AQA
Questions matter

Design and Technology Product Design

Answers and commentaries

A-level (7552)

Paper 2: Design and making principles

Marked answers from students for questions from the June 2022 exams. Supporting commentary is provided to help you understand how marks are awarded and how students can improve performance.

Version 1.0
June 2024

Contents

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Answers and commentaries

This resource is to be used alongside the A-level Design and Technology: Product Design June 2022 Question paper 2 Design and making principles.

4 mark questions

Short response

Question 2

Explain how different prototyping methods may be used in the development of a screwdriver handle.

[4 marks]

Mark scheme

AO4 2c

Marks	Description
3–4 marks	The response gives a detailed explanation of appropriate prototyping.
1–2 marks	The response gives a basic explanation of prototyping used in product.
0 marks	No response or nothing worthy of credit.

Indicative content

The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

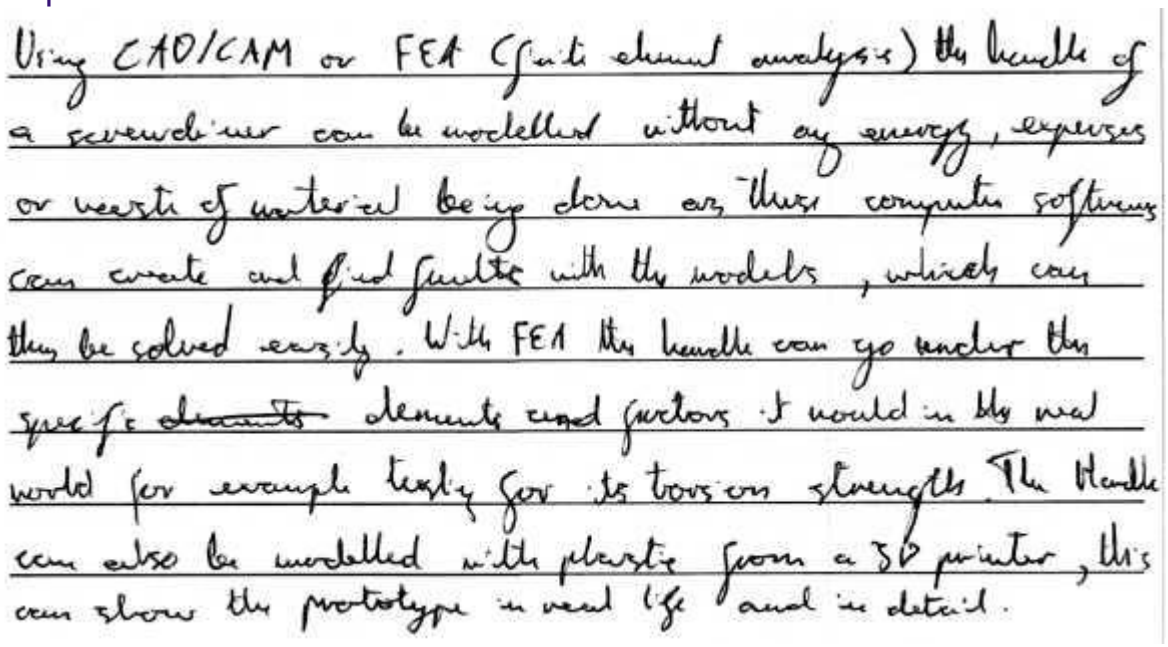
Methods:

- Physical/visual prototype to check handle ergonomics with a focus group.
- 3D computer aided design (CAD) prototype to check aesthetics and colour schemes for branding.
- Sketch prototypes for client feedback before CAD modelling.
- 3D CAD prototype to check costings with different materials.
- Finite element analysis (FEA) prototype to check forces, such as torsion and impact.
- mould flow analysis to check forming processes.
- Working prototypes to assess movement of components within the handle.

Accept any other valid responses.

Student responses

Response A

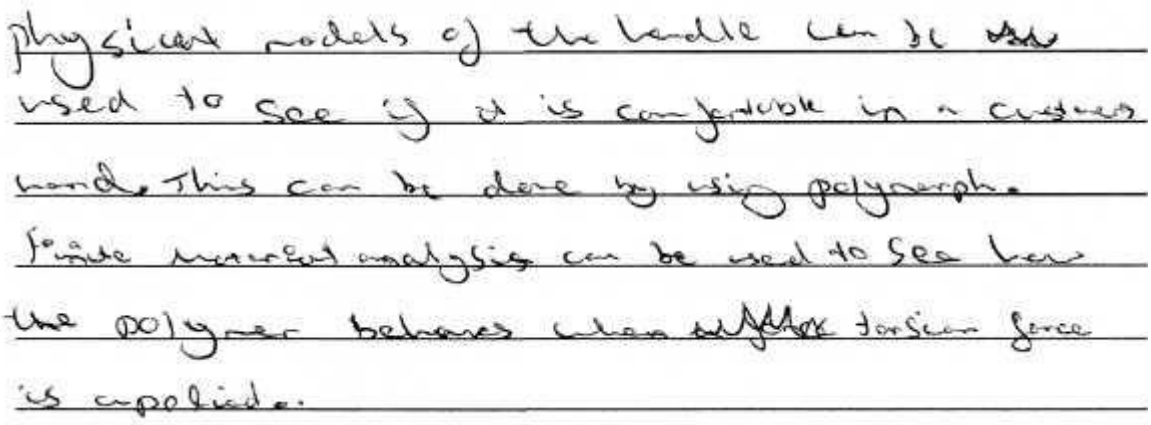


Using CAD/CAM or FEA (finite element analysis) the handle of a screwdriver can be modelled without any energy, expenses or waste of material being done as these computer softwares can create and find faults with the models, which can then be solved easily. With FEA the handle can go under the specific ~~elements~~ elements and factors it would in the real world for example testing for its torsion strengths. The Handle can also be modelled with plastic from a 3D printer, this can show the prototype in real life and in detail.

