GCE A LEVEL MARKING SCHEME

SUMMER 2022

A LEVEL
DESIGN AND TECHNOLOGY - UNIT 3
PRODUCT DESIGN
1603U30-1

INTRODUCTION

This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE A LEVEL DESIGN AND TECHNOLOGY

UNIT 3 - PRODUCT DESIGN

SUMMER 2022 MARK SCHEME

Guidance for examiners

Positive marking

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

Banded mark schemes

For band marked questions mark schemes are in two parts, the indicative content and the assessment grid.

The indicative content suggests the range of issues which may be included in the learner's answers. It can be used to assess the quality of the learner's response. Indicative content is **not** intended to be exhaustive and learners **do not** have to include all the indicative content to reach the highest level of the mark scheme.

In order to reach the highest levels of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that it contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

In Design and Technology, each question addresses one assessment objective: either AO3 or AO4. The assessment grid sub-divides the total mark to allocate for a question. These are shown in bands in the mark scheme. For each question, descriptors will indicate the different skills and qualities at the appropriate level.

Examiners should first read and place a tick in the learner’s answer/s to indicate the evidence that is being assessed in that question; the mark scheme can then be applied. This is done as a two-stage process.

Stage 1 – Deciding on the band

Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptors for that band. If the descriptors at the lowest band are satisfied, examiners should move up to the next band and repeat this process for each band until the descriptors match the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark learners down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Question 1

Designers use a range of methods for exploring possible solutions to solving problems.		AO3	AO4	Mark
(a)	Describe how a designer could use morphological analysis as a method of exploring possible solutions when designing products.		✓	4

*Answers that indicate an understanding of morphological analysis should be awarded up to **4** marks based on:*

- A method of exploring ideas and possibilities using a table, grid or matrix of different attributes and values that can be chosen from.
- Some possible choice combinations may not be feasible. However, this could trigger more creativity in the development stages of a design.
- Dependant on the suitability of what is added to the morphological analysis matrix/table.
- Can be an interesting way to design by forcing you to think in a different way.

Guidance to markers

Incorrect/no answer **0**

Brief description, very little understanding, for example:
Morphological analysis is a table/grid of attributes and values that can be explored and chosen from when creating initial ideas. **1**

Some detail with some understanding, for example:
Morphological analysis is a table/matrix grid that can break down a product into its sub-concepts to allow for multiple options to be explored and incorporated into design ideas. The table would be populated with attributes and values that can be picked from in different combinations. **2**

A more detailed explanation with clear understanding, for example:
Morphological analysis is a table/matrix grid that can break down an idea into its sub-concepts to allow for multiple options to be explored and incorporated into designs. The possibilities are decided upon by using the matrix and choosing different combinations of the attributes, an example of this could be a selection of materials in one column, possible shapes in second column and possible construction methods in another column. When using this method, a larger number of possibilities can be developed, however not all possibilities could be possible. **3**

Fully detailed explanation with clear understanding, for example:
Morphological analysis is a table/matrix grid that can break down an idea into its sub-concepts to allow for multiple options to be explored and incorporated into designs. This method can be an interesting way to design by forcing you to think in a different way. The possibilities are found by using the matrix and choosing different combinations of the attributes and values. When using this method, a larger number of possibilities can be developed, however not all possibilities could be possible. A simple example of this is given in the table below where a design has been developed using the highlighted aspects of the table: **4**

Materials	***Stock***	***Construction***
Copper	***Round***	***Spot welding***
Aluminium	***Square***	***Pop rivets***
Stainless Steel	***Triangle***	***Tig welding***

(b)	Explain why it is important for the designer to consider the design specification during the development of a product.		✓	4

*Answers that indicate an understanding of the design specification should be awarded up to **4** marks based on:*

- Importance to gather views of users to inform the specification of a product.
- Aids design development by ensuring the ideas meet the requirements of the user and target market.
- Allows for ongoing testing and evaluations throughout the iterative design process, which enables constructive changes to be made to meet the needs and wants.
- Enables design decisions to be made in terms of functionality and aesthetics.
- Allows for a set of criteria to be used in a manufacturing specification.
- Using ACCESS FM to judge the effectiveness during the development stages.

Guidance to markers

Incorrect/no answer	***0***
Brief description, very little understanding, for example: When creating a specification, it is important to gather information on the needs and wants of the user to inform the design specification.	**1**
Some detail with some understanding, for example: When creating a specification, it is important to gather information on the needs and wants of the user to ensure their views and opinions are considered within the design proposal to meet their requirements. By creating a design specification, you are able to check against the criteria when designing possible ideas.	***2***
A more detailed explanation with clear understanding, for example: When creating a design specification, it is important to gather information on the needs and wants of the user to ensure their views and opinions are considered within the specification to meet their requirements. The information gathered can allow for the evaluation of positive and negative aspects of a design or prototype throughout the iterative design process and enable further user tests to be carried out. The specification can play a key role in understanding what is required from the product that is to be designed.	**3**
Fully detailed explanation with clear understanding, for example: When creating a design specification, it is important to gather information on the needs and wants of the user to ensure their views and opinions are considered within the design proposal to meet their requirements. The needs and wants of the user will inform the specification and it is vital that these are considered when designing to allow for all the requirements to be met. The information gathered can allow for the evaluation of positive and negative aspects of a design or prototype throughout the iterative design process and enable further user tests to be carried out on the function and aesthetical aspects of the product. This in turn will allow for the product to be more successful before a large manufacturing investment is made to put the product into production and introduced onto the market. The specification can also aid the requirements of manufacture through a manufacturing specification.	**4**

