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Examiners' Report

June 2010

GCE Design and Technology 6RM03

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## **Introduction**

It was pleasing to see a good standard of responses from candidates in this first session of the new examination. Whilst it is undoubtedly the case that centres have delivered the content of the specification well, there were some new elements of the papers content that did cause problems to candidates, such as the Kyoto Protocol. It was pleasing to see that many candidates took note of the command words in the questions and structured their answers appropriately, to their benefit. It was also pleasing to see a good number of strong responses to a range of questions throughout the paper.

### ***Question 1(a)***

This was a straight forward question at the start of the paper. The vast majority of candidates were comfortably able to identify two manufacturing processes carried out by robots. In some cases candidates failed to gain marks due to vague answers such as 'making things'. In a small number of cases candidates had not read the question with sufficient care and gave miss-directed answers such as 'CAD systems'.

### Question 1(b)

Most candidates scored highly showing a clear understanding of the benefits of robotics. There was a wide range of responses across candidates, again indicating a well understood area of the specification. A number of candidates failed to ensure that they had explained each of the benefits given, and only gained single marks for each point. Centres should ensure that candidates are fully aware of the difference between the type of answer required from a 'give' command word and an 'explain' command word.

(b) Explain **three** benefits to the manufacturer of using robots for production.

(6)

- 1 Using robots in manufacture means there would be less human error as robots are machines and don't make mistakes unless they malfunction
- 2 The production length would be a lot shorter as robots can do many things in a short amount of time, than humans can.
- 3 Machines/robots won't get tired and take breaks regularly, can run 24 hours a day 7 days a week.



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Examiner Comments

In this sample answer the candidate has stated both sides of the coin for the first point i.e. that robots don't make mistakes, and there would be less human error. They should have then gone on to give a benefit this increased reliability gives to the manufacturer, but this has not been done, hence the second mark for the explanation has been missed. (1 mark). A suitable benefit would have been less reject components manufactured. The second response explains the benefit to the manufacturer first and then goes on to state what the benefit is i.e. increased speed. (2 marks) The third response is like the first and makes the same point from two different directions, but fails to explain what the benefit to the manufacturer actually is resulting from robots not getting tired. (1 mark)

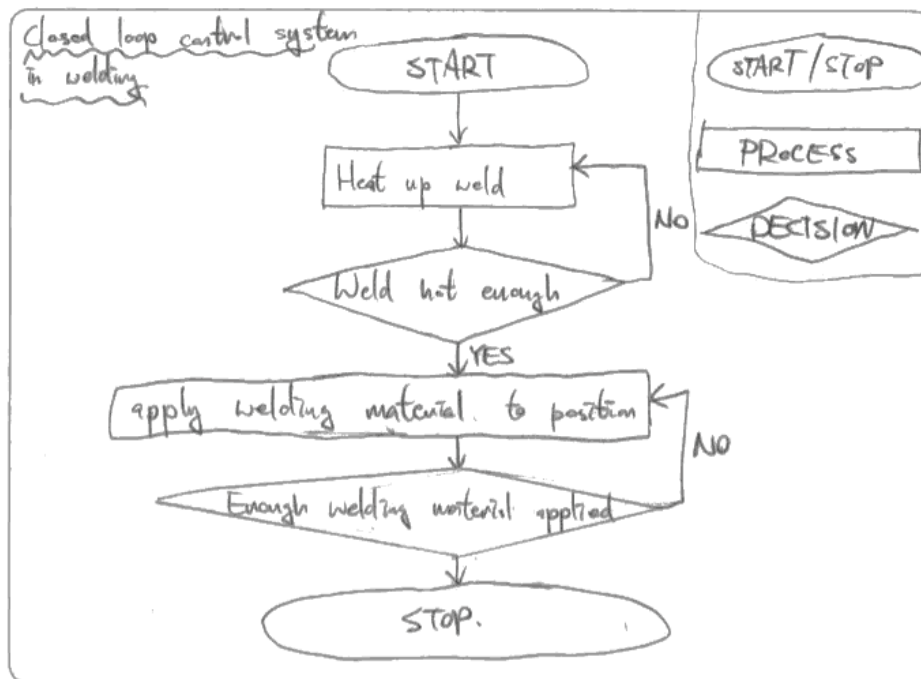
### Question 1(c)

Generally well answered with the majority of candidates gaining both marks. A minority of responses lost marks by failing to add a directional arrow to the feedback loop, resulting in no clear flow direction and multiple routes to take. A few responses presented open loop systems and failed to gain any marks.

