



GCE MARKING SCHEME

DESIGN & TECHNOLOGY AS/Advanced

SUMMER 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCE DESIGN & TECHNOLOGY. 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 - PRODUCT DESIGN

SECTION A

Q.1 Describe two key properties of a named natural material and two key properties of a synthetic material. 2x[2] marks

Identify a specific product where one of these materials has been used and explain why the material was chosen. 4 marks

Description of specific property of the chosen material.
1 mark for each property within each category.

Natural materials – ‘obtained or made from living things’.

Examples include cotton, paper, silk and wool, gold, silver, latex, cottons, natural cellulose.

Silk is the strongest natural textile fibre but loses some of this strength when wet.

The high tensile strength of silk is due to the many bonds in its construction, and when stretched the force is applied to these numerous bonds and they do not break.

Synthetic materials – ‘made from chemicals’.

Examples include nylon, polyester, polyurethanes, acrylic, polyester mix textiles, synthetic fibres, cement, and concrete.

The mechanical properties of nylon include high strength-to-weight ratio, high breaking elongation and excellent recovery from deformation.

Nylon’s properties, when used in carpet manufacture appearance retention, because of abrasion resistance; texture retention; recovery from crushing; durability; and dye fastness.

Identification of specific product, **material** and **why** the material was chosen.

Note: Natural material definition and synthetic material definition.

Not composites, alloys.

1st part – Do not accept generic terms for materials (plastic, woods, metals etc)
Property can be mechanical (hardness, ductility, plasticity etc) chemical (corrosion), thermal, electrical.

1 mark or each property – total 4.

2nd part – One product named 1 mark..... reasons **why** the material was used 3 marks.

4 marks

Q.2 **Quantitative and qualitative testing are important aspects to consider when selecting a material or materials for a specific product.**

Explain what you understand by each of these terms.

2 x [4] marks

Quantitative testing is objective, measurable criteria, which can be assessed against specific performance measurable objectives.

Marks allocated with a full description with any of the following examples up to a maximum of 4 marks:

- The material must weigh no more than
- The material used must be light enough to
- Other examples related to material hardness, malleability, ductility. **4 marks**

Qualitative testing will reflect the intended quality of certain defined aspects of a material's specification. It is a more subjective form of criteria.

Marks allocated with a full description with any of the following examples up to a maximum of 4 marks:

- The material must be aesthetically pleasing.
- Material used must be recyclable.
- The material must be bright. **4 marks**

Q.3 **A production plan consists of important stages in the manufacture of a product.**

Describe four main elements of a production plan for a product of your choice.

4x [2] marks

Look for the important elements within the production plan and a breakdown of the whole process into sections or activities.

The 4 major elements to include:

- A specification for manufacturing the product.
- Use of detailed drawings/computer aided design (CAD).
- Working out the schedule for making.
- The tools to be used.
- Time for each operation.
- Safety and quality checks.
- The cost of production and profit.
- Setting targets and deadlines.

Two marks allocated within each element

4x [2] marks

Q.4 Design specifications are used by designers to identify key criteria in the development of new products.

- (a) Describe the important features of a design specification. **2 marks**
- (b) For a named product, list three primary specification criteria and three secondary specification criteria. **2 x [3] marks**

Design Specification – A product design specification is a statement of what a not-yet-designed product is intended to do. Its aim is to ensure that the subsequent design and development of a product meets the needs of the user. The aim of the product, how is it to achieve its purpose, the target market, ergonomic factors, appearance and finish – aesthetic considerations.

Primary (the key essential elements)

Product: Reading Lamp

1. The material selected must be from a sustainable source and display this information to the consumer.
2. The weight of the unit must not exceed a total weight of 2kg.
3. The individual components must be easily removed for replacement purposes.

Secondary (the additional elements or features)

1. The unit is available in a range of colours.
2. The unit will include a range of different materials in its construction.
3. The unit can be used in a variety of environments.

Responses may also refer to manufacturing specification (for a named product) – quality and safety, quantity to manufacture (will affect any tooling or moulding requirements).

Q.5 The design and manufacture of products can involve the use of ICT. Illustrate how ICT is used for *research, modelling, prototyping* and *manufacturing*.

4x [2] marks

- (a) **Research**
Using the internet, specific search engines, and collation of data in research to aid designing.
- (b) **Modelling**
Compute aided modelling and using specific programmes to produced models. Communication of modelled ideas via the web to other locations.
- (c) **Prototyping**
The use of rapid prototyping machines and how this benefits the whole process before manufacture.
- (d) **Manufacturing**
The use of CAD and CAM systems during manufacturing. The use of computers to control and production line and monitor progress.

2 marks for each description

Q.6 Bought-in or standardised part-assembled components are used by manufacturers in the production of products.

(i) Explain what is meant by bought-in or standardised part-assembled components. 4 marks

(ii) State two advantages to the manufacturer of using bought-in or standardised part-assembled components. 2x[2] marks

(a) 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

- 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

Q.7 Describe the features and benefits of the following Intellectual Property rights to the owner.

(a) Copyright 4 marks

(b) Registered Trade Mark 4 marks

Features and benefits Copyright 4 marks

1. Literary works, including novels, instruction manuals, computer programs, song lyrics, newspaper articles and some types of database.
2. Dramatic works, including dance or mime.
3. Musical works.
4. Artistic works, including paintings, engravings, photographs, sculptures, collages, architecture, technical drawings, diagrams, maps and logos.
5. Layouts or typographical arrangements used to publish a work, for a book for instance.
6. Recordings of a work, including sound and film.
7. Broadcasts of a work.

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, that 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.

Q.8 Concurrent engineering is a process used in the manufacture of products.

(a) Explain what you understand by concurrent engineering. 4 marks

(b) State two advantages of concurrent engineering to the designer and manufacturer. 2x [2] marks

1. Concurrent Engineering is a systematic approach to the integrated, concurrent design of products and their related processes.
2. This includes manufacturing and support and is intended to cause the developers from the very outset to consider all elements of the product life cycle, from conception to disposal, including cost, schedule, quality and user requirements.
3. It is different than the traditional product development approach in that it employs simultaneous, to rather than sequential processes.

Up to 4 marks for explanation

Advantages

- Completing tasks in parallel, product development can be accomplished more efficiently and at a substantial cost savings.
- Rather than completing all physical manufacturing of a prototype prior to performing any testing, concurrent engineering allows for design and analysis to occur at the same time, and multiple times, prior to actual deployment.
- Multidisciplinary approach emphasizes teamwork through and it allows for employees to work collaboratively on all aspects of a project from start to finish.

2 marks for each advantage described

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.

Level 1 0-10 marks	<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
Level 2 11-16 marks	<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 17-23 marks</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 24-30 marks</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.

SECTION C

Q.9 Design can be described as a process of change and increasingly has to meet environmental and technological challenges.

In relation to a product you have used, discuss how the designer has addressed environmental and technological challenges.

How the designer has addressed, through a process of change:

Environmental concerns:

- Planning for product disposal.
- Using suitable materials within the product.
- Raising disposal awareness with consumers.
- Local Legislation.
- Moral issues.

Technological challenges:

- Use of new materials.
- Lean manufacturing systems.
- New inventions and new technological concepts i.e. solar pv development.
- Low emissions.

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.

30 marks

Q.10 Developments in both modern materials and components have influenced the design of products with benefits for the designer, manufacturer and consumer.

Discuss these developments and benefits in relation to named products.

Developments in modern materials and components will include:

- A range of composites.
- Polymers.
- Blended textiles.
- Smart materials.
- Nano technology.

Materials will influence the designer and provide benefits to the manufacturer and consumer:

Designer around:

1. Designer – use of materials will provide new opportunities to form, shape, and colour the new product. New material properties will allow for good strength to weight ratios, lightness and strength and a range of new characteristics for specific uses.
2. Manufacturer – new *multi functional* product manufacturing. Modern materials that may be easier to manufacture in bulk. Less material may be required (yet providing the same qualities and characteristics as previous materials used).
3. Consumer – general range of products available, products with a range of functions available, miniaturisation. Lighter and tougher materials become available increasing performance *i.e. in sport gear and equipment.*

30 marks

11. With reference to a particular product or products, describe the process of quality control and discuss its importance to the manufacturer, consumer and the environment.

Quality Control – description and importance of the process to:

Checks at points for accuracy and safety of product or component – so that it meets consumer and environmental expectations.

Manufacturer:

Quality control methods: dimensional accuracy (tolerances), dimensional accuracy may be checked with a gauge or measuring tool (micrometer, vernier etc). quality of materials (visual marks or blemishes) appearance and finish, durability. The use of CAD/CAM ensuring quality.

Candidates may refer to checks made on production machinery rather than a test on the product itself.

Care is needed here as machinery settings would normally be seen as part of quality assurance so should not be credited here which specifically addresses quality control.

Candidates may refer to packaging systems for products, and their implications for the manufacturer.

Consumer

Important to the consumer because of confidence in the product or manufacturer, aspects of safety important to the consumer, health aspects.

The Environment

Efficiency, producing little waste/emissions, recycling possibilities, consumer safety.

The above responses may be linked within responses (if two areas only are discussed credit a maximum of 23 marks).

30 marks

DT1 - FOOD TECHNOLOGY

SECTION A

Answer **five** questions from this section.

This section is designed to demonstrate your **breadth** of knowledge in Food Technology.

Each question carries 8 marks.

- Q.1 (a) Describe two key properties of sugar and two key properties of fats. 2 x [2]**

Responses could include physical, chemical and nutritional properties.

Responses should *describe* two properties. Award maximum of one mark for simply stating two properties e.g. caramelisation, aeration without any form of description.

Sugar – candidates could give a short explanation of any of the following properties: caramelisation, moisture retention, preservation, aeration, nutritional properties (carbohydrate). Provide energy.

Fats – candidates could give a short explanation of any of the following properties: shortening, plasticity, lubrication, binding, aeration, emulsification, nutritional properties (energy, fat soluble vitamins including omega 3/6).

Accept answers on oils.

Do not credit answers discussing body fat.

