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Mark Scheme (Results)
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GCSE

GCSE Engineering & Manufacturing (5318) Paper 6

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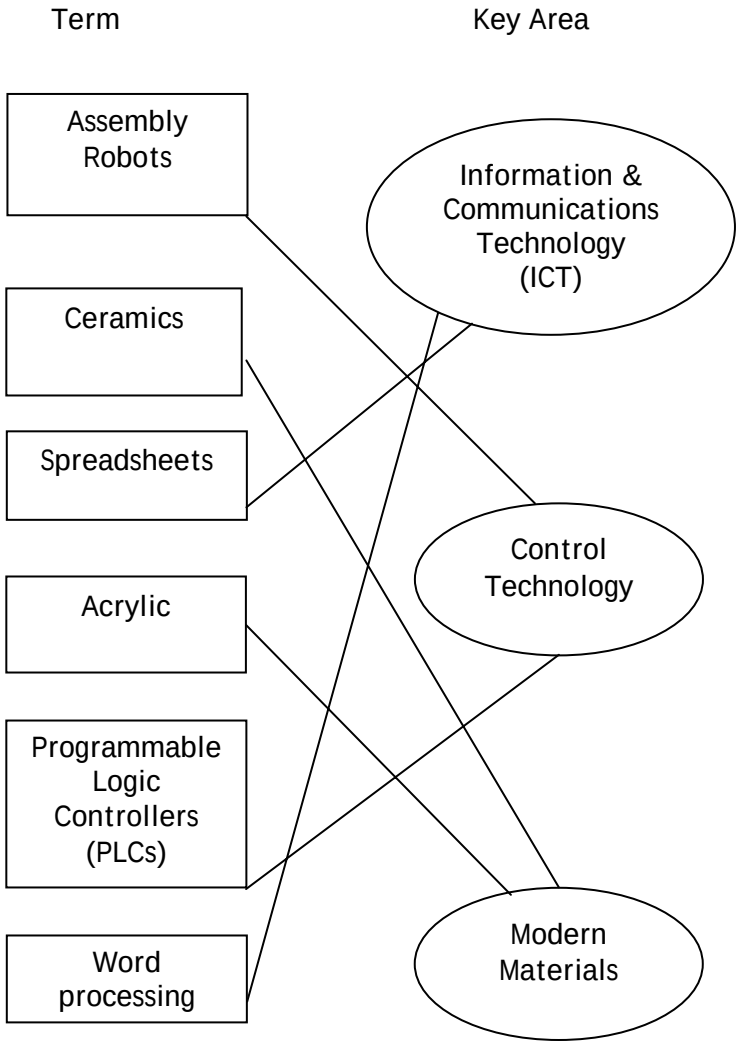
Unit 5318/06 Mechanical, Automotive

Section A

Question Number	Answer	Mark
1(a)	• Metal step ladder (1) • Pillar drill (1) If 3 boxes ticked max marks = 1 mark. If 4 boxes or more ticked no marks. (2x1)	(2)
1(b)	• Hydraulic pump (1) • Steering wheel (1) If 3 boxes ticked max marks = 1 mark. If 4 boxes or more ticked no marks. (2x1)	(2)
	Total mark	4

Question Number	Answer	Mark
2(a)	• Bearing (1) (1x1)	(2)
	• Gear (1) • Spur Gear (1) • Idler Gear (1) • Gear wheel (1) • Cog (1) • Differential cog (1) • Pinion (1) (1x1)	
2(b)	An answer that makes reference to TWO of the following points below: • Used for securing wheels (1) and cowls (1) • Used to secure rotational parts (1) temporarily (1) • Used to hold a wheel (1) on to a shaft or axle (1) • Metal fastening (1) used to join or keep components together (1) • Push through a hole in a spindle (1) opens leg so it doesn't fall out (1) (2 x1)	(4)
	• Used to absorb energy (1) to prevent damage (1) • Used to store mechanical energy (1) • To hold things in place (1) • To stop things vibrating apart (1) • Can be used to act as a return mechanism (1) • Used on suspensions (1) • Can apply a force (1) (2x1)	
	Total mark	6

