

# Examiners' Report

## June 2016

### GCE Design & Technology: Product Design 3 6GR03 01

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## **Introduction**

The examined unit this year covered knowledge and understanding of a range of modern design and manufacturing practices and contemporary design issues. This included a good working knowledge of the use of AGVs, their guidance systems and manufacturing robotics. The use of CAD and virtual modelling, including ongoing development and rapid prototyping, was covered together with in depth product analysis focusing on ergonomics. Additionally, candidates needed to be aware of important contributions by designers from the past which may provide the inspiration for future designs. Candidates also needed to know that sustainable product design and ethical issues are key features of modern design practice. The final question covered provision of power to the UK market considering nuclear energy as a possible alternative to fossil fuelled power stations.

## Question 1 (a)

This question, as an introductory question to ease candidates into the paper, required simple recall and was answered well by many candidates. The most common responses were pallet trucks and forklift trucks followed by towing vehicles and unit load vehicles. Common mistakes included the naming of road vehicles such as a light goods vehicle.

## Question 1 (b)

This question worked well as an introductory question with an even spread of responses across the mark range. Candidates generally had a good understanding of AGV guidance systems. Common appropriate responses included: controlled by computer, use of sensors, floor mounted strip, laser guidance and GPS guidance. Where candidates did less well they tended to focus on the AGV itself rather than the guidance system or they considered the wider issues of automated storage and retrieval systems (ASRS). Another common mistake was to evaluate AGV systems rather than to outline the key features of the guidance systems. Candidates need to ensure they understand the demands and requirements of the common command verbs.

Here the candidate has provided a generic response about Automated Guided Vehicles (AGVs) and has missed the focus of the question which is the guidance systems.

(b) Outline the key features of AGV guidance systems.

(4)

Automatic guided vehicles consist of machines and robots which are able to transport materials and objects which are difficult for humans to grasp and carry. It begins with someone who selects and chooses a material or object. Soon after, on the machine. Soon after, the machine is programmed to locate and retrieve the object and material, and transport it to where it is desired.



### ResultsPlus Examiner Comments

No marks were awarded for this response as the candidate has not considered any aspect of the guidance system.



### ResultsPlus Examiner Tip

Read the question for a second time. Consider the meaning of the command verb eg outline, and make sure that you are aware of the focus of the question e.g. the guidance systems used.

## Question 2 (a)

This question was answered well by the majority of candidates who had a clear knowledge of ergonomics. Most responses related to the comfort or fit of a product to the human body and many made appropriate links to anthropometrics. Fewer candidates linked their response to the range of movement that the human body can make. A common mistake was to produce a response that related to ergonomics alone and only considered measurements of the human body with no links to the use of a designed product.

## Question 2 (b)

This question ramped up the challenge of the examination paper, which was evidenced by many responses. Some candidates merely gave a generic response covering the use of anthropometric data rather than considering two of the four key methods of designing ergonomically to cover a range of different users, these are:

- Producing a single size design
- Designing a range of sizes
- Designing an adjustable/adaptable product
- Designing an accessory that adapts itself to the original design

Where candidates identified the above issues they needed to appropriately link their consideration of anthropometrics to the design method. Many candidates merely referred to the 5<sup>th</sup> to the 95<sup>th</sup> percentile irrespective of the design method adopted rather than making an appropriate link, for example, designing for the 95<sup>th</sup> percentile for the 'one size fits all' option such as a doorway or a rain coverall.

(b) Explain **two** ways that products can be designed ergonomically to suit a range of different users.

(4)

1. Add-ons and accessories can be made to attach to the product, modifying it so that users with different characteristics can safely use it.
2. The product can be adjustable in size and shape, so that it can fit different users.



In the first part of this response the candidate has considered the use of accessories to make a product suitable for others, an example of this would be a car booster seat used by young children to provide a comfortable ergonomic fit and to allow the standard seat belt to be correctly positioned.

The second part of the response considered adjustable products that suit the ergonomic needs of a range of users, an example of this would be a car seat that can be adjusted to enable the driver to safely reach all the controls and have a good view of the road ahead.