- (b) Identify a specific product where one of these materials has been used and explain why the material was chosen. [4]**

Award up to 4 marks for an explanation of the use of the material, possibly in terms of cost, aesthetic, organoleptic, nutritional, functional characteristics etc. Responses must relate to a specific product.

Q.2 Quantitative and qualitative testing are important aspects to consider when selecting a material or materials for a specific food product.

Explain what you understand by each of these terms.

2 x [4]

Quantitative tests are objective; they use measurable criteria, which can be assessed against specific performance measurable objectives.

Marks allocated with a full description with any of the following examples up to a maximum of 4 marks.

Examples:

- The food material must contain no more than x g fat.
- The food material must cost no more than
- The food material must be sourced within 20 kilometres.
- Related to nutritional values, cost etc.

4 marks

Qualitative testing will reflect the intended quality of certain defined aspects of a material's specification. They are a more subjective form of criteria; they will be based on an individual's opinion / perception. Often they will be sensory / organoleptic factors. Often qualitative testing is done in tasting sessions.

Marks allocated with a full description with any of the following examples up to a maximum of 4 marks.

Examples:

- The food material must be red in colour.
- The main food material used must be organic.
- The material must have a soft texture.

4 marks

Q.3 (a) Outline the main functions of protein within the diet. [3]

Proteins are the building blocks of life. Every cell in the human body contains protein. It is the major component of the skin, muscles, organs, glands, blood etc. It is needed to repair cells and to make new one. It is needed for growth and development in childhood, adolescence and pregnancy. Any excess used to provide energy.

Award maximum of **two** marks for 'growth, repair and energy'.
Award maximum of **one** mark for 'growth and repair'.

(b) Explain what you understand by the term 'biological value'. [5]

Award up to **five** marks for clear explanation of the term.

Proteins are made up of amino-acids. Indispensable (previously known as essential) amino-acids cannot be made by the body. Dispensable (previously known as non-essential) amino-acids can be made by the body from excess amounts of other amino-acids. Individual vegetable proteins such as cereals, nuts, seeds, potatoes and pulses do not contain all of the indispensable amino-acids needed by humans, so are said to have a low biological value. Most animal proteins such as meat, fish, eggs and dairy, contain all of the indispensable amino-acids needed by humans so are said to have a high biological value. In order to obtain all of the essential amino-acids from a diet based on vegetable proteins it is essential to have a mixture of different vegetable proteins in order to obtain the different indispensable amino-acids from different foods.

Q.4 A production plan consists of important stages in the manufacture of a food product.

Describe *four* main elements of a production plan for a food product of your choice.

4 x [2]

Look for the important elements within the production plan and breakdown the whole process into sections or activities. Responses may be either Food Technology Room based or industry based.

The **four** major elements to include:

- A specification for manufacturing the product
- Use of detailed drawings
- Working out the schedule for making
- The tools to be used
- Time for each operation
- Sourcing / supply of food materials
- Safety and quality checks
- The cost of production and profit
- Setting targets and deadlines.

Two marks allocated within each element.

4x [2] marks

Q.5 Rotary moulding, sheeting and extrusion are all methods of forming or shaping foods.

Describe in detail two of these methods.

2 x [4]

Award up to **four** marks for a description of **each** of two methods.

Rotary moulding. The dough to be moulded is fed into the hopper and a forcing roller forces the dough into the cavities of the metal moulding roller, uniformly engraved and coated with Teflon. Excess dough is cleared with a knife, to ensure uniform filling. An adjustable rubber roller presses it uniformly against the moulding roller for perfect transfer of moulded pieces from the moulding roller on to the web. The speed of the forcing roller can be altered to alter the density of dough forced in to the moulding cavity. Used to make soft dough cookies and sweet varieties of biscuits. Very accurate, can process large amounts, versatile as die can be changed.

Sheeter. The sheet of biscuit dough is fed via gauge rollers to the cutting apparatus. It is automatically adjusted to compensate for variations in the thickness of the sheet emerging from the gauge rollers. Used to convert lumps of dough into a uniform sheet - especially for hard dough biscuits. The rotary sheeter can be used to extrude all types of portioned doughs, fats, toppings and batter and can extrude continuous sheets of product on to make-up lines. The filler transports the product gently and without crushing or smearing. It extrudes smooth, uniform sheets of fats or dough with consistent thickness and width.

Extrusion - a material is pushed or drawn through a die of the desired cross-section (able to create very complex cross-sections). The extrusion process can be done with the material hot or cold. Products such as certain pastas, many breakfast cereals and ready-to-eat snacks are mostly manufactured by extrusion. Raw materials are first ground to the correct particle size (usually the consistency of coarse flour). The dry mix is passed through a pre-conditioner, where other ingredients are added then steam is injected to start the cooking process. The preconditioned mix is then passed through an extruder, and then forced through a die where it is cut to the desired length.

Q.6 Design specifications are used by designers to identify key criteria in the development of new food products.

(a) Describe the important features of a design specification. [2]

A design specification is a statement of what a not-yet-designed food product is intended to do. Its aim is to ensure that the subsequent design and development of a food product meets the needs of the user. The aims of the food product, how is it to achieve its purpose, the target market, nutritional factors, appearance and finish (aesthetic considerations) etc. A specification may have a hierarchy. Some criteria will be measurable.

Award only **one** mark for stating that specification can be divided into essential and desirable criteria, unless expanded.

(b) For a named food product, list three primary specification criteria and three secondary specification criteria. 2 x [3]

Award **one** mark for **each** of three primary specification points and **one** mark for **each** of three secondary specification points. Must be defined criteria; award maximum of **one** mark for more general points e.g. size, shape, colour would gain only one mark.

Primary - the key essential elements - the most important or essential features a product should have.

Secondary - the additional elements or features - desirable features but not crucial to the success of the product.

Candidates' examples must be appropriate to their named food product.

For example, a design specification could have the following primary specification points:

- be a single portion serving, weighing approximately 125g;
- contain no more than 20g total fat;
- have food costs of no more than £2.20.

And the following secondary specification points:

- include a locally produced food as the main food material;
- include hand-made pasta;
- be suitable for vegetarians.

Award maximum of **two** marks for specification points based on packaging for food rather than an actual food product i.e. **one** mark for an appropriate primary specification point for packaging and **one** mark for an appropriate secondary specification point for packaging.

Q.7 Describe the features and benefits of the following Intellectual Property rights to the owner.

(a) Copyright. [4]

(b) Registered Trade Mark [4]

Features and benefits Copyright

Covers 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.

Another person should only copy or use a work protected by copyright with the copyright owner's permission.

Copyright does not protect ideas for a work. It is only when the work itself is fixed, for example in writing, that copyright automatically protects it - you do not have to apply for copyright.

Covers a period of 10 years.

Breach of copyright can lead to legal prosecutions.

The most common use of copyright regarding food products would be for packaging, including use of images / photographs / information. It would also apply to information on websites as well as company databases or advertisements.

Features and benefits: Trade Mark

- 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. Includes specified colour e.g. Cadbury's purple.
- Registered for 10 years and can be renewed every 10 years indefinitely.
- Celebrity chefs can trademark their own name and that of their restaurant. Can be used to market services and products.
- Brand identity very important with food products – consumer association with quality etc.

Examples: KitKat, "Twinings", 3 Bird logo on custard powder also the 3 stripes Red Yellow Blue. The Crossed Grain Symbol registered by Coeliac UK.

Q.8 The design and manufacture of food products can involve the use of ICT.

Illustrate how ICT is used for research, modelling, prototyping and manufacturing. 4 x [2]

Research – use of internet, search engines, surveys, questionnaires, collation of data in research;

Modelling – computer aided modelling, nutritional analysis, spreadsheets to calculate costings;

Prototyping – use of software packaging for packaging prototypes; evaluating data from sensory analysis;

Manufacturing – use of CAD / CAM systems, data logging.

Look for responses that relate to their contributions 2 marks for each description

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.

Level 1 0-10	<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
Level 2 11-16	<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 ethica/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 17-23 marks</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 24-30 marks</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.

SECTION C

Answer **one** question from this section.

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

Each question carries 30 marks.

Q.9 Design can be described as a process of change and increasingly has to meet environmental and technological challenges.

In relation to a food product or range of food products you have used, discuss how the food technologist has addressed environmental and technological challenges.

[30]

How the designer has addressed these, through a process of change:

Environmental concerns

- Planning for product disposal e.g. recyclable / biodegradable packaging.
- Carbon footprint of the product; some companies now display CO₂ emissions on packaging.
- Using suitable materials within the product e.g. locally sourced food materials (food miles), GM free, organic.
- Raising disposal awareness with consumers e.g. minimal packaging, symbols on packaging to encourage recycling.
- Changing shape of package to reduce waste material e.g. circular tubs instead of square ones.
- Changing fishing methods to be more sustainable e.g. line caught.
- Food waste; food poverty.

Technological challenges

- Use of new materials e.g. GM, smart foods.
- Lean manufacturing systems, efficient use of water etc.
- New inventions and new technological concepts.

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.

30 marks

Q.10 Developments in modern food materials have influenced the design of food products with benefits for the designer, manufacturer and consumer.

Discuss these developments and benefits in relation to named food products.

[30]

Developments in modern materials and components will include:

- Foods with a novel molecular structure e.g. modified starches, fat replacers and sweeteners.
- Functional foods e.g. cholesterol-lowering spreads, probiotics, fortified eggs.
- Meat analogues e.g. Textured Vegetable Protein.
- Encapsulation technology e.g. encapsulated flavours in confectionery.
- Modern biotechnology – Genetically modification e.g. soya bean, tomato plant, particular enzymes.
- Fortified foods.
- GM foods.

Materials will influence the designer and provide benefits to the manufacturer and consumer:

- Designer / manufacturer – use of materials will provide new opportunities to form, shape, and achieve particular textures, flavours, nutritional profiles etc. Premium pricing e.g. nutraceuticals.
- Consumer – wider range of products available with different textures, shapes etc. Products with a range of functions available e.g. nutraceuticals.

