

# Mark Scheme (Results)

June 2011

GCE Design and Technology:  
Product Design (6RM03).

Paper 01: Designing for the Future  
(RMT).

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These instructions should be the first page of all mark schemes

## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Mark
<b>1(a)</b>	Any three of the following :- <ul style="list-style-type: none"> <li>• Easier to contact groups of people. <b>(1)</b></li> <li>• Message content is stored for reference purposes. <b>(1)</b></li> <li>• Attachments can be easily sent. <b>(1)</b></li> <li>• Person does not have to be available to immediately answer the phone. <b>(1)</b></li> <li>• Emails give you more thinking time. <b>(1)</b></li> <li>• Less expensive. <b>(1)</b></li> <li>• Easier to filter / prioritise messages. <b>(1)</b></li> <li>• More secure / private than audible phone calls. <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(3 x 1)</b></p>	<b>(3)</b>
<b>1(b)</b>	Any four of the following :- <ul style="list-style-type: none"> <li>• Cheap method of advertising / facilitating sales <b>(1)</b></li> <li>• Focussed marketing / can be targeted at specific consumers. <b>(1)</b></li> <li>• Has a global reach expanding customer base. <b>(1)</b></li> <li>• Provides a direct link to customers for sales / follow-up. <b>(1)</b></li> <li>• Wide range of information made available (Multimedia, interactive presentations, detailed information, customer reviews). <b>(1)</b></li> <li>• Faster processing of transactions resulting in increased efficiency. <b>(1)</b></li> <li>• Allows customers to customise product. <b>(1)</b></li> <li>• Business can directly monitor sales and respond to trends quickly. <b>(1)</b></li> <li>• Advertisements generated /edited /distributed quickly and easily. <b>(1)</b></li> <li>• Websites available 24/7 encourage sales. <b>(1)</b></li> </ul> <p><i>Do not accept just 'Efficient'.</i></p> <p style="text-align: right;"><b>(4 x 1)</b></p>	<b>(4)</b>
	<b>Total for question</b>	<b>7</b>

Question Number	Answer	Mark
2(a)	<p>Any two of the following with a valid explanation.</p> <p><b>Fibres</b></p> <ul style="list-style-type: none"> <li>• Network of interwoven fibres / matting <b>(1)</b> gives increased strength / toughness / flexibility <b>(1)</b> resulting in the polymer being able to resist greater forces / shock loads/ improve strength to weight ratio. <b>(1)</b></li> </ul> <p><b>Stabilisers</b></p> <ul style="list-style-type: none"> <li>• Increased resistance to UV light / sunlight <b>(1)</b> does not fade / yellow or become brittle / increased life of product. <b>(1)</b> <i>Note – do not accept 'light' on its own.</i></li> <li>• Increased resistance to heat <b>(1)</b> so does not degrade under injection moulding.</li> <li>• Increased resistance to biological attack <b>(1)</b> so will not go mouldy / have fungal growths</li> </ul> <p><b>Foamants</b></p> <ul style="list-style-type: none"> <li>• Cause polymer to form into a cellular structure / fill with bubbles / increasing its volume <b>(1)</b> improving the polymers volume to weight ratio / buoyancy / elasticity / flexibility / toughness / insulation properties. <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(2 x 2)</b></p>	<b>(4)</b>
2(b)	<p>Any two of the following with a linked relevant explanation.</p> <ul style="list-style-type: none"> <li>• Biodegradable / rots quickly <b>(1)</b> so takes up less space in landfill / reduces long term unsightly litter / releases nutrients <b>(1)</b></li> <li>• Will not consume finite sources of oil <b>(1)</b> extending supply <b>(1)</b></li> <li>• Sustainable polymer <b>(1)</b> as it can be re-grown.</li> <li>• Reduced carbon emissions (1) as carbon is absorbed during growth cycle / as there is no need to incinerate it/ reduces global warming <b>(1)</b></li> <li>• Made from an organic base / sugar &amp; carbohydrates <b>(1)</b> so not harmful when rots / non toxic <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(2 x 2)</b></p>	<b>(4)</b>
2(c)	<p>Any two of the following :-</p> <ul style="list-style-type: none"> <li>• Biopol exposed to micro-organisms in soil / water / sewage. <b>(1)</b></li> <li>• Micro-organisms break down / degrade the polymer. <b>(1)</b></li> <li>• The more micro-organisms the faster the degradation. <b>(1)</b></li> <li>• Industrial / commercial composting systems can be used. <b>(1)</b></li> <li>• Reduced oxygen will speed up the process. <b>(1)</b></li> <li>• Heat will speed up the process. <b>(1)</b></li> <li>• It takes approximately 90 days for 90% of the plastic to degraded commercially / 2+ years naturally. <b>(1)</b></li> <li>• Resulting in carbon dioxide and water / non toxic material.<b>(1)</b></li> </ul> <p style="text-align: right;"><b>(2 x 1)</b></p>	<b>(2)</b>
<b>Total for question</b>		<b>10</b>

