

Mark Scheme (Results)

Summer 2008

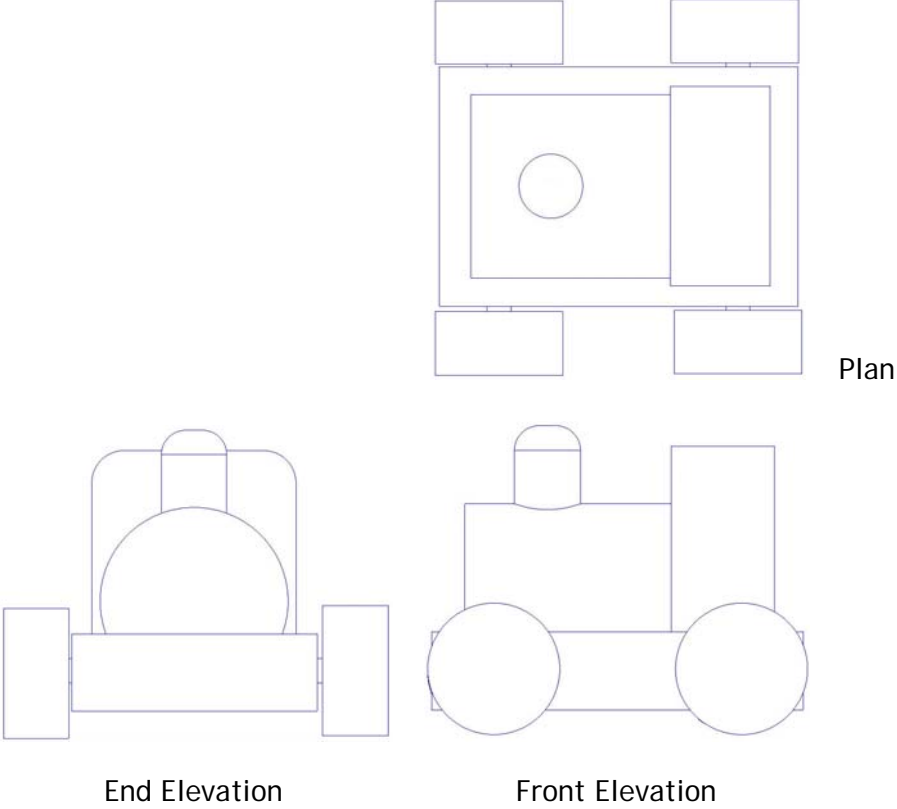
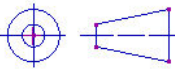
GCE

GCE Design and Technology (6146) Paper 1

Unit 6146/01 Knowledge and Understanding of Product Design

Question Number	Answer	Mark						
1(a)	<p>Any two of the following:</p> <ul style="list-style-type: none"> • Softwoods cost less than hardwoods / cheaper (1) • Easier to work than hardwoods (1) • More abundant / easier to source than hardwoods (1) • Surface finish applied to softwood therefore no need for decorative quality of hardwoods (1) • Sustainable resource / managed forests (1) <p style="text-align: right;">(2x1)</p>	2						
1(b)	<p>Any one suitable surface finish per component:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Component</th> <th>Suitable surface finish</th> </tr> </thead> <tbody> <tr> <td>Brightly coloured tank</td> <td> <ul style="list-style-type: none"> • Painting / Any type of paint i.e. gloss paint / spray paint (1) </td> </tr> <tr> <td>Natural wood wheels</td> <td> <ul style="list-style-type: none"> • Varnish (1) • Wax (1) • Polish (1) • Oil (1) • Stain (1) • Sealer (1) </td> </tr> </tbody> </table> <p style="text-align: right;">(2x1)</p>	Component	Suitable surface finish	Brightly coloured tank	<ul style="list-style-type: none"> • Painting / Any type of paint i.e. gloss paint / spray paint (1) 	Natural wood wheels	<ul style="list-style-type: none"> • Varnish (1) • Wax (1) • Polish (1) • Oil (1) • Stain (1) • Sealer (1) 	2
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Natural wood wheels	<ul style="list-style-type: none"> • Varnish (1) • Wax (1) • Polish (1) • Oil (1) • Stain (1) • Sealer (1) 							
1(c)i	<p>Any two of the following:</p> <ul style="list-style-type: none"> • Purchase / gather of materials inc. softwood / dowel / paint / varnish in appropriate size / measurements (1) • Making of suitable drilling jigs (1) • Setting up / test runs of machinery - pillar drill / disc sander etc (1) • Any named quality control (QC) check (1) • Stock control (1) • Risk assessments made / safety checks (1) <p><i>Candidates may answer this question in bullet form.</i></p> <p style="text-align: right;">(2x1)</p>	2						

