Number	Answer	Mark
5(a)(i)	*One mark per relevant example* • to create virtual products (1) • to produce design drawings (1) • to create 2 or 3D designs (1) • for modelling (1) • to show ideas (1) • to show new product concepts (1) • to modify existing products (1) • to animate designs (1) • to prepare an initial product specification (1) *Do not accept software names on their own; do not accept 'software' without explanation e.g. 2D design software / package; do not accept 'design' or 'designing' on its own.* (1x1) (1x1)	(2)

Question Number	Answer	Mark
5(a)(ii)	One mark for identifying benefit One mark for how • accurately drawn (1) entry of accurate data on sizes (co-ordinates) (1) • quicker development time (1) – through simulation (1) • easier to communicate (1) – transfer of data (1) • easy to make modifications / edit / change (1) – no paper hard copies (1) / computer data (1) • lower initial development costs (1) – concurrent design processes (1) • easy storage of data/information and retrieval (1) – interaction with databases (1) • conversion from 2D to 3D (1) for modelling (1) *Low response (1) or two low responses (1) e.g. its quicker and more accurate (1) or detailed response (2)* *Must relate to one of the examples given and to the manufacturer. If answer in part 5(a)(i) is inappropriate allow follow through up to 2 marks. If no answer given in part 5(a)(i) allow follow though up to 1 mark.* *Do not accept 'easier' without explanation* (1x1) (1x1)	(2)

Question Number	Answer	Mark
5(b)(i)	*One mark per relevant example* • Fax (1) • Mobile phone / infra-red / blue tooth (1) • Email / messaging (1) • Internet / wireless / WI-FI (1) • Video conferencing (1) • Electronic point of sale (EPOS) (1) • EDI (1) • ISDN (1) • Texting (1) • Phone (1) • Walkie Talkie (1) • Voice over internet protocol – VoIP (1) *Do not accept: TV, CAD, Radio, database, computer, laptop, spreadsheets* (1x1) (1x1)	(2)

Question Number	Answer	Mark
5(b)(ii)	One mark for identifying benefit One mark for how • Mobile phone – can talk to supplier when needed (1) flexibility / roaming location (1) • Email – can send or receive instructions that are accurate/can get or send written confirmation of instructions (1) immediate permanent record (1) • Internet – can order and check stock immediately/in real time (1) immediate vast access to information (1) • Video conferencing –no travel expenses / less time wasted in travelling (1) but has face to face contact (1) • Electronic point of sale (EPOS) – faster / more accurate control of stock (1) automatic reading of bar codes (1) • EDI – immediate transfer of information / no hard copies needed / less storage space (1) by use of secure on–line facilities (1) • ISDN – more data transferred in parallel (1) faster response rate with supplier through use of technology (1) • Texting – can refer back to what message was given (1) stored record of transaction (1) • Phone – can clarify and confirm without having to re–visit the discussion later (1) immediate two way conversation (1) • Walkie talkie – can clarify and confirm without having to re–visit the discussion later (1) immediate two way conversation / flexibility / roaming location / cost (1) • Fax – can refer back to what message was given (1) stored record of transaction (1) **Other benefits may be seen in the light of:** Speed, accuracy, JIT, information retrieval, meets consumer demands, quicker, increased sales, reduced stock levels, reduced running costs, reduced lead times, calculation of sales, stock taking quicker/easier, storage space reduced or any other appropriate response *Must relate to one of the examples given and to the manufacturer. No answer in 5(b)(i) no marks, otherwise, allow follow through to one mark. 2 low responses 1 mark only.* (2x1)	(2)