This is a high-level response that makes clear reference to the screwdriver handle context giving a good description of virtual prototyping techniques that would be suitable and how they would benefit the process by reducing materials and energy used during prototyping. There is reference made to specific forces to be tested and the use of 3D printing to produce a physical prototype.

4 marks

Response B



This is a mid-level response. This response makes generic reference to the use of physical models.

FEA is mentioned as a virtual prototyping technique, with reference to torsional force. The response gives limited explanation of the prototyping methods which limits it to 2/4 marks

2 marks

Question 11

Explain why utility furniture was introduced after the Second World War.

[4 marks]

Mark scheme

AO4 2b

Marks	Description
3–4 marks	The response gives a detailed explanation of utility furniture and reasons for its introduction.
1–2 marks	The response gives a basic explanation of utility furniture.
0 marks	No response or nothing worthy of credit.

Indicative content

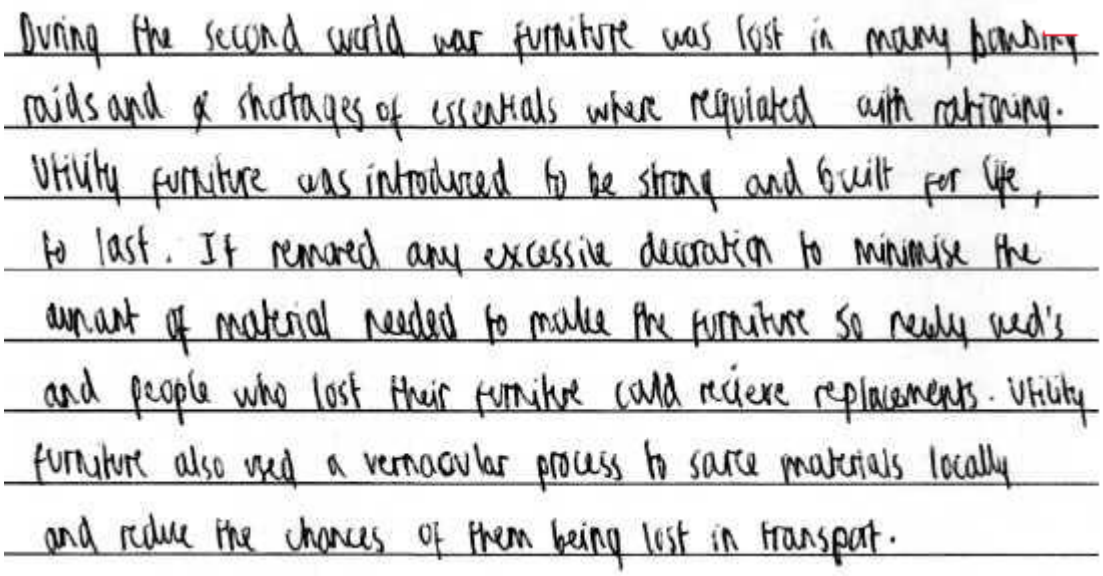
The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

- Utility products were designed to make use of locally sourced materials due to limited resources after the war.
- There was a need for simple good quality furniture due to vast bomb damage within many cities and towns.
- The production of standardised plans allowed a wide range of manufacturers from around the country to produce the products efficiently.
- The production at local manufacturer level was also aimed at a reduction in consumption.

Accept any other valid responses.

Student responses

Response A

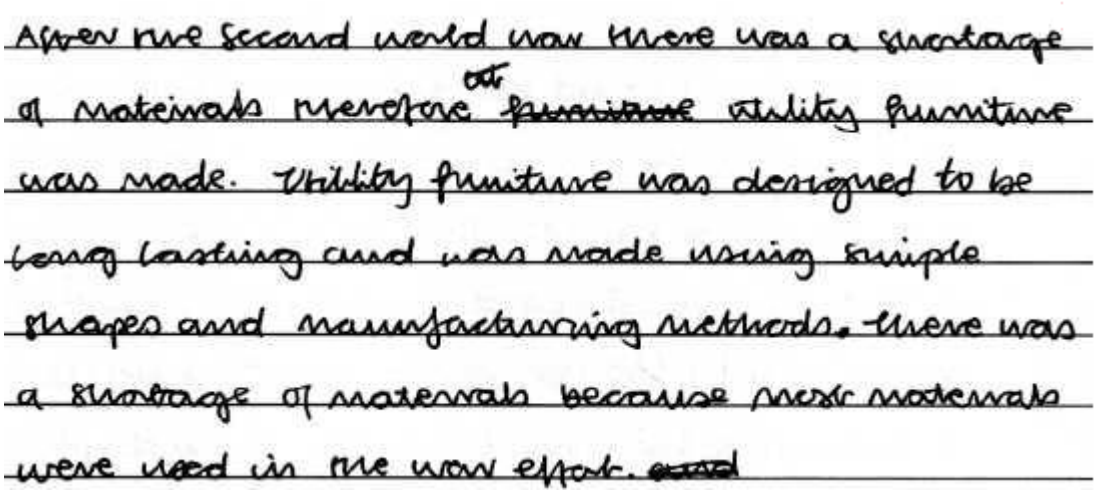

During the second world war furniture was lost in many bombing raids and & shortages of essentials where regulated with rationing. Utility furniture was introduced to be strong and built for life, to last. It removed any excessive decoration to minimise the amount of material needed to make the furniture so newly wed's and people who lost their furniture could recieve replacements. Utility furniture also used a vernacular process to source materials locally and reduce the chances of them being lost in transport.