Question Number	Answer	Mark
3(a)	<p>Any four of the following :-</p> <ul style="list-style-type: none"> <li>• Increased employment opportunities. (1)</li> <li>• Increased training for the workers. (1)</li> <li>• Increased wealth / standard of living. (1)</li> <li>• Local infrastructure / transport /amenities are improved. (1)</li> <li>• Foreign currency is brought into the country increasing its balance of payments / widens the country's economic base / promotes further development.(1)</li> <li>• Brings increased levels of technology to the country. (1)</li> </ul> <p style="text-align: right;">(4 x 1)</p>	(4)
3(b)	<p>Any two of the following with a linked relevant explanation.</p> <ul style="list-style-type: none"> <li>• Can use cheaper labour (1) cheap / readily available land (1) reducing production costs making the company more competitive / sell products cheaper / increase profits. (1) <b>Note – Cheap labour &amp; land can be awarded separately but both have the same justification. Only award justification once.</b></li> <li>• Developing countries have less stringent legislation (H&amp;S / environmental) (1) so companies can cut corners / dispose of their waste with less expense / save on cleaning emissions costs. (1)</li> <li>• Being a large employer they can gain a measure of political influence (1) and use this to ensure that regulations and laws remain advantageous to the company. (1)</li> </ul> <p style="text-align: right;">(2 x 2)</p>	(4)
	<b>Total for question</b>	<b>8</b>

Question Number	Answer	Mark
4(a) i	Any aspect of the following answer :- <ul style="list-style-type: none"> <li>• Computers that can think / make decisions / problem solve / learn / adapt / simultaneously process large amounts of information .(1)</li> </ul> <p style="text-align: right;"><b>(1 x 1)</b></p>	<b>(1)</b>
4(a) ii	Any two of the following with a relevant explanation :- <ul style="list-style-type: none"> <li>• Simulations <b>(1)</b> allow extensive testing / evaluation of products without the need for a prototype. <b>(1)</b></li> <li>• Knowledge based / expert systems / co-worker system <b>(1)</b> apply reasoning skills / suggest modifications to products being designed. <b>(1)</b></li> <li>• Autonomous manufacturing systems <b>(1)</b> which can respond to problems / make adjustments to allow production to continue. <b>(1)</b> <i><b>(not just 'check' production)</b></i></li> <li>• Voice recognition systems <b>(1)</b> help improve communication between designer and computer system.<b>(1)</b></li> </ul> <p style="text-align: right;"><b>(2 x 2)</b></p>	<b>(4)</b>
4(b)	Any three of the following with a relevant explanation :- <ul style="list-style-type: none"> <li>• No wasted storage <b>(1)</b> as materials / products are delivered / dispatched just when needed. <b>(1)</b></li> <li>• No wasted time <b>(1)</b> as production delays are eliminated. <b>(1)</b></li> <li>• No wasted energy <b>(1)</b> movement of materials is minimized. <b>(1)</b></li> <li>• No wasted materials / components / products <b>(1)</b> as only amount needed are ordered /products are made to order. <b>(1)</b></li> <li>• Minimized faulty products <b>(1)</b> as rigorous quality assurance systems are established. <b>(1)</b></li> <li>• No wasted labour <b>(1)</b> as work tasks are carefully planned /systems automated where possible / so minimizing labour costs.<b>(1)</b></li> <li>• No wasted equipment <b>(1)</b> as machinery used efficiently / does not stand idle. <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(2 x 3)</b></p>	<b>(6)</b>