Question Number	Answer	Mark
1(c)ii	<p>Any three of the following processes:</p> <ul style="list-style-type: none"> • Marking out of materials (1) • Cutting of wood and dowel to correct sizes (1) • Sanding / cutting / planing flat on dowel tank (1) • Shaping radii on wooden components (1) • Drilling of holes for funnel / wheels and axles (1) • Smoothing wooden components using glass-paper / file (1) • Finish applied (paint / varnish) on individual components • Any named quality control (QC) check / TQM (1) <p><i>Candidates may answer this question in bullet form. Generic TQM response only acceptable in one section.</i></p> <p style="text-align: right;">(3x1)</p>	3
1(c)iii	<p>Any two of the following processes:</p> <ul style="list-style-type: none"> • Gluing wooden components together (1) • Inserting axles through chassis (1) • Fixing wheels in place / gluing wheels onto axles using PVA / push fit (1) • Inserting funnel into tank (1) • Any named quality control (QC) check / TQM (1) • Safety checks (1) <p><i>Candidates may answer this question in bullet form. Generic TQM response only acceptable in one section.</i></p> <p style="text-align: right;">(2x1)</p>	2
Total for question		11

Question Number	Answer	Mark
2(a)	<p>Appropriate sketch: <i>Diagram shown is indicative of marking points only - marks to be awarded for sketched response only.</i></p>  <p>Plan</p> <p>End Elevation</p> <p>Front Elevation</p> <p>Marking points:</p> <ul style="list-style-type: none"> • Elevations in correct positions (End elevation to the left and plan above front elevation) (1) • Front, end and plan line up (1) • Correct proportions of elevations (1) • Wheels, chassis, tank, funnel, and cabin evidenced on all three elevations (1) • Curved edges on driver's cabin (1) • Rounded top on funnel (1) <p>Additional marking points:</p>  <ul style="list-style-type: none"> • Correct BS symbol for 3rd angle orthographic projection (1) • Centre lines used for holes and circular components (1) <p>(6x1)</p>	6

Question Number	Answer	Mark
2(b)i	Two materials only: <ul style="list-style-type: none"> • Chemical pigment / pigment / coloured pigment (1) • Kaolin / clay (1) Only acceptable answers <p style="text-align: right;">(2x1)</p>	2
2(b)ii	<ul style="list-style-type: none"> • more clay (1) • less graphite (1) Only acceptable answers <p style="text-align: right;">(2x1)</p>	2
Total for question		10


Question Number	Answer	Mark
3(a)	<p>Scale of production:</p> <ul style="list-style-type: none"> • Continuous <p>Only acceptable answer</p> <p><i>Do not accept 'mass production'</i></p>	(1x1) 1
3(b)	<p><i>Response must include both notes and sketches</i></p> <p><i>Notes up to 2 marks / Sketches up to 2 marks</i></p> <div> </div> <p style="text-align: center;"><i>Sketch shown is indicative only</i></p> <p>Sketch should include:</p> <ul style="list-style-type: none"> • Two-part split mould (1) • Parison / pre-form being extruded and clamped in mould (1) • Air being blown in (1) • Two halves of mould opening to release final bottle (1) <p>Description of extrusion method:</p> <ul style="list-style-type: none"> • A small hollow tube of PET (called a parison / pre-form) is extruded downwards between two halves of a mould (1) • The mould closes around the neck and the base (1) • Hot compressed air is blown into the parison (1) • The parison / pre form expands out on to the walls of the mould to form the bottle shape (1) • The mould is cooled then opened to remove the bottle (1) <p><i>Description of Injection moulding method: as above but an injection moulded parison inserted into split mould.</i></p>	(3x1) 3