## Question 2 (c)

This question allowed candidates to expand upon their knowledge of ergonomics within a familiar context. The question worked well with appropriate internal ramping allowing the majority of candidates to achieve a degree of success but only allowing an appropriate proportion of candidates to achieve full marks.

A common mistake was for candidates to start to consider elements of the design that were not evident in the illustration rather than working with the information provided for examples materials and textures.

Figure 1 shows the handset controller for a games console.

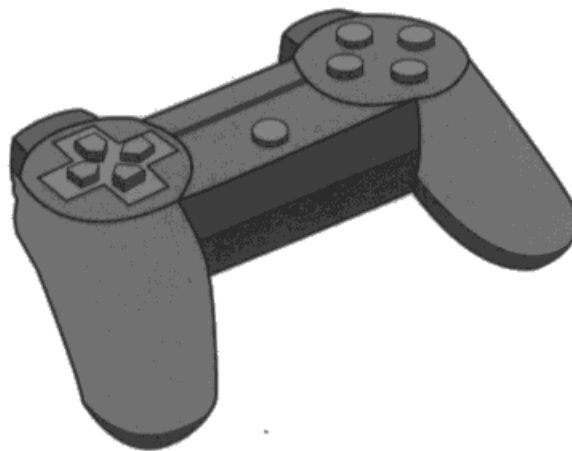


Figure 1

(c) Explain **three** ergonomic features of the handset controller shown in Figure 1.

(6)

- 1 The shape of the product has been designed so both hands can wrap around the controller and use all the buttons. Also the shape allows the controller to be comfortable in the users palms.
- 2 The ~~the~~ button layout has been designed so that on both sides each button can be pressed with ease. This is because each button is under an ~~the~~ average thumb's length away.

3 The two back buttons have been designed so that your two fingers can be placed perfectly against them. This has been designed so that every gamer can reach and access the two buttons.



**ResultsPlus**  
Examiner Comments

This is a good response that achieved the maximum six marks and covers a range of appropriate points from the mark scheme.



**ResultsPlus**  
Examiner Tip

When three responses are required make sure that you do not repeat one of the responses. Also a six mark three response question will not achieve maximum marks for six different identifications. Here you need to explain three features ie identify features and provide linked explanations covering why they are ergonomic features.

### Question 3

A question that generally performed as expected for this stage of the paper. Candidates clearly now have a sound generic knowledge of the use of robotics within manufacturing. However, this question appropriately focuses on the disadvantages for the manufacturer, which raises the level of challenge by ruling out any disadvantages to the workforce or society in general. Candidates covered a broad range of responses from the mark scheme. Candidates who did less well produced generic essays about the use of robotics in modern production systems.

- 3 Robots are often used on production lines but are very expensive to buy, install, service and maintain.

Discuss other disadvantages for the manufacturer of using robots on their production line.

(6)

Disadvantages for the manufacturer of using robots on their production line is that robots can be programmed to perform a range of different tasks ~~the~~ at a better quality (accuracy) than that of human workers, and therefore ~~reduces~~ many workers receive machine minding tasks that can result in poor morale <sup>on</sup> the production line. Robots ~~have to~~ do not have as greater amount of flexibility as humans do and therefore have to be programmed to perform a range of simple / repetitive tasks. <sup>Another problem for the manufacturer of</sup> Using robots <sup>is that it</sup> can also cause problems because present a risk to human workers and therefore a lot of money and time has to go into the company to ensure safety. Another disadvantage is that there isn't a common programming robotic language used to control and integrate the robots in one system, so one brand of robot may not integrate well with another <sup>and cause malfunctions</sup>. If a robot malfunctions it can cause production lines to become extremely disrupted and delayed due to their high speed and consistency resulting in not meeting demand. The manufacturer will have to employ highly skilled professionals to program and work the machines, ~~which~~ and people with this skill can be difficult to find, and expensive.





**ResultsPlus**  
**Examiner Comments**

This is a good response where the candidate has appropriately focussed on the context of the question and considered the disadvantages to the manufacturer in some detail covering a wide range of points from the mark scheme



**ResultsPlus**  
**Examiner Tip**

Double check whether the question requires consideration of the positives or the negatives, the benefits or the drawbacks, the advantages or the disadvantages.