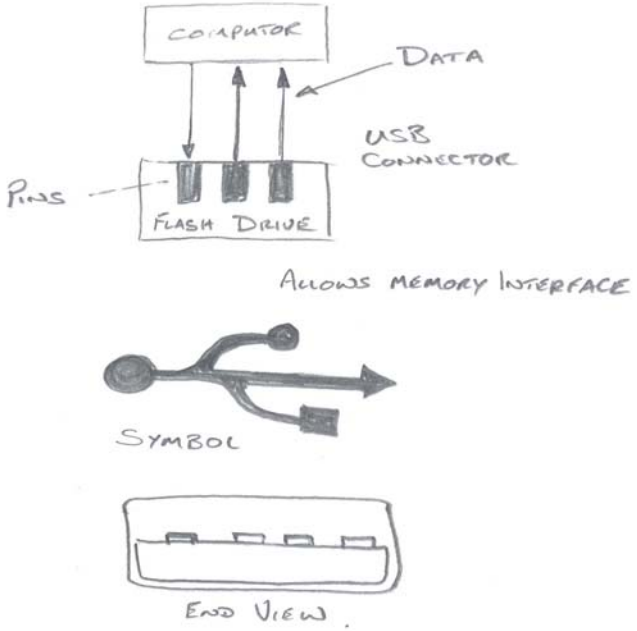
Question Number	Answer	Mark
6(a)	• Materials that have one or more properties that can be significantly changed in a controlled fashion(1) by external stimuli, such as stress, temperature, light, moisture, pH, electric or magnetic fields (1) • Materials that sense environmental conditions (1) and respond to them (1) • Materials that appear to 'think' (1) or have some 'memory' (1) • Or other appropriate answer *Low response (1) or two low responses (2) or up to two marks for a detailed response (2); 1 mark only for naming a smart material related to the sector, i.e. piezoelectric material, shape memory alloys, shape memory polymers, thermoresponsive materials, magnetic shape memory alloys, ph sensitive polymers, carbon fibre etc.* (2x1)	(2)

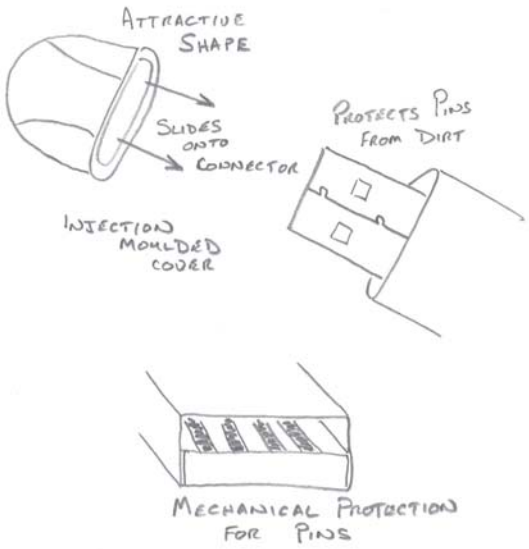
Question Number	Answer	Mark
6(b)	One mark for identifying the benefit One mark for how • reduced ordering times (1) – automatic monitoring (1) • improve quality / accuracy (1) – control of processes (1) • reduced wastage (1) – optimise production methods (1) • improved efficiency (1) – faster / quicker throughput (1) • better process control (1) – in process monitoring (1) • reduced labour (1) – automated processes (1) • lower costs (1) – reduced wastage/faster/continuous production (1) • safer processes (1) – less manual input (1) Do not allow repetition *Do not accept 'easier' without explanation.* *Low response (1) or two low responses (2) or detailed response (2), for each of 3 benefits* (2x1) (2x1) (2x1)	(6)

Question Number	Answer	Mark
7(a)	One mark for each point made up to 2 marks such as: • Guards/sensors on machinery (1) so machinery can shut down automatically (1) • Automated machinery (1) can operate in hazardous environments (1) • Less human input at the production stage (1) reduces errors (1) and results in fewer accidents (1) • Fewer problems with fatigue (1) enables continuous processing (1) • Or any other appropriate response *Low response (1) or two low responses (1) or detailed response (2)* (1x1) (1x1)	(2)