30 marks

Q.11 With reference to a particular food product or products, describe the process of quality control and discuss its importance to the manufacturer, consumer and the environment. [30]

Quality Control – description and importance of the process to:

Checks at points for accuracy and safety of food product – so that it meets consumer and environmental expectations. Candidates may make reference to HACCP systems.

Manufacturer:

Quality control methods: dimensional accuracy (tolerances), quality of materials (visual marks or blemishes) appearance and finish. The use of CAD/CAM ensuring quality.

Candidates may refer to checks made on production machinery rather than a test on the product itself. Care is needed here as machinery settings would normally be seen as part of quality assurance so should not be credited here which specifically addresses quality control.

Candidates may refer to packaging for food products, and their implications for the manufacturer.

Importance to manufacturer may include:

- To build/maintain reputation of manufacturer and to elicit brand loyalty; create positive image to customer.
- To offer consistent product to customer.
- To fulfil legal obligations.
- Food safety.
- To reduce waste, reduce costs, increase profits.
- To maintain records; to be able to refer back to logged data, if required.

Consumer

Important to the consumer because of confidence in the product or manufacturer, aspects of safety important to the consumer, health aspects. Consumers expect consistent products time and time again.

The Environment

Efficiency, producing little waste/emissions, recycling possibilities, consumer safety,

The above responses may be linked within responses (if two areas only are discussed credit a maximum of 23 marks

30 marks

DT1 - SYSTEMS & CONTROL

SECTION A

Q.1 Describe two key properties of a named conductive material and two key properties of a named dielectric material. 2 x [2]

Identify a specific product where one of these materials has been used and explain why the material was chosen. [4]

Description of specific property of the chosen material.

I mark for each property (can be mechanical, chemical, electrical, etc.) within each category.

Conductive material – an electric current can pass through used as an electrical conductor.

Examples include gold, silver, copper, aluminium.

Gold is a very good conductor of electricity and does not tarnish.

Gold used in computer and audio connectors due to its conductivity at high frequencies and the contacts between components do not tarnish causing resistance.

Dielectric materials – ‘an electrical insulator that can be polarized by an electric charge’.

Examples include polyester, paper, air, mica, aluminium oxide and ceramic.

The electrical properties of aluminium oxide include low dielectric loss (energy lost as heat), high dielectric constant, high dielectric breakdown voltage.

Aluminium oxide is used in capacitors as its high dielectric constant enables high value capacitors to be produce with a small physical size.

Identification of specific product, material and why the material was chosen 4 marks

Q.2 Modelling of control systems during designing is an important stage before manufacture.

Describe two methods of modelling a control system during the designing stage and explain why you would use them. 2 x [4]

The response must describe and demonstrate understanding of the two modelling techniques to enable test of potential ideas.

- Bread board modelling – using electronic, pneumatic or mechanical bread boarding to test functionality of system, assemble circuits without soldering, easy to disassemble.
- CAD Modelling – used to simulate and test a particular electronic, pneumatic or mechanical system using suitable software. Can be sent directly (digitally to clients) to other locations across the world, does not require the purchase of the components, no damage to components.
- Prototype or strip board used to construct electronic circuit without the need to make a printed circuit board.

Description of test method and reason up to 4 marks each.

Q.3 A production plan consists of important stages in the manufacture of a product.

Describe *four* main elements of a production plan for a product of your choice.
4x [2]

Look for the important elements within the production plan and a breakdown of the whole process into sections or activities.

The **four** major elements from:

- A specification for manufacturing the product – use of Gantt charts or/and flow charts.
- Use of detailed drawings/computer aided design (CAD) in order to provide information during manufacture.
- Working out the schedule for making with the use of charts.
- The tools and equipment to be used at each stage of manufacture.
- The time allocation for each operation.
- Safety and quality checks at each stage of production.
- The cost of production and setting up of machines and equipment.
- Setting targets and deadlines for short runs and high volume production.

Two marks allocated within each element

4x [2] Marks

Q.4 Design specifications are used by designers to identify key criteria in the development of new products.

(a) Describe the important features of a design specification. [2]

Design Specification – A product design specification is a statement of what a not-yet-designed product is intended to do. Its aim is to ensure that the subsequent design and development of a product meets the needs of the user. The aim of the product, how is it to achieve its purpose, the target market, ergonomic factors, appearance and finish – aesthetic considerations.

2 marks

(b) For a named product, list three primary specification criteria and three secondary specification criteria. 2 x [3]

Primary (the key essential elements) included in the specification.

Product: Reading Lamp

1. *The material selected must be from a sustainable source and display this information to the consumer.*
2. *The weight of the unit must not exceed a total weight of 2kg.*
3. *The individual components must be easily removed for replacement purposes.*

Secondary (the additional elements or features) included in the specification.

1. *The unit is available in a range of colours.*
2. *The unit will include a range of different materials in its construction.*
3. *The unit can be used in a variety of environments.*

Up to 3 marks for each area

Note: Responses may also refer to manufacturing specification (for a named product) – quality and safety, quantity to manufacture (will affect any tooling or moulding requirements).

Q.5 The design and manufacture of products can involve the use of ICT.

Explain how ICT is used for *research, modelling, prototyping* and *manufacturing*.

4x [2]

- (a) Research**
Using the internet, specific search engines, and collation of data in research to aid designing.
- (b) Modelling**
Computer aided modelling and using specific programmes to produce models. Communication of modelled ideas via the web to other locations.
- (c) Prototyping**
The use of rapid prototyping machines and how this benefits the whole process before manufacture.
- (d) Manufacturing**
The use of CAD and CAM systems during manufacturing. The use of computers to control the production line and monitoring progress.

2 marks for each description

Q.6 Temperature sensors and light sensors are often used as inputs in control systems.

- (a) For one of these control systems identify the sensing component and describe why it would be selected.** [4]

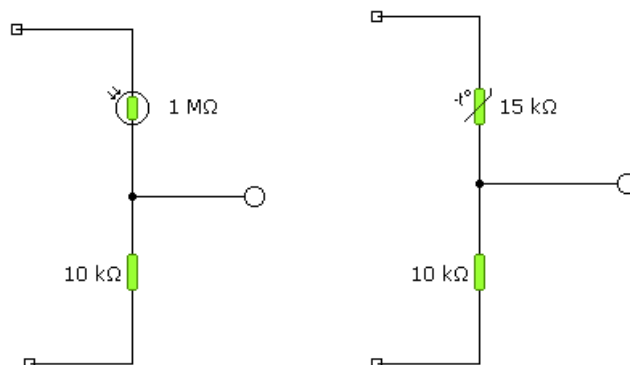
Temperature sensor – thermistor, digital temperature sensor.
Thermistor to activate an alarm when a room becomes too cold for an elderly person.

Light sensor – LDR, photo diode, photo transistor.
LDR to activate a child's night light when it becomes dark.

Up to 2 marks

- (b) With the aid of a circuit diagram describe the circuit that could connect it to the process device of the system.** [4]

Description of circuit for connecting input component to process device.
Potential divider circuits are used as part of the sensing circuit for LDRs and thermistors. The balance of the two sides of the potential divider determines the voltage out to the process device. In the following potential divider diagrams give a high output when the LDR is in light and the thermistor when it is hot. The use of a potential divider circuit for an LDR or thermistor enables the setting of sensitivity by adjusting the value of the resistor.



Up to 6 marks

Q.7 Describe the features and benefits of the following Intellectual Property rights to the owner.

(a) Copyright. [4]

(b) Registered Trade Mark. [4]

Features and benefits Copyright

What is covered?

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 and recordings of a work, including sound and film.

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.

Broadcasts of a work.

- 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.

Note: Copyright does not protect ideas for a work. It is only when the work itself is fixed, for example in writing, which copyright automatically protects it - you do not have to apply for copyright.

Up to 4 marks

Features and benefits: Trade Mark

- Any sign which can be represented graphically.
- Any sign which can distinguish goods or services.
- This 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 the company and provides a clear identity that is easily recognisable (sometimes globally).

Up to 4 marks

Q.8 Concurrent engineering is a process used in the manufacture of products.

(a) Explain what you understand by concurrent engineering. [4]

(b) State two advantages of concurrent engineering to the designer and manufacturer. 2x [2]

1. Concurrent Engineering is a systematic approach to the integrated, concurrent design of products and their related processes.
2. This includes manufacturing and support and is intended to cause the developers from the very outset to consider all elements of the product life cycle, from conception to disposal, including cost, schedule, quality and user requirements.
3. It is different than the traditional product development approach in that it employs simultaneous, rather than sequential, processes.

Up to 4 marks for explanation

Advantages:

- Completing tasks in parallel, product development can be accomplished more efficiently and at a substantial cost savings.
- Rather than completing all physical manufacturing of a prototype prior to performing any testing, concurrent engineering allows for design and analysis to occur at the same time, and multiple times, prior to actual deployment.
- Multidisciplinary approach emphasises teamwork through and it allows for employees to work collaboratively on all aspects of a project from start to finish – this can be relevant to global manufacturing i.e. parts are manufactured elsewhere at the same time.

2 marks for each advantage stated

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.

Level 1 0-10 marks	<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
Level 2 11-16 marks	<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 17-23 marks</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 24-30 marks</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.

SECTION C

Q.9 Design can be described as a process of change and increasingly has to meet environmental and technological challenges.

In relation to a product you have used, discuss how the designer has addressed environmental and technological challenges.

How the designer has addressed, through a process of change:

1. Environmental challenges

- Planning for product disposal.
- Using suitable materials within the product.
- Raising disposal awareness with consumers.
- Local legislation.
- Moral issues.

2. Technological challenges

- Use of new materials.
- Low emissions.
- Lean manufacturing systems.
- New inventions and new technological concepts *i.e. Solar PV development.*

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, ethical and moral issues.
- Uses correct terminology and technical language – in design and technology terms.
- Manufacturing systems and stages of production in relation to environmental factors.
- Detailed knowledge of the form and function of a product, trends and styles of products.

30 marks

Q.10 Developments in both electronic and mechanical components have influenced the design of products with benefits for the designer, manufacturer and consumer.

Discuss these developments and benefits in relation to named products.

