



# **GCE MARKING SCHEME**

## **DESIGN & TECHNOLOGY AS/Advanced**

**JANUARY 2012**

## **INTRODUCTION**

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCE DESIGN & TECHNOLOGY – PRODUCT DESIGN. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were 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 conferences was to ensure that the marking schemes were 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' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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# DT1

## SECTION A

- Q.1 Product designers use CAD (Computer Aided Design) systems to model design proposals.**
- (a) Describe four advantages to the designer of using CAD modelling software. [4]
- (b) Describe four advantages to the manufacturer of using CAD modelling software. [4]

### **Advantages to the Designer:**

Descriptions of functions available to the designer such as editing, viewing different angles, animation, looking at layers (prior to sending it to manufacture), communicating the design electronically.

Accept references to 'flexible management systems' - FMS.

1 mark for each advantage.

### **Advantages to the Manufacturer:**

Provided to the manufacturer: assembly planning, preparing for manufacture, evaluating materials (through simulations), scale drawings produced.

1 mark for each advantage.

- Q.2 (a) Name and describe a finishing process that is applied to a named material being used in the manufacture of a specific product. [4]**
- (b) Describe two benefits that the finish brings to the product or components within the product. 2x[2]**

**Description of finishing techniques may be:**

**Produced during manufacture and by the manufacturer:**

- moulding in polymer
- fabric finish
- colour (anodised in aluminium)
- electroplating
- pressure treating timber.

Up to 4 marks for a clear description.

**Benefits of technique to the function of a product/components:**

**Answers may be based on:**

1. protection from the environment
2. fire protection.
3. providing grip on mouldings for anthropometric reasons
4. aesthetic reasons.

Two marks for each clear benefit.

- Q.3 (a) Outline two reasons why a named product is suitable for mass or high volume production. [2 x 2]**
- (b) Outline two different reasons why a different named product is suitable for batch production. [2 x 2]**

**Examples of reasons could be:**

- Mass production or high volume production is the production of large amounts of standardised products on production lines.
- Named products may contain several components e.g. screws, fittings.
- Product lends itself to assembly.

2 x 2 marks

**Examples of reasons could be:**

- Batch production is used to produce or process any product in groups that are called batches as opposed to a mass or continuous production process, or a one-off production.
- Named products may be fashion items, food based products produced in small runs, incremental improvements of products, testing the market, fluctuations in supply of materials, seasonal demands.

2 x 2 marks.

- Q.4 (a) State the purpose of a design specification. [2]**
- (b) Explain the relationship between a design specification and the process of evaluation when designing and making a product. [6]**

Purpose of a design specification:

*To guide designing (and manufacturing) through from the initial design stage.*

Responses may refer to primary and secondary specifications:

- to set goals
- set targets
- set out specific measurable criteria
- to create a hierarchy of design criteria - as an evaluation tool.

Up to 2 marks

The core of this question is the relationship between the design specification and the process of evaluation used throughout the process of designing and making.

Design specification – purpose and aim will look at function and the user, the market, methods of production and material options satisfy the needs of clients and establish clear parameters.

Process of evaluation – testing feasibility against specification at each stage of designing, end testing, opinions of the target audience and expert knowledge.

Critical points referring to quality control and quality assurance ensuring a successful design.

Credit can be given both to short points or an extended answer.

Up to 6 marks

**Q.5** Product designers could use strategies such as *inversion, disassembly, morphological analysis, analogy* and *lateral thinking* when solving design problems.

**Describe two of these strategies when used to design products.**

**2x[4]**

**Inversion** – *turning the problem around, looking at it in alternative ways.*

**Responses may refer to:**

- The act of inverting, or turning over or backward.
- A change by inverted order; a reversed position or arrangement of things.
- A movement by which the order in line is inverted, the right being on the left, the left on the right, and so on.
- A change in the order of the terms of a proportion, so that the second takes the place of the first, and the fourth of the third.

**Disassembly** – taking apart to analyse parts/components.

This can be an existing product or a product which has reached the end of its life.

**Responses may also refer to:**

- 'Active Disassembly' (AD) technology is a method of disassembling products into their separate components. Any singular or combination use of specifically engineered and/or Smart materials, adhesives, layers and parts, integral or discrete, play a key role within AD.
- AD offers clean, non-destructive, quick & efficient component separation.

