

Mark Scheme (Results)

Summer 2013

GCE Design & Technology Product Design
Resistant Materials (6RM03)

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Question Number	Answer	Mark
1(a)	<p>Any four of the following examples from:</p> <ul style="list-style-type: none"> • Ease of language options (1) • Low cost (1) • Has a global reach/large audience (1) • Provides a quick/direct/targeted link to customers (1) • Multimedia/interactive/3d presentations clearly communicate products (1) • Increased company profile (1) • Faster processing of transactions/data (1) • Reduced sales force/retail outlets (1) • Links can be added to access other sites easily (1) • Updating/adapting info is quick/easy (1) • Available 24/7/anytime/anywhere (1) • Can monitor popularity/demand/trends for products (1) • On-line banking facilities (1) <p style="text-align: right;">(4 x 1)</p>	(4)
1(b)	<p>Any six of the following examples from:</p> <ul style="list-style-type: none"> • Reduces the time to market/lead time) (1) • Keep up with/forecast - trends/fashions/demand/orders (1) • Reduces retooling costs (1) • Increased market share (1) • Recoup money quickly/improve cash flow (1) • Products/materials are only made/bought to order/need (1) • Stock levels/stockpiling are constantly re-evaluated (JIT) (1) • Storage costs reduced (1) • Highly automated/ reduced labour (1) • Reduced human error/waste (1) • Allows customisation/flexibility/ adaptability (1) • Repeat business/customer satisfaction/ confidence/ increase reputation (1) <p>Do not give a mark for increases profit/ money.</p> <p style="text-align: center;">(6 x 1)</p>	(6)
Total for question		10

Question Number	Answer	Mark
2(a)	<p>A maximum of TWO marks for each answer</p> <p>Plasticisers</p> <ul style="list-style-type: none"> • Improve the flow of plastics (1) • Reduce the softening temperature of the plastics (1) • Make the plastics less brittle/ more shock absorbent/ bendable/stretchable/flexible/elastic/malleable/ (1) • Phthalates/particles separate polymer strands (1) <p>Stabilisers</p> <ul style="list-style-type: none"> • make the plastics more resistant to ultra-violet light/ fade/yellow/become transparent when exposed for long periods (1) • reduces the rate/stops, brittleness/degrading (1) • make the plastics more resistant to heat (1) • make the plastics more resistant to micro biological attack (1) • increases the products lifespan (1) <p>Fillers</p> <ul style="list-style-type: none"> • Reduce the amount of plastic necessary/bulk up/add volume/add density to plastics (1) • cheaper/reduces the cost of the plastic (1) • Add chalk/talc/milled glass (1) <p style="text-align: right;">(3 x 2)</p>	(6)
2(b)	<p>Any four of the following examples from:</p> <ul style="list-style-type: none"> • Reduces carbon emissions/greenhouse gases/pollution/global warming (1) • Reduces the amount going to incineration (1) • Reduces the amount going to landfill sites/ disposal (1) • Reduces the demand on raw/finite resources (1) • Less energy used to recycle materials than process new materials (1) • Reduction in scarring/destruction of landscape (1) • Affect on deforestation/wildlife reduced (1) <p style="text-align: right;">(4 x 1)</p>	(4)
Total for question		10

Question Number	Answer	Mark
3(a)	<p>Any five of the following examples from:</p> <ul style="list-style-type: none"> • Extremely accurate/reliable/reduced human error/less waste (1) • Repetitive accuracy/repeatability (1) • Give 'real-time' data/speed of inspection/checking of every/more/all components/100% (1) • Data can be recorded and stored/database (1) • 24/7 capabilities (1) • Reduced maintenance (1) • Reduced labour/pay is required (1) • 3d inspection capabilities/ more complex products can be checked (1) • Tool-less technology (lasers/ultra-sound) can be used (1) • Increased H&S (1) • Inspection can take place in hazardous/remote places (1) • Feedback linked to CAD/FMS/reprogrammable/alteration to manufacture/fix errors (1) • Increased flexibility/can be programmed (1) <p>Do not give a mark for an unqualified 'cheaper'</p> <p style="text-align: right;">(5 x 1)</p>	(5)
3(b)	<p>Any five of the following examples from:</p> <ul style="list-style-type: none"> • High set-up costs (1) • Highly skilled (cost implication) technicians required (1) • Training/retraining implications (1) • Redundancies (1) • Do not have full range of human sensors/senses/range of movement/degrees of freedom (1) • Robots have limited ability to learn/think or make decisions, therefore will make mistakes repeatedly (1) • Maintenance is relatively expensive/frequent (1) • Breakdowns can affect production line (1) • Low worker morale/deskilled workers (1) • No standard for robot 'language' so there are compatibility issues (1) • Complexity of procedures has direct effect on speed of operation (1) • Costs/health and safety of restricting access to humans with fences/walls (1) <p style="text-align: right;">(5 x 1)</p>	(5)
Total for question		10