Developments in electronic and mechanical components will include:

- Integrated Circuits.
- Programmable components.
- Low friction or high temperature capable materials in mechanical components in control systems.
- Smart materials.

Materials will influence the design of products and provide benefits to the designer, manufacturer and consumer:

Discussion around:

1. Designer –new opportunities in performance, functionality. New material properties and components will to provide greater functionality.
2. Manufacturer – fewer components, efficient and faster manufacturing system thereby getting products to the customer quickly. Upgrading functionality of system through software upgrade. Increased reliability creates better product image. Greater product flexibility and adaptability, *multi functional* product manufacturing.
3. Consumer – general range of products available, products with a range of functions available, miniaturisation, greater reliability of product due to fewer components. Reduced costs. Faster products.

30 marks

Q.11 With reference to a particular system or systems, describe the process of quality control and discuss its importance to the manufacturer, consumer and the environment.

Process:

Quality Control – description and importance of the process to:

Checks at points on the production line for accuracy and safety of product or components.

Meet consumer and environmental expectations.

Importance:

Manufacturer:

Quality control methods: function checks, checks for correct function of system, use of test beds. Dimensional accuracy (tolerances), dimensional accuracy may be checked with a gauge or measuring tool (micrometer, vernier etc). Quality of construction/materials (visual checks for faults including automated visual checks of circuit construction, marks or blemishes) appearance and finish, durability. The use of CAD/CAM ensuring quality.

Candidates may refer to checks made on production machinery rather than a test on the product itself.

Note: Care is needed here as machinery settings would normally be seen as part of quality assurance so should not be credited here which specifically addresses quality control.

Candidates may refer to packaging systems for products, and their implications for the manufacturer.

Consumer

Importance to the consumer because of confidence in the system or manufacturer, aspects of safety important to the consumer, health aspects and reliability of product.

The Environment

Efficiency, producing little waste or emissions, recycling possibilities and consumer safety,

Note: The above responses may be linked within responses (if two areas only are discussed credit a maximum within level 3).

30 marks

DT3 - PRODUCT DESIGN

SECTION A

Answer **three** questions from this section.

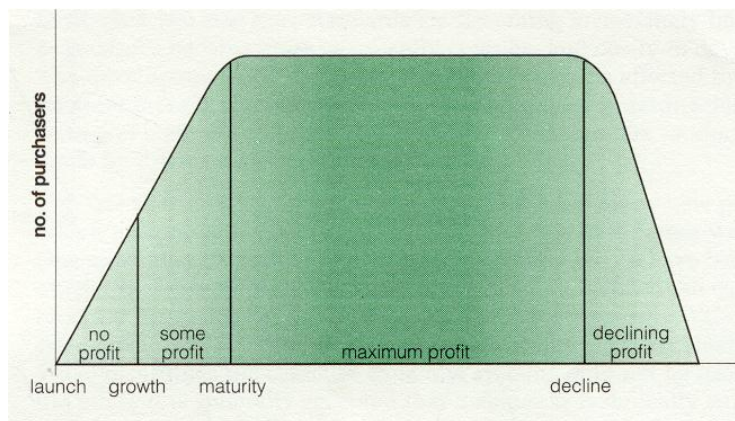
This section is designed to demonstrate your **breadth** of knowledge in Product Design.

Each question carries 8 marks.

- Q.1. (a) **Fully describe the product life cycle using diagrams where relevant.** [6]

Essential features must include:

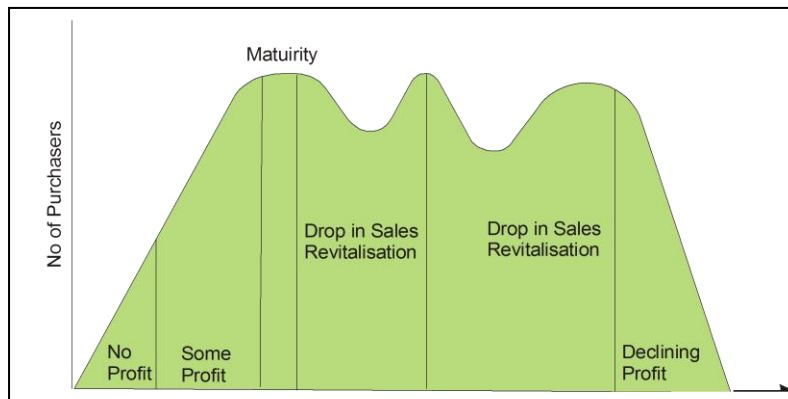
Product launch characterised by slow growth of sales as the product is launched on the market. The company incurs large costs with advertising and promotion considerations. Growth of the product then follows depending on impact on target audience, and the 4 P's, and there is a steady rise in growth. Maturity where sales are at their maximum level and profits remain stable. Decline where sales and profit begin to drop off. At this point the company has to decide whether to inject incremental improvements to boost sales or to allow the decline to continue with the implications of ending production. If the candidate has decided to draw a labelled diagram for part (a), the shape is not critical (though labelling will be), i.e. it need not have a large plateau.



Product Life Cycle

An incrementally improved product will have the same features as the product life cycle depicted but it will have an undulating maturity curve indicating where decline is beginning to happen and where the product has been re-vitalised.

- (b) Draw a labelled diagram demonstrating the life cycle of an incrementally improved product. [2]



Part (b) asks for a diagram, but if the candidate has drawn a diagram in (a) and then refers to this for part (b), credit should be given as appropriate. If the candidate has produced a *separate diagram* with accurate descriptions, allow the full mark range.

- Q.2 (a) State what you understand by the term *target audience* in relation to product design. [2]

The term '*target audience*' refers to the specific '*niche*' market that a particular product is aimed at. The target audience can be a restricted group of people from a particular socio-economic or developmental group, or it can be a larger group of people from a number of sub-groups who will be the perceived users of a particular product. These are the people who will buy a particular product therefore their particular needs and wants must be reflected in the product development.

- (b) Give three reasons why researching a target audience plays such an important role in product design. [6]

Researching the target audience will provide the product designer with up-to-date responses from the market place as to their perceived needs. This information can then be incorporated into the design or re-design of a product to make it more effective and to ensure that any incremental improvements or new design meet the needs of the target audience. The effectiveness of meeting the needs of the target audience will to a large extent determine the success of the product in the market. To improve sales / guarantee sales of a product. Cost implications for the target audience.

Market trends could include such factors as fashion, styling, economic considerations, technological trends, environmental or 'Eco' trends, life style and these will all have an impact on the sales of a product. Therefore marketing strategies entail getting close to the customer whether that be in a mass or 'niche' market depending on the product and its anticipated market share.

Q.3 The product champion and the entrepreneur are two key facilitators in the process of innovation.

Considering the process of product innovation, describe the role of:

(a) the product champion; [4]

(b) the entrepreneur. [4]

The role of **product champion** – an individual or group committed to the development of the project and prepared to ‘champion’ the product against all resistance. Demonstration of the tenacity required to become a lone inventor where one has to undertake the role of **product champion** – an individual or group committed to the development of the project and prepared to ‘champion’ the product against all resistance.

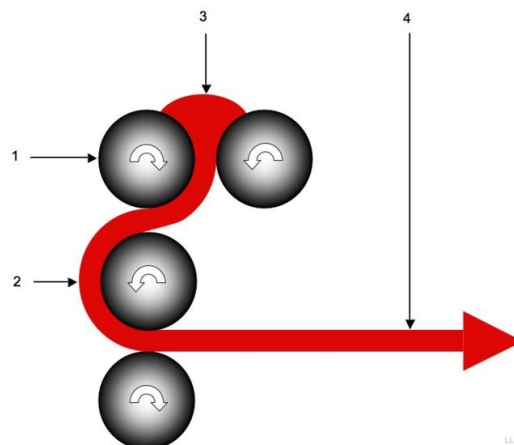
The entrepreneur – prepared to provide or to persuade others to provide the necessary finance for the invention to become an innovation.
To develop the product through to pre-production prototype and then invest funds into manufacture, marketing and distribution. Ensuring world-wide patents are taken out and not infringed.

Q.4 Using diagrams where necessary, describe an industrial method of forming a particular named plastic sheet material. [8]

e.g. Calendering is a finishing process used on cloth where fabric is folded in half and passed under rollers at high temperatures and pressures. Calendering is used on fabrics such as moire to produce its watered effect and also on cambric and some types of sateens.

In preparation for calendering, the fabric is folded lengthwise with the front side, or face, inside, and stitched together along the edges. The fabric can be folded together at full width, however this is not done as often as it is more difficult. The fabric is then run through rollers that polish the surface and make the fabric smoother and more lustrous. High temperatures and pressure are used as well. Fabrics that go through the calendering process feel thin, glossy and papery.

The calendering finish is easily destroyed, and does not last well. Washing in water destroys it, as does wear with time.



Q.5 The materials chosen by designers for the manufacture of products often have a significant impact on sales.

(a) Name and briefly describe two specific products that have benefited from the innovative use of materials. 2 x[1]

One mark for naming and providing a short description.

(b) Describe the typical characteristics of one innovative material used in either product. [6]

Electric kettle, Dyson Vacuum cleaner, Apple computer, etc.

Use of injection moulding of polymers such as polystyrene, ABS, etc
description of characteristics of one material i.e. ABS - While the cost of producing ABS is roughly twice the cost of producing polystyrene.

It is considered superior for its hardness, gloss, toughness, and electrical insulation properties.

ABS is flammable when it is exposed to high temperatures, such as a wood fire. It will melt then boil, at which point the vapors burst into intense, hot flames.

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 (a) Name two forms of product management systems that could be used in school when tracking the development of a product. [2]**

Gantt chart, flow chart, critical path analysis.

- (a) Explain one such system in detail. [6]**

Appropriate description of the product management system. Where a Gantt chart is explained for example the candidate must explain the time line, blocks of activity and the descriptions of the manufacturing activities within the blocks, that there can be concurrent manufacturing and this can be shown in the chart. That the Gantt chart is often used in conjunction with a critical path analysis. Not only are the actual activities given time schedules but the overall project is also subject to a time deadline.