**Morphological Analysis** – *a mechanistic way of analysing and developing from prepared lists.*

- Morphological analysis is a group of methods that share the same structure.
- This method breaks down a system, product or process into its essential sub-concepts.
- Every product is considered as a bundle of attributes.
- New ideas are found by searching the matrix for new combination of attributes that do not yet exist.
- It doesn't provide any specific guidelines for combining the parameters. It tends to provide a large number of ideas.

**Analogy** – *using a similar system to solve a problem.* (This could be a comparison in nature.)

- The use of analogy allows the problem solver to use previously used methods or strategies.
- Information in new problems.
- Making an analogy is drawing parallels between any two things, concepts, processes or Relationships - that way it becomes easier to understand things.
- Making an analogy is understanding a new idea in terms of ideas that we know from before.
- An analogy is based on an underlying similarity in things.

**Lateral Thinking** – *a different way of looking at things, opening out the thinking process.*

Is the ability to think creatively, or 'outside the box' to use inspiration and imagination to solve problems by looking at them from unexpected perspectives.

Lateral thinking involves discarding the obvious, leaving behind traditional modes of thought, and throwing away preconceptions.

**Techniques used:**

- Constructively challenge the status quo to enable new ideas to surface.
- Find and build on the concept behind an idea to create more ideas.
- Solve problems in ways that don't initially come to mind.
- Turn problems into opportunities.
- Select the best alternate ideas and implement them.

4 marks for each description.

**Q.6 Describe the essential features of a design process you have used to design and make products. [8]**

A description of the features from initial design brief to the completion of a design and make process. Responses need to refer clearly to a successful process utilised which may be structured into definitive steps or stages.

**Example sequence/stages may be based on the following:**

- Design brief– an early (often the beginning) statement of design goals.
- Analysis – analysis of current design goals.
- Research – investigating similar design solutions in the field or related topics.
- Specification – specifying requirements of a design solution for a product.
- Problem solving – conceptualizing and documenting design solutions.
- Detailed designing.
- Presentation – presenting design solutions.

**Design during production**

- Development – continuation and improvement of a designed solution.
- Testing –testing a designed solution.

**Post-production design feedback for future designs**

- Implementation – introducing the designed solution into the environment.
- Evaluation and conclusion – summary of process and results, including constructive criticism and suggestions for future improvements.

Up to 8 marks for a clear description and understanding of a process.

**Q.7** *Structural, aesthetic and functional characteristics* are important considerations when designing products.

**Explain each of these terms in relation to a named product or products. [8]**

Look for a specific named product (accept also one named product describing *structural characteristics, aesthetic characteristics* and one product describing *functional properties*).

Structural – strength and form of the material used within the product.

Aesthetic Properties – qualities, how it looks, image.

Functional Properties – product performance, how it operates.

Up to a total of 8 marks

**Q.8** The properties and characteristics of materials can be changed to suit the needs of the designer and manufacturer by the process of *combining or compositing*.

**(a) Name one material produced by each of the above processes. [2]**

**(b) Describe the improved properties and characteristics of each material which make it useful to the designer and manufacturer. 2x [3]**

Combining – Alloys, fabrics (polyester/cotton combinations).

Compositing – MDF, concrete.

1 mark for material

Total 2 marks

Particular properties and characteristics (from two materials).

2x3

Combining – numerous alloys produced to be lightweight, tensile strength.

Compositing – provides strength, reinforced to produce structures.

Improved properties and characteristics of the material should be based on specific descriptions relating to the material i.e.

- Strength to weight ratio.
- Strength in compression, tension or tensile strength.
- Strength across large surfaces.
- Flexibility.
- Moulding or shaping ability when related to manufacture.