Question Number	Answer	Mark
3(c)	<p>Any two of the following justified points:</p> <ul style="list-style-type: none"> • Excellent barrier against atmospheric gases / waterproof (1) therefore protects drink from contamination (1) • Does not allow gas to escape (1) therefore keeping the 'fizz' in the drink (1) • Chemical resistance (1) due to acidity of fizzy drink (1) • Inert (1) therefore does not flavour the drink inside (1) • Sparkling 'crystal clear' appearance (1) to clearly display liquid inside (1) / provide high quality retail appearance (1) • Tough / strong / shatterproof (1) therefore provide protection for contents (1) • Low density (1) therefore does not add much additional weight to the package / lightweight (1) • Thermoplastic (1) that can be easily thermoformed / moulded into interesting shapes (1) <p><i>Do not accept 're-use' / 'recycle'</i></p> <p><i>Do not give marks for the same justification twice.</i> <i>Points must be justified.</i> <i>Up to two marks only for unjustified points.</i></p> <p style="text-align: right;">(2x1) (2x1)</p>	4
3(d)	<p>Any two of the following justified points:</p> <ul style="list-style-type: none"> • Ergonomics (1) comfortable diameter to hold safely (1) • Flexibility (1) standard bottle can be manufactured for several companies (1) • Use on production / filling lines (1) to contain a standard volume of liquid / no expensive re-tooling of machinery in production process (1) • For retail purposes (1) packaging for stock and transit (1) / display on shelving systems (1) • For vending purposes (1) standard size of vending machine stock compartments and dispensing systems (1) <p><i>Points must be justified.</i> <i>Up to two marks only for unjustified points.</i></p> <p style="text-align: right;">(2x1) (2x1)</p>	4
Total for question		12

Question Number	Answer	Mark
4(a)	Suitable printing process: <ul style="list-style-type: none"> • Screen-printing (1) <i>Accept 'Transfer printing'</i> <p style="text-align: right;">(1x1)</p>	1
4(b)	Any two of the following justified points: <ul style="list-style-type: none"> • Ideal for mass production (1) therefore high volumes can be easily / quickly produced (1) • Identical products / accuracy (1) of repeatable high quality / less waste (1) • Low unit cost for each moulding (1) therefore reducing production costs / increasing profit margins / automation / decreased labour costs (1) • Precision moulding (1) therefore intricate / detailed shapes can be produced / internal components fit accurately (1) • High quality surface finish / smooth finish / self-finishing (1) which gives high quality appearance to customer (1) <p><i>Do not give marks for the same justification twice. Points must be justified. Up to two marks only for unjustified points.</i></p> <p style="text-align: right;">(2x1) (2x1)</p>	4

Question Number	Answer	Mark
4(c)	<p><i>Both advantages and disadvantages must be evidenced. Up to four marks for each:</i></p> <p>Advantages: (1-4 marks)</p> <ul style="list-style-type: none"> • Inexpensive / cheaper than other types of cameras to buy (1) • For consumers who don't want to risk using their regular cameras i.e. in uncertain conditions - when skiing / on the beach / at parties etc (1) • Back up for when a consumer's regular digital camera has low battery or contains a nearly full memory card (1) • Battery does not wear out in relation to 24/36 exposures (1) • Increased profit for manufacturer due to built-in obsolescence (1) <p>Performance factors including;</p> <ul style="list-style-type: none"> • Good picture quality for the fraction of the cost of a normal camera (1) • Compactness - can easily fit in pocket / handbag etc (1) • Ease of use - point 'point and click' feature - no complicated settings (1) • Reliability - few working parts to break down - durable under most conditions (1) • Components could be recycled (therefore avoiding landfill) (1) <p>Disadvantages: (1-4 marks)</p> <ul style="list-style-type: none"> • Environmental concerns of throw away culture (1) • Disposal in landfill sites e.g. pollution from batteries and PCB's / years for polymers to decay / non-biodegradable (1) • Uses more materials e.g. depletion of oil reserves (1) • Components have to be separated for recycling / some components cannot be recycled (1) <ul style="list-style-type: none"> • Social / ethical concerns of throw away culture including; <ul style="list-style-type: none"> - Mass consumerism where convenience is the driving factor without taking responsibility for the effects of over consumption (1) - Is it right to simply throw things away? - could they be re-used / recycled into more useful products (1) - Image cannot be electronically stored / edited / e-mailed / viewed (1) - Processing costs higher / slower than digital printing (1) <p style="text-align: right;">(5x1)</p>	5
Total for question		10