Question Number	Answer	Mark
3	Key terms linked to a key area  No mark for any term linked to more than one area. (6 x 1)	(6)
	Total mark	6

Question Number	Answer	Mark
4(a)(i)	Appropriate **product** such as e.g. • Motorbike (1) • Fire extinguisher (1) • Trolley jack (1) • Foot pump (1) • Bbq (1) • Filing cabinet (1) • Car (1) • Gearbox (1) • Toolbox (1) • Hydraulic cylinder (1) • Pneumatic cylinder (1) *Accept brand name of a 'specific' product.* *This list is not exhaustive; accept any product that contains mechanical or automotive componentry or association with the sector.* (1x1)	(1)
4(a)(ii)	Appropriate explanation of what the product does, may include reference to features and function e.g. • To transport you (1) from one place to another (1) • Used in an emergency (1) to put out fires (1) • Used on a car (1) to jack it up (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 marks for 4(a)(ii)* (2x1)	(2)

Question Number	Answer	Mark
4(b)(i)	Note: Stage needs to be relevant to the product named in part (a) (i) • Materials supply (1) • Materials control (1) • Production planning (1) • Any appropriate manufacturing operation i.e. selecting components / placing components / assembly, packaging (1) • 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. casting/fabrication/robots assembly/spraying) 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 and one mark for why.* Appropriate advantage to the manufacturer e.g. **production planning, materials – supply and control, processing / production, assembly / finishing, packaging / dispatch** **Production planning** • speed (1) – faster than human application (1) **materials – supply and control** • cost control (1) – by less waste / faulty parts (1) • waste control (1) – by monitoring processes and quality control of processes (1) **processing / production** • 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 (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** • 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** • 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 a Manufacturing stage allow follow through up to 2 marks. No answer to 4(b)(i) no marks for 4(b)(ii)*	(2)

Question Number	Answer	Mark
4(c)(i)	• plastics / 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)
4(c)(ii)	*One mark for identifying improvement and one mark for how.* • smaller size (1) – miniaturisation (1) • lower weight (1) – better strength to weight ratio (1) • better appearance (1) – smoother / brighter finishes (1) • extends the life-time of product (1) – better wear characteristics (1) • improves wear resistance (1) – harder materials / better surface finish (1) • reduces cost (1) – overall product easier / earlier machine ability (1) *Answer should relate to any of these key features: Function / quality standards / styling aesthetics / performance / intended markets / size / maintenance / production methods / cost / regulations / scale of production.* *If answer in part 4(ai) is inappropriate but the material given in 4(ci) is appropriate allow follow through up to 2 marks. If no answer is given in part 4(ai) but the answer to part (cii) relates to the material stated in part 4(ci) allow follow through up to 1 mark. If no answer or incorrect given in part (ci) no marks awarded for 4(cii).* (2x1)	(2)
	Total mark	9

Question Number	Answer	Mark
5(a)(i)	• materials supply (supplier details / raising orders) (1) • materials control (materials location) (1) • stages in manufacturing (list of processes / standard times) (1) • process control (statistics/references to standards) (1) • storage (location / description) (1) • distribution (customer location / packaging requirements / routing information) (1) • stock control (location / type of stock / critical re-order levels / stock taking / EPOS) (1) • marketing and mailshots (customer listing / customer orders) e.g. questionnaire (1) • queries and searches (product / customer / cost / supplier) (1) *Do not accept 'software' names.* (1x1)	(1)
5(a)(ii)	One mark for identifying the benefit, one mark for how. Two low responses – only one mark Must relate to example given. No answer in (i) no marks, otherwise, allow follow through to one mark. • reduced ordering times (1) – supplier identified automatically (1) • maintaining quality (1) – consistency (1) • reduced wastage (1) – correct process used (1) • improved efficiency (1) - faster access to knowing material location (1) • better process control (1) – easier access to quality standards (1) • reduced labour / costs (1) – less time spent searching for data (1) • reduced storage space (1) - less paper work (1) • efficient marketing (1) – mailmerge / mailshots (1) • storage of information on computer (1) – faster access to data (1) *If answer in part 5(ai) is inappropriate allow follow through up to 2 marks. If no answer given in part 5(ai) allow follow though up to 1 mark.* *Do not accept 'easier' without explanation.* (2x1)	(2)