Total 6 marks

## 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.

<b>Level 1</b> <b>0-10</b> <b>marks</b>	<ul style="list-style-type: none"> <li>• Candidate has a simplistic knowledge of the issues associated with the question.</li> <li>• The use of terminology and technical language is basic.</li> <li>• The candidate has little understanding of the general elements of industrial and commercial practices. Little knowledge of ICT in manufacturing systems.</li> <li>• The candidate has limited knowledge of the form and function of products.</li> <li>• The candidate will express ideas clearly, if not always fluently. Answers may deviate from the question or not be relevant.</li> <li>• Grammar, punctuation and spelling may be weak impacting on effective communication.</li> </ul>
<b>Level 2</b> <b>11-16</b> <b>marks</b>	<ul style="list-style-type: none"> <li>• The candidate has a basic understanding of the issues associated with the question.</li> <li>• The use terminology and technical language is variable.</li> <li>• The candidate understands the general elements of industrial and commercial practices related to manufacturing systems and some aspects of ICT in production.</li> <li>• 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.</li> <li>• The candidate will express straightforward ideas clearly, if not always fluently. Answers may deviate from the question or be weakly presented.</li> <li>• There may be some errors of grammar, punctuation and spelling but is still able to communicate the issues.</li> </ul>
<b>Level 3</b> <b>17-23</b> <b>marks</b>	<ul style="list-style-type: none"> <li>• The candidate demonstrates a clear understanding of the issues associated with the question.</li> <li>• The use terminology and technical language is reasonably accurate.</li> <li>• The candidate understands the general elements of industrial and commercial practices related to manufacturing systems and is aware of aspects of ICT in production.</li> <li>• 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.</li> <li>• The candidate will express moderately complex ideas clearly and fluently, through well linked sentences and paragraphs. Answers will be generally relevant and structured.</li> <li>• There may be occasional errors of grammar, punctuation and spelling.</li> </ul>
<b>Level 4</b> <b>24-30</b> <b>marks</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Uses correct terminology and technical language.</li> <li>• The candidate understands the main feature of industrial and commercial practices related to manufacturing systems including the use of ICT and stages of production.</li> <li>• 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.</li> <li>• 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.</li> <li>• There will be few, if any, errors of grammar, punctuation and spelling.</li> </ul>



**Q.9 Evaluating successful products and concern for ethical and social issues encourage designers to develop products that are effective and environmentally efficient.**

**Discuss the above statement in relation to named products.**

**Evaluation/assessment of products:**

**Look for responses that acknowledge:**

- the importance of assessing past products
- their effect on consumers, and a concern for ethical and social issues
- the environment.

**Concern for present day ethical issues:**

- what are these
- does the response refer to specific named products.

**Effective and environmentally efficient:**

- do designers and manufacturers attempt to address issues here
- does the response highlight specific areas/examples?

Look for reference to all the above areas in order to access the full range of marks.

**Responses will need to refer to:**

- specific products used in the response
- environmental, cultural and/or ethical/moral issues
- uses correct terminology and technical language – in design and technology terms
- the features of industrial and commercial practices
- manufacturing systems and stages of production in relation to environmental factors
- development of a detailed knowledge of the form and function of a product, trends and styles of products.

Answers need to cover all elements of the question, where aspects of the question are not described, mark up to level 3 only.

Answers need to be consistently relevant and structured – and expressed fluently to gain the higher band of marks.

30 marks

**Q.10 Developments in new materials and new technologies have an inevitable effect on the design and manufacture of products.**

**Evaluate the changes that have taken place in products resulting from these developments.**

**New Materials**

- Responses must refer to materials and their effect on the manufacturing process.
- How products have changed either over a short or longer period of time.
- How has the material enhanced the function of the product?

**New Technologies**

- Enhancing the choice of materials.
- New manufacturing methods used.

Look for reference to all the above areas in order to access the full range of marks.

**Responses will need to refer to:**

- How the product has been enhanced through using new or improved materials.
- Manufacturing methods and innovation.
- How the product has improved in its function.
- Improvements brought about through time, changes in style, tastes and people's needs.

30 marks

**Q.11 Innovation is the business of putting an invention in the market place and making it a success.**

**Discuss the above statement. Your answer should include reference to the roles of key people who ensure the success of products.**

Key people will include:

**1. Product Champion:**

Many products (and most of the very successful products) are driven by the vision of one person, or a small group of people - these are called 'product champions'. "Design champions drive the development of the product's function and its recognition internally and externally. Ready to play a major coordinating role between designers, production and marketing."

They have a vision for a product. They work with others around them to push that product out to the market. This new product can be an extension of existing products in an existing company. The vision may be bolder and push an existing company in a direction.

**2. Entrepreneur:**

These play a key role in any economy. They are the people who have the skills and initiative necessary to take good new ideas to market and make the right decisions to make the idea profitable. The reward for the risks taken is the potential economic profits the entrepreneur could earn.

**3. Lone inventor:**

The lone inventor will also fulfil the role of product champion and entrepreneur – a typical example may be Trevor Baylis's clockwork radio.

Look for reference to all the above areas in order to access the full range of marks.