Question Number	Answer	Mark
5(a)	<ul style="list-style-type: none"> • Polystyrene is self-finishing / already has a shiny / coloured surface finish (1) <p style="text-align: right;">(1x1)</p>	1
5(b)	<p>Any two of the following points:</p> <ul style="list-style-type: none"> • Can be heat sealed (1) to keeps food contents fresh (1) • Excellent barrier to air / light / water / moisture / bacteria and other flavours (1) which can cause food to deteriorate / doesn't react with food (1) • It is flexible (1) so it can be easily peeled back for accessing contents (1) • Has a good printing surface (1) to provide bold brand identity (1) • Durable (1) does not deteriorate / rust (1) <p style="text-align: right;">(2x1)</p>	2
5©	<p>Any three of the following points:</p> <ul style="list-style-type: none"> • Moulds produced accurately to required tolerances / no human error (1) • Moulds produced efficiently / less waste in less time (1) • Moulds produced more economically / cost effective (than employing a skilled manual machine operator) (1) • Manufacturing data can be stored for future use (minimising 'down time') / identical moulds can be produced (1) • Design data can easily be modified for future use (minimising development costs) / electronically transferred (1) • Increased speed of production (1) <p style="text-align: right;">(3x1)</p>	3
5(d)	<p>Any three of the following points:</p> <ul style="list-style-type: none"> • It costs considerably less to develop vacuum forming moulds in China than in Europe (1) • It costs considerably less to manufacture in China than in Europe (1) • Lower wages, overheads and real estate / less legislation (1) • Increased profits / lower unit costs (1) • 'Western' company can still control the quality of the product (1) • Greater access to expanding overseas markets (1) • Quick transfer of data electronically, enabling fast efficient 'offshore' manufacture (1) • Drawing upon the individual manufacturing expertise of China (1) <p style="text-align: right;">(3x1)</p>	3
Total for question		9

Question Number	Answer	Mark									
6(a)	<p>Any two of the following points:</p> <ul style="list-style-type: none"> • Determine the mechanical / functional / performance properties of materials (1) • Ensure quality of materials (1) • Ensure safety of materials (1) • Ensure the fitness for purpose of materials / protect consumers (1) <p style="text-align: right;">(2x1)</p>	2									
6(b)	<div style="border: 1px solid black; padding: 10px; width: fit-content; margin: auto;"> <p>Sketch:</p>  <p style="text-align: right;">(1)</p> <hr/> <p>Name of symbol:</p> <ul style="list-style-type: none"> • Kite Mark (1) </div> <p style="text-align: right;">(2x1)</p>	2									
6(c)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Mechanical property</th> <th>Characteristic of mechanical property</th> <th>Name of BS performance test</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Toughness</td> <td> <ul style="list-style-type: none"> • withstands sudden impact / shock loading (1) </td> <td> <ul style="list-style-type: none"> • The Izod Test (1) • The Charpy Test (1) </td> </tr> <tr> <td style="text-align: center;">Hardness</td> <td> <ul style="list-style-type: none"> • Withstands abrasive wear / indentation (1) </td> <td> <ul style="list-style-type: none"> • The Brinell Test (1) • The Vickers Test (1) • The Rockwell Test (1) </td> </tr> </tbody> </table> <p style="text-align: right;">(2x1) (2x1)</p>	Mechanical property	Characteristic of mechanical property	Name of BS performance test	Toughness	<ul style="list-style-type: none"> • withstands sudden impact / shock loading (1) 	<ul style="list-style-type: none"> • The Izod Test (1) • The Charpy Test (1) 	Hardness	<ul style="list-style-type: none"> • Withstands abrasive wear / indentation (1) 	<ul style="list-style-type: none"> • The Brinell Test (1) • The Vickers Test (1) • The Rockwell Test (1) 	4
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6(d)	<p>Tensile strength experiment (as outlined in textbook page 103) to include four of the following points:</p> <ul style="list-style-type: none"> • Clamping a bar of the material in a vice (1) • Adding a standard weight to the end of the bar (load) (1) • Measuring the amount of deflection of the bar (1) • Repeating the test with other cross-sectional bars (bar length must be constant) (1) • Material with least deflection is able to resist stretching forces (1) <p>Using a tensile testing machine (tensometer) for testing to include four of the following points:</p> <ul style="list-style-type: none"> • Clamping specimens of a uniform cross section at both ends (1) • The tensile testing machine pulls the sample from both ends (1) • Measures the force required to pull the specimen apart (1) • How much the sample stretches before breaking (1) • Load-extension graph can be plotted electronically (1) <p style="text-align: right;">(4x1)</p>	4
Total for question		12

