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Mark Scheme (Results)

June 2012

GCSE Engineering/Manufacturing (5EM03) Paper 3E

Electrical & Electronics, Process Control, Computers, Telecommunications

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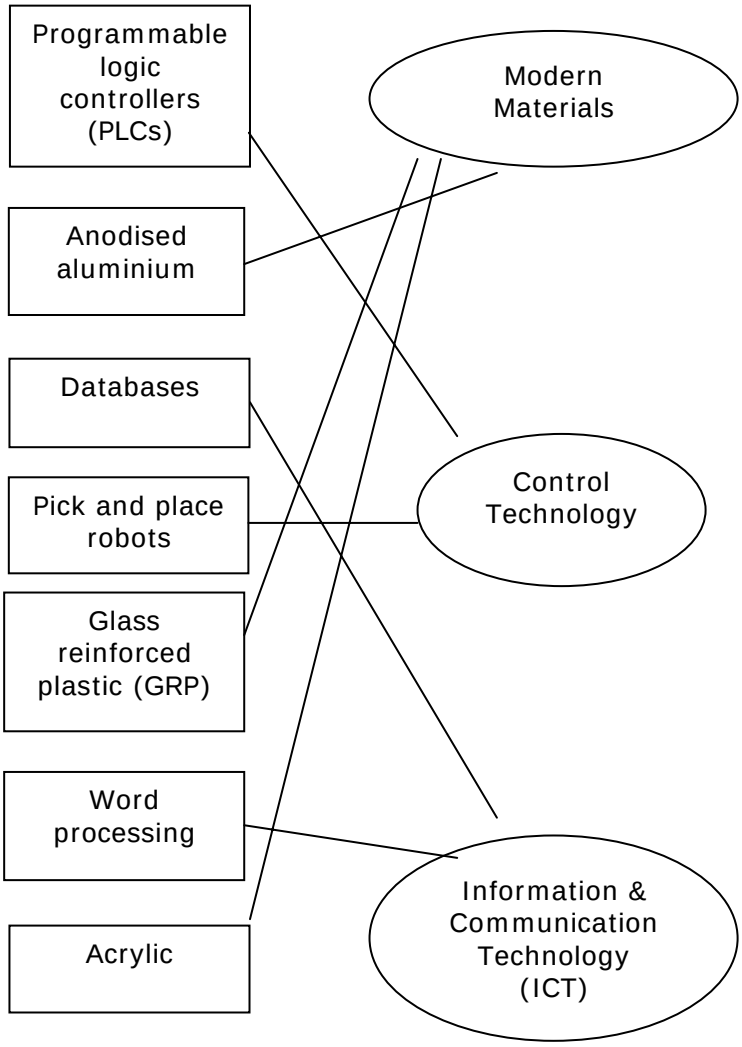
Question	Answer	Mark
1(a)	• MP3 player • Smartphone *If 3 boxes or more crossed- no marks.* (2 x 1)	**(2)**
1(b)	• Security alarm panel • Laptop computer *If 3 boxes or more crossed - no marks.* (2 x 1)	**(2)**
		(Total 4 marks)

Question	Answer	Mark
2(a)	• Thermistor • NTC Resistor • Input transducer • NTC • Negative Temperature Coefficient • Thermoresistor Do not accept transducer on its own Do not accept resistor on its own Do not accept TTC *Accept any recognisable spelling (phonetic) of the answers above.* (1 x 1)	
	• Piezo transducer • Beeper • Output transducer • Buzzer • Piezo • Siren Do not accept transducer on its own *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: • To act as a switch • To switch low voltage to higher voltage • Incorporated in a circuit • Can switch a second circuit Accept any other appropriate response e.g. to act as a switch (1) switching from low voltage to high voltage (1) (2 x 1)	
	An answer that makes reference to TWO of the following points: • provide light/illumination • provides signal indication • allows current flow • reduces the need for other components e.g. resistor • used in standard low voltage applications e.g. torch Accept any other appropriate response e.g. current flows through filament (1) to provide illumination (1) (2 x 1)	**(4)**

