



GCE MARKING SCHEME

SUMMER 2016

**DESIGN AND TECHNOLOGY
DT3 - FOOD TECHNOLOGY
1113/02**

INTRODUCTION

This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

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

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

**GCE DESIGN AND TECHNOLOGY
DT3 - FOOD TECHNOLOGY**

SUMMER 2016 MARK SCHEME

- 1. Evaluate the use of packaging as a marketing tool for both economy and luxury food products. [8]**

Answers must cover both economy and luxury – maximum of 5 marks for a response which focuses on only one or the other. To gain higher marks candidates must cover a good range of factors in detail. Maximum of 3 marks if discuss using packaging as marketing tool without reference to either economy or luxury food products. Award no marks for discussion of physical functions of food packaging.

Use of packaging to create an identity / particular image for the food product, to appeal to specific target groups and to make product easy to identify quality level / brand. Use of brands, logos and trade names. The use of colour, size, shape and typography. For example:

	<i>Economy</i>	<i>Luxury</i>
Image	communicating message that money hasn't been wasted on the packaging – intentionally looks 'low cost'	sometimes 'understated' look; sophisticated.
Brand names	'economy', 'basic'	'finest', 'best'
Product description	no description or only basic description	more detailed, more descriptive, more flowery language
Shape	standard shapes	sometimes unusual shape e.g. heart shaped box
Colours	white, red / blue. Often only 2 colours	richer colours eg. purple / maroon / black / gold / silver. Sometimes wider range of colours.
Images / photography	often no image on packaging	more likely to have images of product; sometimes 'lifestyle' pictures e.g. use of quality crockery etc.
Typography	basic lettering	more flowing scripts, sometimes with appearance of 'hand-writing'. Sometimes raised typography
Paper / materials	lower grade of paper, thinner, texture of paper less tactile	higher grade paper, thicker, sometimes more sensual feel / textured; glass / ceramic
Sustainability		more use of recycled paper; FSC paper / card.
Use of logos to denote quality		E.g. Tractor logo

2. Salmonella, Staphylococcus, E. Coli and Clostridium are examples of micro-organisms which can threaten food safety.

For any one of these:

(a) outline the main source of infection; [3]

Up to 3 marks, depending on level of detail. Response must focus on one of the three only. Maximum of 1 mark for generic answer which does not reference a named micro-organism.

- Salmonella – eggs, poultry, sausages;
- Staphylococcus – humans – gut / bowel / nose / throat / mouth.
- E. Coli – human gut, ground beef, unpasteurised milk, bean sprouts, salad, spinach, unpasteurised juices;
- Clostridium Botulinum – meat, fish, milk, fruits and vegetables if incorrectly preserved or treated, canned foods.

(b) describe precautions taken by food manufacturers to avoid contamination (by food poisoning bacteria). [5]

Up to 2 marks for each developed point.

Some points may be relevant to any one of these food poisoning bacterium:

- staff training;
- rules re' working with food when been unwell;
- sourcing of quality food materials; high specifications for suppliers of food materials; buying from reputable suppliers;
- good hygiene practices;
- uniform policy,
- hand washing procedures;
- signage to encourage high standards of personal hygiene;
- provision of appropriate toilet and changing facilities.
- HACCP procedures, assess and monitor risks;
- control of high risk foods – separate storage and preparation areas, colour-coded equipment, staff;
- carry out microbial analysis and sampling;
 - Use of use-by dates;
 - Reduce human contact;
 - Don't wash chicken or other meat;
- temperature control – storage, cooking, transportation etc.

Some points may be specific to one particular food poisoning bacteria:

- Salmonella – use of pasteurised eggs, use of Lion marked 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.
- E. Coli – thorough washing of vegetables. Tracking provenance of beef products.
- Clostridium botulinum – high temperatures to sterilise cans. Cans designed to be strong to avoid denting.