Question Number	Answer	Mark
5(b)(i)	Mark allocation 1 per relevant example • Mobile phone / infrared / Bluetooth (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) • Fax (1) • Voice over internet protocol - VoIP (1) *Do not accept the following:* *TV, CAD, radio, computer / laptop / database* (1x1)	(1)
5(b)(ii)	Must relate to example given. No answer in (i) no marks, otherwise, allow follow through to one mark. • Mobile phone – flexibility (1) / roaming location (1) • Email (1) – immediate permanent record (1) • Internet (1) – immediate vast access to information (1) • Video conferencing – no travel expenses (1) / less time wasted in travelling (1) • Electronic point of sale (EPOS) – faster (1) / more accurate (1) • EDI – immediate transfer of information (1) - no hard copies needed / less storage space (1) • ISDN (1) – more data transferred in parallel (1) • Texting (1) – stored record of transaction (1) • Phone (1) – immediate two way conversation(1) • Walkie talkie (1) – flexibility / roaming location / cost (1) • Fax (1) – hard copy record (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 reason* *Benefits must relate to the manufacturer* 2 low responses – 1 mark only e.g. faster & easier (2x1)	(2)

Question Number	Answer	Mark
5(c)	One mark for identifying the benefit, one mark for how. If two low responses given - one mark e.g. cheaper and quicker – only one mark • Less returns (1) – more consistent products (1) • Lower purchase price (1) – increase sales (1) • Shorter order times (1) – greater use of appropriate software / automated orders (1) • Increase sales (1) – more profit (1) • Better reputation / customer satisfaction (1) – more reliability (1) • Increased profits (1) – fewer waste products / faster throughput (1) • Better quality products (1) – systems reject faulty products or stop them being produced (1) *Any combination of the answers below as long as appropriately linked e.g. better quality products (1) therefore more profit (1)* *Benefit must relate to the manufacturer* (2x1)	(2)
	Total mark	8

Question Number	Answer	Mark
6	**Two different examples** • Process control (1) • PLCs (1) • Embedded computers (1) • Robotics (1) • CIM (1) • CAD / CAM links (1) • CAM (1) • CIE (1) • Quality control (1) • Automation (1) *Don't accept examples that are about handling data and information e.g. databases / spreadsheets , CAD, computers, CNC* (1x1) (1x1)	
	Two different methods used • Cam timers (1) • Manual operations associated with the sector (1) • Manual placing (1) • Manual testing (1) • Manual recording (1) • Manual measurement (1) • Physical activity / employees (1) *Must be a feasible replacement* If answer in 6(a) is not appropriate allow follow through If no answer in 6a no mark for 6(b) (1x1) (1x1)	

6 cont	**Explain two different benefits** **One mark for identifying the benefit.** **One mark for how** **Examples** • Reduce the time (1) testing is quicker (1) • Reduce the money spent (1) lower stock level / JIT techniques (1) • Lower labour costs (1) reduction in staffing (1) • Increased overall productivity (1) via increased throughput (1) • Improve quality (1) more consistent processes (1) • Continuous production (1) machines work 24/7 (1) *Benefits must relate to new methods and the manufacturer.* *Low response (1) or two low responses (1) or detailed response (2). Allow follow through up to one mark providing either (a) or (b) is answered for each example.* (2x1) (2x1)	(8)
	Total mark	8

