



GCE MARKING SCHEME

SUMMER 2016

**DESIGN & TECHNOLOGY
DT1 - PRODUCT DESIGN
1111/01**

INTRODUCTION

This marking scheme was used by WJEC for the 2016 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 DESIGN & TECHNOLOGY
DT1 - PRODUCT DESIGN**

SUMMER 2016 MARK SCHEME

1. **Smart materials and composite materials are often used to manufacture modern day products.**

(a) **Identify one smart material and describe the advantages of using it in a named product.** [4]

(b) **Identify one composite material and describe the advantages of using it in a named product.** [4]

Award one mark for **each** named specific material and one mark for the suitable named product. *This must match the advantage to award the mark.*

Allow 2 marks for the advantages provided. (up to 4 marks)

(a) SMART materials could include shape memory alloys, photo chromic Liquid/inks (accept specific liquids/inks as SMART materials), polymorph, nitinol, - one mark for each named specific material. *Thermo chromatic is insufficient on its own. Fast Skin.*

Provide advantages of its use in a named product.

(b) COMPOSITE materials could include:

- Fibre composites (MDF);
- carbon fibre;
- glass fibre;
- kevlar;
- tufnel;
- plywood;
- concrete.

Coya, jute, sizal, hemp & flax accepted but must be bonded with epoxy resin. Gortex must have a bonding agent.

Do not accept trade names.

Award up to **four** marks for **the** advantage of using that specific material in named products.

Answers could be based on:

- strength to weight ratio;
- specific hardness;
- lightness;
- reaction to external stimuli.

No specific product named max 2 marks only.

2. Patents, Copyrights, Registered Trade Marks and Design Rights are all forms of design protection granted by the Patent Office.

Explain the features and protection of any two of these with reference to specific products. 2 x [4]

Features and benefits: Patents 4 marks

Monopoly rights to the exclusive use of an invention.
Can last for a maximum of 20 years if annual renewal fees are paid.
Becomes a property that can be bought, sold, hired or licensed.

An invention is patentable only if it is:

- New and previously undisclosed.
- Distinguished by an inventive step.
- Capable of industrial application (that it could actually be made).

Benefits may be to the company in terms of sales and staying at the forefront of developments.

Features and benefits Copyright 4 marks

- Literary works, including novels, instruction manuals, computer programs, song lyrics, newspaper articles and some types of database.
- Dramatic works, including dance or mime.
- Musical works.
- Artistic works, including paintings, engravings, photographs, sculptures, collages, architecture, technical drawings, diagrams, maps and logos.
- Layouts or typographical arrangements used to publish a work, for a book for instance.
- Recordings of a work, including sound and film.
- Broadcasts of a work.
- Lasts up to 70 years after death of author.

Benefits the copyright owner in that

- Another person should only copy or use a work protected by copyright with the copyright owner's permission.
- Copyright applies to any medium - this includes, publishing photographs on the internet, making a sound recording of a book, a painting of a photograph and so on. Copyright does not protect ideas for a work. It is only when the work itself is fixed, for example in writing the copyright automatically protects it - you do not have to apply for copyright.

Features and benefits: Registered Trade Mark 4 marks

- Any sign which can be represented graphically.
- Any sign which can distinguish goods or services.
- Includes words, personal names, designs, letters and the shape of goods and their packaging.
- Registered for 10 years and can be renewed every 10 years indefinitely.

Benefits may include the protection of a logo/catchphrase belonging to the company (that people associate with one brand) i.e. Tesco, McDonald's, and Nike.

Responses may combine both features and benefits.

Features and benefits: Design Right

4 marks

- any sign which can be represented graphically
- a form of protection for the shape or configuration of articles;
- design must not be commonplace;
- it is not a monopoly but a right to prevent copying;
- it lasts 10 years;
- becomes a property that can be bought, sold, hired or licensed.

Benefits short term protection for the rights to prevent copying the design. Can be sold, hired or licensed by the creator.

Note: maximum 2 marks if only the features are stated and not the level of protection.

3. All designers consider the use of ergonomics and anthropometrics in order to design successful products.

Describe using examples why:

(a) ergonomic principles are important in the design of products; [4]

(b) anthropometric data is important in the design of products. [4]

(a) The importance of Ergonomics within environments.