## Question 4 (a)

A straightforward recall question designed to reduce the ramping at this point of the paper. The three most common responses were:

- 3D printing
- Stereolithography
- Selective laser sintering

The question was well answered by the majority of candidates.

## Question 4 (b)

Candidates performed well on this question demonstrating a sound understanding of computer aided design and the use of virtual modelling and rapid prototyping. This is a key area where candidates have improved their performance as centres become better equipped and prepared for the teaching of this area of the design technology curriculum. Many candidates recognised the ability to make ongoing changes to virtual models, the lack of physical resources/equipment needed for virtual modelling and the ability to send to a client as an email attachment. More able candidates were able to consider virtual testing and automated material content/mass calculations.

(b) Describe **two** advantages of virtual modelling compared with rapid prototyping.

(4)

1. models can be made quicker and more accurately with the use of digital tools, such as Google Sketchup or SolidWorks, as well as copies easily being made, editing them slightly, not losing original
2. People in different locations can work on the same project, allowing different expertise to create a finished prototype.



### ResultsPlus Examiner Comments

A typical candidate response hitting a range of points from the mark scheme covering ease of editing and file sharing.



### ResultsPlus Examiner Tip

Remember a describe question requires you to provide an identification of a key point, for example 'made quicker' with a linked elaboration such as 'with the use of digital tools ... editing them'.

## Question 4 (c)

Candidates demonstrated good knowledge of EPOS systems generally performing well on this question even though there was a specific focus on benefits to the retailer rather than a mere generic appraisal of the system. A common mistake was for candidates to mistakenly believe that an electronic point of sale system was an electronic advertising system placed at the checkout.

(c) Discuss the benefits to the retailer of an electronic point of sale (EPOS) system.

(5)

- EPOS allow for tracking of products and stock.
- Data from EPOS can be placed into a graph and analysed.
- It can allow designers to retailers to view any trends in product sales.
- It can allow retailers to check the amount of stock they have remaining.
- It allows retailers to securely track deliveries to customers to ensure safe delivery.
- The retailer can use the EPO to identify an item, once scanned by a barcode scanner they can see information about this product.
- EPOS can allow retailers to see how many sales they have made.
- Allow data for a product to be stored electronically.



### ResultsPlus Examiner Comments

This is a clear response covering a range of mark scheme responses although it does not cover the key use of efficient and speedy processing sales at the checkout it nevertheless achieves the maximum score of five marks.



### ResultsPlus Examiner Tip

Do not forget to consider the key response to a question although remember to check that it is not excluded by the question stem.

(c) Discuss the benefits to the retailer of an electronic point of sale (EPOS) system.

(5)

A EPOS system creates an engaging advert to a consumer as the advert can be animated with bright colours allowing it to be noticed in somewhere like a shopping centre. EPOS systems are also placed in high traffic areas so they reach a wide audience quickly, giving maximum publicity for the product. They can also run day and night 24/7, so more people can be reached, especially in cities on the street. They can also clearly show a product to a customer engaging them making them want to buy a product, and recommend it to others, gaining publicity for their product.



**ResultsPlus**  
Examiner Comments

In this response the candidate has clearly missed the focus of the question and appears to believe that an electronic point of sale (EPOS) system is some kind of electronic advertising system used to attract customers.



**ResultsPlus**  
Examiner Tip

Remember anything in the examination will be in the specification. Make sure that your revision covers all areas of the specification content.

## Question 5 (a)

Answered well by a large proportion of candidates who have a good understanding of the benefits to a developing country of hosting the manufacturing facilities of a multinational company. Key responses included:

- Economic regeneration of the host country
- Increased employment within the country
- Improvements to the skillset of the workforce
- Development of infrastructure

Some candidates also considered:

- Increased awareness of the country leading to further international investment
- Improvements to the countries balance of payments

5 Many developing countries host 'offshore' manufacturing facilities for multinational companies.

(a) Discuss the benefits to a developing country of hosting the manufacturing facilities of a multinational company.