- Q.7 (a) Explain the importance of on-going evaluation when designing. [4]**

Enabling the designer to assess the viability of design solutions, that they meet the needs identified in the research and that the on going evaluation is making incremental judgements with regard to the hypotheses that is being tested by the designer.

- (b) Evaluate the impact that the design specification has on this process. [4]**

All aspects of the on-going evaluation should reference back to the original specification and that aspects of ideas that develop should be tested against this specification. Some points may be fully met whereas other aspects could be completely left out. The stronger aspects could even be transferred to another solution.

Q.8 Rights granted by the Intellectual Property Office can protect the outward appearance of a product.

(a) Name the form of Intellectual Property that affords this protection. [2]

Registered Design (1 mark for Registered Design Mark). 'Design Right' is an acceptable response.

(b) Describe the essential elements of this Intellectual Property. [6]

A Registered Design is a legal right which protects the overall visual appearance of a product or a part of a product in the country or countries you register it. For the purposes of registration, a design is legally defined as being "the appearance of the whole or part of a product resulting from the features of, in particular, the lines, contours, colours, shape, texture or materials of the product or ornamentation." This means that protection is given to the way a product *looks*. The appearance of your product may result from a combination of elements such as shapes, colours and materials.

References to texture and materials does not mean that protection may be granted for the feel of a texture, or what the product is actually made from; only that these features may influence what the overall product looks like. Equally, design registration cannot protect non-stylised wording (i.e.. basic text), the way something works, or the idea or concept behind a product.

You can register a three-dimensional product such as an industrial or handicraft item (other than a computer program), or two-dimensional ornamentation alone, e.g.. a pattern intended for display upon a product, or a stylised logo. In all cases, the term "product" can mean things like packaging, get-up, graphic symbols, typographic typefaces, and parts of products intended to be assembled into a more complex product.

In respect of 'get-up', protection may be granted to the *overall presentation* of those products which comprise multiple components but which are sold as one single item, eg. a board game complete with playing pieces, or a product in its packaging. 'Get-up' does not include sets of items which may be bought individually, such as cutlery or suites of furniture.

Q.9 Combining plastics with traditional materials has offered many new opportunities for product designers. [8]

Name a specific material that has been enhanced in this way and describe how product designers have utilised the enhanced properties of the material.

Carbon fibre, formica (layered composite), glass fibre (GRP), MDF, tufnol, manufactured boards such as chipboard, plywood and corrugated card. (2)

From a textiles perspective, composite materials are usually made from a synthetic component and a natural component, e.g. Polyester Cotton, wool and nylon, lycra and cotton, viscose, silk and acrylic.

Use of an applied plastics finish – 1 mark only. However, candidates may still access the full range of marks for the enhancement and the use of the properties made by designers.

Candidates may make reference to the composition/structure of each composite in describing the enhanced properties. Examples include, layered formica – heat resist layer produced, MDF – fibre bonded with synthetic resin to produce fine surface finish, strands of glass (*or carbon fibre*) set in rigid polyester resin, tufnol is a layered composite with woven linen impregnated.

A blended composite example: - polyester cotton is made by blending polyester and cotton fibres together to make one yarn which is then knitted/woven to form the fabric.

A mixed composite example: - microfibre in weft threads, wool/cotton/linen in the warp threads (*woven structure only*).

A layered composite example: - tough cordura outer layer and a woven kevlar inner layer or laminated fabrics such as a permatex breathable membrane to an outer layer of nylon.

Q.10. When products are manufactured in volume, explain the part played by:

(a) Quality Control [4]

Quality control, or QC for short, is a process by which entities review the quality of all factors involved in production. This approach places an emphasis on three aspects:

1. Elements such as controls, job management, defined and well managed processes, performance and integrity criteria, and identification of records.
2. Competence, such as knowledge, skills, experience, and qualifications.
3. Soft elements, such as personnel integrity, confidence, organizational culture, motivation, team spirit, and quality relationships.

The quality of the outputs is at risk if any of these three aspects is deficient in any way.

Quality control emphasizes testing of products to uncover defects and reporting to management who make the decision to allow or deny product release, whereas quality assurance attempts to improve and stabilize production (and associated processes) to avoid, or at least minimize, issues which led to the defect(s) in the first place.

(b) Quality Assurance

[4]

Quality assurance, or QA (in use from 1973) for short, is the systematic monitoring and evaluation of the various aspects of a project, service or facility to maximize the probability that minimum standards of quality are being attained by the production process. QA cannot absolutely guarantee the production of *quality* products.

Two principles included in QA are: "Fit for purpose", the product should be suitable for the intended purpose; and "Right first time", mistakes should be eliminated. QA includes regulation of the quality of raw materials, assemblies, products and components, services related to production, and management, production and inspection processes.

Quality is determined by the product users, clients or customers, not by society in general. It is not the same as 'expensive' or 'high quality'. Low priced products can be considered as having high quality if the product users determine them as such.

<p>Level 1 0-9 marks</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, with little knowledge of ICT in manufacturing systems if appropriate to the question. • 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 10-14 marks</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. These aspects are 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 15- 20 marks</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 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. • 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 21-26 marks</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. These aspects are 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.

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 Give a detailed description of the aesthetic style of a designer you admire and explain how the designer has influenced the style of other similar products.** [26]

Description of aesthetic style is the first aspect that will need to be developed and this must have specific details of products and their unique styling features that are a source of admiration to the candidate. This needs to be followed by the way that the designer has influenced other products.

- Q.12 Discuss the value judgements that are implicit in most product design solutions particularly relating to economic, aesthetic and environmental considerations.** [26]

The candidate may choose to answer this question by giving examples from a range of manufactured products. However there must be specific reference to the three aspects contained within the question. If this is not the case then the candidate is restricted to the top of level 2.

- Q.13 Designers need a detailed knowledge and understanding of materials to make successful products.**
Describe the particular purpose, characteristics and working properties of two materials that have been selected for use in a particular named product and explain what features made them appropriate for use. [26]

Description of materials with reference to their particular purpose in the components that have been made from them followed by the characteristics of the particular material and finally the material's working properties of both materials. If candidates give a generic description of the properties and characteristics of two materials not related to a specific product, no higher than tier 2.

- Q.14 Describe how the development of a design consciousness within society has impacted on product design.**
In your answer discuss the materials selected, the manufacturing considerations, the product life cycle and the eventual disposal of the product. [26]

Marks allocated for the inclusion of the four elements materials selected, the manufacturing considerations, the product life cycle and the eventual disposal of the product.

- Q.15 'The art of designing is often said to be a social activity.'**
Explain how this phrase is depicted in the many activities that designers are involved with when designing a product. [26]

Identify all aspects of designing that require the designer to have contact with other groups, experts, manufacturers, etc in the course of their work. This answer may relate to an industrial or a school setting.

DT3 - FOOD TECHNOLOGY

SECTION A

Answer **three** questions from this section.

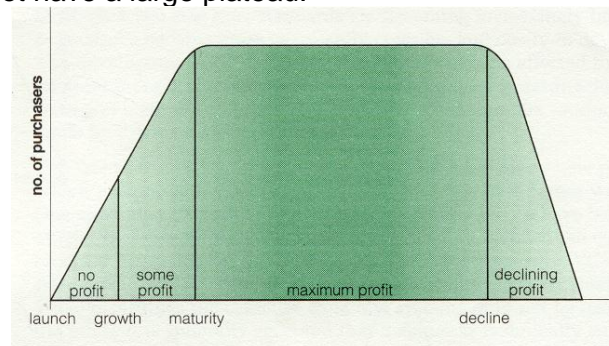
This section is designed to demonstrate your **breadth** of knowledge in Food Technology.

Each question carries 8 marks.

Q.1 (a) Fully describe the product life cycle using diagrams where relevant. [6]

Essential features must include:

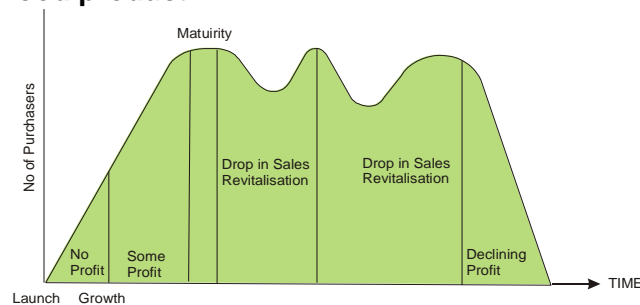
Product launch characterised by slow growth of sales as the product is launched on the market. The company incurs large costs with advertising and promotion considerations. Growth of the product then follows depending on impact on target audience, and the 4 P's, and there is a steady rise in growth. Maturity where sales are at their maximum Level and profits remain stable. Decline where sales and profit begin to drop off. At this point the company has to decide whether to inject incremental improvements to boost sales or to allow the decline to continue with the implications of ending production. If the candidate has decided to draw a labelled diagram for part (a), the shape is not critical (though labelling will be), i.e. it need not have a large plateau.



Product Life Cycle

An incrementally improved product will have the same features as the product life cycle depicted but it will have an undulating maturity curve indicating where decline is beginning to happen and where the product has been re-vitalised.

(b) Draw a labelled diagram demonstrating the life cycle of an incrementally improved food product. [2]



Part (b) asks for a diagram, but if the candidate has drawn a diagram in (a) and then refers to this for part (b), credit should be given as appropriate. If the candidate has produced a *separate diagram* with accurate descriptions, allow the full mark range.

Q.2 The Food Standards Agency estimates that 5.5 million people contract food poisoning in Britain every year.

For one named type of food poisoning:

(a) Outline the main sources of infection for a named type of food poisoning.

[3]

Responses must focus on the sources of infection of one specific type of food poisoning.

- Salmonella – eggs, poultry, sausages
- Staphylococcus – humans – gut / bowel / nose / throat / mouth.
- Campylobacter – undercooked meat, unpasteurised milk / cheese, contaminated water;
- Listeria – soil, unwashed vegetables, some soft cheeses, pâté;
- Bacillus cereus – cereals – rice – danger from insufficient reheating;
- Clostridium botulinum – meat, fish, milk, fruits and vegetables if incorrectly preserved or treated;
- E. Coli – human gut, ground beef, unpasteurised milk, bean sprouts, salad, spinach, unpasteurised juices;
- Biological / chemical contamination perhaps caused by fertiliser / cleaning materials.