4(c)	<p>Any six of the following :-</p> <ul style="list-style-type: none"> <li>• Reduced need for manual skills. <b>(1)</b></li> <li>• Increased unemployment as many systems become automated. <b>(1)</b></li> <li>• Some jobs reduced to machine minding / repetitive / boring. <b>(1)</b></li> <li>• Improved safety levels as workers removed from hazards. <b>(1)</b></li> <li>• Workers need CAD/CAM skills /able to work with computers/ high technology. <b>(1)</b></li> <li>• Workers need to be re-trained frequently to keep up with new technology. <b>(1)</b></li> <li>• Workers need to be good team players / have better people skills. <b>(1)</b></li> <li>• Workers need to be flexible so they can fulfil a number of roles. <b>(1)</b></li> <li>• Increased levels of numeracy and literacy are required in order to access ICT based systems. <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(6 x 1)</b></p>	<b>(6)</b>
	<b>Total for question</b>	<b>17</b>



Question Number	Answer	Mark
5(a)	Any four of the following :- <ul style="list-style-type: none"> <li>• Primary focus of the design is to function well, which then dictates the styling. <b>(1)</b></li> <li>• To be comfortable / stable / strong. <b>(1)</b></li> <li>• There is no added decoration / not highly stylised. <b>(1)</b></li> <li>• Looks machine made / designed for machine manufacture / designed or mass production.<b>(1)</b></li> <li>• Mass production reduces the cost of the chair. <b>(1)</b></li> <li>• Economic materials used. <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(4 x 1)</b></p>	<b>(4)</b>
5(bi)	The following is the only acceptable answer :- <ul style="list-style-type: none"> <li>• The measurement of human sizes. <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(1 x 1)</b></p>	<b>(1)</b>
5(bii)	Any five of the following points :- <ul style="list-style-type: none"> <li>• The target population for the product identified. <b>(1)</b></li> <li>• Specific data acquired/ measurements taken. <b>(1)</b></li> <li>• Data would provide distribution curve / sketch of distribution curve. <b>(1)</b></li> <li>• An appropriate percentile range would be considered (ie. 5th to 95<sup>th</sup>) / maximum- minimum sizes. <b>(1)</b></li> <li>• It is not economic to include people outside the identified percentile range as there will be very few of them. <b>(1)</b></li> <li>• Products will be designed to fit / correct measurements used. <b>(1)</b></li> <li>• Some products will be designed for the average person. <b>(1)</b></li> <li>• Some products will be designed with adjustment incorporated. <b>(1)</b></li> <li>• Some products will be designed in a range of sizes. <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(5 x 1)</b></p>	<b>(5)</b>
<b>Total for question</b>		<b>10</b>

Question Number	Answer	Mark
6(a)	<p>Any two of the following with a relevant explanation :-</p> <ul style="list-style-type: none"> <li>• Reduce the volume / range of materials /processes required <b>(1)</b> enabling materials costs to reduce. <b>(1)</b></li> <li>• Reduce the amount of energy required to design / manufacture / distribute the product <b>(1)</b> helping the company meet emissions targets / reduce energy costs. <b>(1)</b></li> <li>• Promote the product /company as being environmentally friendly <b>(1)</b> so increasing its appeal / sales to conscientious consumers.<b>(1)</b></li> <li>• Setup production nearer to suppliers / markets (1) reducing transportation costs. <b>(1)</b></li> <li>• Establish a life length for the product <b>(1)</b> so that they know when to launch a new product / establish a warranty length.<b>(1)</b></li> </ul> <p style="text-align: right;"><b>(2 x 2)</b></p> <p><i>Note - Only award 'reduced costs' as a justification once.</i></p>	<b>(4)</b>
6(b)	<p>Any four of the following points but the response must contain at least one positive and one negative to gain full marks.</p> <p><b>Positives</b></p> <ul style="list-style-type: none"> <li>• Reconditioned products appeal more to environmentally aware consumers. <b>(1)</b></li> <li>• Fewer products will be discarded to landfill /reduced pollution. <b>(1)</b></li> <li>• Manufacturer has reduced need for raw materials / production systems / energy. <b>(1)</b></li> </ul> <p><b>Negatives</b></p> <ul style="list-style-type: none"> <li>• Workable collection systems need to be established in order to recover the used products. <b>(1)</b></li> <li>• A system to refill / reprocess the product needs setting up. <b>(1)</b></li> <li>• Systems for quality checking the reprocessed products need to be established. <b>(1)</b></li> <li>• Consumers expect a lower price on a reconditioned product. <b>(1)</b></li> <li>• Less new products will be sold. <b>(1)</b></li> <li>• Often costs more to re-process than manufacture new. <b>(1)</b></li> <li>• Products designed to be re-used need to be more robust adding to production costs / some products are not robust enough to be re-used <b>(1)</b></li> </ul> <p style="text-align: right;"><b>(4 x 1)</b></p>	<b>(4)</b>
	<b>Total for question</b>	<b>8</b>