Question	Answer	Mark
		(Total 6 marks)

Question	Answer	Mark
3	Award 1 mark for each key term correctly linked to a key area. **Key Term** **Key Area**  *No mark awarded where 2 or more lines are drawn from a key term. Lines do not have to be straight but key term and key area must be clearly linked.* (7 x 1)	**(7)**
		(Total 7 marks)

Question	Answer	Mark
4(a)(i)	Appropriate **products** such as e.g. • Digital camera • DVD Player • Camcorder • MP3 player • Computer/Laptop computer • Electric drill • Soldering Iron • Gaming console • A brand name of a specific product *This list is not exhaustive, accept any product that contains electrical and electronic, process control, computers, telecommunication or association with the sector* (2 x 1)	**(2)**
(a)(ii)	Accept any appropriate polymer suitable for the product named in Product 1. e.g. • Digital camera - ABS • DVD Player – Polystyrene, PP • Camcorder - ABS • MP3 player - ABS • Computer/Laptop computer - ABS • Electric drill – Polystyrene HDPE • Soldering Iron - Polypropylene • Gaming console - ABS Do not accept rubber or any other elastomer or composite. Do not accept the term thermoplastic, thermosets or plastic. (1 x 1)	**(1)**
4(a)(iii)	One mark for identifying each reason One mark for each explanation • Better functional characteristics (1) - weight (1) / size (1) / protection (1) / rigidity (1) • Better mechanical characteristics (1) - strength (1) / durability (1) • Better aesthetic characteristics (1) -	

Question	Answer	Mark
	surface finish (1) / texture (1) / colour (1)/ appearance (1) • Meets requirements of intended markets (1) – appeal to target audience (1) • Better quality standards (1) – consistency (1) / reliability (1) • Reduced weight (1) – better strength to weight ratio (1) • Reduced cost (1) – quicker / quicker to assemble (1) • Any other appropriate functional / mechanical / aesthetic characteristic relating to the reason (1) e.g. improves strength and durability of the product (1) allowing items to be made smaller (1) If answer in 4(a) (ii) is a general term 'thermoset', 'thermoplastic' or 'plastic' allow follow through up to 4 marks. If answer in 4 (a) (ii) is an incorrect material allow follow through up to 1 mark for each of the two answers. If there is no answer or the answer is a product in 4(a)(ii), no marks for 4(a)(iii). (2 x 1) (2 x 1)	**(4)**
4(b)(i)	• production planning (1) • materials supply & control (1) • processing/production (1) • assembly/finishing (1) • packaging/dispatch (1) (1 x 1)	**(1)**
4(b)(ii)	One mark for identifying advantage One mark for why Appropriate advantage to the manufacturer e.g. **Production planning, materials supply & control,** **processing/production,**	

Question	Answer	Mark
	assembly / finishing, packaging / dispatch **production planning** • speed (1) – faster than human application (1) • accuracy (1) – reliability of data (1) • integrates with other software systems (1) giving more accurate plan (1) **materials supply & 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	

Question	Answer	Mark
	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)* (2 x 1)	**(2)**
		(Total 10 marks)

Question	Answer	Mark
5(a)	One mark for each identification One mark for each extension • For accurate drawings (1) – through entry of accurate data on sizes (co-ordinates) (1) • Quicker development time (1) – through simulation (1) • Easier to communicate, i.e. ICT (1) – for 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) • Easier storage of data/information and retrieval (1) – interaction with databases (1) • Ability to convert from 2D to 3D (1) for modelling (1) *Low response (1) or 2 low responses (1) e.g. its quicker and more accurate – only one mark or detailed response (2)* *Do not accept 'easier' without explanation* (2 x 1) (2 x 1) (2 x 1)	**(6)**
5(b)	One mark for reason One mark for extension • 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) • faster processes (1) – less manual input (1) • Safer/cleaner (1) – more suitable for	