(b) Describe measures taken by food manufacturers to prevent cross-contamination for the type of food poisoning you have chosen.

[5]

Candidates may discuss e.g.:

- staff training
- sourcing of high quality food materials
- good hygiene practices
- uniform policy
- hand washing procedures
- HACCP procedures, assess and monitor risks
- control of high risk foods – separate storage and preparation areas, equipment, staff
- carry out microbial analysis and sampling;
- tracking foods
- buying from reputable suppliers
- temperature control – storage, cooking, transportation etc.

Maximum of 3 marks for responses which do not refer to a specific type of food poisoning. For the full 5 marks they must refer to control measures for a specific named type of food poisoning, for example:

- Salmonella – use of pasteurised eggs, checking core temperature of cooked chicken, rapid cooling of chicken and egg products.
- Staphylococcus – staff training, signage to encourage high standards of personal hygiene; rules re' working with food when been unwell; provision of appropriate toilet and changing facilities.
- Campylobacter – checking core temperature of meat products. Use of pasteurised dairy products.
- Listeria – thorough washing of vegetables. High specifications for suppliers of food materials.
- Bacillus cereus – rapid chilling of rice products. Warning information on packaging re' consumers reheating product.
- Clostridium botulinum – high temperatures to sterilise cans. Cans designed to be strong to avoid denting.
- E. Coli – thorough washing of vegetables. High specifications for suppliers of food materials. Tracking provenance of beef products. Staff training, signage to encourage high standards of personal hygiene; rules re' working with food when been unwell; provision of appropriate toilet and changing facilities.
- Biological / chemical contamination – safe practices re' use and storage of chemicals. Adherence to COSHH. Staff training, signage.

- Q.3 (a) Explain what you understand by the term target audience in relation to a food product. [2]**

The term '*target audience*' refers to the specific '*niche*' market that a particular product is aimed at. The target audience can be a restricted group of people from a particular socio-economic group or age group, or it can be people with e.g. a particular dietary restriction who will be the perceived users of a particular food product. These are the people who will buy a particular product therefore their particular needs and wants must be reflected in the product development.

- (b) Outline three reasons why researching a target audience plays such an important role in the design of food products. [6]**

Researching the target audience will provide the food technologist with up-to-date responses from the market place as to their perceived needs. This information can then be incorporated into the design or re-design of a food product to make it more effective and to ensure that any incremental improvements or new design meet the needs of the target audience. The effectiveness of meeting the needs of the target audience will to a large extent determine the success of the product in the market. To improve sales / guarantee sales of a product. Cost implications for the target audience.

Market trends could include such factors as food fashions / fads, styling, economic considerations, technological trends, environmental or 'Eco' trends, life style and these will all have an impact on the sales of a food product. Therefore marketing strategies entail getting close to the customer whether that be in a mass or 'niche' market depending on the product and its anticipated market share.

Q.4 The materials chosen by food technologists for the manufacture of food products often have a significant impact on sales.

- (a) Name and briefly describe *two* specific products that have benefited from the use of smart materials. 2 x [1]**

One mark for naming and providing a short description of each of two specific products. For example a probiotic drink which contains active live cultures of bacteria to improve intestinal balance so inhibit production of pathogens / harmful bacteria. A vegetarian shepherds pie which use TVP which is made from soya but has flavours / textures similar to meat.

- (b) Describe the characteristics of one smart material used in either product. [6]**

Responses should focus on the characteristics of the material, not how it is produced. For example:

Textured Vegetable Protein (TVP) can be in various forms such as chunks, flakes, strips etc. On its own it is relatively flavourless. Because it is fibrous and porous, it can soak up to three times its own weight in liquids. This allows it to soak up juices etc from food it is prepared with so that it takes on the flavours of these other foods. The fibrous structure of TVP gives it a texture similar to meat. It is very versatile and can take on the flavour and texture of various meats. TVP is high in protein – approximately equivalent to meat. It is low in fat. It can be fortified to provide vitamins which would be found in meat. TVP is low cost; it is considerably cheaper than meat. It can be added to meat because of its low cost, high protein content and because it will take on the flavours of the meat. It is good at retaining weight once hydrated. TVP is suitable for vegetarians and vegans. It is very light-weight which makes it suitable for expeditions etc. It has a long shelf-life (over a year) in its dehydrated form.

Other Smart food materials chosen by candidates might include:

- Foods with a novel molecular structure e.g. modified starches, fat replacers and sweeteners
- Functional foods e.g. cholesterol-lowering spreads, probiotics, fortified eggs
- Encapsulation technology e.g. encapsulated flavours in confectionery
- Modern biotechnology – Genetically Modified foods e.g. soya beans, tomato plants

Q.5 Canning, irradiation and Ultra Heat Treatment (UHT) are all methods of preserving foods.

- (a) Describe one of these processes for a named food product. 2x[1]**

The candidate should describe one process e.g.

Irradiation - food is exposed to gamma rays or x-rays in form of beam – ionising radiation. The energy absorbed causes the formation of free radicals which kill micro-organisms and interact with other food molecules. This slows down sprouting of potatoes / onions and ripening of fruit (particularly used for soft fruit). It delays enzyme activity, kills / reduces moulds, yeasts, bacteria and insects.

- (b) Outline the effect of this treatment on shelf-life and the sensory and nutritional properties of that named food product. [5]**

Responses should focus on one named food. Award maximum of two marks for general discussion of effects without reference to a particular food.

Canning

Example of named food products – fruits, vegetables, soups. Foods will keep for more than a year. Softening of food / loss of texture because of heating. Colour changes e.g. in fruits and vegetables. Often nutrient maintenance is good as commercially foods are generally preserved quickly when very fresh, though there could be some loss of vitamins due to use of water and heat. Vitamin loss varies greatly – e.g. more vitamin C lost, but little loss of vitamin A.

Irradiation

Example of named food products – strawberries. Slows down sprouting of potatoes / onions and ripening of fruit (particularly used for soft fruit) so increases shelf-life by several days. Strawberries retain desired texture and flavour for longer as moulds would make texture deteriorate and impart unacceptable flavours. There is no change in the sugar content so strawberries are as sweet. There can be some loss of redness of colour. There can be some loss of nutrients e.g. vitamins A, C, E and K. The levels of trace elements such as sodium and zinc increases.

UHT

Example of named food products – milk, cream, fruit juice, soups. Change in flavour. Shelf-life of 6 to 9 months. Change in taste and smell due to Maillard browning. There is some loss of vitamin B12, vitamin C, thiamin and folate.

SECTION B

Answer **three** questions from this section.

This section is designed to demonstrate your **breadth** of knowledge in Food Technology.

Each question carries 8 marks.

- Q.6 (a) Name two forms of product management systems that could be used in school when tracking the development of a product. [2]**

Gantt chart, flow chart, critical path analysis.

- (b) Explain one such system in detail. [6]**

Appropriate description of the product management system. Where a Gantt chart is explained, for example the candidate must explain the time line, blocks of activity and the descriptions of the manufacturing activities within the blocks, that there can be concurrent manufacturing and this can be shown in the chart. That the Gantt chart is often used in conjunction with a critical path analysis. Not only are the actual activities given time schedules but the overall project is also subject to a time deadline.

- Q.7 Explain, with examples, the advantages and disadvantages of one-off production in the food industry to both the manufacturer and the consumer. [8]**

Advantages

- high Level of satisfaction for producer resulting in good morale, lack of boredom;
- demands premium price, can be good profit Levels;
- can give producer good reputation for quality products which brings in other custom;
- allows time for manufacturer to achieve high Level of finish / detail;
- might use minimal equipment – not mass produced – lower set up costs;
- no wastage;
- exclusivity for consumer, gives sense of being special;
- personalisation of choice;
- meet dietary needs.

Disadvantages

- expensive;
- labour intensive;
- might achieve low profit Levels despite premium price because of amount of time uses;
- usually requires high Level of skill;
- not suitable for automation so no scales of production;
- time consuming – requires long lead-in time;
- often process involves a number of stages;
- requires specialist equipment;
- demand might fluctuate lot;
- lot of storage required for work in progress;
- expectations of consumer very high;
- customer can't see before buys – might be disappointment in final product.

Award up to **eight** marks for outlining the advantages and disadvantages to the manufacturer and consumer.

Maximum of **five** marks for explaining only advantages or disadvantages.

Maximum of **five** marks for only manufacturer or consumer.

Maximum of **three** marks for explanation of either only advantages or disadvantages to either only manufacturer or consumer.

Q.8 Lights granted by the Intellectual Property Office can protect the outward appearance of a food product or its packaging.

(a) Name the form of Intellectual Property that affords this protection. [2]

A Registered Design is a legal right which protects the overall visual appearance of a product or a part of a product in the country or countries you register it.

Award **one** mark for 'Registered Design Mark'.

'Design Right' is an acceptable response.

[6]

(b) Describe the essential elements of this Intellectual Property. [6]

For the purposes of registration, a design is legally defined as being "the appearance of the whole or part of a product resulting from the features of, in particular, the lines, contours, colours, shape, texture or materials of the product or ornamentation." This means that protection is given to the way a product *looks*. The appearance of your product may result from a combination of elements such as shapes, colours and materials.

References to texture and materials does not mean that protection may be granted for the feel of a texture, or what the product is actually made from; only that these features may influence what the overall product looks like. Equally, design registration cannot protect non-stylised wording (ie. basic text), the way something works, or the idea or concept behind a product.

The term "product" can mean things like packaging, graphic symbols, or typographic typefaces.

May be the shape of the food product e.g. Toblerone.

Q.9 (a) Explain the importance of on-going evaluation when designing. [4]

Enabling the designer or food technologist to assess the viability of design solutions, that they meet the needs identified in the research and that the on-going evaluation is making incremental judgements with regard to the hypotheses that is being tested by the designer.