**Responses will need to refer to:**

- Response demonstrates a specific ability to analyse the question, describing the role of a product champion and an entrepreneur in ensuring the success of a product or range of products.
- Reference to quality products in the market.
- An understanding of the main features of industrial and commercial practices.
- Development of a detailed knowledge of the form and function of a product, trends and styles of products.
- Environmental, cultural and/or ethical/moral issues are considered where appropriate.

30 marks

## DT3

### SECTION A

Answer **three** questions from this section.

This section is designed to demonstrate your **breadth** of knowledge in Product Design.

**Each question carries 8 marks.**

**Q.1 Identify FOUR reasons why a designer may have to incrementally develop an existing product. 4x[2]**

- Boost market sales
- Introduce new technology into an existing product
- Include aesthetic upgrades to a product
- Create sufficient profit from a high initial investment
- Extend the product life cycle
- Substitute more advanced materials
- To meet changing market needs/wants
- Meet changing environmental needs, e.g. energy saving features.

**Q.2 Describe the main stages in the product life cycle of a *fad* product. [8]**

- Fad product will have a steep curve after launch requiring a great deal of advertising and promotion. There could also be pre launch promotion so that peak sales can be achieved as soon as possible after the launch.
- The introduction stage as the product grows in the market here it is essential to maximise sales in a very short time because these sales are limited by market factors e.g. niche market, small target audience, short-term impact.
- There will be a relatively short period of maturity as sales will drop soon after they have reached their peak.
- Decline will then happen very soon after the maximum sales of the product have been achieved.

**Q.3 Explain the benefits that rapid prototyping can give a product designer when modelling a design idea. [8]**

- Speed of creating an accurate 3D prototype
- Part or components production
- Identifying design flaws
- Testing hypotheses – will a particular mechanism work
- Illustration when pitching the design to a client
- Test the market gathering opinions/data
- Enabling a shorter lead in time for the product to market
- Testing ergonomic features.

**Q.4 Identify the difference between consumer 'needs' and 'wants' when designing products. Give TWO examples of these features within a named product. [2x2] [4]**

- Needs are essential features that have to be included if a product is to work successfully, e.g. the cyclone technology that differentiated the product from its competitors.
- Wants are supplementary features which could be included as enhancing features. e.g. aesthetic detailing in terms of the colour coding of parts of the Dyson cleaners.

**Q.5 Describe how the use of jigs and fixtures within manufacturing serve to improve aspects of production. [8]**

A **jig** is a type of tool used to control the location and/or motion of another tool. A jig's primary purpose is to provide repeatability, accuracy, and interchangeability in the manufacturing of products.

A jig is often confused with a fixture; a **fixture holds** the work in a fixed location. A device that does both functions (holding the work and guiding a tool) is called a jig.

An example of a jig is when a key is duplicated; the original is used as a jig so the new key can have the same path as the old one. Since the advent of automation and computer numerical controlled (CNC) machines, jigs are often not required because the tool path is digitally programmed and stored in memory.

Jigs may be made for reforming plastics.

Jigs or templates have been known long before the industrial age. There are many types of jigs, and each one is custom-tailored to do a specific job. Many jigs are created because there is a necessity to do so by the tradesmen. Some are to increase productivity, to do repetitious activities and to do a job more precisely.

## SECTION B

Answer **three** questions from this section.

This section is designed to demonstrate your **breadth** of knowledge in Product Design.

**Each question carries 8 marks.**

- Q.6 Describe TWO examples of Primary Specification Criteria and TWO examples of Secondary Specification Criteria for a specific named product. 2x[4]**

Primary specification criteria are aspects of a product that must be in place for it to function successfully e.g. the pedals on a cycle, the gears, the brakes etc.

Secondary specification criteria refer to aspects that are less important to the function and safety of the product, e.g. frame colour, fork suspension, range of gears.

Up to four marks if they don't mention a specific product.

- Q.7 Explain FOUR ergonomic considerations that have been successfully applied to a particular named product. 4x[2]**

One mark for identifying the consideration and a further mark for reason, example or justification of the need for the ergonomic consideration.

e.g. The height of the handle on a Dyson vacuum cleaner.

No marks for anthropometric considerations without reference to the ergonomic consideration.

- Q.8 Outline FOUR sustainability issues, when designing products that can bring about the conservation of raw materials. 4x[2]**

Issues relating to the use of less material e.g. veneers instead of solid wood.