Total	**8**

Question 2

Manufacturers use knock-down fittings in the production of flat packed products.		AO3	AO4	Mark
(a)	Explain one factor that the manufacturer would need to consider when using temporary knock down fittings like the one shown above.		✓	2

*Answers that indicate an understanding of knock-down fittings should be awarded up to **2** marks based on:*

- The quality control of the alignment of holes to fit the knock down fitting.
- Availability of bought in components and the advantage of the consistency.
- Skill level of the consumer to be able to fit the fittings correctly.
- Manufacturer would need to provide clear instructions to construct the product with the knock down fittings.
- Ease of use/fitting by the consumer.
- Suitability of materials.
- How it can affect the finish of the product.
- The location of the joints to ensure the ease of assembly.

Guidance to markers

Incorrect / no answer **0**

Brief description, a simple fact, for example:
The manufacturer will need to consider the alignment and correct fitting of the knock-down fittings. **1**

More detailed description with understanding, for example:
The manufacturer will need to consider the quality control of the product to ensure the alignment of the holes and correct fitting of the knock-down fittings when assembled by the consumer. **2**

Credit for a named knock down fitting – 1 mark only.

(b)	Discuss the advantages and disadvantages of flat packed products to the consumer.		✓	6

*Answers that indicate an understanding of advantages and disadvantages of flat packed products to the consumer should be awarded up to **6** marks based on:*

Advantages:

- Minimal skills required to construct the product.
- Reduced price of the product as manufacturer doesn't have to assemble the product.
- Easily transported as the product is packed into manageable pieces.
- Ability to disassemble to move if needed.
- Products can be customisable.
- Missing components can be collected.
- Range of tools provided by manufacturer to be able to assemble.

Disadvantages:

- Products have limited designs as the customer is assembling so the designs are more often simpler.
- Products are much more fragile than solid furniture, as they are usually made from cheaper materials.
- Dismantling the products a few times will make their durability drop significantly.
- They won't last as long as ready-to-use furniture.
- Parts can sometimes be missing, which makes assembly more complicated.
- Consumer struggling to assemble with ease.
- No tools available to assemble.

Guidance to markers

Incorrect/no answer	**0**
Brief description of advantages and disadvantages to flat packed products, for example: Products that are flat packed allow for easier transportation. However, these products are sometimes less quality that don't last as long as ready assembled products.	**1-2**
More detailed description of advantages and disadvantages to flat packed products for the consumer, for example: Products that are flat packed allow for easier transportation due to the product being packed into manageable pieces. Another advantage to the customer would be the reduced price of the product as manufacturer doesn't have to assemble the product and this saving in cost can be passed on. These products do have their disadvantages such as; they are sometimes less quality that don't last as long as ready assembled products due to them being made from manufactured materials rather than quality natural materials. Although the products are easily dismantled their durability can drop significantly if this is done several times.	**3-4**

	Fully detailed discussion and explanation of advantages and disadvantages to flat packed products for the consumer, for example: Products that are flat packed allow for easier transportation for the customer from the supplier and into the customers houses due to the product being packed into manageable pieces. Another advantage to the customer would be the reduced price of the product as manufacturer doesn't have to assemble the product and this saving in cost can be passed on. There is an increasing trend that these flat packed products are customisable, which appeals to the customer to purchase. Along with this customisable aspect the products often are modular and allow multiple design combinations. These products do have their disadvantages such as; they are sometimes less quality that don't last as long as ready assembled products due to them being made from manufactured materials rather than quality natural materials. Although the products are easily dismantled their durability can drop significantly if this is done several times due to the knock-down fittings being damaged. On a whole assembling these products can be simple but on occasions parts and fittings can sometimes be missing, which makes assembly more complicated and more time consuming.	**5-6**
	Total	**8**

Question 3

The aluminium chair shown below has been finished using the process of anodising.		AO3	AO4	Mark
(a)	Explain the benefits of anodising the aluminium chair.		✓	4

Answers that indicate an understanding of the benefits of anodising the chair *should be awarded up to **4** marks based on:*

- Protection of the materials/products.
- To improve aesthetical appearance.
- To change the colour of a material to enhance its appearance.
- To increase the products value.
- No risk of fading.
- Corrosion resistance of the surface as it prevents further oxidisation.
- Helps to protect against scratching.
- Easier to clean.