(b) Evaluate the impact that the design specification has on this process. [4]

All aspects of the on-going evaluation should reference back to the original specification and that aspects of ideas that develop should be tested against this specification. Some points may be fully met whereas other aspects could be completely left out. The stronger aspects could even be transferred to another solution.

10. When food products are manufactured in volume, explain the part played by:

(a) Quality Control. [4]

Quality control, or QC for short, is a process by which entities review the quality of all factors involved in production. This approach places an emphasis on three aspects:

1. Elements such as controls, job management, defined and well managed processes, performance and integrity criteria, and identification of records.
2. Competence, such as knowledge, skills, experience, and qualifications.
3. Soft elements, such as personnel integrity, confidence, organizational culture, motivation, team spirit, and quality relationships.

The quality of the outputs is at risk if any of these three aspects is deficient in any way.

Quality control emphasises testing of products to uncover defects and reporting to management who make the decision to allow or deny product release, whereas quality assurance attempts to improve and stabilise production (and associated processes) to avoid, or at least minimise, issues which led to the defect(s) in the first place.

(b) Quality Assurance. [4]

Quality assurance, or QA (in use from 1973) for short, is the systematic monitoring and evaluation of the various aspects of a project, service or facility to maximise the probability that minimum standards of quality are being attained by the production process. QA cannot absolutely guarantee the production of quality products.

Two principles included in QA are: "Fit for purpose": the product should be suitable for the intended purpose; and "Right first time": mistakes should be eliminated. QA includes regulation of the quality of raw materials, assemblies, products and components, services related to production, and management, production and inspection processes.

Quality is determined by the product users, clients or customers, not by society in general. It is not the same as 'expensive' or 'high quality'. Low priced products can be considered as having high quality if the product users determine them as such.

<p>Level 1 0-9 marks</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, with little knowledge of ICT in manufacturing systems if appropriate to the question. • 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 10-14 marks</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. These aspects are 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 15- 20 marks</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 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. • 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 21-26 marks</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. These aspects are 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.

SECTION C

Answer **two** questions from this section.

Your answer should be substantial and show the **depth** of your knowledge in Food Technology.

Each question carries 26 marks.

- Q.11 Each chef, restaurateur and food writer has their own food style and values. Contrast the food style and values of any two chefs, food writers or restaurateurs of your choice and discuss their influence on consumer demand. [26]**

Responses should focus on the food style and values of the individual, for example aesthetic qualities of the dishes they prepare; their style e.g. traditional / modern European / molecular gastronomy; the type of ingredients they are known for using e.g. game / vegetarian / seasonal; their ethical concerns in terms of local / organic etc; Candidates should contrast two individuals. This needs to be followed by discussion of the way the individuals have influenced consumer demand.

- Q.12 Food technologists need a detailed knowledge and understanding of the materials they select to make successful food products.**

Describe the particular purpose, characteristics and properties of two food materials that have been selected for use in named food products and explain what features make them appropriate for use. [26]

Description of food materials with reference to their particular purpose in the components / products that have been made from them followed by the characteristics of the particular material and finally the working properties of both materials. Candidates may refer to nutritional and organoleptic characteristics and properties as well as physical and aesthetic functions.

- Q.13 Discuss the value judgements that are involved in the design of some food products, particularly relating to economic, aesthetic and environmental considerations. [26]**

The candidate may choose to answer this question by giving examples from a range of food products. However there must be specific reference to the three aspects contained within the question. If this is not the case then the candidate is restricted to the top of Level 2. If a candidate gives a generic description of the properties and characteristics of two food materials not related to a specific product marks are restricted to the top of Level 2.

Economic might include amount of money available to target market, economic trends including credit crunch, costs of production, transportation and distribution, using bulkers to reduce food costs, Levels of profit. Aesthetic might include size, shape, colour, pattern of food products and design of food packaging. Environmental might include food miles, efficient food production methods, use of fertilisers, pesticides, growth promoters in production of food materials, 6Rs, design of packaging.

Q.14 Evaluate the advantages and disadvantages on the use of Computer Aided Manufacture (CAM) in modern high volume food production. [26]

Candidates may give examples of the use of CAM within food production and may choose to illustrate their answer with reference to specific food products. They must *evaluate* the use of CAM, for example:

On the one hand, some advantages of CAM are:

- Accuracy after design is produced on software and exported to the CAM machine; standardisation;
- Quality tends to be high;
- Repeatability.
- Reducing human error; avoid staff becoming bored / careless due to repeat processes;
- Increased safety / reduction in accidents as staff not carrying out potentially hazardous tasks due to automation;
- Possibly reduced hygiene risks because of lower human contact;
- Speed;
- System can operate 24/7 with minimal down-time for maintenance / cleaning;
- Large production output / quantities.

On the other hand, some disadvantages of CAM are:

- Expensive to set up / maintain;
- Higher energy requirements so increased energy costs;
- Down time for change-over;
- If breaks down production stops;
- Work of operatives can be repetitive – problems of boredom / morale / recruitment / retention;
- Need some highly skilled, specialist operatives;
- Loss of uniqueness of product / 'hand-made' qualities;
- Can be difficult to response to changes in demand quickly.

Q.15 Discuss how the needs and demands of consumers of food products have evolved and how food technologists and manufacturers have responded to these changes. [26]

Candidates should link changes in requirements of consumers to introduction of new products / adaptation of existing ones.

Responses may focus on, for example:

- Awareness of healthy eating issues. Reduction in Levels of sugar / salt / fat, changes in types of fats, omega 3 and 6.
- Nutraceuticals.
- Environmental concerns – food miles, organic, reduced packaging, 6Rs etc.
- Ethical issues – fair trade, free range, provenance / traceability, over-fishing.
- Supporting local producers.
- Vegetarianism.
- Special dietary diets / food allergies.
- Use of additives / GM.
- Economic factors e.g. credit crunch, 'eating in is the new eating out'.
- Social factors – grazing, eating alone, women working.
- Other cultures / travel.

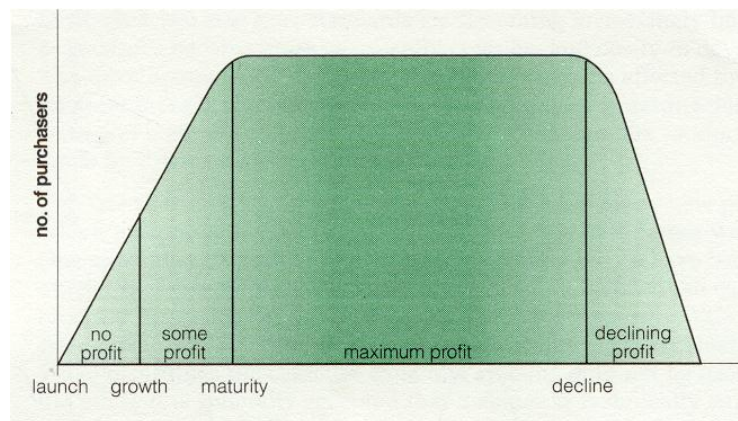
DT3 - SYSTEMS & CONTROL

SECTION A

Q.1 (a) **Fully describe the product life cycle using diagrams where relevant.** [6]

Essential features must include:

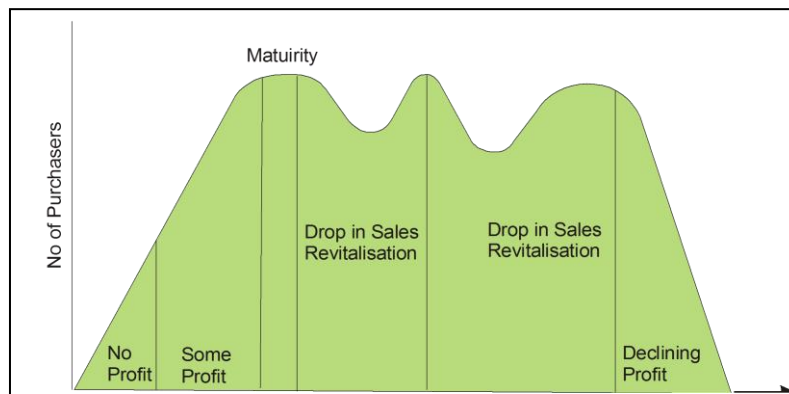
Product launch characterised by slow growth of sales as the product is launched on the market. The company incurs large costs with advertising and promotion considerations. Growth of the product then follows depending on impact on target audience, and the 4 P's, and there is a steady rise in growth. Maturity where sales are at their maximum level and profits remain stable. Decline where sales and profit begin to drop off. At this point the company has to decide whether to inject incremental improvements to boost sales or to allow the decline to continue with the implications of ending production. If the candidate has decided to draw a labelled diagram for part (a), the shape is not critical (though labelling will be), i.e. it need not have a large plateau.



Product Life Cycle

An incrementally improved product will have the same features as the product life cycle depicted but it will have an undulating maturity curve indicating where decline is beginning to happen and where the product has been re-vitalised.

(b) **Draw a labelled diagram demonstrating the life cycle of an incrementally improved product.** [4]



Part (b) asks for a diagram, but if the candidate has drawn a diagram in (a) and then refers to this for part (b), credit should be given as appropriate. If the candidate has produced a *separate diagram* with accurate descriptions, allow the full mark range.

Q.2 Explain the impact CAD has in the designing and development of control systems for products. [8]

CAD or computer aided designing can be used in many ways by the designer. CAD can be used to quickly design electronic systems, to test and modify circuits as required. CAD allows designs to be developed without the use of 'real' components because ideas are simulated. Designs can be saved electronically and accessed at later dates. Designs can also be emailed to other branches of the company who might undertake production at different locations. Revitalised products often use similar control systems and older CAD files are sometimes the starting point for this. Responses could include examples of electronic, mechanical or microcontroller specialist software. CAD can be expensive to set up but very economical once setup costs have been settled. Specialists / employees trained in the relevant CAD systems can be very efficient and productive. CAD data can be used with CAM for rapid prototyping and production.

Q.3 The product champion and the entrepreneur are two key facilitators in the process of innovation.

