

# Mark Scheme (Results)

## Summer 2010

GCE

GCE Design and Technology (A2)  
6RM03  
Paper 01 Designing for the  
Future

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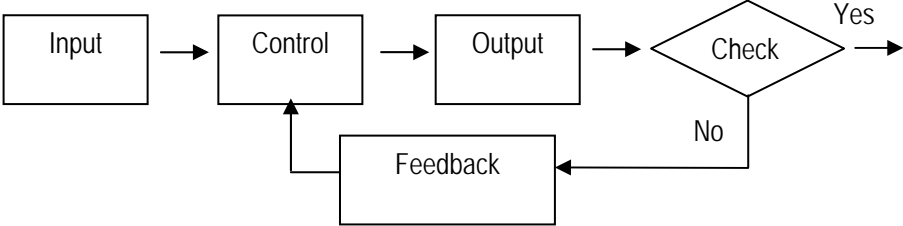
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## General Marking Guidance

- 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.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:
  - i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that means is clear
  - ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  - iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Question Number	Answer	Mark
1(a)	<p>Any two of the following processes.</p> <ul style="list-style-type: none"> <li>• Spot weld / weld (1)</li> <li>• Spray paint (1)</li> <li>• Pick &amp; Place / Moving components around factory (1)</li> <li>• Pop rivet (1)</li> <li>• Insert screws (1)</li> <li>• Checking for quality (1)</li> <li>• Applying adhesive (1)</li> <li>• Assembly (1) (Do not accept fixing things)</li> <li>• Routing (1)</li> <li>• Laser cutting (1)</li> <li>• Drilling (1)</li> <li>• Milling (1)</li> </ul> <p style="text-align: right;">(2x1)</p> <p>Answers are indicative of the responses expected of candidates. They are not exhaustive so apply professional judgement to interpret if candidates response is appropriate, using the indicative answers as a guide.</p>	(2)
1(b)	<p>Any <b>three</b> of the following benefits with its linked relevant explanation :-</p> <ul style="list-style-type: none"> <li>• Speed of movement (1) increases production capacity. (1)</li> <li>• Accuracy of positioning / movement / measurement (1) means increased levels of complexity can be gained (1)</li> <li>• Reliability / repetitive accuracy / less human error (1) leads to fewer rejects / higher quality components.(1)</li> <li>• Flexibility / easily re-programmed (1) means range of products can be manufactured / production easily updated.</li> <li>• Reduced labour requirements (1) leads to wage / cost savings.</li> <li>• They can work 24/7 without breaks / shifts / etc. (1) giving increased productivity / so production is more reliable. (1)</li> <li>• Can remove employees from hazardous environments (1) making manufacturing safer reducing risk of injury. (1)</li> </ul> <p style="text-align: right;">(1x2) (1x2) (1x2)</p>	(6)

1(c)	<p>A diagram such as that shown with marks for the bullet pointed features :-</p>  <ul style="list-style-type: none"> <li>• Some form of checking indicated. (1)</li> <li>• Some form of feedback indicated with a return flow line (1)</li> </ul> <p style="text-align: right;">(2 x 1)</p> <p>- Input / control / output boxes on their own represent an open loop system and are worth no marks, although some evidence of such a system needs to be shown in order to apply the feedback.  - Ignore shape of boxes.</p>	(2)
<b>Total for question</b>		<b>10</b>