(c) Robots are usually designed to operate using closed loop control systems to increase their reliability.

In the following box, draw a flow chart that illustrates a closed loop control system.

(2)



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Examiner Comments

The candidate has presented a clear answer containing a quality check function with a 'Yes' and 'No' route, which then feeds back to a previous part of the system if the quality check is negative.



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Examiner Tip

Take time to present diagrams clearly and accurately ensuring that details are clear.

### Question 2(a)

Many candidates struggled to define precisely what ergonomics is about, although they could identify ergonomic features successfully in the following question. Many answers were vague and misdirected, although marks were awarded where candidates hit forms of the key words in the mark scheme.

2 Ergonomics are an important aspect of product design.

(a) Explain what is meant by the term 'ergonomics'.

(2)

Ergonomics means, how well a product has been designed and manufactured to meet its function and purpose. The function and usability is taken into consideration

Figure 1 shows a plastic jug kettle and its base unit.

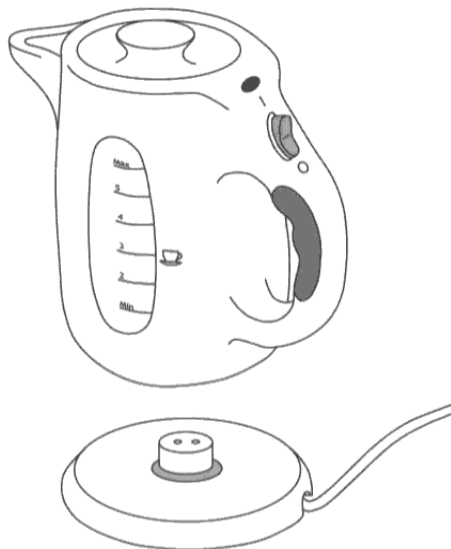


Figure 1



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Examiner Comments

In this sample the candidate's first statement focuses solely on the function of the product rather than the link between its function and how it is used. The second phrase shows an understanding of the ergonomic thrust of how it is used with the term 'usability'. (1 mark)



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Examiner Tip

Take time to think about your answer before you write it, don't just write the first thing that comes into your head. When you have written your answer, read it and check that it does actually say what you think it says.

### Question 2(b)

The vast majority of candidates were easily able to identify and explain four ergonomic features of the kettle, showing that candidates had a good grasp of ergonomic concepts. There were many answers to choose from as can be seen by the length of the mark scheme. Those candidates who failed to score full marks often did not identify the ergonomic aspect of a feature and simply gave the feature, ie. 'the position of the switch' is an ergonomic feature, whilst 'the switch' isn't, it is a functional feature. However, this level of response was rare.

(b) Identify and explain **four** ergonomic features of the kettle shown in Figure 1.

(8)

- 1 The handle is on the side of the kettle. This helps the user to pour the water ~~easier~~ more easily and also allows the water container to be larger. Allows the handle to be a convenient size.
- 2 The switch is located just above the handle in the form of a rocker switch. This will allow the user to turn the kettle on or off when holding the handle by just moving their thumb.
- 3 The inside of the handle is shaped to follow the contours of your fingers as you hold it. This makes it more comfortable to hold while providing a more secure grip.
- 4 The lid has a round handle on it. Around this round handle, the area is sunken and the sides of the round handle curve in on themselves. This allows the user to take a firm grip easily around the handle and remove the lid.

(Total for Question 2 = 10 marks)



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Examiner Comments

The candidate here clearly identifies four ergonomic features and then goes onto explain why they are ergonomic for the second mark on each point.

### ***Question 3(ai)***

This 1 mark question was a straight forward introduction to this section of the exam paper and was well answered. Most candidates correctly identified the function of AVG's, although a small minority were too vague in their answers settling for phrases such as 'to keep production running smoothly'. This level of response did not gain a mark.

### ***Question 3(aii)***

Candidates were much more unclear about the different guidance methods AVG's use. Most were able to identify one system with the most popular answers being line following or buried wire guided. A few candidates correctly identified two, but few managed all three. There were many incorrect answers that focussed on vague 'remote control' systems or 'train track' systems.