This is an excellent response worthy of full marks due to a clear understanding of the reasons behind the introduction of utility furniture and the process of their production.

The response is concise and effective covering all key aspects required.

4 marks

Response B


After the second world war there was a shortage of materials therefore ~~furniture~~ utility furniture was made. Utility furniture was designed to be long lasting and was made using simple shapes and manufacturing methods. There was a shortage of materials because new materials were used in the war effort. ~~and~~

This is a mid-level response. The response shows an understanding of why utility furniture was introduced (shortage of materials) and the basic principles of the furniture design (simple forms and manufacturing methods).

2 marks

6 mark questions

Extended response

Question 4

Explain how the Art Deco design style was influenced by:

- historical design styles
- socio-economic factors.

[6 marks]

Mark scheme

AO4 2b

Marks	Description
5–6 marks	The response gives a detailed explanation of socio-economic factors and historical design styles that impacted on Art Deco design and how these influences were seen within the style.
3–4 marks	The response gives a good explanation of socio-economic factors or historical design styles on Art Deco design.
1–2 marks	The response gives a basic explanation of the Art Deco design style.
0 marks	No response or nothing worthy of credit.

Indicative content

The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

Socio-economic factors

- The end of World War One (WW1) signalled a new beginning for a modern world with a need to rebuild, this is reflected in the use of **sunburst motifs used to show a 'new dawn'/start**.
- The zoning regulation of 1916 was concerned with the building of skyscrapers that blocked light to streets below. The regulation ensured that buildings were stepped back from the streets like **ziggurats** to increase light.
- Building on the need for **simple and affordable style** suitable for those returning from WW1, the class system was changing and a modern style was needed to embrace this.
- **Modern mass manufacturing techniques** used during WW1 lent themselves to the production of simple geometric forms.

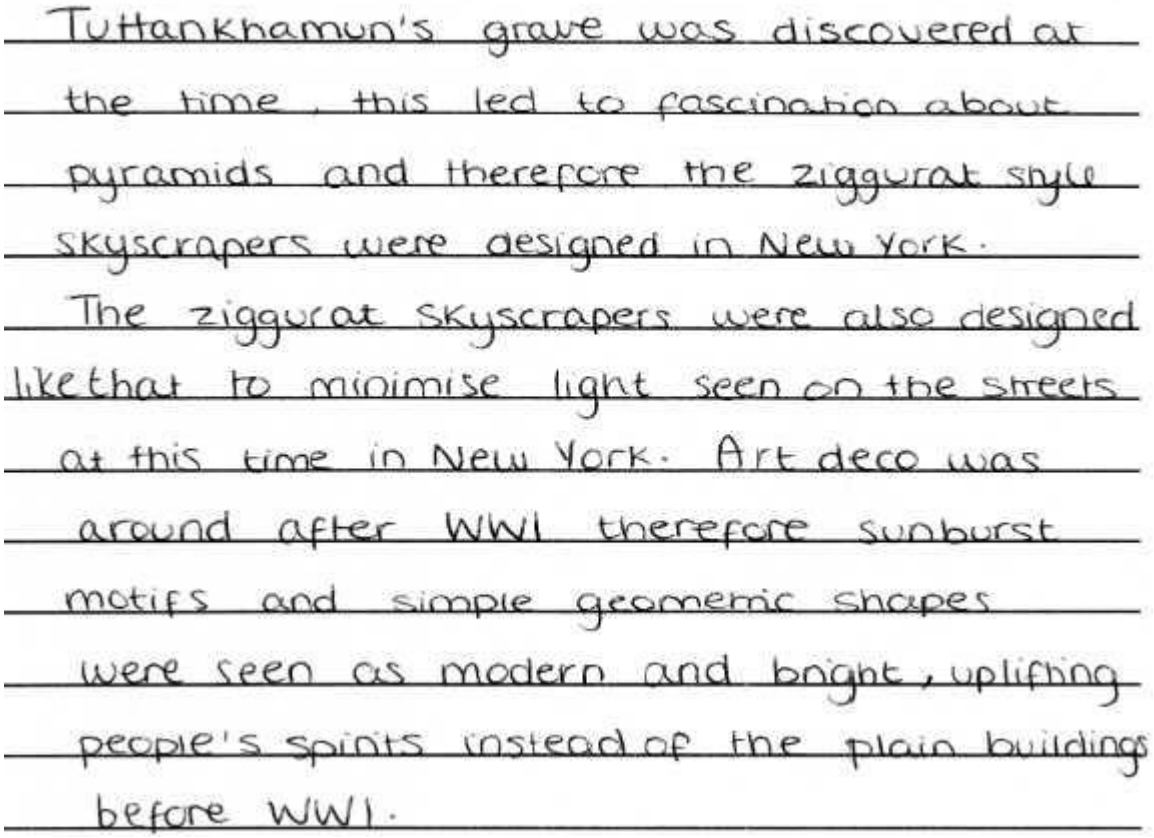
Historical design styles

- The discovery of Tutankhamun's tomb in Egypt was a huge international story that caused a desire to **replicate the Egyptian style** of simplistic imagery and costume.
- **African art influences** with patterns.
- **Rectilinear forms** to emphasise height and power.

