



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2024**

Technology and Design

Assessment Unit AS 1

assessing

Design and Materials

[STE11]

MONDAY 13 MAY, AFTERNOON

**MARK
SCHEME**

General Marking Instructions

Introduction

The main purpose of the mark scheme is to ensure that examinations are marked accurately, consistently and fairly. The mark scheme provides examiners with an indication of the nature and range of candidates' responses likely to be worthy of credit. It also sets out the criteria which they should apply in allocating marks to candidates' responses.

Assessment objectives

Below are the assessment objectives for **GCE Technology and Design**.

Candidates should be able to:

- AO1** Demonstrate specific knowledge and understanding, be able to apply that knowledge and understanding in combination with appropriate skills in their designing, communicate ideas and outcomes, and demonstrate strategies for evaluation.
- AO2** Apply skills, knowledge and understanding of relevant materials to produce suitable and appropriate outcomes; communicate ideas and outcomes, and demonstrate strategies for evaluation.

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 17 or 18-year-old which is the age at which the majority of candidates sit their GCE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 17 or 18-year-old GCE candidate.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Marking Calculations

In marking answers involving calculations, examiners should apply the 'own figure rule' so that candidates are not penalised more than once for a computational error. To avoid a candidate being penalised, marks can be awarded where correct conclusions or inferences are made from their incorrect calculations.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response

In deciding which level of response to award, examiners should look for the 'best fit' bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement.

The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **Intermediate performance:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.
- **High performance:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

Quality of written communication

Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

Level 1: Quality of written communication is basic.

Level 2: Quality of written communication is good.

Level 3: Quality of written communication is excellent.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

Level 1 (Basic): The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

Level 2 (Good): The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

Level 3 (Excellent): The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

- 1 (a) Elasticity is the ability of a material to flex, bend and be deformed and return to its original shape once the force is removed [1]
Plasticity is the ability of a material to permanently change shape as a result of forces applied to it, without cracking or breaking. [1] [2]

All relevant, valid responses will be given credit.

- (b) Electrical conductivity relates to the movement of electricity through a piece of material and how conductive it is,[1] whereas thermal conductivity relates to the movement of heat through a piece of material and how conductive it is. [1]

Award [2] for a full explanation and [1] for a limited explanation.
(2 × [1]) [2]

All relevant, valid responses will be given credit.

- 2 (a) Any **two different** reasons why PVC is used for example:

- Weather resistant.
- Good mechanical properties.
- Can be provided in a range of colours.

(2 × [1]) [2]

All relevant, valid responses will be given credit.

- (b) Any **two different** reasons why acrylic is used for example:

- Good transparency levels for rear lights. [1]
- A lightweight material. [1]
- Resistant to cleaning products. [1]

(2 × [1]) [2]

All relevant, valid responses will be given credit.

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- 3 (a) Any **one** property of oak which would make it suitable to be used for indoor seating.
- Durable. [1]
 - Tough. [1]
- [1]

All relevant, valid responses will be given credit.

- (b) Any **two** advantages of plywood for indoor seating for example:
- Plywood has good strength to weight ratio which makes it suitable for indoor seating. [1]
 - Plywood is resistant to warping and cracking which makes it suitable for indoor seating. [1]
 - Plywood is cost effective for indoor seating. [1]
- (2 × [1])
- [2]

All relevant, valid responses will be given credit.

- (c) The main purpose of using a stain as a finish is to change the colour of the wood in the indoor seating whilst leaving the grain still visible. [1]
The main purpose of using an oil on the outdoor seating is to provide water protection.[1]
- [2]

All relevant, valid responses will be given credit.

- 4 (a) Any **one specific** reason why pressure die casting is used for example:
- Can produce a well-defined quality rim. [1]
 - Requires little or no additional finishing to the rim. [1]
- [1]

All relevant, valid responses will be given credit.

- (b) Suitable sketch of the pressure die casting process to include a pair of die blocks, mould cavity, cavity for molten metal and ram.

| Description | Marks awarded |
|------------------------------------------------------------------------------------------------------------------|---------------|
| The annotated sketch is excellent with all the main elements of the pressure die casting process included. | [4] |
| The annotated sketch is good with most of the main elements of the pressure die casting process included. | [2]–[3] |
| The annotated sketch is basic with only a few of the main elements of the pressure die casting process included. | [1] |
| The response is not worthy of any credit. | [0] |

[4]

5

- 5 (a) A thermochromic material is a material which changes colour at specific temperatures [1] whereas a photochromic material is a material that undergoes colour changes induced by exposure to different lighting conditions. [1]

Award [2] for a full explanation and [1] for a limited explanation. [2]

All relevant, valid responses will be given credit.