(4)

There would be more jobs brought to the country as the company would need people to make the products for the company. By hosting the company it may also encourage more investment to the country, boosting the economy, as well as encouraging more companies to move here, bringing more jobs and money. With more people having money, people can afford to have luxuries and afford healthcare, overall helping the country to develop.



### ResultsPlus Examiner Comments

A good response awarded the full four marks to include:

- Increased employment
- Future inward investment
- Economic regeneration
- Attracting other companies
- Improved healthcare/lifestyles etc



### ResultsPlus Examiner Tip

Once again make sure you carefully read the question correctly. Here some candidates missed the focus of the question and discussed benefits to the company.

## Question 5 (b)

A more challenging extension question that performed as expected to provide a level of discrimination between the candidates. Candidates needed to concentrate on the focus of the question to ensure that they considered the disadvantages for the multinational company. Some candidates mistakenly continued with the theme of part (a) and considered disadvantages to the country. Successful candidates covered a range of linked responses from the mark scheme, but the most common responses related to:

- Increased transportation
- Negative company image
- Potential political instability

(b) Explain **two** disadvantages for a multinational company of having its manufacturing facilities in a developing country.

(4)

- 1 People in developed countries lose their jobs as they have been outsourced, and manufacturing in developing countries may lead to worker exploitation due to sweatshops and poor working conditions, bad press.
- 2 It may also impact the cost of sending it back to the selling country through shipping costs and product quality may be reduced through shipping causing damaged goods and impacting upon profit.



**ResultsPlus**  
Examiner Comments

The first part of the question appears to be a zero marked response until the comment 'bad press' and that then relates the response to negative company image. The second part of the response appropriately covers increased transportation costs and their impact upon the company's profits. The candidate was therefore appropriately awarded the full four marks.

(b) Explain **two disadvantages** for a multinational company of having its manufacturing facilities in a developing country.

(4)

- 1 building the factories in the area can destroy the environment and cause lots of pollution to and CO<sub>2</sub> emissions to the local area.
- 2 The employees would have low wages, poor working conditions and lack of safety with no opportunity to be able to be promoted this can be bad for morale of workers.



**ResultsPlus**  
Examiner Comments

In this response the candidate has not focused on the disadvantages to the company so has therefore been awarded zero marks. The first part of the response is a generic disadvantage relating to the environment and the second part of the response is a disadvantage for the workers.



**ResultsPlus**  
Examiner Tip

Remember to check 'what is' or 'who is' the focus of the question.

## Question 6 (a)

This part of the question performed well with candidates having an even spread of marks across the mark range and discriminating well between candidates of differing abilities. Candidates, all too often, concentrated too heavily on describing what they could see in the photograph rather than using the image of the chair as a starting point for their discussion. The focus of the question is on the influence of the design movements. Candidate responses covered a range of points from the mark scheme. Unsuccessful candidates confused and mixed elements of 'Art Deco' with 'Art Nouveau'.

- 6 Figure 2 and Figure 3 show chairs by famous designers who were influential in their design movements.

Style	Philosophy
<ul style="list-style-type: none"> <li>- Symmetry</li> <li>- Repetition</li> <li>- Ancient Egypt</li> <li>- Geometric</li> <li>- Zig-zag</li> <li>- Materials modern</li> </ul>	<ul style="list-style-type: none"> <li>- Reaction to post war austerity</li> <li>- consumerism</li> <li>- opulent</li> </ul>



Eileen Gray's 'Bibendum' chair  
(Art Deco movement)

1925 - 1939

Figure 2

Style	Philosophy
<ul style="list-style-type: none"> <li>- pure, clean lines</li> <li>- geometric</li> <li>- new modern materials/tech</li> </ul>	<ul style="list-style-type: none"> <li>- machine aesthetic</li> <li>- form follows function</li> <li>- functionalism</li> <li>- omit decorative frills.</li> <li>'less is more'</li> </ul>



Marcel Breuer's 'Wassily' chair  
(Bauhaus modernist movement)

1920 - 1930.