Accept any other valid responses.

Student responses

Response A


Tuttankhamun's grave was discovered at the time, this led to fascination about pyramids and therefore the ziggurat style skyscrapers were designed in New York.
The ziggurat skyscrapers were also designed like that to minimise light seen on the streets at this time in New York. Art deco was around after WWI therefore sunburst motifs and simple geometric shapes were seen as modern and bright, uplifting people's spirits instead of the plain buildings before WWI.

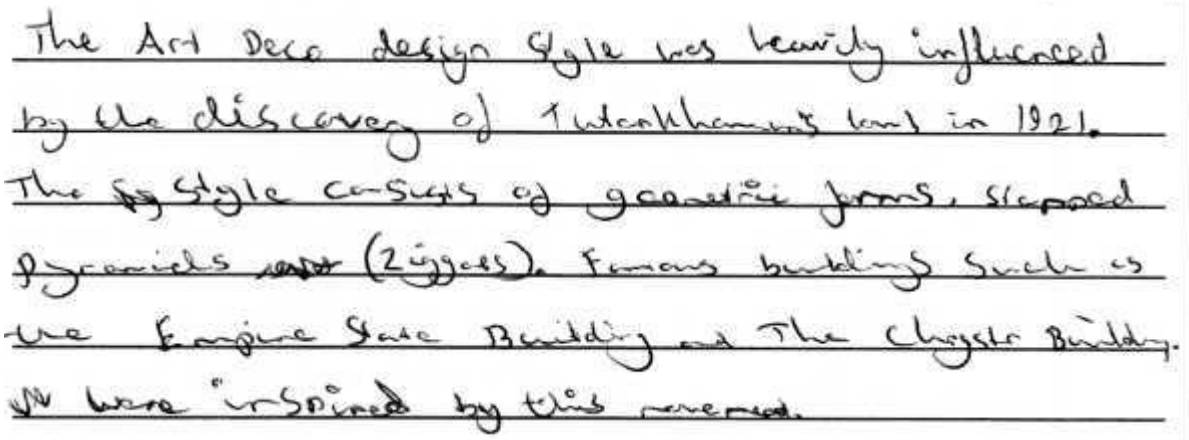
This is a high-level response. This is an excellent response that deals with both historical design styles and socio-economic factors. The student links all aspects referred to with key characteristics of the design style.

Although there is a slight confusion between minimising and maximising light seen on the streets it is clear that the student understands the concept.

The response is concise and uses constant references to relevant design terminology throughout.

6 marks

Response B


The Art Deco design style was heavily influenced by the discovery of Tutankhamun's tomb in 1921. The style consists of geometric forms, stepped pyramids (Ziggurats). Famous buildings such as the Empire State Building and The Chrysler Building were inspired by this movement.

This is a mid-level response which refers to key characteristics associated with historical design influences. The student gives relevant design examples, but unfortunately does not mention the key socio-economic factors associated with World War 1.

3 marks

Question 9

Outline the ways a design team can reduce the time from idea conception to product release.

[6 marks]

Mark scheme

AO4 2b

Marks	**Description**
5–6 marks	The response gives a detailed description of specific, relevant methods used to reduce time from idea conception to product release.
3–4 marks	The response gives a good description of suitable methods to reduce time from idea conception to product release.
1–2 marks	The response gives a basic description of generic methods, which are largely appropriate to reduce time from idea conception to product release
0 marks	No response or nothing worthy of credit.