Question	Answer	Mark
	hazardous environment (1) *Do not accept 'easier' or 'faster' / 'quicker' without explanation.* *Low response (1) or two low responses (2) or detailed response (2)* (2 x 1)	**(2)**
		(Total 8 marks)

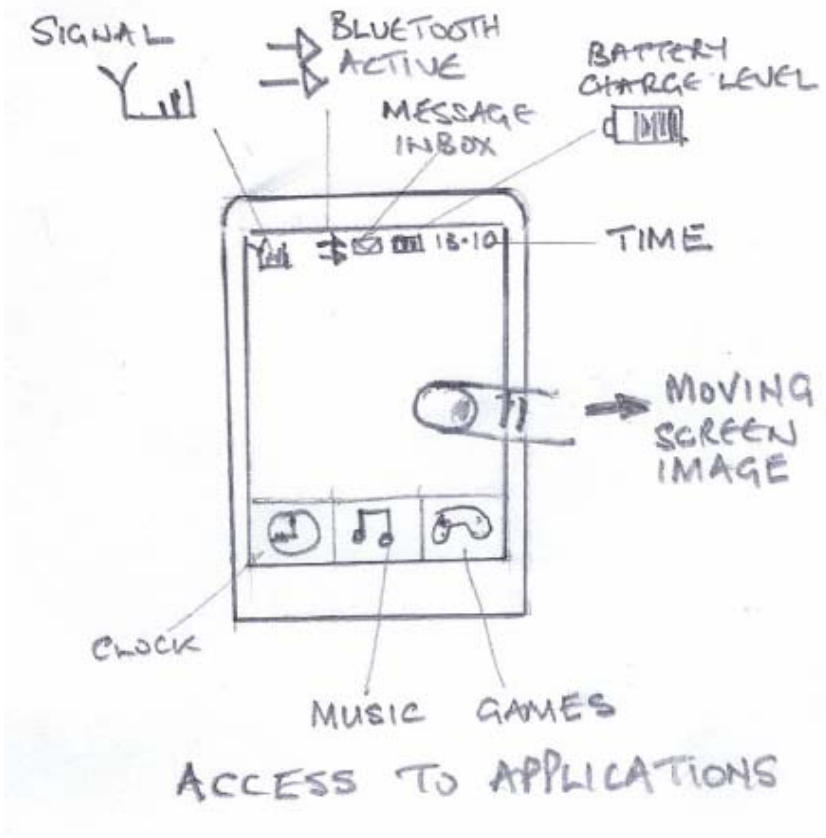
Question	Answer	Mark
6(a)(i)	• a method of exchanging digital messages (1) across the Internet (1) • a protocol (1) for sending, receiving and storing messages (1) • the exchange of computer-stored messages (1) by telecommunications (1) • A quick method (1) which allows functions such as attachments / read receipts (1) *Accept any other appropriate response* *Low response (1) or two low responses (2) or detailed response (2)* (2 x 1) (1 x 2)	**(2)**
6 (a) (ii)	1 mark for identification 1 mark for why o Messages go to Junk mail (1), issues with accessing the message (1) o Insecure (1), loss of confidential data (1) o Mail boxes can be full (1), mail not received (1) o Inefficient (1) intended recipient doesn't always receive the message (1) o Hard to translate (1) could receive incorrect meaning (1) o Restriction on size of message (1), unable to send large files (1) o Recipient doesn't always receive the message immediately (1), delay in access to computer software (1) *Do not accept any answer that is not directly related to email or lower costs.* *Low response (1) or two low responses (2) or detailed response (2)*	**(2)**