Question Number	Answer	Mark
7(b)	One mark for each point made up to 2 marks such as: • Accurate sales information (1) for instant feedback (1) • Detailed customer information (1) to tailor product to target market (1) • Information for marketing strategies/campaigns (1) to enable choice of correct media (1) • Information for advertising campaigns (1) and modelling sales versus demand (1) • Profit information available (1) and predicting demand for popular products (1) • Ordering to meet sales faster (1) for a just in time response (1) • Or any other appropriate response *Low response (1) or two low responses (1) or detailed response (2)* (1x1) (1x1)	(2)
	Total marks for section A	45

Section B

Question Number	Answer	Mark
8(a)	An answer that makes reference to three of the following points: • Provides electrical connection (1) • Gold plated contacts give good conductivity (1) • Provides interface with computer (1) • Serial buss to transfer data (1) • Provides power to the memory device (1) • Unique design makes it impossible to incorrectly connect (1) • Connectors are designed to be robust (1) • Protected by an enclosing metal sheath (1) • Can fit any USB port (1) *Answer must contain both notes and sketches.* *Max two marks if only notes or only sketches used.*  (3x1)	(3)

Question Number	Answer	Mark
8(b)	An answer that makes reference to three of the following points: • Stops dirt from entering connector(1) • Provides mechanical protection (1) • Provides an attractive enclosure (1) • Allows aesthetic designs to be utilised (1) • Injection moulding allows complex shapes (1) • Keeps connector clean/slides into place (1) • Reduces risk of damage (1) *Answer must contain both notes and sketches.* *Max two marks if only notes or only sketches used*  (3x1)	(3)

Question Number	Answer	Mark
9(a)(i)	• Production Planning (accept 'Planning' on its own; do not accept 'Production' on its own) • Materials supply and control (accept 'Materials supply' or 'Materials control' but not 'supply' or 'control' on its own) *Must be in this order.* (1x1) (1x1)	(2)

Question Number	Answer	Mark
9(a)(ii)	• Packaging and Dispatch / P and D (1) • Dispatch (1) • Stage 7 / stage seven (1) • 7 / seven (1) *Accept any recognisable spelling (phonetic) of the answers above.* *Do not accept 'packaging' on its own* (1x1)	(1)

Question Number	Answer	Mark
9(b)(i)	Appropriate descriptions including three of the following points: <u>Design</u> • Development of the design brief (1) • Design specification for the mass market USB Flash Drive (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 before manufacture (1) • Sourcing materials/supplies/consumables (1) • Costing resource requirements (1) • Communicating with client/customer (1) • Or similar *Example: the stage where the design brief for casing of the USB flash drive would be developed (1) and where designs would be created (1), by hand and using CAD software (1), in order to model the casing images prior to manufacture (1).* *Up to 3 marks* *Low response (1) or three low responses (3) or up to three marks for a detailed response (3)* (3x1)	(3)

Question Number	Answer	Mark
9(b)(ii)	Appropriate descriptions including three of the following points: <u>Production</u> • Use of available resources (1) • Materials, parts and components used (1) • Processes that are used (1) • Use of available equipment and machinery (1) • Following the production plan (1) • Carrying out inspection and quality control (1) • Complying with health and safety factors (1) • Where the casing is injection moulded (1) • Where the printed circuit board is manufactured (1) Or similar, but must be related to the manufacture of mass produced USB flash drives. *Example: The machinery would be prepared for a production run (1) and the mass produced USB flash drive would be injection moulded etc. (1). At this stage the product would need to be checked to see that it has been made correctly (1).* *Up to 3 marks* *Low response (1) or three low responses (3) or up to three marks for detailed response (3)* (3x1)	(3)

Question Number	Answer	Mark
10(a)	Specific material used in the manufacture of the USB connector • Stainless steel (1) • Chromed steel (1) • Copper (1) • Brass (1) • Gold (1) • ABS (1) • PTFE (1) • Copolymer (1) • Polycarbonate **(1)** *Do not accept generic terms, i.e. 'metal' or 'plastic/polymer'* *Accept any recognisable spelling (phonetic) of the answers above.* (1x1)	(1)