Question Number	Answer	Mark
4(a)	<p>Any of the following examples from:</p> <ul style="list-style-type: none"> • Shape prevents rolling (1) • Left/Right handed (1) • Textured/ smooth (1) • Balance (1) • Grip/ hold/ grasp (1) • Colour (1) • Anthropometrics/Size of hand/shape of hand/fit the hand/5th to 95th percentile/90% of people/most users(1) • Comfort (1) • Weight (1) <p style="text-align: right;">(4x1)</p>	(4)
4(b)	<p>Any mention of the following features:</p> <ul style="list-style-type: none"> • Seat height (length of leg) (1) • Seat depth/length (1) • Seat width (1) • Arm height/relationship of seat to arms (1) • Arm length (1) • Arm width (1) • Angle of backrest – adjustable (1) • Width of backrest (1) • Height of backrest (1) • Comfort (1) • Predominantly straight lines except where body requirements define need for curves (1) • Minimum number of slats used in the back (1) <p style="text-align: right;">(4 x 1)</p>	(4)
Total for question		8

Question Number	Answer	Mark
5(a)	<p>Any four of the following examples from:</p> <ul style="list-style-type: none"> • Products will become outdated (1) • Increased/continued, sales/profit/money (1) • Customers will want/ replace/need to buy the latest product/upgrade (1) • A predetermined lifespan/broken product (1) • Manufacturers can plan/control, change/improve/release designs more effectively/often (1) • Less money is tied up in stock (1) • Fewer spares need to be stocked (1) • Fewer repairs need doing (1) • Cheaper parts/ materials can be used (1) • Warranties can be given with confidence (1) <p style="text-align: right;">(4 x 1)</p>	(4)
5(b)	<p>Any two of the following examples from:</p> <ul style="list-style-type: none"> • Manufacturer must make new/latest/best, products/designs available/keep ahead of competition (1) • Allows the consumer to keep up to date/in fashion/follow trends/be cool, have latest/newest technology (1) • Companies are in greater competition to deliver new products (1) • Consumers have a wider choice (1) • Designs can become more innovative (1) • As products are upgraded the second-hand market thrives (1) <p style="text-align: right;">(2 x 1)</p>	(2)

<p>5(c)</p>	<p>A maximum of 2 marks per answer (e.g. 3 x 2) Suitable examples e.g.:</p> <ul style="list-style-type: none"> • Shape memory alloy (SMA) Nitinol (1) Plating of broken bones/Teeth braces/Kinetic clothing/window openers (1) change in response to heat/ electrical stimulus (1) • Shape memory alloy (SMA)/memoflex (1) Glasses frames (1) return to original shape after being deformed/ are flexible(1) • Thermo-chromic materials (1) Cup/kettle/spoon/sensors/thermometers (1) change colour according to temperature (1) • Photo-chromic materials (1) visors/rear view mirrors (1) change colour according to UV light (1) • Reactive glass (Silver Halide) (1) Glasses (1) Turn dark in response to UV light (1) • Smart glass (1) Windows (opacity/darkness)/welding masks (1) Turns dark in response to an electric input (1) • Smart fluid/grease/oil (1) Car suspension (1) Become more viscous in response to an electrical/ magnetic input (1) • QTCs (1) Power tools/torches/robots/clothing (1) Electrical resistance reduced by pressure (1) • Electro luminescent lighting (1) computer display/dashboards (1) emits light from an electric input (1) • Solar panels/photovoltaic cells (1) for electricity generation (1) Converts light to electricity (1) • Memory foam (1) Mattresses/ seats (1) Form body shape from pressure (1) • LCD/ nematic (1) screens (1) Change shade/colour in response to an electric input (1) • Piezo-electric actuators (1) strain gauges/buzzer/guitar pick-up (1) pressure results in current/current results in pressure (1) <p>Do not award marks for examples using the lamp as it is in the question</p> <p style="text-align: right;">(3 x 2)</p>	<p style="text-align: right;">(6)</p>
Total for question		12