'The systematic study of human capabilities, behaviour, limitations and requirements, and the application of such knowledge on the design of products. The study of people in their working environments – the interaction between people and built products/artifacts, equipment.'

Areas or situations – driving seats or positions within a range of vehicles (for operators to have comfortable sight of controls), aircraft, checkout operators working in supermarkets – a description of the important needs of each user in these situations.

Hand held products.

User interface between user and product.

(b) Anthropometrics within products. [4]

(A scientific study of human measurement taken across a range of human groupings).

- In general things measured include dimensions, weight, strength, range of movement, physical size - *the physical fit between people and the equipment/products.*
- Layout and physical size of buttons and controls to enable the product to be used. (could be referred to as **point**)

Issues essential for success from handle size/form, weight, movement required to pour successfully, internal physical dimensions.

Look for understanding and differentiation between the two terms.

Maximum 2 marks for explanation of terms.

4. (a) **State the benefits of making a physical three-dimensional model when developing a design proposal.** [4]
- (b) **State the benefits of making a final three-dimensional prototype prior to manufacturing.** [4]

Accept all forms of three dimensional modelling.

Physical models, computer generated models, styro-foam models and prototyping.

(a) Benefits of Modelling – *up to two marks per benefit.*

- Consumer tests carried out.
- Physical models or computer generated models shared and evaluated.
- Judging the functionality and proportion of the product.
- Methods of assembling the product evaluated.
- Reasons for using the modeling material – e.g. styro-foam to calculate physical sizes/proportion of products when designing.

(b) Benefits of a 3D Prototype to manufacturing -*up to two marks per benefit.*

Note: 3D Prototyping – look for understanding of the term (not just a 3 dimensional model)

- Testing product performance before manufacturing.
- Materials tests carried out.
- Check on the quality of the product.
- Processes may be planned for each component part (tooling produced, jigs and templates).
- Specific physical tests may be carried out (compression and tensile tests).
- Working out costs.
- Provides opportunities to test product with intended user/target market.
- Hall tests carried out to ensure product works and is tested out.

5. (a) **Name a finishing process that can only be applied during manufacturing to a named product and explain why this is appropriate.** [4]

(b) **Name a finishing process that needs to be applied by the consumer after the manufacture of a named product and explain why this is appropriate.** [4]

(a) Manufacturer Finish:

Finish applied to material when the product is being manufactured.

Type of finish award 1 mark

Reason for finish award up to 3 marks

Product: Range of electrical product cases (textured as part of moulding), textile products (use of specialist dyes/fireproofing agents), agricultural products (galvanised).

Finish applied: Heat treatment (case hardening), galvanising, anodising, textured surfaces (to improve grip).

Reason: Use of specialist equipment required and only available during manufacture; safety aspects of applying the finish, process i.e. moulding, is undertaken during manufacture.

Moulding a texture or a finish; tactile finishes.

Chrome plating, galvanizing, anodizing, laminating and plastic dip coating.

(b) Consumer finished:

The range of finishes may be to improve aesthetic, physical and functional characteristics giving the consumer choice.

Personalisation/embellishment.

Choice of finish; within textiles.

Type of finish award 1 mark

Reason for finish award up to 3 marks

Product: furniture item (varnish), external timber products (sealer), steel products (painted), textile products (which are dyed by the consumer).

Self-finishing: Paint, varnish, plating to provide colour, texture - applied to range of specific woods, metals.

Reason: prolonging the life of a product, the flexibility to change a finish i.e. the colour or shade of paint, dye, varnish etc.

6. Reverse Engineering involves the disassembly of a product.

Explain in detail how product disassembly benefits the designer. [8]

Reverse Engineering

(Award up to a max four marks without any examples)

The process of discovering the technological principles of a product, device or system.

- Analysis of its structure and form.
- Take something apart and analyse its workings (mechanical, electrical or software).
- Product development can be accomplished more efficiently and at a substantial cost savings.
- The process of discovering the technological principles of a product/component or system.
- Involves taking something apart and analysing its workings in detail.
- With the intention to construct a new device.
- The new device does the same thing without actually copying anything from the original.

Benefits through reverse engineering:

- designers analyse its function
- a study of its structure
- how the product operates (under different conditions).