Question Number	Answer	Mark
10(b)(i)	Any three of the following: • Injection moulding • pick and place • etching • drilling • plating • crimping • forming • fabricating • Die Stamping/Pressing • Any other appropriate response 1 mark per response up to 3 *Accept any recognisable spelling (phonetic) of the answers above.* (1x1) (1x1) (1x1)	(3)

Question Number	Answer	Mark
10(b)(ii)	An explanation that makes reference to two of the following points: • Quick method/fast production rate • SMT component is usually smaller than alternatives • SMT has smaller leads or no leads at all • Components are smaller which has allowed miniaturisation • Allows much higher circuit densities • Reducing labour cost and greatly increasing production rates • Highly automated process • Reliable process • Minimal waste • Not labour intensive • Or similar *1 x 1 mark low response, or up to 3 marks for detailed response* (1x1) (1x1) (1x1)	(3)

Question Number	Answer	Mark
10(c)	An explanation that makes reference to three of the following points: • Aesthetics – high quality surface finishes, printing effects, colours, textures etc. • Availability – lower cost, larger product range etc. • Functionality – lightweight, more compact etc. • Mechanical characteristics – increased strength, durability etc. • Environmental characteristics – biodegradability/degradability, easier to disassemble etc. • Any other appropriate response *Up to 3 x 1 mark low responses or up to 3 marks for a detailed response* (1x1) (1x1) (1x1)	(3)

Question Number	Answer	Mark
11(a)(i)&(ii)	One mark for identifying QC procedure One mark for how • Checking physical damage (1) – by visual inspection (1) or comparison check against specification/ prototype /-first–off / template etc. (1) • Size check/s (1) – by direct measurement or gauging / templates / optical sensors (1) or checking against drawing / specification / tolerances (1) • Functional check/s (1) – operation of connector (1) or operation of pcb (1) • Positional check/s (1) – circuit board alignment (1) • Sampling procedures (1) - analysing reported data (1) • Printing check/s (1) – use of colour bar (1) or densitometer readings (1) • Properties testing – electrical testing (1) or destructive testing of final product (1) *Must be within production stage.* (2x1) (2x1)	(4)

Question Number	Answer	Mark
11(b)(i)&(ii)	One mark for identifying benefit to the manufacturer One mark for how • Reduced customer complaints (1) – accurate products (1) • Control of costs (1) – cheaper product / more profit (1) • Avoids faulty parts being assembled (1) – early detection (1) • Increased sales (1) – consistent product / lower prices (1) • User confidence (1) – consistent product / less returns (1) • Reduced waste (1) – control of manufacturing processes (1) • Made to same quality standard (1) • Reliable product (1) – monitoring standards / testing (1) • Detection of broken machinery (1) – less damaged product (1) • Increased output/productivity (1) increased profit (1) • Any other appropriate response Do not accept repetitive responses *2 x 1 marks for low responses (1) or 2 x 2 marks for detailed responses* *If no answer or inappropriate answer is given in 11(a)(i) or 11(a)(ii) allow follow through up to 1 mark for each benefit.* (2x1) (2x1)	(4)

Question Number	Answer	Mark
11(c)(i)&(ii)	One mark for identifying benefit to the distributor One mark for how • Safer product (1) – confidence in product reliability (1) • Consistent product (1) – assured that standards are being met (1) • Higher quality product (1) – easier to sell (1) • Fewer returns (1) – less time spent on documentation (1) • Less requirement to check goods inward (1) – lower costs (1) • Confidence in the manufacturer (1) – less requirement to source from several companies (1) • Improved reputation (1) – repeat purchases (1) • Increased sales (1) – increased profits (1) • Customer satisfaction (1) – greater market share (1) • Any other appropriate response Do not accept repetitive responses *2 x 1 marks for low responses (1) or 2 x 2 marks for detailed responses* *If no answer or inappropriate answer is given in 11(a)(i) or 11(a)(ii) allow follow through up to 1 mark for each benefit.* (2x1) (2x1)	(4)