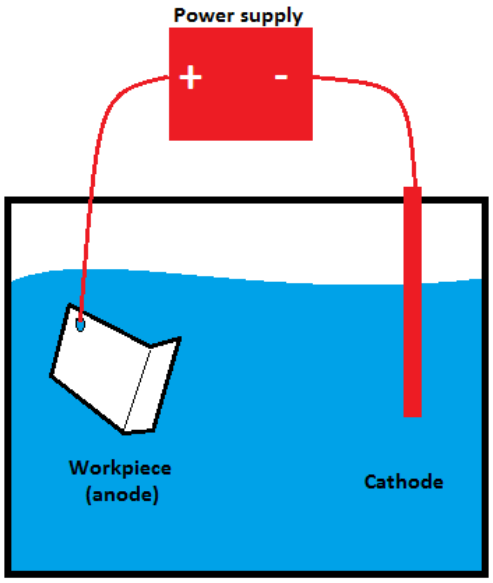
Guidance to markers

Incorrect / no answer	**0**
Brief description, very little understanding, for example: The chair has been anodised to protect it from the environment and allow the product to last longer.	**1**
Some detail with some understanding of the importance of anodising, for example: The chair has been anodised to protect it from the environment and allow the product to last longer. Another important reason to apply this finish is to improve the physical appearance of a product in terms of aesthetics.	**2**
A more detailed explanation with clear understanding of the importance of anodising, for example: The chair has been anodised to protect it from the environment and allow the product to last longer. Another important reason to apply this finish is to improve the physical appearance of a product in terms of aesthetics. This can be done by the manufacturer to help increase the value of a product.	**3**
Fully detailed explanation with clear understanding of the importance of anodising the chair, for example: The chair has been anodised to protect it from the environment and allow the product to last longer. Another important reason to apply this finish is to improve the physical appearance of a product in terms of aesthetics. This can be done by the manufacturer to help increase the value of a product. The anodising process allows for better corrosion resistance as it prevents further oxidisation.	**4**

(b)	Using annotated sketches explain this process of anodising the aluminium chair.		✓	8

Answers that indicate an understanding of anodising aluminium *should be awarded up to 8 marks based on:*

- Anodising aluminium is a method of increasing the corrosion resistance by forming a layer of oxide on its surface.
- The part that is being treated forms the anode electrode of an electrical circuit.
- Anodising increases resistance to corrosion and wear and provides better adhesion for paint primers and glues than bare metal does.
- The process of creating this protective oxide coating is achieved electrolytically.
- The aluminium part is first submerged in an electrolytic solution bath along with a cathode.
- When a current is passed through the acid solution hydrogen is released from the cathode and oxygen forms on the surface of an anode.
- This results in a metal oxide film growing on the surface of the part being treated.



Guidance to markers

Incorrect/no answer	**0**
A basic method explained with basic sketches, lacking detail to show understanding of the process.	**1-2**
A clear method explained with clear annotated sketches. Main details identified to show understanding of the process.	**3-4**
A detailed method explained with detailed annotated sketches. Most key details identified to show a clear understanding of the process.	**4-6**
A fully explained method with very detailed annotated sketches. All key details identified to show a full understanding of the process.	**6-8**

Total	**12**

Question 4

The balance trike shown below is manufactured from a range of components and materials.		AO3	AO4	Mark
(a)	Describe one reason why plywood has been used instead of natural wood for the frame of the balance trike		✓	2
	*Answers that indicate an understanding of reasons for choice of plywood should be awarded up to **2** marks based on:* • Plywood can be supplied in bigger boards resulting in cheaper material costs. • The strength of the plywood can be stronger due to the lamination of layers. • Pre-finishing can take place to add different colour variations. • More sustainable as waste can be limited by tessellating parts on a manufactured board. • Can be easily machine using CAM. • Less imperfections in the plywood. • The use of waterproof marine plywood. **Guidance to markers** *Incorrect/no answer* **0** *Brief description of reason, for example*: Plywood is used rather than natural as it can be stronger due to is structure. **1** *Detailed description of reason, for example*: Plywood is used rather than natural as it can be stronger due to is structure. This is because alternating layers result in a stronger product. **2**			

(b)	Explain the advantages to the manufacturer of using standard bought in components for parts of the trike.		✓	4

*Answers that indicate an understanding of bought in components should be awarded up to **4** marks based on:*

- A bought in component is usually an individual part or component, manufactured in thousands or millions, to the same specification such as size and weight. E.g steel bolt.
- Bolts are available in a vast range of standard sizes. Each size is manufactured to an internationally accepted standard.
- Standard components can be manufactured in vast quantities, keeping costs down.
- Safety / quality testing is easier when dealing with standard components. Often a number of standard components, from a batch will be tested.
- Setting up a production line is easier if standard components are used. It is easier to train staff / the workforce, as they are dealing with the same standard components, when assembling products.
- Allows for the development of the product, rather than having to design each individual component. This speeds up product development.
- Don't need to manufacture these parts so reduces tooling costs.
- Can be used with JIT manufacturing.
- Allows the product to be repairable to attract more consumers.