Using timber from managed plantations.

Using recyclable plastics instead of metals.

Using fewer components in a product.

Extending the product's life span.

Can be designed so that there's is provision for servicing and repair.

- Q.9 Describe in detail how a product qualifies for a patent and describe the features of the Intellectual Property that are applied to protects a specific named product. [8]**

### **Patents.**

Full description of patent requirements

An invention is patentable only if it is:

- (a) new and previously undisclosed;
- (b) distinguished by an inventive step;
- (c) capable of industrial application (that it could actually be made).

It gives monopoly rights to the exclusive use of an invention.

Can last up to a maximum of 20 years if annual renewal fees are paid.

Becomes a property that can be bought, sold, hired or licensed.

- Q.10 Outline FOUR reasons why a manufacturer would choose batch production over high volume production. 4x[2]**

Intermittent sales predictions, product incremental improvements, market trends and fluctuating demand, reacting to JIT manufacturing, etc.

## SECTION C

Section C 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:

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- 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.

<b>Level 1 0-9</b>	<ul style="list-style-type: none"> <li>• Candidate has a simplistic knowledge of the issues associated with the question.</li> <li>• The use of terminology and technical language is basic.</li> <li>• The candidate has little understanding of the general elements of industrial and commercial practices, with little knowledge of ICT in manufacturing systems if appropriate to the question.</li> <li>• The candidate has limited knowledge of the form and function of products.</li> <li>• The candidate will express ideas clearly, if not always fluently. Answers may deviate from the question or not be relevant.</li> <li>• Grammar, punctuation and spelling may be weak impacting on effective communication.</li> </ul>
<b>Level 2 10-14</b>	<ul style="list-style-type: none"> <li>• The candidate has a basic understanding of the issues associated with the question.</li> <li>• The use terminology and technical language is variable.</li> <li>• The candidate understands the general elements of industrial and commercial practices related to manufacturing systems and some aspects of ICT in production.</li> <li>• 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. These aspects are not always considered.</li> <li>• The candidate will express straightforward ideas clearly, if not always fluently. Answers may deviate from the question or be weakly presented.</li> <li>• There may be some errors of grammar, punctuation and spelling but is still able to communicate the issues.</li> </ul>
<b>Level 3 15- 20</b>	<ul style="list-style-type: none"> <li>• The candidate demonstrates a clear understanding of the issues associated with the question.</li> <li>• The use terminology and technical language is reasonably accurate.</li> <li>• The candidate understands the general elements of industrial and commercial practices related to manufacturing systems and is aware of aspects of ICT in production.</li> <li>• The candidate has demonstrated a knowledge of the form and function of a product, trends and styles of products reflecting environmental, cultural and/or ethical /moral issues. These aspects are considered.</li> <li>• The candidate will express moderately complex ideas clearly and fluently, through well linked sentences and paragraphs. Answers will be generally relevant and structured.</li> <li>• There may be occasional errors of grammar, punctuation and spelling.</li> </ul>
<b>Level 4 21-26</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Uses correct terminology and technical language.</li> <li>• The candidate understands the main feature of industrial and commercial practices related to manufacturing systems including the use of ICT and stages of production.</li> <li>• 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. These aspects are considered where appropriate.</li> <li>• 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.</li> <li>• There will be few, if any, errors of grammar, punctuation and spelling.</li> </ul>

## SECTION C

Answer **two** questions from this section.

Your answer should be substantial and show the **depth** of your knowledge in Product Design

**Each question carries 26 marks.**

- Q.11 Explain the underlying design philosophy that has been the signature of a particular designer and describe the impact of some of the products that he/she has designed. [26]**

For example, Dieter Rams ten principles of good design and the impact on Braun goods, James Dyson's cyclone and colour coded points of the products user interfaces and his impact on the many manufacturers of vacuum cleaners, etc.

- Q.12 Describe the features and function of a product design icon that you admire and fully explain the reasons why it is considered to be iconic in its design genre (category). [26]**

Appropriate identification of a design icon including a detailed description of the features and function that makes the product a success and a full description in the form of an essay detailing the reasons for achieving its status.

- Q.13 "We live in a world of materials; it is materials that give substance to everything we see and touch"**

*Ashby and Johnson Materials and Design Elsevier 2002*

**Explain how selecting appropriate materials can accentuate the visual and tactile elements within products [26]**

Candidates must give reasons for selecting particular materials which are able to accentuate visual elements within products and the processes by which those materials are shaped or formed. Examples of any products may be given to highlight or explain aspects of material selection.