Figure 3

Discuss how the designers have been influenced by the style and design philosophy of their movements.

You may refer to Figure 2 and Figure 3 as a starting point for your answers.

- (a) Eileen Gray's 'Bibendum' chair (Figure 2).

(4)

The Art Deco movement occurred in the reaction to post war  
(1925-1939)  
austerity so they had opulent designs and used lavish  
materials such as the leather seen in Fig 2. They used ivory,



bronze and polished stone combined with low cost materials such as steel to make products more accessible for average people <sup>"working class"</sup>. Symmetry and repetition were used, as seen in the chair. ~~the~~ Form came over function as people bought <sup>t</sup> products because of <sup>such as the chair</sup> their aesthetics. This was also the age of the consumer society meaning that products had to be able to be mass produced, so Eileen Gray will have chosen materials and techniques which were easy to reproduce with the modern technology at the time.



**ResultsPlus**  
Examiner Comments

A good well planned response covering a wide range of points from the mark scheme considering the style and design philosophy of the Art Deco movement.

## Question 6 (b)

Candidates generally achieved higher marks on this part of the question primarily because there was less confusion with other design movements. They generally had a clear understanding of the design philosophy of the Bauhaus movement. Common key correct responses included:

- Form follows function
- Less is more / minimalist
- Everyday objects for everyday people
- Use of modern materials such as tubular steel
- Products for a machine age

(b) Marcel Breuer's 'Wassily' chair (Figure 3).

(4)

The Wassily chair only uses two materials and is able to produce a product with style and a variety of complex shapes. The chair looks basic however, the shapes used show the style of Bauhaus modernism movement. The straps are positioned to hold the use in the correct place, however so its form rather than function.



**ResultsPlus**  
Examiner Comments

This is an example of a limited response, awarded zero marks, that does not cover the style and design philosophy of the Bauhaus design movement other than attempts to guess, based on descriptions of the chair as photographed. The candidate has incorrectly stated that form over function is a Bauhaus style.

(b) Marcel Breuer's 'Wassily' chair (Figure 3).

(4)

Marcel Breuer has been influenced by the ~~new~~ new materials and manufacturing during this period. The use of tubular steel that has been bent into shape. The ~~for~~ chair follows the function over form ~~is~~ philosophy of the design movement, as the chair has no decorative 'frills'. Modernism was a reaction against the decorative form of Art's and Craft, and this is shown in the design of the Wassily chair where it has been taken back to include only the essentials. The use of geometric shape was also part of the style of Bauhaus which is shown in the Wassily chair. During modernism product were design for mass production so often had a machined look which can be seen in Breuer's work.

Total for Question 6 = 8 marks)



### ResultsPlus Examiner Comments

This was a good well planned response awarded the full four marks covering a broad range of key points from the style and philosophy of the design movements, including:

- New materials and manufacturing techniques
- Use of tubular steel
- Function over form
- No decorative 'frills'
- Reaction against decorative form of Arts and Craft
- Use of geometric shape
- Design for mass production
- Machined look



### ResultsPlus Examiner Tip

Remember to fully express your knowledge within the context of the question and demands of the command verb.

### Question 7 (a)

A short two mark recall question that performed as expected to provide an appropriate ramping and introduction to the extended writing question in part (b). Most candidates covered a specific change to the biological characteristics of the tree but often were not sufficiently specific as to the benefit provided by the genetic engineering. Candidates needed to cover the insertion of a gene or DNA to achieve the first marking point.

### Question 7 (b)

A question that performed well providing appropriate discrimination across a broad range of qualification grades. Candidates generally had good knowledge of the use of genetic engineering used in the production of timber for the paper and board industry and covered a broad range of marks from the mark scheme. Some candidates were able to consider appropriate advantages and disadvantages.

\*(b) Evaluate the use of genetically modified wood in paper and board production.