Question Number	Answer	Mark
6(a)	<p>Any of the following examples from:</p> <ul style="list-style-type: none"> • Reduce the product – size/weight (1) • Reduce the packaging – size/weight/stackable product/packaging/multi-pack/flatpack (1) • Proximity to raw materials (1) • Proximity to work force (1) • Proximity to customers (1) • Alternative/greener/electric/Bio fuels/more efficient fuels/engines used for transport (1) • Driving more carefully/efficiently (1) • Speed limiters on vehicles (1) • More streamlined vehicles (1) • Different forms of transport (rail/water) (1) • Upscale/larger/trucks/transport/more transported in one load (1) • Planning journeys to avoid being stuck in traffic/use shortest/most efficient route/ full both ways/ fewer journeys (1) <p>Do not award a mark for 'uses less fuel'.</p> <p style="text-align: right;">(5 x 1)</p>	(5)
6(b)	<p>Any of the following examples from:</p> <p>Advantages</p> <ul style="list-style-type: none"> • They produce quite a lot of power/amounts of electricity easily/quickly/efficiently (1) • Currently relatively cheap/low cost (1) • Reliable source of energy/available when needed/demand is high (1) • We already have the power stations/infrastructure in place/low set up cost (1) • Power stations can be built 'anywhere' as they are not reliant on wind/water/etc (1) • Relatively small space required compared to wind farms for example (1) <p>Disadvantages</p> <ul style="list-style-type: none"> • Emissions/global warming/greenhouse gases/Acid rain (1) • Transport – heavy material/long distances (1) • Cost of extraction (1) • Environmental impact of extraction (1) • International tensions over supply/cost (1) • Finite resource (1) • Finite nature will push up the cost (1) • Large amount of ash produced needs disposal (1) <p>Award a maximum of 6 marks if only advantages or disadvantages are given.</p> <p style="text-align: right;">(7 x 1)</p>	(7)
Total for question		12

Question Number	Answer	Mark
7	<p>Any of the following examples from:</p> <p>Reduce</p> <ul style="list-style-type: none"> • The amount of material used/product made smaller (1) • The range of materials/colours used (1) • The amount of energy used by the product (1) • The amount of energy used during manufacture (1) • Emissions (1) • The impacts of distribution/transport (1) • The environmental impact of disposal (1) • Use of non-biodegradable materials (1) • Materials from non-sustainable sources (1) • Produce a product that has a long life expectancy (1) • Wasted time/JIT • Wasted materials/wasted stock//tessellation/efficient use of materials/right first time/TQM/CAM/CAQ/RPT/lean manufacturing/human error (1) • Replaceable heads means one toothbrush can be used by more than one person (1) <p>Reuse</p> <ul style="list-style-type: none"> • Use materials which can be reused without further processing (1) • Only the head/brush needs replacing (1) • Use of rechargeable batteries (1) <p>Recover</p> <ul style="list-style-type: none"> • Design the product so materials can easily be removed at the end of life (1) • Recover energy from the plastic casing by incineration and energy generation (1) <p>Recycle</p> <ul style="list-style-type: none"> • Only use materials that can be recycled (1) • Ensure all plastic components have a recyclable symbol (1) • Off cuts/surplus materials can be recycled (1) • Manufacture product using recycled materials (1) <p>Do not award marks for packaging as this is not part of the toothbrush production</p> <p style="text-align: right;">(8 x 1)</p>	<p style="text-align: right;">(8)</p>
	Total for question	8

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