- (b) The main characteristic of phosphorescent pigments is their capacity to absorb, store and emit light. [1]

Any **one** application for example:

- Clothing. [1]
- Escape route signs. [1] [1]

All relevant, valid responses will be given credit.

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6 Indicative content

Product example – Racing bicycle

Solid modelling is the practice of modelling 3D objects and concepts that are mathematically accurate using computer-aided design software. Solid modelling consists of wireframes that present the object in the form of a wire mesh. This object is given a solid appearance by applying surface representations to the 3D wireframes of the model in different views.

Solid modelling may be used for the racing bicycle for example:

- It could generate 3D models which could be photo rendered with material and colour representation of the concept of the bicycle to show potential clients their design. In addition, solid modelling can facilitate quick and easy changes to help visualise variations to the design of the bicycle.
- It can also be used to analyse the stress on the frame of the design of the bicycle and suggest changes or improvements to the profile in order to minimise materials, whilst maximising specific mechanical properties.

Rapid prototyping is a group of manufacturing techniques that facilitates the fast fabrication (either through additive, subtractive or compressive manufacture) of a physical part, model or assembly using 3D computer aided design (CAD).

Rapid prototyping may be used for the racing bicycle for example:

- Rapid prototyping allows designers to realise their concepts of the bicycle beyond virtual visualisation. This enables one to understand the look and feel of the bicycle and how the components are assembled. This in turn may help to confirm or justify any changes that occurred during the development phase.
- The materials available for rapid prototyping closely resemble the physical and strength properties of the actual components for the bicycle. This will make it possible to perform physical tests easily and quickly. This can identify flaws and help to improve the performance of individual components.

| | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Excellent selection and use of a writing form and style appropriate to the content. The content relating to solid modelling and rapid prototyping is organised with excellent information outlined for each area and widespread and accurate use is made of appropriate technological vocabulary. | [6]–[8] |
| Good selection and use of a writing form and style which is mostly appropriate to the content. The content relating to solid modelling and rapid prototyping is organised with good information outlined for each area and good use is made of appropriate technological vocabulary. | [4]–[5] |
| Basic selection and use of a writing form and style which is vaguely appropriate to the content. The content relating to solid modelling and rapid prototyping is poorly organised with basic information outlined for each area and little use is made of appropriate technological vocabulary. | [1]–[3] |
| The response is not worthy of any credit. | [0] |

[8]

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All relevant, valid responses will be given credit.

- 7 (a) A solution could be based on a one-piece injection moulded PVC design. The top part of the design would contain a 90-degree corner protector which would be attached to the storage box edge with the use of epoxy resin. For the base, a threaded foot adjuster with locknut would enable the user to adjust the height of the corners. The foot adjuster would be secured to the base using screws.

Marks should not be awarded for repetitive sketches which do not show any design thinking.

| | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Excellent sketches and annotation of an appropriate design that can be attached to the front and side panel of the storage box. This will provide protection to the vertical edge and can also be attached to the base of the corner to allow the user to adjust the height. | [5]–[6] |
| Good sketches and annotation of a design. The design represents an improvement as it can be attached to the front and side panel of the storage box to provide protection to the vertical edge and can also be attached to the base of the corner to allow the user to adjust the height. The design lacks the finesse appropriate for the product. | [3]–[4] |
| Basic sketches and annotation of a design. Difficulties in determining if the design can be attached to the front and side panel of the storage box to provide protection to the vertical edge and if it can be attached to the base of the corner to allow the user to adjust the height. | [1]–[2] |
| The response is not worthy of any credit. | [0] |

All relevant, valid responses will be given credit. [6]

- (b) The front and side panels of the storage box could be modified to improve the safety of the user by having a recessed portion (15 mm machined out closest to the lid along approximately 80% of the length of the front and side panels). Injection moulded stoppers could be inserted in the corners to give further protection.

Marks should not be awarded for repetitive sketches which do not show any design thinking.

| | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Excellent sketches and annotation of an appropriate design to the top of the front and side panels of the storage box. This design will clearly reduce the chance of the user getting injured when closing the lid. | [4] |
| Good sketches and annotation of a design. The design represents an improvement as it would reduce the chance of the user getting injured when closing the lid. The design lacks the finesse appropriate for the product. | [2]–[3] |
| Basic sketches and annotation of a design. Difficulties in determining if the design to the top of the front and side panels of the storage box would reduce the chance of the user getting injured when closing the lid. | [1]–[2] |
| The response is not worthy of any credit. | [0] |

All relevant, valid responses will be given credit. [4]

Total

10

40