Guidance to markers

Incorrect / no answer	**0**
Brief description, limited understanding, for example: Standard components have been used to the reduce costs of manufacturing the product as these components can be bought in larger quantities.	**1**
Some detail with some understanding of bought in components, for example: Standard components have been used to reduce the costs of manufacturing the product as these components can be bought in larger quantities. An example of this can be seen in the trike, where the manufacturer has used standard size fixings such as bolts to join the main body together.	**2**
A more detailed explanation of more than one reason with clear understanding of bought in components, for example: Standard components have been used to reduce the costs of manufacturing the product as these components can be bought in larger quantities. An example of this can be seen in the trike, where the manufacturer has used standard size fixings such as bolts to join the main body together. Another advantage would be that the safety and quality testing is easier when dealing with standard components. Often a number of standard components, from a batch will be tested.	**3**
Fully detailed explanation of more than one reason with clear understanding of bought in components with clear understanding, for example: Standard components have been used to reduce the costs of manufacturing the product as these components can be bought in larger quantities. An example of this can be seen in the trike, where the manufacturer has used standard size fixings such as bolts to join the main body together. These components are available in a vast range of standard sizes where each size is manufactured to an internationally accepted standard. Another advantage would be that the safety and quality testing is easier when dealing with standard components. Often a number of standard components, from a batch will be tested before the manufacturer uses the component in their product development, this also speeds up the manufacturing process as these components are bought in rather than manufactured by themselves.	**4**

(c)	The manufacturer has decided to use batch production. Discuss the benefits of using batch production to manufacture the balance trike.		✓	6

*Answers that indicate an understanding of reasons why batch production has been used should be awarded up to **6** marks based on:*

- Batch production is easier to change, the manufacture parts of the trike for example, change of colour and design shape of main body.
- Allow for market changes otherwise there might be too much stock in storage if manufactured in mass.
- Less initial investment needed for equipment and production lines.
- As the work is concentrated on a specific unit, supervision and inspection of work is relatively simple therefore work is generally of a high quality.
- The manufacturer is reducing its risk on simply concentrating on one product as it produces a variety of different ones of the same type such as different types of trikes.
- Can be batch produced at different times throughout the year dependant on needs and trends.
- Less monotonous to staff manufacturing the product.

Guidance to markers

Incorrect/no answer	**0**
Brief justification of using batch production, for example: The manufacturer has decided to use batch production due to the flexibility of being able to change the design during the manufacturing process. This could include different variations and colour options.	**1-2**
More detailed justification for using batch production, for example: The manufacturer has decided to use batch production due to the flexibility of being able to change the design during the manufacturing process. This could include different variations and colour options. Batch production allows for market changes as the manufacturing line can be altered and changed easily, which results in less stock having to be stored compared to large amounts in mass production. Another advantage would be that the initial investment can be significantly less compared to mass production.	**3-4**
Fully detailed justification and explanation of why batch production has been used, for example: The manufacturer has decided to use batch production due to the flexibility of being able to change the design during the manufacturing process. This could include different variations and colour options. Batch production allows for market changes as the manufacturing line can be altered and changed easily, which results in less stock having to be stored compared to large amounts in mass production. Another advantage would be that the initial investment can be significantly less compared to mass production. Batch production can also sometimes result in higher quality products as the work is concentrated on a specific unit meaning supervision and inspection of work is relatively simple. This in turn can help to improve quality control and quality assurance processes during the batch production process.	**5-6**

	Total	**12**

Question 5

The logo shown below is the registered trademark of a watersports company.		AO3	AO4	Mark
(a)	Describe the features of a registered trademark and explain how this benefits the company.		✓	4

*Answers that indicate an understanding of the features and benefits of trademarks should be awarded up to **4** marks based on:*

- A symbol/sign that identifies your products or services.
- Is often relating to a company logo.
- A fee is paid to the Intellectual Property Office, who decide whether a symbol/logo can be regarded as a protected trademark.
- Often used to advertise products or services.
- A trademark must be distinctive and distinguish your goods from those of others so can prevent other similar trademarks.
- It grants the right to file a trademark infringement lawsuit.
- Every 10 years to renew.
- A registered trademark is denoted by ®.

Guidance to markers

Incorrect / no answer	**0**
Brief description, a simple fact, for example: A registered trademark is a symbol or sign that can identify a product or service.	**1**
More detailed description with understanding of benefit, for example: A registered trademark is a symbol or sign that can identify a product or service. A registered trademark is related to the logo of the watersports company. The benefit of the trademark is to grant the right to file an infringement suit if others try to use a similar symbol/sign.	**2**
Very detailed description with understanding of benefit, for example: A registered trademark is a symbol or sign that can identify a product or service. A registered trademark is related to the logo of the watersports company. The benefit of the trademark is to grant the right to file an infringement suit if others try to use a similar symbol/sign. A trademark must be distinctive and distinguish your goods from those of others so can prevent other similar trademarks. A registered trademark is denoted by ®.	**3-4**

(b)	The company has developed an innovative product. Explain in detail how the innovative product is protected using a specific intellectual property right.		✓	4

*Answers that indicate an understanding how an innovative product can be protected should be awarded up to **4** marks based on:*

- Identification of using a patent to protect innovative product.
- A patent protects a person or company that invents something new.
- This should prevent anyone or another company from stealing your idea and manufacturing it.
- A patent protects your design for the first five years and then you must apply annually for the next fifteen years (twenty years in total).
- Invention or product must never have been made public in any way, anywhere in the world.
- Patents must be applied for and can sometimes be a costly and long process.
- Patents can be applied for by others on your behalf. The licence can be hired or sold to someone else.
- To avoid wasting time, effort and money you should carry out a search through published patents and other documents such as trade catalogues before thinking about applying.