Question Number	Answer	Mark
2(a)	<p>Any two of the following points :-</p> <ul style="list-style-type: none"> <li>• The relationship / link between the product /environment and the user, (1) making the product easy to use (1) a comfortable size (1) safe. (1)</li> </ul> <p style="text-align: right;">(2 x 1)</p> <p><i>Note - Do not award marks for examples in this answer.</i></p>	(2)
2(b)	<p>Any four of the following with a relevant explanation :-</p> <ul style="list-style-type: none"> <li>• Position of switch (1) is carefully placed for operation with the users thumb when holding the handle / easily accessible on top of the handle. (1)</li> <li>• Different coloured switch (1) draws attention to it. (1)</li> <li>• Water scale allows user to see how much water is in the kettle (1) so lid doesn't have to be taken off / so don't need to lift it to feel weight / so avoids boiling un-necessary water / clearly indicating min &amp; max safe levels. (1)</li> <li>• Cup symbol relates water levels to easily understood units (1) so correct amount can be boiled / understood across languages (1)</li> <li>• Separate base unit allows easy / safe electrical connection and disconnection (1) so movement not limited to cable length / reducing risk of electric shock. (1)</li> <li>• Round shaped base and plug (1) allows kettle to be placed down at any angle without the necessity of orientation. (1)</li> <li>• Position of handle (1) allows kettle to be easily lifted / poured / reduces risk of scalding as it is away from spout.(1)</li> <li>• Size / shaped / textured handle (1) improves grip / reduces risk of slipping with boiling water / comfortable for most adults' usage. (1)</li> <li>• The '0' and '1' graphics around the switch are standard symbols (1) which clearly indicate whether kettle is on or off. (1)</li> <li>• The position of the light above switch (1) is in a highly visible place (1) clearly indicates whether it is on or off. (1)</li> <li>• Large spout / removable lid (1) for easy filling.(1)</li> <li>• Spout at front (1) allows easy pouring/ without spilling /means hot water &amp; steam is max distance from handle. (1)</li> <li>• Shaped lid handle (1) for easy removal. (1)</li> <li>• Plastic casing is a good thermal and electrical insulator (1) providing protection from heat and electrocution. (1)</li> <li>• Plastic case is light weight (1) making the kettle easier to lift and pour. (1)</li> <li>• Button will usually auto switch off (1) reducing risk of kettle boiling dry / filling room with steam / wasting energy. (1)</li> </ul> <p style="text-align: right;">(1x 2) (1x2) (1x2) (1x2)</p>	(8)
	<b>Total for question</b>	<b>10</b>

Question Number	Answer	Mark
3(a)i	<ul style="list-style-type: none"> <li>• To move materials / tooling / parts (1)</li> </ul> <p style="text-align: right;">(1 x 1)</p>	(1)
3(a)ii	<p>Any three of the following:-</p> <ul style="list-style-type: none"> <li>• Floor mounted reflective strip / tape / line guided. (1)</li> <li>• Floor embedded radio wire / magnetic strip. (1)</li> <li>• Laser guided. (1)</li> <li>• Gyroscopic guided. (1)</li> <li>• GPS guided (1)</li> </ul> <p style="text-align: right;">(3 x 1)</p>	(3)
3(b)	<p>Any two advantages and two disadvantages from the following :-</p> <p>Advantages</p> <ul style="list-style-type: none"> <li>• Parts / materials are retrieved for the precise time needed so no delays ie. quicker. (1)</li> <li>• Can run 24/7 (1)</li> <li>• Reduced employment costs. (1)</li> <li>• Reduced error in losing / damaging components / selecting wrong parts. (1)</li> <li>• Improved safety regarding storage at height (1)</li> </ul> <p>Disadvantages</p> <ul style="list-style-type: none"> <li>• High set-up costs / repair costs. (1)</li> <li>• All parts / materials need a uniform system of unitising / palletising. (1)</li> <li>• Lack of flexibility. (1)</li> <li>• Faulty damaged components may go undetected. (1)</li> <li>• Puts people out of work (1)</li> </ul> <p style="text-align: right;">(2x1) (2x1)</p>	(4)
<b>Total for question</b>		<b>8</b>