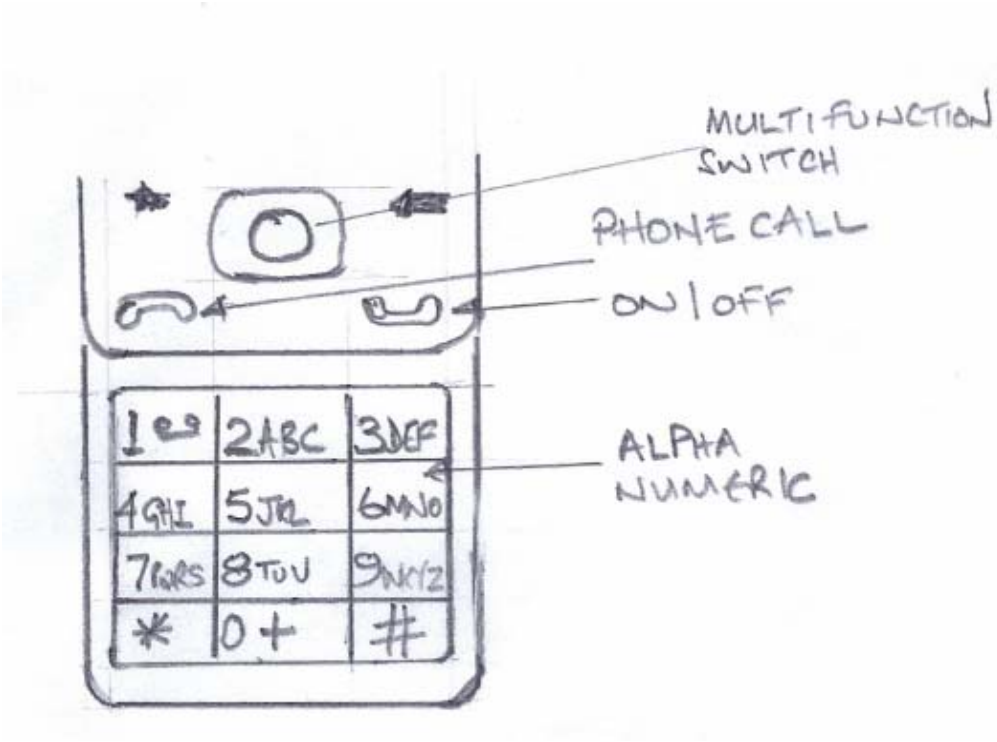
Question	Answer	Mark
	Do not accept repetitive responses (2 x 1) (1 x 2)	
6(b)(i)	• Face to face meeting/meeting (1) • Telephone (1) • Conference (1) *Accept any appropriate response* (1 x 1)	**(1)**
6(b)(ii)	One mark for each identification One mark for each extension • convenience (1) – don't have to travel to venue (1) • cost savings (1) – travel costs reduced (1) • time savings (1) – communication in real time (1) • 'work environment' (1) – all material/information at hand (1) • access to outside experts (1) – regular meetings to compare data etc (1) • staff development (1) – encourages employees to keep up to date with modern technology (1) • Can be arranged at short notice (1) – avoids lengthy planning (1) • Can be recorded (1) – played back to remind/recall information (1) *Accept any other appropriate response* *Low response (1) or two low responses (2) or detailed response (2)* *Do not accept repetitive responses* (2 x 1) (1 x 2)	**(4)**
		(Total 9 marks)