Indicative content

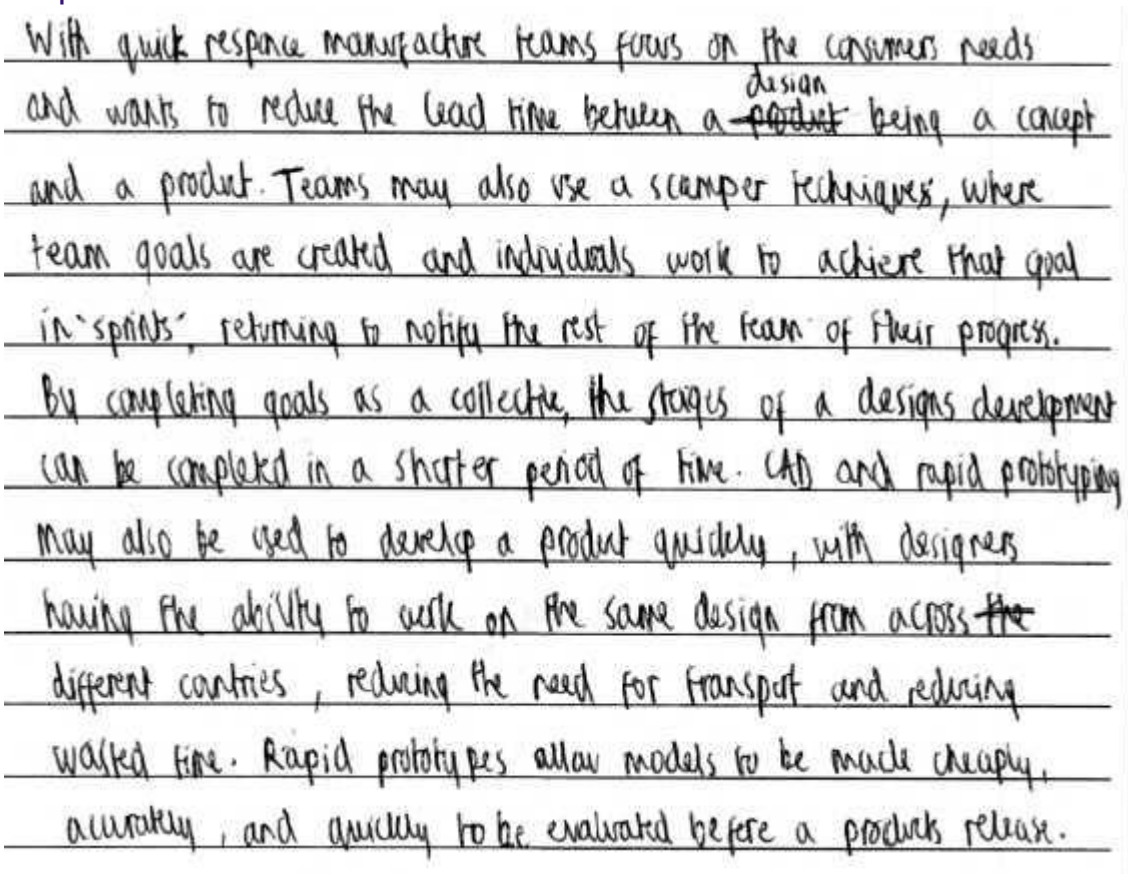
The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

- Constant **reference to a detailed specification** ensures concepts are appropriate.
- **Focus groups and effective primary research** ensures that concepts meet consumer demands.
- **Rapid prototyping** using 3D printing techniques allows clients and consumers to visualise concepts and make adjustments early on in the development process.
- Use of **online shared documents to enable collaboration** between workers.
- The **use of concurrent engineering** to ensure all members of the team are involved throughout the development will reduce lead time as errors can be found earlier.
- The use of **critical path analysis** allows the team to predict log jams and allocate staffing accordingly to prevent delays, this also ensures that all processes are started as promptly and early as possible.
- The use of a project management system to **check the progress** of all elements at regular intervals and **redistribute staffing** accordingly increases efficiency, (Scrum).
- The use of a project management system to **analyse all processes** and **reduce errors**, (Six sigma).
- The use of **virtual modelling** of concepts prior to production reduces monetary investment and time in production processes that may be incorrect.

Accept any other valid responses.

Student responses

Response A



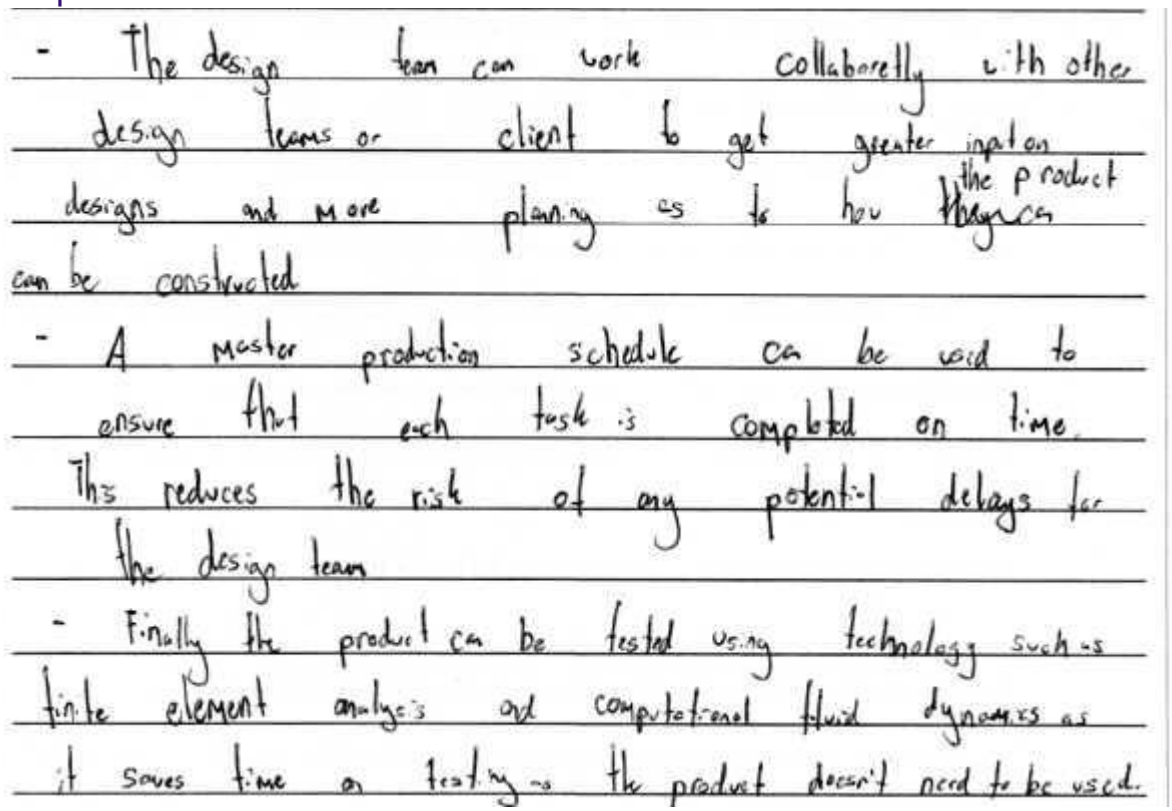
With quick respons manufacture teams focus on the consumers needs and wants to reduce the lead time between a ~~product~~ design being a concept and a product. Teams may also use a scamper techniques, where team goals are created and individuals work to achieve that goal in 'sprints', returning to notify the rest of the team of their progress. By completing goals as a collective, the stages of a designs development can be completed in a shorter period of time. CAD and rapid prototyping may also be used to develop a product quickly, with designers having the ability to work on the same design from across ~~the~~ different countries, reducing the need for transport and reducing wasted time. Rapid prototypes allow models to be made cheaply, accurately, and quickly to be evaluated before a products release.