Question Number	Answer	Mark
12(a)(i)	• Smaller in size (1) • Higher level of skills / better educated less employment for unskilled (1) • Work patterns (1) • Higher pay (1) (1x1)	(1)

Question Number	Answer	Mark
12(a)(ii)	• Smaller in size – more responsibility (1) for undertaking a variety of operations (1); different skills required (1) which are less traditional (1) • Higher level of skills/better educated/less employment for unskilled – more able people required (1) with the ability to re–train often (1); ability to cope with constant change (1) and to undertake complex work (1); but less overall cost for company (1) • Work patterns – shifts often necessary (1) resulting in better paid staff (1); often working with different people (1) hence ability to communicate vital (1) *Low response (1) or two low responses (2) or up to two marks for a detailed response (2); up to 2 marks each response* *If no answer in 12(a)(i), or the answer is inappropriate allow follow through up to 1 mark each.* (2x1) (2x1)	(4)

Question Number	Answer	Mark
12(b)	• Safer (1) • Cleaner (1) • Quieter (1) • Healthier (1) • Noise pollution (1) • More space (1) • Less space (1) • More machines (1) • Less machines (1) • Any other appropriate response (1x1)	(1)

Question Number	Answer	Mark
12(c)	• Increased efficiency / lower emissions (1) resulting in less consumption (1) and a reduction in the increase in global warming (1) • Improved manufacturing control (1) meaning less waste and pollution (1) • Increased productivity / less fuel used (1) hence less use of fossil fuels (1) resulting in lower consumption and emissions (1) • Technology that is less dependant on finite resources (1) and makes efficient use of finite resources (1) or can use sustainable alternatives (1) • Reduced wastage in production (1) hence less materials used in production (1) resulting in less waste thrown into landfill (1) • Ability to adapt process (1) to reduce rework/waste (1) *Low response (1) or two low responses (2) or up to two marks for a detailed response (2); up to 2 marks each response* (2x1) (2x1)	(4)

Question Number	Answer	Mark
13	An explanation that makes reference to four of the following points. The following could be either positive or negative influences: • Research and development time / costs (1) • Life cycle costs (1) • Sales / profits (1) • Long term savings (1) • Transferring technology into further new products (1) • Wider product range (1) • Risk evaluation (1) • Waste (1) • Manufacturing efficiencies (1) • Derivative products i.e. smaller, larger versions faster to develop (1) Example: The application of new materials can have a high initial development cost (1) due to the time taken in researching and testing the product (1), but can result in savings in the long term (1) due to lower product costs meaning increased sales and profits (1) which could result in increased product range (1) or transference of technology into new product ranges (1). Such new ranges could result in competitive advantage (1). *Low response (1) or detailed response (up to 4)* (4x1)	(4)

Question Number	Answer	Mark
14	A explanation that makes reference to four of the following points to a maximum of four marks: • Modern processes are highly automated (1) so require a lot of electricity, or other forms of energy, to operate them (1) • Modern processes are developing to replace work undertaken manually at present (1) leading to further automation (1) • Modern processes require more equipment/machinery/tooling (1) leading to higher energy consumption earlier in the supply chain (1) • Modern processes are most efficient at higher volumes (1) leading to higher production rates and therefore overall energy consumption increases (1) • Efficient modern processes may lead to a reduction in costs, meaning lower prices (1) which increases overall demand for products and leads to increased overall energy use (1) • The use of efficient modern processes may lead to economic wealth (1) which increases overall demand for products and leads to increased overall energy use (1) • The complexity of modern processes may lead to specialisation and production being concentrated in a particular area of the world (1) leading to increased energy use for transportation (1) • Or other appropriate answer *Low response (1) or detailed response (up to 4)* (4x1)	(4)
	Total Marks for section B	55
	Total marks for paper	100