Question Number	Answer	Mark
4(a)	<p>Any four of the following :-</p> <ul style="list-style-type: none"> <li>• Reduces the demand on finite / limited resources. (1)</li> <li>• Use of recycled materials requires less energy / generates less emissions compared to when raw materials are extracted / processed (1)</li> <li>• Less waste needs to be disposed of in landfill. (1)</li> <li>• Reduces the need to incinerate waste. (1)</li> <li>• Reduction in scarring landscape / affecting wildlife due to reduced resource extraction.</li> </ul> <p>NB. Do not accept vague statements such as 'more sustainable'/ environmentally friendly' as answers above all lead to these.</p> <p style="text-align: right;">(4 x 1)</p>	(4)
4(b)	<p>Any three of the following:-</p> <ul style="list-style-type: none"> <li>• Can reduce the size of a product / reduce materials costs (1) increasing its appeal. (1)</li> <li>• Can reduce the complexity of a product (1) enabling a reduction in manufacturing costs. (1)</li> <li>• Can give a product improved / additional features (1) increasing its performance / competitiveness. (1)</li> <li>• Extend the life of a product (1) as it has fewer components to fail / reduces need to replace batteries and power sources.(1)</li> <li>• An identified smart material / described smart material / product containing a smart material (1) and a benefit its use brings. (1)</li> </ul> <p style="text-align: center;"><i>Note - Award 1 mark for each different example given and 1 mark for its benefit for up to 3 examples (maximum 6 marks).</i></p> <p style="text-align: right;">(1x2) (1X2) (1X2)</p>	(6)
<b>Total for question</b>		<b>10</b>



Question Number	Answer	Mark
5(ai)	Any one of the following points :- <ul style="list-style-type: none"> <li>• To reduce green house gas emissions / prevent climate change. (1) (Only acceptable answer)</li> </ul> <p style="text-align: right;">(1X1)</p>	(1)
5(aii)	Any two of the following points :- <ul style="list-style-type: none"> <li>• Because their current emissions are far lower than developed countries. (1)</li> <li>• A reduction in their emissions would have very little impact globally. (1)</li> <li>• Restricting their emissions puts an un-necessary burden on their development as a country. (1)</li> </ul> <p style="text-align: right;">(2 x 1)</p>	(2)
5(aiii)	Any three of the following points :- <ul style="list-style-type: none"> <li>• Only a few countries initially signed it / some countries refused to sign it. (1)</li> <li>• A small number of countries acting alone would economically disadvantage themselves. (1)</li> <li>• Action by a small number of countries would have minimal impact on reducing global emissions. (1)</li> <li>• Time needed to negotiate / recruit non signatory countries. (1)</li> <li>• Countries needed time to consider the implications (government / industry / costs / public support) of the agreement and develop implementation strategies before signing it. (1)</li> <li>• They waited until sufficient countries responsible for at least 55% of global emissions signed, so that a realistic difference could be made. (1)</li> </ul> <p style="text-align: right;">(1X1) (1X1) (1X1)</p>	(3)

5(b)	<p>Any four of the following but must contain at least one pro and one con:-</p> <p>Pro</p> <ul style="list-style-type: none"> <li>• It is a clean energy source with no greenhouse gas emissions. (1)</li> <li>• Large amounts of energy are readily available. (1)</li> <li>• The power stations are relatively small compared to other forms. (1)</li> <li>• They generate only small amounts of waste. (1)</li> <li>• Generation costs are relatively low. (1)</li> <li>• Reliable / consistent supply (1)</li> </ul> <p>Con</p> <ul style="list-style-type: none"> <li>• Leaks from nuclear energy / waste are extremely harmful / dangerous. (1)</li> <li>• It cannot easily be destroyed, but has to be securely stored for many years. (1)</li> <li>• Accidents / attacks could have devastating effects. (1)</li> <li>• Not in my backyard. (1)</li> <li>• Developmental costs / complexity are prohibitive. (1)</li> <li>• Can enable to the spread of nuclear weapons. (1)</li> </ul> <p style="text-align: right;">(4 x 1)</p>	(4)
	<b>Total for question</b>	<b>(10)</b>