### Question 3(b)

The majority of candidates were able to access this question well and provide correct answers from the well rehearsed stock of general advantages arising from the use of computer driven systems i.e. quicker, safer, cheaper, and reliable. Having said this, candidates and centres need to note that one word answers were not accepted as they do not convey sufficient understanding. For example, 'faster'. This could be taken as the system runs faster than manually controlled systems, which is correct, or that the system is faster to set up than manual system, which isn't.

It should also be noted that candidates lost marks where they gave disadvantages that were equally applicable with manually controlled systems. See the sample below.

(b) Automated Storage and Retrieval Systems (ASRS) are used in manufacturing.

Give **two** advantages and **two** disadvantages of using ASRS instead of manual systems.

(4)

Advantages

- 1 Quicker - These systems can retrieve and store away goods in a more faster way, especially when these goods are out of reach.
- 2 Safer - Using these new systems can ensure more safety due to the fact that some products may be larger than others and can cause strain on individuals.

Disadvantages

- 1 Orders may become mixed up, <sup>(they are on)</sup> ~~over the~~ machine collects an item not intended.
- 2 Systems could break down ~~pre~~ preventing orders being met, meaning that things would manually have to be carried out.



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Examiner Comments

Two relevant advantages given, but the two disadvantages could both be directly applied to manual systems also, making them invalid, i.e. if the order is mixed up whether it's on a piece of paper or in electronic format, it will still result in a wrong component being retrieved. Similarly manually operated lifts, winches or forklifts can also breakdown.

### Question 4(a)

This question begins to dig a little deeper into candidate's knowledge as many were only able to give two valid answers, some three, but few reached four. It was notable that candidates did not leave blank answers and had a go, but these were repetitions or deviations away from benefits to the environment. Common deviations focused on financially cheaper to recycle, or biodegradable products.

\*4 (a) Give **four** reasons why it is favourable to the environment to use recyclable materials.

(4)

1 Firstly it will cut back on the amount of products that get sent to landfill.

2 When a product is sent to landfill it takes many of years to de-compose into nothing. Which is damaging the environment.

3 Would cut back on the new material which has to be extracted from the earth.

4 finally would cut back on the gasses produced from extracting new material, but also from the product de-composing in landfill.



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Examiner Comments

This candidate has given three valid points, but the second point is simply an exemplification of the first, and hence does not gain an additional mark.



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Examiner Tip

Repetition of a point using different words commonly loses candidate's marks. Be alert to this when you check your answers.

### Question 4(b)

This question elicited a wide range of response levels. The majority of candidates clearly understood what smart materials were, and many gave good examples, but also many of these answers stopped short of stating the benefit of using the smart material. Candidates could make a significant difference to their scores by using 'spare' time at the end of the exam to re-read questions and ask themselves whether their response answers all parts of the question.

Smart materials are increasingly being used in products.

(b) Explain **three** benefits of smart materials.

(6)

1 Smart materials can often be used for a diverse range of purposes, reducing the need for multiple materials when just one will be sufficient.

2 Smart materials can often be reused, as many of them can return to their original form after use, which reduces damage to the environment from material extraction and costs of new material.

3 Smart materials can adapt to suit their environment, for example, photochromic glass which changes from transparent to translucent in bright light, protecting the users' eyesight whilst enabling them to see normally in 'indoor' conditions.

(Total for Question 4 = 10 marks)



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Examiner Comments

The candidate's first response shows a clear understanding that use of a single smart material can replace multiple components in a product (1 mark), but then fails to go on and nail home the benefit that this brings. 'Reducing manufacturing costs' would have been an appropriate benefit. The second response is miss-directed as it is confused with sustainable issues. (0 marks). The third response contains an example of the use of a smart material and a clear benefit which arises from this, i.e. 'protecting the users eyesight'. (2 marks).

### Question 5(ai)

A straight forward single mark question as an introduction to this section of the paper. The aim of reducing emissions was correctly identified by the vast majority of candidates, although again some failed to gain the mark due to vague or misdirected statements concerning increasing recycling levels or changing energy generation methods.

### Question 5(aii)

A wide range of responses was presented to this question. The most common correct response was the low level emissions of developing countries, followed by their need to continue developing unhindered. Responses that focussed on the level of finance available in a country or their access to sustainable technology were not awarded as, although in some cases this may be true, these are not reasons in themselves for exemption from Protocol emission targets.