7. (a) Explain why bought-in or standardised part-assembled components are used when manufacturing products. [4]

(b) Describe one advantage and one disadvantage of using bought-in or standardised part-assembled components to the designer or manufacturer.

2 x [2]

Definition of term

4 marks

Components that are standardised can be substituted one for another i.e. using the same thread, fixings etc. These can be sourced from other companies and bought in making it possible to complete products very quickly.

Buying in means that the main company can specialise in its core operations, leaving other companies to take responsibility for the quality of a *bought in* component.

(b) Advantages (2 marks)

- Aspects of quality previously checked and signed off (the responsibility for quality lies with the other supplier). Consistent quality is maintained.
- Components may be produced by a specialist manufacturer from another location, allowing the main manufacturer to concentrate on assembly.
- Lower costs from buying in bulk and investment possible elsewhere within the manufacturing process allowing for flexibility (the ability to shop around for lower costs).

Up to 2 marks for each full description

(b) Dis-advantages (2 marks)

Perishable goods with a limited shelf life.

Expensive

Waiting delays to supply products JIT (Just in Time)

Lower profit margins if buying into a product.

8. The use of Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) has now become an integral part of the design process for both designers and manufacturers when creating products.

(a) Describe the benefits of using CAD to the designer. [4]

(b) Describe the benefits of using CAM to the manufacturer. [4]

Benefits to the designer:

- CAD can be used to illustrate a design to a client.
- Renderings and different finishes can be applied quickly.
- Colour ways explored by designers.
- CAD speeds up the process.
- Design Ideas communication between designer and client/manufacturer
- CAD Design work can be altered easily.
- CAD drawings can be e mailed across the globe to different locations for use.
- Candidates may explain the type of software used:
Pro Desk Top, Pro Engineer, Solid Edge, Solid Works, Autodesk Inventor etc.

Up to 2 marks for each detailed response

Benefits to manufacturer:

- Computer controlled manufacturing via laser cutters, rapid prototyping.
- CAM speeds up the process.
- CAM can be used to manufacture multiple products that are identical.
- Allows the manufacturer to send designs and receive them by email across the globe to different locations.
- CAM improves the accuracy of the manufacturing process and improves the quality of the product.
- CAD Changes can be made easily to designs if adjustments need to be made.

2 marks for each detailed response

No duplication of responses credit once only.

SECTION B

Section B involves extended written answers in which the mark awarded must take into account the quality of written communication – as indicated to candidates in the rubric on the front of the question paper. This should form an integral part of the judgement on the question, the following criteria being applied in deciding whether the points outlined in the marking scheme are communicated sufficiently clearly to award the full credit:

- Legibility; accuracy of spelling, punctuation and grammar.
- Organisation of information clearly and coherently (appropriate to purpose and to complexity of subject matter); use of specialist terms.

At the same time it should be noted that over-rigidity in interpretation of the mark scheme is not intended, and it is accepted that points may be made in a variety of different ways. Thus, except where terms are specifically requested, correct responses using different words are acceptable providing that points are clearly communicated.

The following levels of achievement grid should be used in conjunction with question specific guidance listed below. In each case you are asked to check the mark you have arrived at against the grid before finalising it.

ESSAY LEVELS:

<p>Level 1</p> <p>0-10</p>	<ul style="list-style-type: none"> • Candidate has a simplistic knowledge of the issues associated with the question. • The use of terminology and technical language is basic. • The candidate has little understanding of the general elements of industrial and commercial practices. Little knowledge of ICT in manufacturing systems. • The candidate has limited knowledge of the form and function of products. • The candidate will express ideas clearly, if not always fluently. Answers may deviate from the question or not be relevant. • Grammar, punctuation and spelling may be weak impacting on effective communication.
<p>Level 2</p> <p>11-16</p>	<ul style="list-style-type: none"> • The candidate has a basic understanding of the issues associated with the question. • The use terminology and technical language is variable. • The candidate understands the general elements of industrial and commercial practices related to manufacturing systems and some aspects of ICT in production. • The candidate has some general knowledge of the form and function of a product, trends and styles of products. Environmental, cultural and/or ethical /moral issues not always considered. • The candidate will express straightforward ideas clearly, if not always fluently. Answers may deviate from the question or be weakly presented. • There may be some errors of grammar, punctuation and spelling but is still able to communicate the issues.
<p>Level 3</p> <p>17-23</p>	<ul style="list-style-type: none"> • The candidate demonstrates a clear understanding of the issues associated with the question. • The use terminology and technical language is reasonably accurate. • The candidate understands the general elements of industrial and commercial practices related to manufacturing systems and is aware of aspects of ICT in production. • The candidate has developed a common knowledge of the form and function of a product, trends and styles of products. Environmental, cultural and/or ethical /moral issues are also considered. • The candidate will express moderately complex ideas clearly and fluently, through well linked sentences and paragraphs. Answers will be generally relevant and structured. • There may be occasional errors of grammar, punctuation and spelling.
<p>Level 4</p> <p>24-30</p>	<ul style="list-style-type: none"> • The candidate demonstrates a specific ability to analyse questions, takes into account of a wide range of factors and has a clear understanding of the issues associated with the question. • Uses correct terminology and technical language. • The candidate understands the main feature of industrial and commercial practices related to manufacturing systems including the use of ICT and stages of production. • Candidate has developed a detailed knowledge of the form and function of a product, trends and styles of products. Environmental, cultural and/or ethical /moral issues are also considered where appropriate. • The candidate will express complex ideas extremely fluently. Sentences and paragraphs will follow on from each other smoothly and logically. Answers will be consistently relevant and structured. There will be few, if any, errors of grammar, punctuation and spelling.

9. Production lines rely on getting the right material or component to be available at the right time and place. This is often referred to as 'Just in Time' (JIT).

Describe the importance of this and explain how it is achieved along with the advantages to the manufacturer. Use examples of products to fully explain how the principle is used to its full effect.

Achieved: Key features of Just in Time (JIT) manufacture - manufacturing according to an agreed plan that is governed by material and resource availability. Features may be descriptions of aspects of production and meeting the needs of customers, control of stock, and the arrival of materials and components just in time.

Advantages to the manufacturer:

Less storage space, efficient and faster manufacturing system thereby getting products to the customer/consumer quickly, releasing capital for use elsewhere, no depreciation in material costs, increased profit margins.

- Systems of storage and ordering.
- Description of *just in time* manufacturing.
- Ordering systems.
- Issues of saving on storage space for the manufacturer.
- Efficiency of manufacturing, production lines and cells.
- Product or range of products.

Note: responses may not necessarily state the JIT process (or any other related process) in order to access the higher band of marks.

10. Sustainability policies require the designer to consider the importance of material selection and product disposal.

Discuss the importance of this statement when developing new products. [30]

- (a) Material Selection and its importance.
- Specific material used in the manufacturing process.
 - Bulk buying
 - Selection process - linked to manufacturing and possible product disposal.
 - Aesthetic, product performance, functions and characteristics.
 - Moral and ethical issues.
 - Company / policy to use particular
- (b) Product disposal and its importance.
- Which processes were used to make the product?
 - Function and purpose of the product which affects disposal.
 - Different parts of the product and how do they work together.
 - Regulations within different countries.
 - Re-cycle plant available locally.

Sustainability is relevant to both areas.

Note: If only one of the above areas (material selection, product disposal) is included in the response the candidate may not be awarded the full range of marks.

11. Discuss how trends, styles and new technical capabilities have all influenced the design, production and sale of products.

[30]

- Fashion Trends – Development of wearable electronics.
- New Products – demand for use of up to date technology.
- Product Life Cycle and its effect on the market.
- Product Range: To suit a range of users.
- Technical advances in production techniques and materials technology.
- Faster and more efficient products.
- Technology push and pull to satisfy market trends and demands.
- Simple to use interfaces.
- Different finishes and colour ways.
- Material selection and style to suit male and female users.
- Planned obsolescence and life span of products before they are changed or updated.
- Introduction, growth, maturity, saturation and decline of products.
- New products are first exported to similar countries, countries with similar needs, preferences, and incomes.
- Product range with different features or unique selling points (USPs).
- Fad products can be accepted if justified and linked to the question.

Examples could be used within the response to exemplify points made.

Some candidates may also use diagrams to support their response.

END OF PAPER