Question Number	Answer	Mark
<b>7(a)</b>	The following with its explanation :- <ul style="list-style-type: none"><li>• Investing in developing clean technologies / carbon reducing programmes (1) in order to counteract/reduce your emissions. <b>(1)</b></li></ul> <p style="text-align: right;"><b>(1 x 2)</b></p>	<p style="text-align: right;"><b>(2)</b></p>

<p><b>7(b)</b></p>	<p>Any of the following points up to eight marks, but the discussion must include at least one positive and one negative to gain maximum marks.</p> <p><b>Positives</b></p> <ul style="list-style-type: none"> <li>• Biomass is a relatively inexpensive source of energy <b>(1)</b> as large amounts of cheap fuel available from agricultural sources and land fill. <b>(1)</b></li> <li>• Biofuels are a sustainable source of energy <b>(1)</b> so it reduces the need to consume other finite fuel resources. <b>(1)</b></li> <li>• The use of biofuels is said to be carbon neutral, <b>(1)</b> in that during growth the crop absorbs as much carbon as it emits when it is burnt as a fuel.<b>(1)</b></li> <li>• Controlled combustion of biomass fuel in power stations significantly reduces the levels of methane that would normally be emitted <b>(1)</b> which reduces carbon emissions in the carbon cycle.<b>(1)</b></li> <li>• The use of trees as a biomass source requires significantly less agricultural energy than the use of field crops. <b>(1)</b></li> <li>• 2<sup>nd</sup> 3<sup>rd</sup> and 4<sup>th</sup> generation bio-crops are more efficient for fuel production (1) and compete much less with food crops. <b>(1)</b></li> <li>• By products from biogas production can be sold for re-use as composts<b>(1)</b> further reducing volumes of waste / recouping costs of production.<b>(1)</b></li> <li>• Can be used as an alternative vehicle fuel. <b>(1)</b></li> <li>• Biofuel gives increase power over comparable vehicle fuel.</li> </ul> <p><b>Negatives</b></p> <ul style="list-style-type: none"> <li>• The fuel used by agricultural machinery producing the crop / energy used in processing it, generates significant carbon emissions <b>(1)</b> therefore it is far from carbon neutral. <b>(1)</b></li> <li>• Agricultural land given over to biomass crops reduces the area available for growing food crops <b>(1)</b> which may contribute to increased food costs / insufficient being available in some of the parts of the world. <b>(1)</b></li> <li>• Biofuels are not as efficient as petroleum based fuels <b>(1)</b> therefore more are needed to carry out the same task. <b>(1)</b></li> <li>• Limited availability of biofuels <b>(1)</b> due to the technology being in its infancy / so refuelling vehicles may be a problem. <b>(1)</b></li> <li>• The burning of biomass still generates some carbon emissions <b>(1)</b> further contributing to greenhouse gasses. / So cleaner combustion methods still need to be found. <b>(1)</b></li> <li>• Deforestation / habitat destruction / ecological damage could happen when harvesting fuel (1) so sustainable land management / forests are essential. <b>(1)</b></li> <li>• Additional water is needed for irrigation and processing of biofuels. <b>(1)</b> This increased demand for water can put an unsustainable burden on available supplies. <b>(1)</b></li> <li>• Vehicle engines modifications needed to use fuel. <b>(1)</b></li> <li>• Cost of biofuel is higher than comparable fuels. <b>(1)</b> due to expensive processing procedures.<b>(1)</b></li> <li>• Bad odours can be given off when using biomass.<b>(1)</b></li> </ul> <p style="text-align: right;">Any combination of <b>(4 x 2)</b> or <b>(8 x 1)</b></p>	<p style="text-align: right;"><b>(8)</b></p>
	<p><b>Total for question</b></p>	<p><b>10</b></p>

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