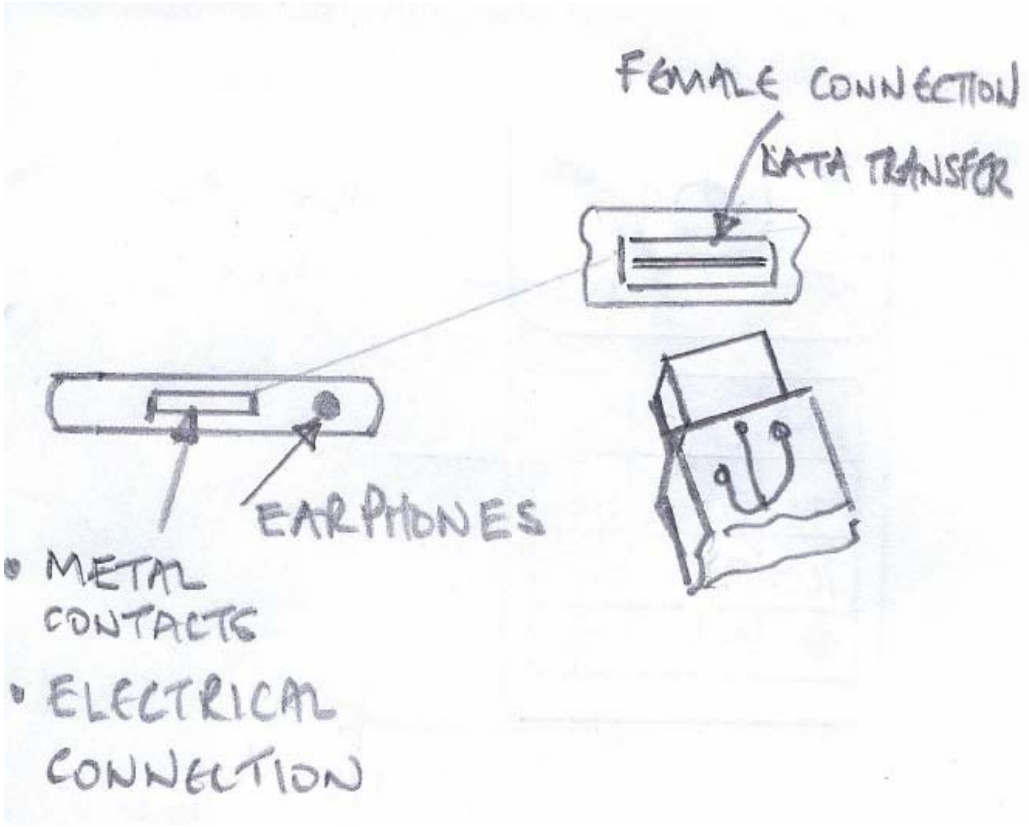
Question	Answer	Mark
7(a)	One mark for benefit One mark for extension • Accurate information (1) – updated regularly (1) • Detailed information (1) – high storage space (1) • Fast access to data (1) – search/sort/query (1) • Improved planning (1) – short lead times (1) • Forecasting (1) – collects volumes 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 • Training records (1) – skills monitoring (1) • Wage information (1) – ease of cost monitoring (1) *Accept any other appropriate response* (1 x 2)	**(2)**
7(b)	One mark for each benefit One mark for each extension • Accurate orders (1) – updated regularly (1) • Detailed stock movement information (1) – efficient storage space (1) • Fast access to data (1) – search/sort/query (1) • Effective goods tracking (1) – barcoding/EPOS (1) • Fast distribution (1) – Fast delivery details	**(4)**

Question	Answer	Mark
	• Improved stock control (1) – process monitoring/control (1) • Regulating drivers' workload (1) – to meet delivery demand/schedules (1) • Improved stock security (1) – less theft (1) • Less stock obsolescence (1) - efficient stock turnover (1) *Accept any other appropriate response* (1 x 2) (1 x 2)	
		(Total 6 marks)

Question	Answer	Mark
8(a)	• Provides visual display (1) • Display information on battery life(1) • Show information on time (1) • Show information on signal (1) • Acts as an input device(1) • Acts as a view finder (1) • Provides haptic feedback (1) Accept any other appropriate response *Must have notes and sketches*	**(3)**

Question	Answer	Mark
	 *Max 2 marks if only notes or only sketches used* (3 x 1)	
8(b)	• Allows a mobile number to be entered/dialled (1) • Controls the access to other functions (1) • Switches phone ON/OFF (1) Accept any other appropriate response *Must have notes and sketches*	**(3)**

Question	Answer	Mark
	 *Max 2 marks if only notes or only sketches used* (3 x 1)	
8(c)	• Allows the charging of the battery (1) • Allows data access (1) • Connects the female terminal to the male connector (1) • Has a protective cover (1) Accept any other appropriate response *Must have notes and sketches*	**(3)**

Question	Answer	Mark
	 *Max 2 marks if only notes or only sketches used* (3 x 1)	
		(Total 9 marks)