(ii) Developing countries are exempt from the requirements of the Kyoto Protocol.  
Give **two** reasons for these exemptions. (2)

1 They are not considered to be as much of a concern in the production of greenhouse gases and cause of global warming.

2 They are not able to meet the requirements due to lack of available technology and resources to assist them in meeting the requirements.



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Examiner Comments

The first response is valid but the second, although it may be true, is not a reason for exemption from a protocol emission target. Few countries would claim that they have sufficient funding and technology in place to meet emissions targets.

### Question 5(aiii)

Few candidates had a clear grasp of the reasons behind the delay. Some candidates scored one, occasionally two marks, but explanations were often vague. Centres need to encourage students to research this area in more depth as it is an area that is continually developing.

(iii) Give **three** reasons why the Kyoto Protocol was agreed in 1997 but did not come into force until 2005.

(3)

- 1 At the time not all countries were prepared to agree with the protocol.
- 2 Scientists were still experimenting the earth's climate to see what could be done. (Decisions were being made)
- 3 Preparations were being made by countries to organise themselves to act upon the agreement of cutting down on their emissions.



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Examiner Comments

The first and third points are valid and were awarded a mark, but the second point, although true, is not a reason why the enforcement of the protocol was delayed.

### Question 5(b)

A well understood topic by most candidates. Scores of three and four were common with candidates being able to present a balanced argument containing both positive and negative arguments.

(b) Nuclear energy is being considered as a possible major contributor to our future energy needs.

Evaluate the use of nuclear energy for our future energy needs.

(4)

Nuclear energy is becoming a huge alternative to fossil fuels. It helps to produce relatively clean and efficient energy at a reasonable price to the consumer. When compared to fossil fuels it seems to be the best alternative as a proportion of the UK's electricity is nuclear. Having more nuclear power stations would also mean more jobs in the local area.

However disposing of the radioactive fuel is the main issue with nuclear power. The radioactive waste is harmful to the environment as well as animals and people.

Overall however nuclear power is the best alternative power source and when an efficient way to dispose of the waste is found nuclear power will be the main contributor to future energy needs.

(Total for Question 5 = 10 marks)



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Examiner Comments

The candidate has made two positive points in the first sentence stating that nuclear energy is 'clean' and a 'reasonable price'. The candidate then meanders and ends the first paragraph with an invalid point as any power station would create jobs. The candidate goes on to state that nuclear waste is harmful but goes no further. (3 marks) Look at the marks available and ensure you give at least that many points. Also note that with the command word 'Evaluate', at least one positive and one negative point must be given in order to gain the full mark.

### Question 6(a)

The questions at this end of the paper are more probing now and require candidates to stay focussed and structure answers carefully. The command word is 'Explain', so candidates should be taught to realise that they need to identify three benefits and explain them, in order to gain full marks, although presenting four would be wise. This can be achieved using a fraction of the space on the page. Many candidates produce rambling answers that quickly diverge from the question and missed the marks available.

6 (a) Explain the benefits to a business of using electronic methods of market analysis.

(6)

Electronic methods of market analysis reduce wastage of time to the business, as they are quick and well organised.

They are less time-consuming because research can be obtained via emails and the internet. The market research can then be stored on a database, and easily compared with other information by using up-to-date software on computers.

A business will have an advantage over its competitors if they use new technology and the others don't. Feedback from customers, suppliers, manufacturers and competitors will be collected quickly, and the business can use this to their advantage by making the correct changes first, and resolving any problems necessary.



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Examiner Comments

This response starts well by identifying that data can be collected quickly, but then diverges into describing how it is collected quickly rather than explaining the benefit of fast data collection to the business. Eg. Data is upto date / allows trends to be responded to immediately. Use of software to easily compare / easily analyse data gets the candidate a second mark, but again no explanation of the benefit follows directly. The candidate then repeats the 'fast data collection' point, and goes on to state that this allows them 'to make changes first', which is accepted a valid explanation linked to QRM. (total 3 marks)



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Examiner Tip

In an 'Explain' type question for 6 marks, make three clear points and explain them. If you can, explain a fourth as well.

### Question 6(b)

Again this 'explain' type question required three clear points each with a relevant explanation. Most candidates grasped the direction of the question and were able to pick up one or two marks with rambling answers, but higher ability students scored well structuring clear answers appropriate to the question.