This is a high-level response. A response that fits in the top mark band using a range of relevant examples. Although the student has referred to Scamper instead of Scrum the explanation of the technique is very clear and related directly to the question context.

The response shows a clear understanding of how CAD and rapid prototyping can be used in conjunction with Electronic Data Interchange for rapid collaborative working between countries.

5 marks

Response B



- The design team can work collaborelly with other design teams or client to get greater input on the product designs and more planing as to how they can can be constructed
- A master production schedule ca be used to ensure that each task is completed on time. This reduces the risk of any potential delays for the design team
- Finally the product can be tested using technology such as finite element analysis and computational fluid dynamics as it saves time on testing so the product doesn't need to be used.

This is a mid-level response. The response refers to several methods for reducing the time from idea conception to product release. All the methods a clearly relevant, but there is limited depth of explanation as to how they will accomplish this time saving.

For this to improve I would expect to see further detail (as seen in response A).

3 marks

12 mark question

Extended analysis and evaluate

Question 1

Figures 1 and **2** show two screwdrivers.

Figure 1

Jeweller's screwdriver

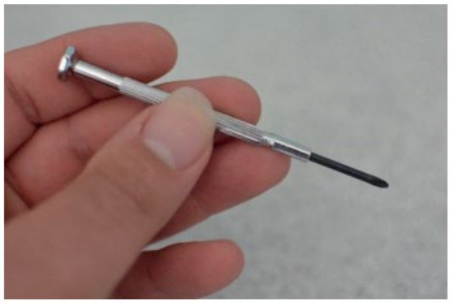


Figure 2

General purpose screwdriver

	Figure 1	Figure 2
Handle material(s)	Aluminium	Thermoplastic and elastomer
Handle formed by	Casting	Injection moulding
Screwdriver tip	Fixed tip	Interchangeable magnetic attachment

Compare the two screwdrivers shown.

In your answer you should refer to:

- ergonomics
- material suitability
- product function.

[12 marks]

Mark scheme

AO3 1a
AO3 1b

Marks	Description
9–12 marks	The response provides detailed analysis and comparison of both screwdrivers, referring with technical details to ergonomics, material suitability and product function. The response makes judgements regarding the design of both products using the majority of the information provided.
5–8 marks	The response provides a good comparison of both screwdrivers referring to all reference points. The response makes analytical judgements regarding the design of both products referring to some aspects of the information provided.
1–4 marks	The screwdrivers are compared in basic terms with limited use of the information provided. Responses may refer to elements such as material properties without linking these to the bullet points.
0 marks	No response or nothing worthy of credit.

Indicative content
The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

Material suitability
- **Figure 2** has a thermal and electrical insulator for the handle.
- Aluminium can be textured using the die casting process.
- Texture can be applied within the injection moulding process.
- **Figure 1** requires fine adjustment and has flutes suitable for this.
- Use of aluminium for the handle gives rigidity not possible from polymer of the same thickness.
- Aluminium is a non-ferrous metal and will not corrode/rust.
- The rotating top of the jeweller's screwdriver has been attached by bolt which may be possible using polymer but would not last as long.
- Material recyclability: aluminium kept pure, thermoplastic elastomer (TPE) and Thermoplastic require separation.

Ergonomics
- TPE gives a degree of elasticity required for increased grip when using **Figure 2**.
- **Figure 1** is for precision and doesn't generally require a lot of force to be applied, leading to the slender pencil like grip.
- **Figure 2** may require significant force and therefore has a wide handle allowing pressure to be applied without harming the palm of the hand.