Considering the process of product innovation describe the role of:

(a) the product champion; [4]

(b) the entrepreneur. [4]

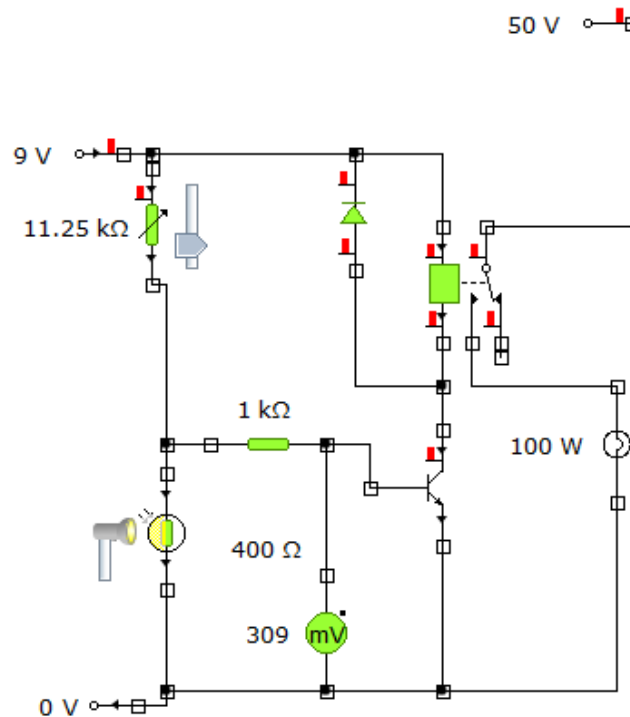
The role of **product champion** – an individual or group committed to the development of the project and prepared to 'champion' the product against all resistance. Demonstration of the tenacity required to become a lone inventor where one has to undertake the role of **product champion** – an individual or group committed to the development of the project and prepared to 'champion' the product against all resistance.

To develop the product through to pre-production prototype and then invest funds into manufacture, marketing and distribution. Ensuring world-wide patents are taken out and not infringed.

Q.4 Using diagrams where necessary, describe how a relay switch can be used to connect a low voltage sensing system to higher voltage control system. [8]

Many systems use low voltage sensing to activate more powerful systems. Central heating systems, irrigation, motion sensing, lighting are all examples.

A relay is a switch activated by an energised coil when the low volt sensing system triggers. The relay pulls and allows the higher voltage system to activate. A diode is required to prevent back emf or feedback. Diagrams may contain the relay with labelled connections, illustrating how it could be used.



Q.5 The control system components chosen by designers for the manufacture of products often have a significant impact on sales. [4]

(a) Name and briefly describe two specific products that have benefited from the innovative use of control system components. [4]

One mark for naming and providing a short description.

(b) Describe the typical characteristics of control system component used in either product. [4]

ipod touch wheel, use of compressed file format used in ipod, ipad etc, touchscreen technology used in apple products.

Sustainable products e.g. Baylis freeplay radio – use of win up technology. Solar garden lights, the use of a pv cell to generate and store electricity for use in dark conditions.

The condensate heat exchanger in new combi boilers utilising all of the heat that would be waste, breaking and releasing water as the by product.

Surface mount technology / the application of smaller smt chips to control systems, Moore's law and miniaturization..

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 (a) Name two forms of product management systems that could be used in school when tracking the development of a product. [2]**

Gantt chart, flow chart, critical path analysis.

- (b) Describe one such system in detail. [6]**

Appropriate description of the product management system. Where a Gantt chart is explained for example the candidate must explain the time line, blocks of activity and the descriptions of the manufacturing activities within the blocks, that there can be concurrent manufacturing and this can be shown in the chart. That the Gantt chart is often used in conjunction with a critical path analysis. Not only are the actual activities given time schedules but the overall project is also subject to a time deadline.

- Q.7 (a) Explain the importance of on-going evaluation when designing [4]**

Enabling the designer to assess the viability of design solutions, that they meet the needs identified in the research and that the on-going evaluation is making incremental judgements with regard to the hypotheses that is being tested by the designer.

- (b) Describe the impact that the design specification has on this process. [4]**

All aspects of the on-going evaluation should reference back to the original specification and that aspects of ideas that develop should be tested against this specification. Some points may be fully met whereas other aspects could be completely left out. The stronger aspects could even be transferred to another solution.

Q.8 Rights granted by the Intellectual Property Office can protect the outward appearance of a product.

(a) Name the form of Intellectual Property that affords this protection. [2]

(b) Briefly describe the essential elements of this Intellectual Property. [6]

A Registered Design is a legal right which protects the overall visual appearance of a product or a part of a product in the country or countries you register it. For the purposes of registration, a design is legally defined as being "the appearance of the whole or part of a product resulting from the features of, in particular, the lines, contours, colours, shape, texture or materials of the product or ornamentation." This means that protection is given to the way a product *looks*. The appearance of your product may result from a combination of elements such as shapes, colours and materials. 'Design Right' is an acceptable response.

References to texture and materials does not mean that protection may be granted for the feel of a texture, or what the product is actually made from; only that these features may influence what the overall product looks like. Equally, design registration cannot protect non-stylised wording (ie. basic text), the way something works, or the idea or concept behind a product.

You can register a three-dimensional product such as an industrial or handicraft item (other than a computer program), or two-dimensional ornamentation alone, eg. a pattern intended for display upon a product, or a stylised logo. In all cases, the term "product" can mean things like packaging, get-up, graphic symbols, typographic typefaces, and parts of products intended to be assembled into a more complex product.

In respect of 'get-up', protection may be granted to the *overall presentation* of those products which comprise multiple components but which are sold as one single item, eg. a board game complete with playing pieces, or a product in its packaging. 'Get-up' does not include sets of items which may be bought individually, such as cutlery or suites of furniture.

Q.9 Microcontrollers which can be re-programmed offer major advantages to systems designers.

Describe two other advantages of using programmable microcontrollers in control systems. 2x[4]

Other advantages may include reduced size – the PIC is a relatively small IC and can save space when compared to using the additional components required in a control system if PIC was not used.

Versatility in being able to control a range of inputs and outputs, drive larger systems and hold complex tailor made flowcharts of programs to control the product accurately.

Reusability – the PIC is easy to remove from circuit boards and can be placed in other control systems easily.

Cost – a standard PICAXE 08 IC is around £1.20, and provides the designer with a low cost alternative with the potential to control timing, a multitude of mathematical expressions and counting, etc.

Q.10 When a control system for a product is manufactured in volume explain the part played by:

(a) Quality Control [4]

Quality control, or QC for short, is a process by which entities review the quality of all factors involved in production. This approach places an emphasis on three aspects:

1. Elements such as controls, job management, defined and well managed processes, performance and integrity criteria, and identification of records.
2. Competence, such as knowledge, skills, experience, and qualifications.
3. Soft elements, such as personnel integrity, confidence, organizational culture, motivation, team spirit, and quality relationships.
The quality of the outputs is at risk if any of these three aspects is deficient in any way.

Quality control emphasizes testing of products to uncover defects and reporting to management who make the decision to allow or deny product release, whereas quality assurance attempts to improve and stabilize production (and associated processes) to avoid, or at least minimize, issues which led to the defect(s) in the first place.

(b) Quality Assurance [4]

Quality assurance, or QA (in use from 1973) for short, is the systematic monitoring and evaluation of the various aspects of a project, service or facility to maximize the probability that minimum standards of quality are being attained by the production process. QA cannot absolutely guarantee the production of *quality* products.

Two principles included in QA are: "Fit for purpose", the product should be suitable for the intended purpose; and "Right first time", mistakes should be eliminated. QA includes regulation of the quality of raw materials, assemblies, products and components, services related to production, and management, production and inspection processes.

Quality is determined by the product users, clients or customers, not by society in general. It is not the same as 'expensive' or 'high quality'. Low priced products can be considered as having high quality if the product users determine them as such.

<p>Level 1 0-9 marks</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, with little knowledge of ICT in manufacturing systems if appropriate to the question. • 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 10-1 marks</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. These aspects are 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 15- 20 marks</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 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. • 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 21-26 marks</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. These aspects are 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.

SECTION C

Answer **two** questions from this section.

Your answer should be substantial and show the **depth** of your knowledge in Systems and Control Technology.

Each question carries 26 marks.

- Q.11 Give a detailed description of the aesthetic and functional style of a designer you admire and explain how the designer has influenced the style of other similar products. [26]**

Description of aesthetic style is the first aspect that will need to be developed and this must have specific details of products and their unique styling features that are a source of admiration to the candidate. This needs to be followed by the way that the designer has influenced other products.

- Q.12 'Often it is the control system within a product that is the main driving force in product innovation.' With the use of named examples, explain how this statement may be supported. [26]**

Typical responses will centre on the concept of improved function, efficiency, performance or reliability. There may be reference to reduced size control system and therefore product, miniaturisation is an acceptable trend. Technological advancement in terms of production methods, materials and components available or an increased capacity to carry out the original functions. Named products must support this discussion.

- Q.13 An essential attribute that designers need to produce a successful product is a detailed knowledge and understanding of the materials or components that they select to make components for the product.**

Describe the particular purpose, characteristics and working properties of two materials or components that have been selected for use in a particular named product and explain what features made them appropriate for use. [26]

Description of materials or components with reference to their particular purpose in the part or parts that have been made from them followed by the characteristics of the particular material and finally the material's working properties of both materials.

Q.14 Describe how the development of a design consciousness within society has impacted on the design and development of control systems used in products.

In your answer discuss the materials selected, the manufacturing considerations, the product life cycle and the eventual disposal of the product.

[26]

Marks allocated for the inclusion of the four elements materials selected, the manufacturing considerations, the product life cycle and the eventual disposal of the product. There should be mention of energy efficiency in use, energy rating issues, the economic factors of running products, the pollution / waste created when producing and using the product.

Q.15 ‘The art of designing is often said to be a social activity.’

Explain how this phrase is depicted in the many activities that designers are involved with when designing a product.

[26]

Identify all aspects of designing that require the designer to have contact with other groups, experts, manufacturers, etc. in the course of their work. This answer may relate to an industrial or a school setting.



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