Question Number	Answer	Mark
7(a)	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 • 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) • improved quality (1) - because the machines can manufacture automatically and more accurately (1) *Do not accept 'easier' without explanation.* (2x1)	(2)
7(b)	• More consistent products (1) – process reliability (1) • Lower purchase price (1) – increased efficiency / productivity (1) • Shorter delivery times (1) – automated systems (1) • Customer satisfaction (1) – availability of different products (1) • Quality product (1) – fit for purpose (1) • Product guarantee (1) – ability to design / produce products to higher standards (1) • Product flexibility (1) – more variation within processes (1) • Products cost less (1) - as the manufacturer can make them more efficiently (1) *1 mark for benefit, 1 mark for how. Low response (1) or detailed statement (2) or two low responses (2)* *Example:* *Readily available products of good quality (1) means fewer complaints about sub-standard products (1)* *Any combination of the answers above as long as appropriately linked e.g. more consistent product (1) fit for purpose (1)* (2x1)	(2)
	Total mark	4
	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. Diagrams and notes up to 3 marks. • Allows the operator to push the riveter to action the process (1) • To make the riveting action easier (1)  • Allows hand to fit neatly into grip (1) Answer must contain both notes and sketches. Max two marks if only notes or sketches used. (3x1)	(3)

Question Number	Answer	Mark
8(b)	An answer that makes reference to three of the following points. Diagrams and notes up to 3 marks. • To allow riveting action to take place (1) • To link the hand grip to the head and jaws (1) • Allows human force to be converted into mechanical action (1) • To allow riveting action to take place (1) Moves in and out when pushed ↔  • It closes up to allow the riveter to be stored away in a smaller place (1) Answer must contain both notes and sketches. Max two marks if only notes or sketches used. (3x1)	(3)
	Total mark	6

Question Number	Answer	Mark
9(a)(i)	• Stage 1 - Design / product development (1) • Stage 4 - Material supply and control / purchasing / material supply / material control / supply of components / supply of parts (1) *Do not accept development on its own for stage 1* *Do not accept product on its own for stage 1* *Do not accept design ideas for stage 1* *Do not accept material on its own for stage 4* (2x1)	(2)
9(a)(ii)	• Marketing (1) • Stage 2 / stage two (1) • 2 / two (1) (1x1)	(1)

Question Number	Answer	Mark
9(b)(i)	Low response (1) or three low responses (3) or up to three marks for detailed response (3) Appropriate descriptions including three of the following points: <u>Production</u> • Use the available resources (1) • Materials, parts and components used (1) • Processes that are used (1) • Used of available equipment and machinery (1) • Following the sequence of production (1) • Carrying out inspection and quality control (1) • Complying with health and safety factors (1) • Where the lattice parts are drilled (1) • Where the jaws are machine or hardened (1) • Or similar but must relate to the manufacture of the lazy tong riveters (1) *E.g. This is the stage where resources are used by operators (1) to machine the jaws of the lazy tong riveters (1) and where they are checked by inspection methods (1)* (3x1)	(3)
9(b)(ii)	Low response (1) or three low responses (3) or up to three marks for detailed response (3) Appropriate descriptions including three of the following points: <u>Assembly</u> • Assembly activities (1) • Putting together component parts (1) • Finishing (1) • Cleaning parts (1) • Painting (1) • Any assembly process (1) • Handle, lattice and jaws are all fitted together (1) *E.g. This is the stage where the component parts of the lazy tongs riveters are put together (1). The parts might be cleaned (1) before the handle is fitted to the lattice (1).* (3x1)	(3)
	Total mark	9