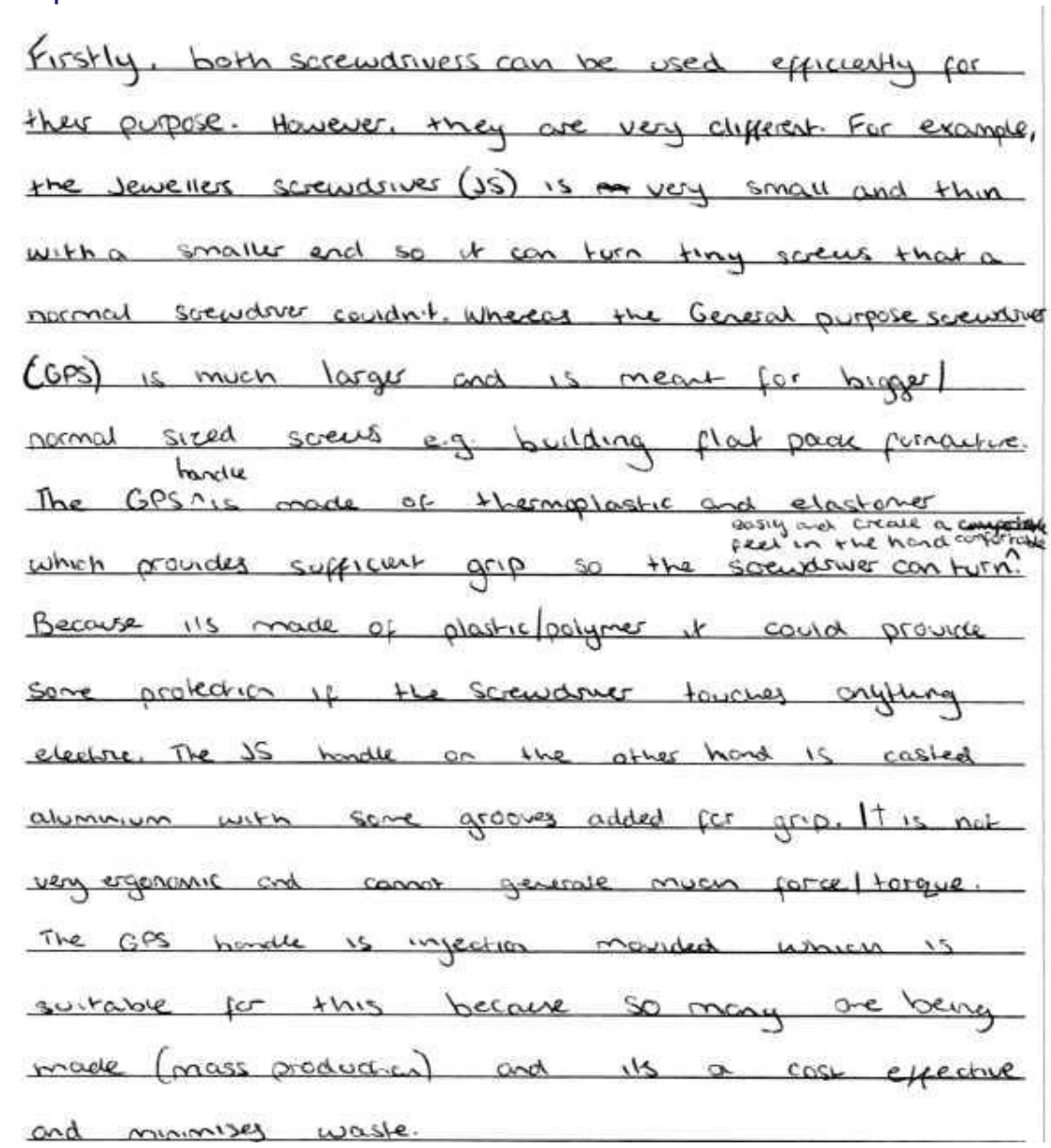
Function

- The interchangeable ends for **Figure 2** means fewer tools are required.
- If a tip was damaged then the whole product does not need to be replaced.
- The use of standardised hexagonal tips allows for a wide range of functions to be achieved with one tool.
- **Figure 1** the long narrow body means recessed screws can be reached easily.
- **Figure 2** the magnetic tip means that removed screws are less likely to be lost when removed as they may remain attached to the tip upon removal.

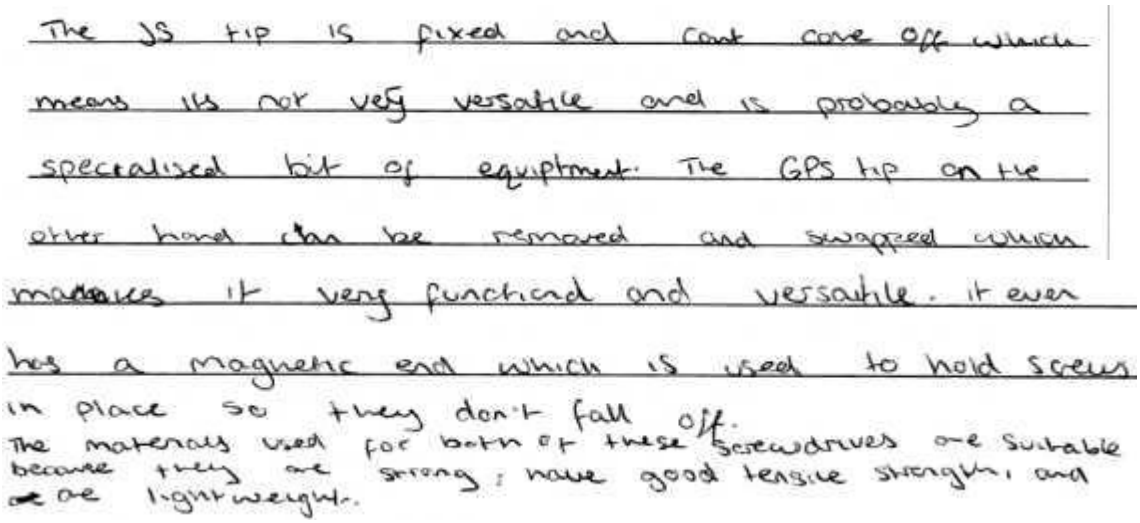
Accept any other valid responses.