Question	Answer	Mark
9(a)(i) 1	• Production planning • Planning • Planning for production *Do not accept 'production' on its own* (1 x 1)	
9 (a) (i) 2	• Production and processing • Production • Processing (1x1)	**(2)**
9(a)(ii)	• Assembly & finishing • Assembly • Stage 6/stage six • Six/6 (1 x 1)	**(1)**
9(b)(i)	Appropriate descriptions including three of the following points (statements must be applicable to the mobile phones): • Gathering consumer opinion (1) • Calculating products costs (1) • Developing market plan (1) • Using market research (1) • Developing a competitive edge (1) • Advertising the mobile phones (1) • Promoting the mobile phones (1) • Carrying out questionnaires/surveys (1) • Contributes to sales activities (1) e.g. The stage where the advertising (1) of mobile phones is carried out following a range of market research strategies (1) to gather consumer opinion (1). e.g. The stage where the manufacturer uses a range market research strategies (1) to gather people's opinions (1) to be able to promote (1) the mobile phones. *Accept any other appropriate response* *Up to 3 marks* *1 x 1 mark low response, 3 x 1 mark 3 low responses or up to 3 for detailed response*	**9(b)(i)**

Question	Answer	Mark
	(3 x 1)	
9(b)(ii)	Appropriate descriptions including three of the following points (statements must be applicable to the mobile phone): • Availability of suitable materials (1) • Purchase of suitable materials (1) • Sourcing of bought-in components (1) • Purchasing of bought-in components (1) • Good inwards inspection (1) • Storage of materials (1) e.g. The stage where the manufacturer would use a database (1) to source suitable materials (1) and bought-in components (1) for the mobile phone. These parts could then be purchased (1) and then inspected (1) on arrival at the company. *Accept any other appropriate response* *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)	• Coltan • Gold • Copper • Nickel • Tantalum • Columbite tantalite • Any other appropriate material *Do not accept 'steel'* (1 x 1)	**(1)**
10(b)(i)	Any three of the following: • drilling • wave soldering/soldering • polishing/coating/painting/powder coating/plating • inserting components • robotic pick and place • shaping/moulding • gluing • riveting • Injection moulding • Any other appropriate response 1 mark per response up to 3 *Accept any recognisable spelling (phonetic) of the answers above.* (1x1) (1x1) (1x1)	**(3)**
10(b)(ii)	An explanation that makes reference to three of the following points: • highly automated process • reliable process • minimal waste • not labour intensive • can be mass produced easily • products have consistent quality • Smaller components. Smallest is	

Question	Answer	Mark
	currently 0.4 x 0.2 mm. (.01" x .005" - 01005) • Much higher number of components and many more connections per component. • Fewer holes need to be drilled through abrasive boards. • Simpler automated assembly. • Small errors in component placement are corrected automatically (the surface tension of the molten solder pulls the component into alignment with the solder pads). • Components can be placed on both sides of the circuit board. • Lower resistance and inductance at the connection (leading to better performance for high frequency parts). • Better mechanical performance under shake and vibration conditions. • SMT parts generally cost less Fewer unwanted RF signal effects in SMT parts when compared to leaded parts, yielding better predictability of component characteristics. • Faster assembly. • *1 x 1 mark low response, or up to 3 marks for detailed response* (1x1) (1x1) (1x1)	**(3)**
10(c)	An explanation that makes reference to three of the following points: • Improved wear resistance • Longer lasting parts such as the case • Moving products needed less	**(3)**

Question	Answer	Mark
	maintenance • Easier manufacturing • Better functionality • More variation of products • Expanding markets (Android market, I - Pad) i.e. different size mobile phones doing similar work to older models etc • Smaller components • Improved aesthetics • Reduced costs • Environmental improvements • Any other appropriate answer *Up to 3 x 1 mark low responses or up to 3 marks for a detailed response* (3 x 1)	
		(Total 10 marks)