Question Number	Answer	Mark
7(a)	<p>Process to include four of the following points:</p> <ul style="list-style-type: none"> • Produce an accurate mould of the structure (1) • Apply release agent to surface of mould / tapered sides (1) • Lay sheets of glass fibre matting over the mould and wet with resin (1) • Add additional layers with resin to build up extra thickness where required (1) • Liquid resin is cured or hardened (around the fibres) (1) • Polymerisation reaction occurs which converts the resin into a rigid cross-linked thermoset solid (1) • Use of a spraying system involves spraying a mixture of glass fibres and resin on to a mould (1) • Continuous spool of fibres wound off a drum (1), mixed in a spray gun with the resin, catalyst and hardener (1) • Edges are trimmed to correct shape / size (1) <p style="text-align: right;">(4x1)</p>	4
7(b)	<p>Any two of the following justified points:</p> <ul style="list-style-type: none"> • High strength to weight ratio (1) therefore it is a lightweight material / with good strength / personnel can wear protection for longer times (1) • Increased protection (1) fibres are five times stronger ounce for ounce than steel and flexible to stop ballistics (1) • Extended wear life (1) fibres are durable and do not corrode like steel (1) • Flame resistant (1) and self-extinguishing (1) therefore excellent for high risk areas • Multiple layers (laid in opposite directions) (1) add strength to high stress areas (1) • Low thermal shrinkage (1) therefore easily washable (1) <p><i>Points must be justified.</i> <i>Up to two marks only for unjustified points.</i></p> <p style="text-align: right;">(2x1) (2x1)</p>	4
Total for question		8

Question Number	Answer	Mark
8(a)	<p>Any two of the following points from two design principles:</p> <p>'Form follows function':</p> <ul style="list-style-type: none"> • An object's appearance should be influenced mainly by what it is intended to do (1) • The function of the product is more important than its appearance (1) <p>'Everyday objects for everyday people':</p> <ul style="list-style-type: none"> • Products should be affordable to a wide range of consumers (1) • Design should not simply be for the rich - design must be for the masses (for the people) (1) • Use of readily available / cost effective materials (1) <p>'Products for a machine age':</p> <ul style="list-style-type: none"> • Products should be designed to be made with the use of mechanised processes / mass production • Use of modern materials i.e. tubular steel (1) • Products that are made by machines should look like they have been made by machines and not by hand / they look 'machine-like' (1) <p>'Less is more':</p> <ul style="list-style-type: none"> • Designs should use vertical, horizontal, geometric shapes and clean lines with no fuss or clutter / simplistic, functional (1) • Use of basic tones and colour for subtlety / often primary colours and black (1) • Highly ornate and over-decorative design is redundant (1) <p style="text-align: right;">(2x1) (2x1)</p>	4

Question Number	Answer	Mark
8(b)	<p>Any four of the following points:</p> <p>Sustainability:</p> <ul style="list-style-type: none"> • No longer good enough that a product is aesthetically pleasing, inexpensive or widely available - environmental performance has to be improved (1) • Future generations will inherit the problem of current manufacturing methods, resulting pollution and disposal issues (1) • Use of non-finite / biodegradable materials extends life of natural resources (1) • Reduction of emissions to air (greenhouse gases) contributing to global warming / climate change (1) <p>Ecological/ environmental issues:</p> <ul style="list-style-type: none"> • Minimising waste production / less impact on landfill - (4 R's) <ul style="list-style-type: none"> - Recycle - Product made from recycled materials or materials / parts that are recyclable (1) - Re-use - Products should be able to be re-used and not simply thrown away (1) - Reduce - Minimise product packaging / reduce components therefore saving on raw materials, processing and energy (1) - Recover - Ensure that disposal of product involves recovery of energy i.e. incinerated in specialist power-stations for electricity generation (1) • Repair vs replacement / easily disassembled and parts replaced (1) • Efficiency - The product in manufacture and use requires less energy, materials and water e.g. using less electricity means less fuel burnt at the power station and so fewer emissions and less pollution (1) • Efficient manufacturing produces less material waste, therefore greater profit margins (1) • Renewable energy - The product in manufacture and use consumes only renewable energy (1) • Safety - All releases to air, water and land are non-polluting i.e. does not chemically or physically cause harm to people or other life (1) <p>Social issues:</p> <ul style="list-style-type: none"> • Product manufacture and use supports basic human rights. No exploitation and maltreatment of workforce e.g. Fairtrade Foundation ensures that producers receive a fair price for their product (1) • Reflects company in good light / good PR / setting a good example for others to follow (1) • Considerations for LCA and responsibilities by client, designer, manufacturer / cradle to grave considerations / reducing carbon footprint (1) • Lifestyle marketing - popularity / greater quantities sold to eco-friendly consumers (1) <p style="text-align: right;">(4x1)</p>	4
Total for mark question		8
Total for paper		80