Question Number	Answer	Mark
10(a)(i)	1 mark per named material. • Aluminium / aluminium alloy (1) • Zinc alloy (1) • Polythene / High density polythene (1) • Polystyrene (1) • Acrylonitrile - butadiene-styrene / ABS (1) • Chrome molybdenum (1) • Stainless steel (1) • Carbon steel (1) • PVC plastic coating *Do not accept any generic term – 'metal or steel'* (1x1)	(1)
10(a)(ii)	1 mark for improvement, 1 mark for how If no answer in 10(a)(i) then no marks. Allow follow through up to 1 mark if incorrect material is given in 10(a)(i) • Size – better strength to size ratio (1) – stronger material (1) • Weight – better strength to weight ration (1) – stronger material (1) • Ease of use – can be formed to comfortable shape / warm to hold (1) – better thermal characteristics (1) • Ergonomics - can be formed to comfortable shape (1) – size / shape allows maximum response (1) • Aesthetics – looks better (1) – easier to produce the handle with no sharp edges (1) • Control - can be formed to comfortable shape (1) – size / shape allows maximum response (1) (2x1)	(2)
10(b)(i)	1 mark for low response. 2 marks for detailed response. 2 marks for 2 low responses. • Provides effective hard wearing surface for jaws (1) • Ensures the continual insertion of rivets does not wear out the jaws (1) • Pivot points on the lattice will withstand continual wear (1) • Improves strength / durability (1) (2x1)	(2)

Question Number	Answer	Mark
10(b)(ii)	1 mark per process. Up to 2 marks • Material removal such as turning / drilling / CNC (1) • Shaping such as die casting (1) • Other heat and chemical treatment processes such as plating (1) • Surface finishing such as coating (1) (2x1)	(2)
10(c)	Low response (1) or three low responses (3) or up to three marks for detailed response (3) Appropriate explanation including three of the following points: • Lower costs (1) • Availability of range of colours (1) • More attractive (1) • Improved accuracy (1) • Better durability / stronger material (1) • Smaller size / lighter product (1) • Improved functionality (1) • More varieties available (1) • Better aesthetics (1) *e.g. Modern materials has enabled the manufacture to sell more riveters as the materials used are now stronger and more durable (1) which means the riveter can either be lighter or smaller (1). This also means that the riveter will function better (1).* (3x1)	(3)
	Total mark	10

Question Number	Answer	Mark
11(a)	Must have relevant automation technology link Low response (1) or two low responses (2) or detailed response (2) **Example of automation** • PLC (1) to control processes in production (1) • Robots (1) dealing with heat treatment processes (1) • Use of conveyor systems (1) to move parts of the riveters about (1) • Pick and Place (1) to part assemble the riveters (1) • Embedded computers (1) to perform dedicated functions (1) • Remotely operated vehicles (1) moving boxed riveters to dispatch or storage (1) *Do not accept 'CIM' or 'CNC' without links to automation*	(4)

Question Number	Answer	Mark
11(b)	**Benefits to manufacturer** If answer in 11(a) is inappropriate, allow follow through up to one mark. If no answer given in part (a), no mark. 2 x 1 mark for low response or 2 x 2 marks for detailed responses. Must be appropriate to those described in (a) and relate to the manufacturer e.g. • Flexible production (1) leads to meeting customer requirements better (1) • Consistent results and quality (1) achieved through accurate use of technology (1) • Reduced human intervention (1) of plant means safer operation (1) • Reduced labour costs (1) as less people involved (1) • Safer method (1) as humans have less exposure (1) • Reduced customer complaints (1) as better quality product (1) • Control of costs (1) lower unit cost as less waste (1) • Retailer confidence (1) through less complaints (1) • Customer confidence increased (1) through more reliable systems • Reduced waste (1) by less mistakes being made (1) • Reduced energy costs (1) through increased efficiency (1) • Improved production rates (1) through reduced downtime (1) • Gives customers variation of products in a quicker time (1) faster production changeovers (1) (2x1) (2x1)	(4)

Question Number	Answer	Mark
11(c)	**Benefit to consumer** If answer in 11(a) is inappropriate, allow follow through up to one mark. If no answer given in part (a), no mark. 2 x 1 mark for low responses. 2 x 2 marks for detailed responses Must be appropriate to those described in (a) and relate to the consumer e.g. • Consistent product (1) controlled better (1) • Product reliability (1) more likely to be produced to specification (1) • Reduced time to distributor / shorter delivery times (1) as manufacturer can vary product to meet demand (1) • Less wastage (1) as processes monitored better (1) • Lower prices (1) less waste / quicker production (1) • Better availability (1) due to faster throughput • Better quality (1) through improved process control (1) • Better value (1) because production costs are reduced (1) • Product guarantee (1) as confidence in process (1) • Customer satisfaction (1) because of consistent products (2x1) (2x1)	(4)
	Total mark	12