**Q.14 Product designers will often use a 'toolbox' containing various strategies for creative thinking such as brainstorming.**

**Describe in detail AND evaluate TWO other creative thinking strategies. [26]**

**Candidates could explain any two of the following creative thinking techniques but they must be included in an essay.**

### **Brainwriting**

**6-3-5 Brainwritings** (also known as the 6-3-5 Method, or Method 635) is a group creativity technique used in marketing, advertising, design, writing and product development originally developed by Professor Bernd Rohrbach in 1968.

Based on the concept of brainstorming, the aim of 6-3-5 Brainwriting is to generate 108 new ideas in half an hour. In a similar way to brainstorming, it is not the quality of ideas that matters but the quantity.

The technique involves 6 participants who sit in a group and are supervised by a moderator. Each participant thinks up 3 ideas every 5 minutes. Participants are encouraged to draw on others' ideas for inspiration, thus stimulating the creative process. After 6 rounds in 30 minutes the group has thought up a total of 108 ideas.

### **Problem abstraction**

This technique sets about to reduce problems to their most basic elements and then set problem goals and boundaries. All notions or statements are continually interrogated until the eventual goal is reached.

The value of this process is that by exploring issues a new set of potential solutions may be reached.

### **SCAMPER**

The SCAMPER technique uses a set of directed questions which you answer about your probortunity in order to come up with new ideas. The stimulus comes from forcing yourself to answer questions which you would not normally pose. The questions direct you to thinking about a probortunity in ways which typically come up with new ideas.

Because of the difficulty in determining the difference between a problem and an opportunity and because there are many negative implications in using the word "problem", the word **probortunity** has been created. Probortunity is the merging of the word "problem" and "opportunity".

A probortunity can take any form: challenge, question, mystery, concern, problem, puzzle, difficulty or opportunity. Probortunity is an all-inclusive word to describe something you want to improve or change for the better.

**SCAMPER** is an acronym which stands for questions relating to the following:

**S = Substitute:** Think about substituting part of your product/process for something else. By looking for something to substitute you can often come up with new ideas.

**C = Combine:** Think about combining two or more parts of your probortunity to achieve a different product/process or to enhance synergy.

**A = Adapt:** Think about which parts of the product/process could be adapted to remove the probortunity or think how you could change the nature of the product/process.



M= Modify: Think about changing part or all of the current situation, or to distort it in an unusual way. By forcing yourself to come up with new ways of working, you are often prompted into an alternative product/process.

P= Purposes: Think of how you might be able to put your current solution/product/process to other purposes, or think of what you could reuse from somewhere else in order to solve your own probortunity. You might think of another way of solving your own probortunity or finding another market for your product.

E= Eliminate: Think of what might happen if you eliminated various parts of the product/process/probortunity and consider what you might do in that situation. This often leads you to consider different ways of tackling the probortunity.

R= Rearrange or reverse: Think of what you would do if part of your probortunity/product/process worked in reverse or done in a different order. What would you do if you had to do it in reverse? You can use this to see your probortunity from different angles and come up with new ideas.

### **Morphological analysis**

Define the problem; identify the objective of the creative session, defining the problem in a short and clear statement.

Identify attributes and values; List the things about the situation that can be varied or changed in some way. Select a subset of two to six variables to investigate further. These will normally be significant parts of the situation. For each of the variables from step 3, list possible values they may have, including those away from the conventional values (you can be creative at this step too).

Combing items find a way of combining items from the lists you have created. If there are only two lists, then a matrix may be used as in the example below. Another way is to have six variables in each list and throw one die per list to select items to combine. You could also write them on cards and pick them from six 'hats' (the methods are as many as you can imagine).

Repeatedly combine selections of ideas generated, forcing all items together to build a creative solution. Do not worry too much at this time if the ideas are not particularly feasible as they may be developed at a later stage or used to trigger other creative possibilities.

Select ideas to use or develop into practical solutions to your problem.

**Q.15 “Enjoy failure and learn from it. You can never learn from success.”**

**James Dyson**

**Describe how this philosophy relates to designing successful products. [26]**

Candidates may give examples from designers' biographies - James Dyson, Thomas Eddison - or examples from their own experiences as to how learning is truly understood by making even if failure becomes part of the learning process.



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