Question	Answer	Mark
11(a)(i)	One mark for identifying each QC procedure One mark for each extension • Checking for physical damage on the mobile phone or packaging (1) – by visual inspection (1) • Packaging weight checks (1) – using packaging scales (1) • Packaging size checks (1) – by direct measurement or optical sensors (1) • Packaging security checks (1) – by optical scanning (1) • Checking quantities / batch size (1) – through bar coding (1) • Tracking of packaging (1) – by RFID (1) *Do not accept repetitive responses* *Must be within packaging and dispatch stage* *Low response (1) or two low responses (2) or detailed response (2) per example* (1 x 2) (1 x 2)	**(4)**
11(a)(ii)	One mark for identifying each automation used One mark for each extension • PLCs (1) to control processes in packaging and dispatch (1) • Automated wrapping of mobile phone packaging (1) • Automated labelling of mobile phone packaging (1) • Automated coding of mobile phone (1) to allow automated order picking (1) • Use of conveyor systems (1) to move mobile phone packaging from one packaging and dispatch process to the next (1) • Embedded computers (1) to perform dedicated functions (1)	**(4)**

Question	Answer	Mark
	• Remotely operated vehicles (1) moving mobile phone packaging to next stage / storage / dispatch (1) • Pick and place robots (1) moving mobile phone packaging to next stage / storage / dispatch (1) • Automated counting/weighing (1) carton erector (1) *Any other appropriate response* *Do not accept repetitive responses* *Do not accept 'CIM' or 'CNC' without links to automation* *Must relate to the packaging and dispatch stage* *Low response (1) or two low responses (2) or detailed* *response (2) per example* (1 x 2) (1 x 2)	
11(b)	One mark for identifying advantage to the manufacturer One mark for how • Reduced customer complaints (1) – accurate products (1) • Control of costs (1) – cheaper product / more profit (1) • Avoids further processing of faulty product (1) – early detection of rejects (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) – increased customer satisfaction/company reputation (1) • Reliable product (1) – monitoring standards / testing (1) • Detection of broken machinery (1) – less damaged product (1) • Increased output/productivity (1) - increased profit (1) • Less expensive to operate (1) – fewer manual checks (1)	**(2)**

Question	Answer	Mark
	Any other appropriate response *Low response (1) or two low responses (2) or detailed response (2)* (1 x 2)	
		(Total 10 marks)

Question	Answer	Mark
12(a)(i)	One mark for impact, 2 marks for extension An explanation that makes reference to three of the following points: • Smaller in size (1) • Increased competition for fewer jobs(1) • Higher level of skills (1) • Work patterns – shifts (1) • Need to retrain(1) • Better educated (1) • Higher level of development skills required (1) • Less employment for unskilled (1) • Updating and training often required (1) • Team working more important(1) • Improved promotion prospects (1) • Reduced income/standard of living (1) • Cleaner workplace (1) • Safer workplace (1) • Less physically demanding tasks (1) • Job insecurity (1) e.g. Employees would need to retrain(1) and there would be increased competition for jobs(1) and there would be less employment opportunities for unskilled people(1) *Accept any other appropriate response* *Up to three low responses (3), detailed response (3)*	**(3)**

Question	Answer	Mark
	(3 x 1) *(1 x 3)*	
12(a) (ii)	One mark for impact, 2 marks for extension An explanation that makes reference to three of the following points: Positive answers • Reduced carbon emissions (1) • Operational efficiencies – less fossil fuels (1) • Reduced waste – landfill (1) • Healthier local environment(1) • Improved quality – less waste(1) Negative answers • Distribution - network increased (extra fuel) (1) • Increased consumption of raw materials (1) • Over production(1) • Increased energy consumption(1) • Increased pollution (1) *Accept combinations of the above that are positive or negative.* *e.g.* *Changes in the working environment could lead to reduced waste going into landfill (1) and would create a healthier local environment (1). However over production (1) could result in increased energy consumption (1)* *Up to 3 marks* *Accept any other appropriate response* *Up to three low responses (3), detailed response (3)* *(3 x 1)* *(1 x 3)*	**(3)**
12(b)(i)	Any two of the following: • Analyse market research data in database (1) • Assists with pricing products (1) • Pricing products in spreadsheets (1) • Cost the resource requirements for mobile phone in spreadsheets (1)	**(2)**