(b) Many businesses are changing their manufacturing systems from inflexible automated machinery to Flexible Manufacturing Systems (FMS).

Explain the implications of this change.

(6)

The previous machinery wasn't able to adjust well, it only knew one way of processing and could not be changed or adjusted to do any other tasks. By having the new systems it can be adjusted, changed and altered to do a number of different tasks.

The implications of this change is that the manufacturing systems can be used for all manufacturing instead of having one machine for each process. Having the new system will provide a cost and efficient solution to the inflexible machinery. It will save the company a substantial amount of money.

Due to the flexible systems ability to ~~execute~~ complete a number of different tasks this would also have the implication of reducing the number of jobs at many businesses.



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Examiner Comments

This candidate quickly gains one mark by identifying the adaptable nature of the machines, but never goes on to explain the implication of this to the business. The response repeatedly comes back to the machines being adaptable which is said in many different ways, but goes nowhere else worthy of a clear mark. It finishes with a reference to job losses which, in this case is invalid as automated machinery requires minimal labour levels as well. If the candidate had a clear three point answer structure in mind they may have scored significantly better.



### Question 7(a)

This question being towards the end of the paper is very specific and probing, requiring candidates to explain how a business could reduce the amount of energy used by its manufacturing systems. The question was not meant to catch candidates out, but to focus them on the changes that could be made to manufacturing systems. However many candidates missed the thrust of this and gave answers that focussed on using alternative energy sources to run manufacturing systems, rather than reducing actual energy usage. Another common miss-directed answer was to turn machines off when not needed, which does not reduce the energy used in manufacturing as no manufacturing is taking place. However, some candidates looked a little more carefully and directed their answers appropriately gaining marks.

\*7 (a) Explain **two** ways in which a business could reduce the energy usage of its manufacturing systems.

(4)

A Business could reduce its energy usage of its Manufacturing Systems by simply turning off the equipment and lights at night, if the business has a big order coming in, they should try and do it all together rather than in stages because an enormous amount of energy is used by turning these machines on and off frequently. Mass production would use less energy because it is all made in one big lump not in batches.



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Examiner Comments

The first point made by the candidate is not valid for the reasons stated in the examiners comment section above. The second however shows understanding that continually starting and stopping machines wastes energy, which is then explained.



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Examiner Tip

Read questions really carefully. It's so important! Underline key words and grasp the direction of the question.

### Question 7(b)

This is a 'stretch & challenge' question designed to give high ability candidates an opportunity to present arguments for and against designing products for repair or replacement. For those candidates that read the question carefully and understood the direction of it, good marks were achieved, although very few scored the full six marks. Unfortunately, a large number of candidates did not understand the question and answered on a very superficial level discussing the issues of getting a newly purchased faulty product repaired or replaced by the manufacturer. Some good arguments were made with valid points by those who correctly perceived the direction of the question.

(b) Discuss, from the manufacturers' perspective, the issue of 'repair versus replacement' with regard to consumer goods.

(6)

If a manufacturer producing a product that can easily be repaired then more consumers may purchase it but they would not have people wanting to purchase another one. But if they produce a product that can not be replaced then they may have less consumers purchase it but they will have more repeat purchases so they need to make sure they find a balance between them. Also with an increasing demand for sustainable goods manufacturers have to make sure that they are not just producing a product for profit so producing a product that could be repaired would be the more sustainable than a product that would have to be replaced when broken or obsolete. Also the cost of producing a product that can be repaired will be greater and they would have to manufacture the spare parts for it.

(Total for Question 7 = 10 marks)



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Examiner Comments

This candidate presents several valid points from both directions gaining a good mark.

- All candidates should be taught how to respond to the different command words used and published in the support material and endorsed text book. This will help them structure their answers appropriately and will affect their marks.
- The quality of handwriting in a growing number of situations is a concern. Examiners will do their utmost to decipher text, but candidates need to know that if they do not write legibly their marks will be affected.
- The number of candidates misinterpreting questions is always a concern, and great lengths are gone to during paper construction to make questions as clear and precise as possible. However, actively teaching candidates to underline key words in questions, and re-read them carefully, will reduce this issue and help them focus their answers much more precisely.

## Grade Boundaries

Grade	Max Mark	A*	A	B	C	D	E	N	U
Raw mark boundary	70	56	50	44	38	33	28	23	0
Uniform scale mark boundary	80	72	64	56	48	40	32	24	0

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