Guidance to markers

Incorrect / no answer	**0**
Brief description, limited understanding, for example: An innovative product can be protected *by applying for a patent.*	**1**
Some detail with some understanding of patents, for example: An innovative product can be protected by applying for a patent. A patent protects a person or company that invents something new. This should prevent anyone or another company from stealing your idea and manufacturing it.	**2**
A more detailed explanation of patents with clear understanding of the process of protecting an innovative product, for example: An invention or innovative product can be protected by applying for a patent. A patent protects a person or company that invents something new. A patent will usually last 20 years once granted and this should prevent anyone or another company from stealing your idea and manufacturing it. To be able to apply for a patent the Invention or product must never have been made public in any way, anywhere in the world.	**3**
Fully detailed explanation of patents with clear understanding of the process of protecting an innovative product, for example: An innovative product can be protected by applying for a patent. A patent protects a person or company that invents something new. A patent will usually last 20 years once granted and this should prevent anyone or another company from stealing your idea and manufacturing it. To be able to apply for a patent the Invention or product must never have been made public in any way, anywhere in the world. The process of applying for a patent can be a costly and time-consuming process and it is important that you carry out a search through published patents and other documents such as trade catalogues before thinking about applying to prevent wasting valuable time and money as the product or invention may already exist.	**4**

Total	**8**

Question 6

The regulatory and legislative framework for health and safety has a big impact when manufacturing products in a workshop environment.		AO3	AO4	Mark
(a)	Describe **two** key features of the Health and Safety at Work Act that need to be adhered to in a workshop environment.		✓	4

Answers that indicate an understanding of the Health and Safety at Work Act *should be awarded up to **4** marks based on:*

Employers responsibilities:

- Must make sure the workplace is safe and without risks to health by assessing risks.
- Ensure plant and machinery are safe/hygienic and that safe procedures of work are set and followed.
- Provide adequate welfare facilities including first aid arrangements.
- Provide the information, instruction and training.
- Make sure that work equipment is suitable for intended use, and that it is properly maintained.
- Provide correct PPE.
- Ensure that appropriate safety signs are provided and maintained.

Employees responsibilities:

- Take reasonable care for their own health and safety and that of others who may be affected by their actions.
- Correctly use work items provided by their employer, including personal protective equipment (PPE).
- Using anything provided for health, safety or welfare correctly.
- Use extraction when using machines that can create dust.

Guidance to markers

Incorrect / no answer	**0**
*Brief description of **one** feature, very little understanding, for example*: A key feature of the Health and Safety at Work Act is the importance of using the correct PPE when in the workshop.	**1**
*Detailed description of **one** feature, for example:* A key feature of the Health and Safety at Work Act is the importance of using the appropriate PPE that has been provided, such as the use of eye protection when using the machinery.	***2***
*A more detailed description of **two** features, with clear understanding, for example:* The Health and Safety at Work Act is the key piece of legislation covering occupational health and safety in the UK. A key feature of the Health and Safety at Work Act is the importance of employers to follow the requirements and guidelines set out by the act, such as supplying appropriate PPE and training to their employees to minimise the risks of accidents. Along with this requirement it is vital that they ensure appropriate safety signs are provided and maintained. The act doesn't just relate to employers. The employee's actions are also key for the success of the act as they would need to ensure they take reasonable care for their own health and safety and that of others who may be affected by their actions. This can be achieved by correctly using work items provided by their employer, including personal protective equipment.	**3-4**

(b)	The British Standards Institute (BSI) kitemark has been awarded to a new product. Explain what this tells the consumer.		✓	4

*Answers that indicate an understanding of BSI should be awarded up to **4** marks based on:*

- The British Standards Institution (BSI) is a service organisation that produces standards across a wide variety of industry sectors.
- The standards are an agreed way of doing something. It could be about making a product, managing a process, delivering a service or supplying materials.
- The BSI assists organisations wishing to achieve the European CE mark certification.
- The BSI also awards the BSI Kitemark to products that meet its quality standards.
- Tells the consumer it is safe.
- Organisations may apply for the BSI Kitemark to certify a product has met certain standards.

Guidance to markers

*Incorrect / no answer **0 marks***

Brief description, limited understanding, for example:
BSI kitemarks tells the consumer that the product has been tested and meets standards. **1**

Some detail with some understanding of BSI, for example:
BSI kitemarks tells the consumer that the product has been tested and meets standards. They play a big role in setting standards for products such as children's toys. For a product to achieve these standards they must apply for the BSI kitemark. **2**

A more detailed explanation of BSI with clear understanding of the role, for example:
BSI kitemarks tells the consumer that the product has been tested and meets standards. The standards outlined by BSI are an agreed way of doing something. It could be about making a product, managing a process, delivering a service or supplying materials. These standards are designed for voluntary use. However, they play a big role in setting standards for products such as children's toys. For a product to achieve these standards they must apply for the BSI kitemark. **3**