Question	Answer	Mark
	• Plan marketing campaign using DTP software (1) • Use of internet/website/social networking for marketing (1) • Use of emails for marketing purposes (1) • Video conferencing to discuss marketing + research proposals (1) • Assists with profit analysis/ predictions (1) • Assists with 'pitching'/powerpoint presentations (1) • Provides legal information (1) *Accept any other appropriate response* *1 mark per response up to 2* *Do not accept generic responses with no link to marketing or a marketing context.* (1 x 1) (1 x 1)	
12(b)(ii)	One mark for identifying the use One mark for how: • Electronic monitoring (1) of some assembly processes (1) • Use of sensors (1) to monitor assembly /finishing of mobile phones (1) • Use of software (1) to record, log output of mobile phones (1) *Accept any other appropriate response* *Low response (1) or two low responses (1) or detailed response (2)* (2 x 1)	**(2)**
12(b)(iii)	One mark for identifying the benefit One mark for how • Establishes a market database (1) shared with the manufacturer (1) • Has accurate costing information (1) shared with the manufacturer (1) / that can be manipulated easily (1) • Gives distributors opportunity to match the market needs (1) with production of mobile phones (1) • Gives distributors sales data fast (1) possibly leading increased sales/profits (1) • Accurate sales data (1) leads to	**(2)**

Question	Answer	Mark
	accurate pricing (1) • Advertising/selling online (1) leads to wider market (1) • Assists with stock rotation (1) leading to less waste (1) • Navigation software (1) planning routes to reduce costs (1) • Efficient tracking/monitoring (1) leads to fewer product losses (1) *Low response (1) or two low responses (1) or detailed response (2)* (2 x 1)	
		(Total 12 marks)

Question	Answer	Mark
13	An explanation that makes reference to four of the following points: • 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) • Cleaner environment (1) air quality improved (1) e.g. Control technology is now used to prevent machines from starting when guards are not in place (1), and to shut down machines when something goes wrong (1), which means that accidents are less likely to happen (1) and therefore people won't get hurt (1). *Accept any other appropriate response* *Up to 4 marks* *Up to 4 low responses (4) or detailed response (up to 4)* (4 x 1) (1 x 4)	**(4)**
		(Total 4 marks)

Question	Answer	Mark
14 **QWC i, ii, iii**	Discussion may address the following issues: • *Issue - Reduce energy consumption* ▪ The mobile phone could be made from locally sourced materials • *Development* ▪ Less need for transportation over long distances ▪ Review of distribution networks and frequencies • *Issue - Reduce energy consumption* ▪ The mobile phone could be manufactured using less / recycled materials and other materials / fittings that need less processing • *Development* ▪ Using recycled materials reduces the need for energy intensive primary processing ▪ The mobile phone could be made using materials that are strong enough to be assembled without extra components • *Issue - Reduce energy consumption* ▪ Use of modern processes / machinery and equipment / technology enabling more energy efficient production • *Development* ▪ Minimise high temperature operations ▪ Contain heated air ▪ Use of automation and control systems ▪ Retrofit existing machinery rather than buy new • *Issue - Reduce energy consumption* ▪ Use of sustainable sources of energy and producing as little waste as possible when manufacturing the mobile phone • *Development* ▪ Generating own energy through solar / wind power ▪ Using combined heat and power / energy recovery systems ▪ Minimising overproduction	**(6)**

Question	Answer	Mark
	▪ Lean manufacturing	
		(Total 6 marks)

Level	Mark	Descriptor
	0	No material deserving of reward
1	**1-2**	The learner identifies at least two methods for reducing energy consumption or gives a brief description of one method. 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 methods for reducing energy consumption or a detailed description of one method. The learner uses some technological / manufacturing / environmental 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 for reducing energy consumption. The learner uses a range of appropriate technological / manufacturing / environmental 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**

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