Question Number	Answer	Mark
6(a)	<p>Any <b>three</b> of the following points with a valid linked explanation:-</p> <ul style="list-style-type: none"> <li>• Fast data transmission/ collection (1) so business is working with up to date data / reduces lead time / enables QRM . (1)</li> <li>• Data collected is accurate (1) providing the basis for good decision making / allowing accurate prediction of future trends /increasing competitiveness (1)</li> <li>• Costs of information gathering are reduced (1) as fewer personnel are needed / less postage costs. (1)</li> <li>• More detailed information can be collected (1) allowing businesses to better match products to market needs. (1)</li> <li>• Allows large volume of data to be quickly analysed or interrogated in different ways (quantative, qualative, trend) (1) identifying patterns upon which immediate action can be taken. (1)</li> <li>• Efficient storage of data (1)so minimal space needed / makes archiving and retrieval easier (1)</li> </ul> <p style="text-align: right;">(3 x 2)</p> <p><b>NB.</b> The points above may lead to explanations given for the other points. If it is a valid link then award the mark, but be aware of repetition.</p>	(6)
6(b)	<p>Any <b>three</b> of the following with its linked explanation:-</p> <ul style="list-style-type: none"> <li>• Production can be quickly altered (1) allowing fast response to market changes / shorter lead times / increased market share. (1)</li> <li>• Smaller batches of products can be manufactured when needed (1) reducing capital tied up in unsold stock. (1)</li> <li>• Products can be customized for individual consumers (1) increasing the appeal / sales / profits from the product. (1)</li> <li>• Less reject components (1) as FMS systems are able to check the quality of their own work. (1)</li> <li>• Large capital investment needed for initial set up (1) which would be off-set against minimal alteration costs when production is changed. (1)</li> <li>• Production rate could reduce on large batches (1) due to CNC machines being slower than automated machinery. (1)</li> <li>• Staff would need retraining / new staff recruited (1) as different skills are needed to operate the new equipment. (1)</li> <li>• Consideration of the downtime needed to install new systems is needed (1) so that it is minimized / does not lead to financial problems.(1)</li> </ul> <p style="text-align: right;">(3 x 2)</p> <p><b>NB.</b> Answers are indicative of the responses expected of candidates. They are not exhaustive so apply professional judgement to interpret if candidates response is appropriate, using the indicative answers as a guide.</p>	(6)
	<b>Total for question</b>	<b>(12)</b>

Question Number	Answer	Mark
7(a)	<p>Any two of the following with its justification :-</p> <ul style="list-style-type: none"> <li>• Identify energy hungry manufacturing processes (1) and replace them with ones that use less (Eg. replacing casting with machining / welding with riveting). (1)</li> <li>• Reduce the number of components in the product (1) which would require less energy to assemble it. (1)</li> <li>• Ensuring that effective quality control measures are in place as early as possible in the production process (1) to reduce energy wasted in manufacturing / further processing of sub standard components. (1)</li> <li>• Ensure production is set up in a manner that requires minimal material movement around the factory (1) as less energy would be needed to run transportation equipment. (1)</li> <li>• Ensure machines run efficiently / do not waste energy (1) by having an effective maintenance programme / upgrading to more efficient machines/ avoid continual starting and stopping of machines. (1)</li> </ul> <p>NB. Do not accept the use of alternative sources of energy as this does not reduce the usage.</p> <p style="text-align: right;">(1x2) (1X2)</p>	(4)
7(b)	<p>Any six of the following but must include at least one positive and one negative to gain maximum marks :-</p> <p>Positives points that increase profits.</p> <ul style="list-style-type: none"> <li>• Product has an increased appeal and therefore sales due to having an extended life time. (1)</li> <li>• Increased sales of spares / revenue from repair service. (1)</li> <li>• Reputation of business improves as it is seen as a responsible manufacturer. (1)</li> <li>• It is not economically viable to repair some products, resulting in replacement sales. Eg. biros, DVD's, (1)</li> </ul> <p>Negatives points that reduce profits.</p> <ul style="list-style-type: none"> <li>• Sell fewer new products / stifles upgrading products. (1)</li> <li>• Increased demand on after sales support team. (1)</li> <li>• Product will need re-designing to allow for easily interchangeable parts. (1)</li> <li>• Stocks of spare parts need to be manufactured and kept, tying up capital / requiring storage facilities. (1)</li> <li>• Repairing products can be very time consuming making it expensive. (1)</li> </ul> <p style="text-align: right;">(6 x 1)</p> <p><i>[The above answers are from the view point of making products repairable rather than replacing them. Any correctly stated converse point from the replacement point of view should also be accepted, but not both.]</i></p>	(6)
	Total for question	(10)

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