Question Number	Answer	Mark
12(a)(i)	1 mark for change. • Smaller in size (1) • Higher level of skills / better educated less employment for unskilled (1) • Work patterns (1) • Higher pay (1) (1x1)	(1)
12(a)(ii)	Low response (1) or two low responses (2) or up to two marks for a more detailed response (2) • 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) Up to 2 marks each response (2x1) (2x1)	(4)

Question Number	Answer	Mark
12(b)(i)	1 mark for change. Positive answers • Increased efficiency (1) • Lower emissions / reduced global warming (1) • Increased productivity (1) • Less fuel used (1) • Reduced wastage in production (1) Negative answers • Greater use of machinery (1) • Higher emissions (1) • Use of finite resources to manufacture control technologies (1) • Greater overall volume of products generated (1) (1x1)	(1)

Question Number	Answer	Mark
12(b)(ii)	Low response (1) or two low responses (2) or up to two marks for a more detailed response (2) **Positive answers** • Increased efficiency - lower emissions: 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: 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: less materials used in production (1) resulting in less waste thrown into landfill (1) / ability to adapt process (1) to reduce rework / waste (1) **Negative answers** • Greater use of machinery – higher emissions: resulting in greater consumption (1) and an increase in the rate of global warming (1) / issues associated with acid rain (1) and toxic gases (1) • Use of finite resources to manufacture control technologies: increased consumption of raw materials (1) leading to increased likelihood of overuse / lack of supply (1) / issues associated with disposal of technologies (1) and use of finite resources for disassembly (1) • Greater overall volume of products generated: distribution network increased (extra fuel) (1) meaning higher CO_2 emissions (1) / higher quality products leading to greater demand (1) and reduced product lifespan (1) Up to 2 marks each response *If answer in 12(b)(i) is inappropriate allow follow through up to 1 mark each. If 12(b)(i) has no answer, no mark for 12(b)(ii)* (2x1) (2x1)	(4)
	Total mark	10

Question Number	Answer	Mark
13(a)	An explanation that makes reference to four of the following points. Low response (1) or four low responses (4) or detailed response (up to 4) The following could be either positive or negative influences. • Climate change (1) • CO_2 emissions from coating or other processes (1) • Land fill, packaging materials (1) • Environmental contamination (1) • Burning fossil fuels in manufacturing processes (1) • Renewable energy (1) • Global expansion (1) • Lifespan of product (1) • Disposal of riveters e.g. worn out / old (1) • Disassembly costs (1) • Recycling (1) • Polymer shredding (1) • Biodegradable (1) **Positive example** The use of biodegradable materials (1) has lessened the need for landfill (1) and reduced environmental contamination (1) which could lead to the reduction of CO_2 emissions(1) because of less decomposition of the product. **Negative example** The difficulty of the disposal of damaged or worn out riveters (1) has led to disassembly costs (1) and reduced the scope for recycling (1) because of limited lifespan of products (1) and increased the need for landfill (1) Up to 4 marks (4x1)	(4)

Question Number	Answer	Mark
13(b)	An explanation that makes reference to four of the following points. Low response (1) or four low responses (4) or detailed response (up to 4) 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) • Size (1) • Weight / density – riveters have become lighter but retain their strength and force capability (1) • Ease of use – components do not wear out as the riveter is used and therefore continues to be easy to use (1) • Health and safety (1) • Energy consumption (1) • Efficiency (1) *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).* *Light handles (1) with intricate shapes (1) can be made using aluminium alloys and die casting methods (1) as they have low melting points (1) which means less energy is consumed (1)* Up to 4 marks (4x1)	(4)
	Total mark	8
	Total Marks for section B	55
	Total marks for paper	100