Fully detailed explanation of BSI with clear understanding of the role, for example:
BSI kitemarks tells the consumer that the product has been tested and meets the required safety standards. The standards outlined by BSI are an agreed way of doing something. It could be about making a product, managing a process, delivering a service or supplying materials. These standards are designed for voluntary use. However, they play a big role in setting standards for products such as children's toys. For a product to achieve these standards they must apply for the BSI kitemark and this can give the product or service an advantage over other competitors that do not hold the BSI kitemark as it can tell the consumer that the product is of better quality. **4**

Total	**8**

Question 7

3D printing uses a polymer heated to its melting point and then extruded, layer by layer, to create a three-dimensional object.		AO3	AO4	Mark
(a)	Explain a drawback to this method of 3D printing.		✓	2
	*Answers that indicate an understanding of drawbacks should be awarded up to **2** marks based on:* • 3D prints can be difficult to bond to printer build plate. • Long processing time for high quality prints. • Post production cleaning is needed to remove supports. • Layer lines on final parts are often visible. • The quality of layer adhesion can influence the mechanical strength of the part. • Supports need to be used for overhangs or more complicated designs which leads to more material being used. • Polymer reals can run out mid print. • Nozzles can become blocked and cause failed prints. **Guidance to markers** *Incorrect/no answer* **0** *Brief description of **one** drawback, little detail, for example:* This type of 3D printing can take a long time for high quality parts. **1** *More detailed explanation of **one** drawback with clear understanding, for example:* 3D printing can be a time-consuming process due to the thin layers of filament building up. For higher quality prints thinner layers are needed which in some cases can be as little as 0.2mm. **2**			
(b)	Evaluate the benefits and limitations of 3D printing prototypes when designing products.	✓		10
	Answers that indicate an understanding of benefits and limitations of 3D printing prototypes *should be awarded up to **10** marks based on:* **Benefits include:** • It enables quick production with a high number of prototypes or a small-scale version of the real object in less time than using conventional methods. • Helps designers to improve their prototypes, for any design flaws that may affect the quality of the product. • The initial cost for setting up a 3d printing facility can be high; however, it is much cheaper compared to labour costs and manufacturing costs while using the conventional way. • Can allow clients and users to have a 3D prototype to test throughout the design process. • Ability to print functional and moving parts for prototypes to test function. • Using sustainable 3d printing polymers.			

Limitations include:

- The time for prototypes to print can take a long time.
- The decrease in manufacturing jobs will greatly affect the economy of countries that rely on a large number of low skill jobs.
- The size of objects created with 3d printers can be limited.
- Limited materials to print prototypes from.
- Production of Dangerous Items – With 3d printers, plastic knives, guns and any other hazardous objects can be created.
- Printer reels run out of polymers.

Both benefits and limitations need to be evaluated for higher band marks.

Guidance to markers

• Incorrect/no answer	**0**
• Candidate has a simplistic knowledge. • The use of terminology and technical language is basic. • Brief description of the benefits and limitations of 3D printing prototypes; little understanding evident; basic or no example.	**1-2**
• Candidate has some basic understanding of the issues associated with the question. • The use of terminology and technical language is variable. • Some detail with some understanding of the benefits and limitations of 3D printing prototypes which have been briefly explained.	**3-4**
• The candidate has a clear understanding of the issues associated with the question. • The use of terminology and technical language is mostly accurate. • More detailed evaluation of the benefits and limitations of 3D printing prototypes with clear knowledge and understanding evident; appropriate examples included to aid evaluation.	**5-6**
• The candidate has a very clear understanding of the issues associated with the question. • The use of terminology and technical language is accurate. • More detailed evaluation of the benefits and limitations of 3D printing prototypes with detailed knowledge and understanding evident; detailed examples included to aid evaluation.	**7-8**
• The candidate demonstrates an excellent understanding of the issues associated with the question. • Uses correct terminology and technical language including types of materials and processes. • Full and detailed description and understanding of the benefits and limitations of 3D printing prototypes with full and detailed explanation with highly relevant exemplars included.	**9-10**

Total	**12**

Question 8

The role of marketing, enterprise and innovation can influence the development of products.		AO3	AO4	Mark
(a)	Promotion is one of the four P's of marketing. Explain the impact of effective promotion on a new product entering the market.		✓	4

*Answers that indicate an understanding of promotion should be awarded up to **4** marks based on:*

- Promotion: The activities that communicate the product's features and benefits and persuade customers to purchase the product.
- Promotion can help determine a clear and effective strategy to bring a product to market.
- Promotion of a product can help you differentiate your product from others on the market.
- Promotion can create brand awareness and drive sales of the product.
- Promotion can create word of mouth opportunities.
- Location of promotions taking into considerations such as ethnical factors.
- Using influencers to help promote.
- Pre-launch advertising to help with presales.