Student responses

Response A



Firstly, both screwdrivers can be used efficiently for their purpose. However, they are very different. For example, the Jewellers screwdriver (JS) is very small and thin with a smaller end so it can turn tiny screws that a normal screwdriver couldn't. Whereas the General purpose screwdriver (GPS) is much larger and is meant for bigger/ normal sized screws e.g. building flat pack furniture. The GPS handle is made of thermoplastic and elastomer which provides sufficient grip so the screwdriver can turn easily and create a comfortable feel in the hand. Because it's made of plastic/polymer it could provide some protection if the screwdriver touches anything electric. The JS handle on the other hand is casted aluminium with some grooves added for grip. It is not very ergonomic and cannot generate much force/torque. The GPS handle is injection moulded which is suitable for this because so many are being made (mass production) and it's a cost effective and minimises waste.


The JS tip is fixed and can't come off which means it's not very versatile and is probably a specialised bit of equipment. The GPS tip on the other hand can be removed and swapped which makes it very functional and versatile. it even has a magnetic end which is used to hold screws in place so they don't fall off.
The materials used for both of these screwdrivers are suitable because they are strong, have good tensile strength, and are lightweight.

This is a high-level response. This form of extended response question requires students to use the information provided within a table to compare two similar products. For responses to access the higher mark bands students must expand upon the information given and recognise the impact of the information on the reference points given at the end of the question.

The response begins with a generic point referring to the physical size of the screwdrivers. This is relevant but could be improved by linking to the type of product to be disassembled by a jeweller's screwdriver.

The student refers to relevant functional properties of the materials and relates them to the screwdriver's context. Reference to ergonomic issues and torque based upon the size of the handle show a good level of understanding.

The student then makes reference to the screwdriver tips showing clear understanding of the relevance of the magnetic attachment.

Although the response is sufficiently well structured to access the top band there are aspects that could be further explored, leading to a mark of 9/12.

9 marks

Response B

Each screwdriver is designed for different use scenarios, Figure 1 ~~bein~~ being for small intricate / delicate products and Figure 2 for general use on larger products.

Figure 1 being cast from aluminium means it is not very comfortable to use compared to the screwdriver in figure 2 which has elastomer injection moulded to form a comfortable shape for the user. However Figure 1 has a turning end which the user can place one finger on and apply pressure while turning the screwdriver.

The fixed tip on ~~the~~ Figure 1 means a different screwdriver is needed for different types of head / head sizes. Where as the Figure 2 screwdriver has an interchangeable ~~head~~ tip so a different tip can be attached depending on use. The magnetic tips make this a lot easier with the magnets holding the tip firmly in position during use

Overall they each have their benefits, the screwdriver in figure 2 is a great all rounder due to its versatility and comfort however it wouldn't be great for small / intricate projects where the Jewellers screwdriver (fig 1) would come into its own

This is a mid-level response. The student makes several relevant points regarding the two screwdrivers. Reference to the precision associated with the size is alluded to but could be expanded upon.

Although there is reference to the materials used, the explanation of their suitability is limited to generic points which could be expanded to include relevant functional properties.

The student recognises the rotating end of the jeweller's screwdriver as a relevant feature showing an understanding of its use.

The response refers clearly to the data regarding the screwdriver tips and makes relevant points related to the context of use.

Although the response refers to most of the data within the table the student would need to respond to the three reference points more explicitly to improve the mark.

5 marks

Response C

- Jeweller's Screwdriver is thinner and has less grip than the general purpose screwdriver.
- The materials used for the jewellery screwdriver is more expensive than the general purpose thermoplastic and elastomer.
- The cross head for the jewellers screwdriver is smaller for smaller screws than the general purpose screwdriver.
- The tip of the jewellers screwdriver is fixed whereas the general purpose one is magnetically interchangable.
- The handle for the jeweller's screwdriver was derived from cutting tech means the screwdriver was handmade.
- The function for a jewellery screwdriver is to screw or unscrew parts of watches, pendants and other fine products.
- The function for a general purpose screwdriver is for screwing woodscrews and metal nuts together.
- The handle for the general screwdriver was derived from injection molding which means the screwdriver was mass produced.

This is a low-level response. The response is structured in simple bullet points which is not ideal for an extended response question. The points included state features of the two products and data given in the table with very little expansion of detail.

When the response offers further clarity of a point it is stated using generic terminology.

To improve the response the student would need to expand the points given relating them to the product function.

For example:
Jeweller's screwdriver is thinner and has less grip than the general purpose screwdriver.

The jeweller's screwdriver has a thin handle that is designed to be held like a pencil for precision adjustment of small screws, whereas the general purpose screwdriver has a large diameter handle with a textured grip to allow it to be held in the palm and generate more torque for unscrewing larger screws.

2 marks

Get help and support

Visit our website for information, guidance, support and resources at **aqa.org.uk/7552**

You can talk directly to the Design Technology subject team

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