(8)

Genetically modified wood could positively effect the paper and board industry because can be genetically modified to have reduced lignin content and therefore fewer processes have to be undergone to remove this and can be used to produce high quality paper and boards. Genetically Modified (GM) wood can also ~~have to be~~ modified to be resistant to pests and diseases and therefore less energy has to be used in paper and board production to de-contaminate the paper. The wood ~~can~~ can also be modified to have increased growth rate which will help to meet the demands of the paper and board production and industry. The <sup>timber</sup> ~~paper~~ produced by the GM trees can also be more durable and of a high quality, reducing the need for imported virgin pulps to be used ~~to~~ and the GM trees can be modified to be more easily and frequently recycled - increasing the paper and boards lifespan which is more sustainable. On the other hand, pests and diseases can ~~be~~ <sup>become</sup> resistant to the GM timber, resulting in lower quality timber and more virgin pulp required in the paper and board production. Also, the longterm effects of GM wood is not aparant yet and therefore

could produce paper with harmful effects. The fast growth rate can have a 'knock on' effect causing soil nutrient/water cycling to struggle and make it difficult to re-grow the timber for future paper and board production and therefore is unreliable.

(Total for Question 7 = 10 marks)



**ResultsPlus**  
**Examiner Comments**

A very comprehensive candidate response covering a wide range of points from the mark scheme, awarded the full eight marks.

The candidate has considered a number of issues within the response:

Reduced lignin content

Reduced processing required

Resistant to pests and diseases

Reduced decontamination and use of energy

Modified for increased growth rate

Durability

Recycling issues

Pests and diseases can become tolerant/resistant to genetic changes

Long term effects not apparent

Nutrient/water cycle issues as a result of demands from fast growth

### Question 8 (a)

This was a short answer question that provided appropriate challenge at this point in the examination paper. Candidates often considered alternative energy rather than methods of reducing energy wastage. Common correct responses included:

- Ensuring plant is running at peak efficiency
- Switching off machinery when not in use
- Reclaiming energy/heat losses to heat the building
- Identifying areas of high energy consumption

### Question 8 (b)

A question that performed well providing appropriate discrimination across a broad range of qualification grades. Candidates generally had good knowledge of the provision of nuclear energy and were able to effectively evaluate its potential future use to meet the UK's future energy needs. Candidates utilised a broad range of responses covering the advantages and disadvantages identified within the mark scheme.

\*(b) Evaluate the use of nuclear power for the UK's future energy needs.

(8)

The advantages to nuclear power is that there is a large release of energy from a small input. Also nuclear power is a green source of energy because no fossil fuels are burnt and no carbon is released into the environment. Nuclear power is also very reliable as it will constantly give power. The heat from a powerstation can be used to boil water to produce more power. The disadvantages however are that people are scared to use it, this is because if something does go wrong the results can be catastrophic. Nuclear power stations also require large amounts of water

to cool them so can only be built next to large bodies of water. Radiation from nuclear waste can cause mutations and abnormalities to organisms. Nuclear powerstations are not only highly expensive to set up but also expensive to deal with the waste.



**ResultsPlus**  
Examiner Comments

A good response awarded the full eight marks.

The candidate had considered a broad range of key points relating to the use of nuclear energy in meeting the UK's future energy needs including:

Large release of energy from a small amount of fuel

No fossil fuels are burnt/depleted

No carbon emissions

Reliable source of energy

Public fear/perception

Large amounts of cooling water needed/built next to large bodies of water

Radiation and nuclear waste issues

Effects on human health

High initial costs

## Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- Analyse and respond appropriately to the command verb used in the question.
- Read the question carefully and respond appropriately to the specific focus or scenario of the question.
- Be able to demonstrate a sound understanding of key design principles.
- Draw upon detailed knowledge of the specification content.
- Demonstrate understanding of the design movements including their design style and philosophy.
- Demonstrate a sound understanding of modern industrial production systems.
- Demonstrate an understanding of the benefits of sustainable design practice.

Try to avoid:

- Providing generic responses rather than focusing upon the specific requirements of the question.
- Relying purely on knowledge recall rather than application of knowledge.

Candidates need to have covered all areas of the specification in detail and apply their knowledge in unfamiliar contexts rather than relying on generic responses. A key issue is to provide appropriate focus on the command verb in use.

Overall the paper performed well and in line with previous examination series providing appropriate content and rigour across the ability range.



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