Guidance to markers

Incorrect/no answer	**0**
Brief identification of why promotion is important, little detail, for example: Promotion of a product can help drive sales of a product and increase profits.	**1**
Identification of why promotion is important with limited explanation, for example: Promotion of a product can help drive sales of a product and increase profits. This is because the activities that communicate the product's features and benefits such as online promotions can help persuade customers to purchase the product.	**2**
Identification of why promotion is important and effective with a more detailed explanation and clear understanding of the topic, for example: Promotion of a product can help drive sales of a product and increase profits. This is because the activities that communicate the product's features and benefits such as online promotions can help persuade customers to purchase the product. Effective promotion of a product can help you differentiate your product from others on the market and this can give you an advantage over competitor products.	**3**
Identification of why promotion is important and effective with a fully detailed explanation and full understanding of the topic, for example: Promotion of a product can help drive sales of a product and increase profits. This is because the activities that communicate the product's features and benefits such as online promotions can help persuade customers to purchase the product. Effective promotion of a product can help you differentiate your product from others on the market and this can give you an advantage over competitor products. Another reason why promotion can affect the sales of a product would be the ability to build brand awareness and drive sales of the product when entering the market.	**4**

(b)	Explain how the development of smartphones can be attributed to technology push.		✓	4

*Answers that have fully explained technology push should be awarded up to **4** marks based on:*

- Technology Push is when research and development in new technology drives the development of new products.
- Smartphones are re-designed because of changes in materials or manufacturing methods.
- Technology Push usually does not involve market research. It tends to start with a company developing an innovative technology and applying it to a product.
- Technology developments have resulted in smaller handsets.
- Function of smartphones have developed over time. i.e. More storage, internet access, cameras, finger print access and voice recognition.
- Development of new materials have influenced the aesthetics of smartphone. i.e. aluminium casing for iPhone.
- New manufacturing techniques and processes developed through technology push.

Guidance to markers

Incorrect/no answer	**0**
Brief identification of the development from technology push, little detail, for example: *Smartphones have been developed over time because of the new developments in technology capabilities and material development, such as increased storage and internet capabilities.*	**1**
Some detail with some understanding of how technology push has been used to develop smartphones, for example: Technology Push is when research and development in new technology drives the development of new products. Products are re-designed because of changes in materials or manufacturing methods. Smartphones have benefited from this technology push by increasing storage capabilities along with the development of the smartphones becoming smaller in size.	**2**
A more detailed explanation of how smartphones have been developed from technology push with clear understanding of the topic, for example: Technology Push is when research and development in new technology drives the development of new products. Smartphones have benefited from this technology push by increasing storage capabilities along with the development of the smartphones becoming smaller in size due to new developments in nanotechnology. Products are also often re-designed because of changes in materials or manufacturing methods. This has led to the smartphones being made from more aesthetically pleasing materials such as aluminium in the case of an iPhone. The technology Push usually does not involve market research and it tends to start with a company developing an innovative technology. This is also evident though the development of the iPhone over time as it has led the development of other companies' products.	**3**

	A fully detailed explanation of how smartphones have been developed from technology push with full understanding of the topic, for example: Technology Push is when research and development in new technology drives the development of new products. Smartphones have benefited from this technology push by increasing storage capabilities along with the development of the smartphones becoming smaller in size due to new developments in nanotechnology. Other developments of smartphones are internet capabilities, camera functions, finger print safety and voice recognition. All of these functions have been led from the technology push over time. Products are also often re-designed because of changes in materials or manufacturing methods. This has led to the smartphones being made from more aesthetically pleasing materials such as aluminium in the case of an iPhone. The technology Push usually does not involve market research and it tends to start with a company developing an innovative technology. This is also evident though the development of the iPhone over time as it has led the development of other companies' products.	**4**

(c)	Explain how market pull is often the driving force behind revitalising products.		✓	4

Answers that have fully explained market pull *should be awarded up to* ***4*** *marks based on:*

- A need/requirement for a new product or a solution to a problem, which comes from the market place.
- The need is identified by potential customers or market research.
- A product or a range of products are developed, to solve the original need.
- Market pull sometimes starts with potential customers asking for improvements to existing products.
- Focus groups are often central to this, when testing a concept design or an existing product.
- Reference made to an example product.

Guidance to markers

Incorrect/no answer	**0**
Brief identification of what market pull is, little detail, for example: The term market pull refers to a need/requirement for a new product or a solution to a problem, which comes from the market place. An example of this could be the digital camera.	**1**
Some detail with some understanding of market pull with reference to revitalisation, for example: The term market pull refers to a need/requirement for a new product or a solution to a problem, which comes from the market place. An example of this could be the digital camera as years ago, there was a market requirement for a camera that could take more photographs, that could be viewed almost immediately. This market pull then led to electronics companies revitalising digital cameras to solve this problem.	**2**
A more detailed explanation of market pull with reference to a revitalised product with clear understanding of the topic, for example: The term market pull refers to a need/requirement for a new product or a solution to a problem, which comes from the market place. The need is identified by potential customers or market research. An example of this could be the digital camera as years ago, there was a market requirement for a camera that could take more photographs, that could be viewed almost immediately. This market pull then led to electronics companies revitalising digital cameras to solve this problem and creating digital storage, better processing power and improved battery performance to meet the requirements of the customers.	**3**
A fully detailed explanation of market pull with reference to a product with full understanding of the topic, for example: The term market pull refers to a need/requirement for a new product or a solution to a problem, which comes from the market place. The need is identified by potential customers or market research. Focus groups are often central to this, when testing a concept design or an existing product. An example of this could be the digital camera as years ago, there was a market requirement for a camera that could take more photographs, that could be viewed almost immediately. This market pull then led to electronics companies developing digital cameras to solve this problem. From market research they realised that customers wanted a range of better digital cameras with bigger storage, better processing power and improved battery performance. This can also link with technology push as at the time the technology is also a factor that needs to be taken into account when products are revitalised.	**4**

Total	**12**

Question 9

Customer support can be a key selling point for a person to choose a product over a competitor product.	AO3	AO4	Mark
Discuss possible methods of customer support that a company would need to consider when launching a product and the impact this could have on the company's reputation.		✓	8

*Answers that indicate an understanding of technical support should be awarded up to **8** marks based on:*

- Support can be a key selling point, a reason for a person to choose the product over the competition.
- **Phone support** – Supporting users by phone is time-consuming, but for some types of products, it can reassure potential buyers, particularly if they are not Internet-savvy or if the product handles sensitive information. Users might trust the product more if they know they can speak to a real person.
- **E-mail support** – The advantages are that you don't need any additional software, and everyone uses email. Relies heavily on personnel to respond to support requests.
- **Social Media support** - Ability to quickly respond to someone who is having a problem or has a question about your product. Relies heavily on personnel to respond to support requests. Popular method these days as most people use social media.
- **Ticketing system** – Ticketing systems make the process of providing support easier when multiple staff members are involved, because you can see whether a request is being responded to and who is working on it. They also make it far easier to keep track of the support requests coming in and how much time they are taking up.
- **Real time chat support** – Real-time support on websites can be helpful for companies that offer a service. You can chat to someone on your website, so guiding someone through a potentially confusing process would be simple. It does, however, require that someone be available to provide this support should users come to rely on it.
- Reference made to the impact of the customer support such as increased brand loyalty, faith in the product, word of mouth reputation.
- Warranties used as a customer support mechanism offering returns, repairs, refunds, replacements.
- Consumer protection act to protect the consumer after purchase.
- Using FAQ's and step by step guides to support.

Guidance to markers

• Incorrect/no answer	**0**
• Candidate has a simplistic knowledge. • The use of terminology and technical language is basic. • Brief description of one to two methods of technical support; little understanding evident; basic examples.	**1-2**
• Candidate has some basic understanding of the issues associated with the question. • The use of terminology and technical language is variable. • Some detailed discussion of three to four methods of technical support with some explanation and examples.	**3-4**

	• The candidate has clear understanding of the issues associated with the question. • The use of terminology and technical language is mostly accurate. • More detailed discussion of three to four methods of technical support with more detailed knowledge and understanding evident; appropriate examples included.	**5-**	
	• The candidate demonstrates very clear understanding of the issues associated with the question. • Uses correct terminology and technical language. • Full and detailed discussion of four methods of technical support with full and detailed explanation with highly relevant exemplars included.	**7-8**	
		Total	**8**

Question 10

Analyse the importance of testing and evaluating a product throughout the iterative design process and on completion of the product. *Marks will be awarded for the content of the answer and the quality of written communication.*	**AO3**	**AO4**	**Mark**
	✓ (10)	✓ (2)	12

*Candidates should demonstrate knowledge and understanding and apply it to designing and making principles to be awarded up to **12** marks based on:*

- Testing and evaluation throughout the iterative design process can confirm that the product will work as it is supposed to, or if it needs refinement.
- Allows the client to assess the viability of a design.
- Testing and evaluation allows the client to view the prototype and to give their views. Changes and improvements can be agreed with further work carried out if needed.
- Testing also helps identify potential faults, which in turn allows the designer to make improvements.
- Safety issues can be identified.
- Evaluating and testing allows the production costs to be assessed and finalised.
- Production methods can be explored and decided upon through testing and evaluation.
- Testing against the design specification throughout and at completion of a product, helps ensure a full and relevant evaluation of a product is carried out.
- Evaluations of finished products are completed in order to test whether they work well and if the design can be corrected or improved.
- Final testing with end users.
- Testing materials and performance attributes throughout the development processes.
- CAD simulation testing to help identify flaws.

Guidance to markers

• Incorrect / no answer	**0**
• Limited understanding and application of knowledge and understanding of the testing and evaluation processes. • There is limited evidence of relevant examples. • Quality of Written Communication is limited, presenting material with limited coherence, many errors of grammar, punctuation and spelling.	**1-3**
• Generally good understanding and application of knowledge and understanding of the testing and evaluation processes. • There is a line of reasoning which is generally coherent and relevant. • Quality of Written Communication is basic, presenting occasional appropriate material with some coherence, some errors of grammar, punctuation and spelling.	**4-6**

	• Very good understanding and application of knowledge and understanding the testing and evaluation processes, links with the iterative design process. • There is a sustained line of reasoning which is generally coherent, relevant and substantiated. • Quality of Written Communication is good, presenting mainly appropriate material in a coherent manner, few errors of grammar, punctuation and spelling.	**7-9**	
	• Excellent understanding and application of knowledge and understanding of the testing and evaluation processes, links with the iterative design process. • There is a sustained line of reasoning which is coherent, relevant and substantiated. • Quality of Written Communication is excellent, presenting wholly appropriate material in a coherent and logical manner, hardly any errors of grammar, punctuation and spelling.	**10-12**	
		Total	**12**