3. ICT is used extensively in the design and manufacture of food products. Explain the benefits of ICT in:

- (a) nutritional analysis during the development of food products. [4]**
Databases can be used to manipulate possible combination of food materials. Provides additional information when deciding whether to take forward a design. For choosing appropriate food materials to fit in with nutritional requirements of specification. To help develop food product to meet RDAs. To calculate how healthy a food product is. To help determine portion size. To provide information for labelling, particularly fat (saturated / unsaturated), sugar, salt and calories content. Helps with decisions re' traffic light labelling – whether the food product is red, amber or green. Allows food technologists to see result of altering individual ingredients by different amounts.
- (b) stock control during the manufacture of food products. [4]**
If a manufacturing business does not manage its stock well it can start to lose profits. Automatic Replenishing Systems can be used so using ICT for stock control should ensure that stock does not run out so the manufacturing process can continue effectively. Customers continue to be able to buy and the company able to sell. Not too much stock is allowed to build up – this would increase storage costs and lead to shorter consequent shelf-life and greater food wastage. JIT (Just In Time). Increased efficiency through use of ICT will mean only a minimum amount of stock waiting to be used in the production process. It becomes easier, faster and cheaper to find information and manipulate data than using non-ICT system.

4. UHT (Ultra heat treatment) processing is used as a method of preservation for milk.

- (a) Briefly outline the process of UHT. [2]**
Milk is sprayed through a nozzle into a chamber filled with high temperature steam under pressure. It is heated above 135°C (between 135°C and 150°C) for 1 to 2 seconds. It is then cooled instantly.
- (b) Describe the effect on microbial levels and shelf-life. [3]**
This heating kills spores as well as bacteria. Much increased keeping properties - UHT milk will have a shelf-life of 6 to 9 months and does not need to be kept refrigerated.
- (c) Evaluate the effect on the physical, sensory and nutritional properties [3]**
Change in taste and smell (off-flavours) due to Maillard browning – these changes are unacceptable to some customers. There can be slight changes in colour – slight browning. There is some loss of vitamin B12, vitamin C, thiamin and folate.

5. (a) **Outline the main requirements placed on food businesses by the 1990 Food Safety Act.** [4]

Award up to 4 marks for correctly outlining at least 2 of the following points:
In summary, the Act requires food businesses not to commit offences of:

- *rendering food injurious to health*, whether deliberately or not, by adding an article or substance to it, using an article or substance as an ingredient in its preparation, abstracting any constituent from it or subjecting it to any other process or treatment;
- *selling food which is not of the nature or substance or quality demanded*. “nature” covers a product sold as one thing, but which is in fact another, e.g. haddock sold as cod; “substance” covers situations where the food contains foreign bodies (e.g. an insect) or where there is a statutory or other standard for a food and the substance falls below it; “quality” covers commercial quality;
- *falsely describing or presenting food* - creates offences for false or misleading labels and advertisements and misleading presentation. The offence can occur when statements or pictorial material concerning food are untrue or presented in a misleading way. The offence also covers material that is correct but given such emphasis that the purchaser is led to the wrong conclusion, for example it could cover products which are not cream but which are presented in cartons of the traditional colour of cream cartons and displayed amongst cream cartons.

(b) **Describe four actions available to the enforcement authorities if food businesses fail to meet these requirements.** 4 x [1]

Award 1 mark for each correct point.

The Act gives enforcement authorities powers to intervene in cases of breach of the Act.

Authorised officers of food authorities can:

- take samples of food and food ingredients;
- enter food premises to investigate possible offences;
- inspect food to see if it is safe and detain suspect food or seize it;
- inspect premises, processes and records and may seize or copy any relevant records;
- take their own visual records, such as photographs and videos;
- issue the owner with a notice requiring the food to be kept in a specific place and not to be used for human consumption while they investigate;
- seize the food and have it removed to be dealt with by a JP/ Sheriff;
 - impose penalties;
 - refer to Crown Court for custodial sentence;
- close unsatisfactory premises or issue improvement notices requiring improvements to specific processes to be made by a certain date;
- serve an emergency prohibition notice, without prior reference to a court when a business presents an imminent risk of injury to health. The premises, or some specific part of them, are then required to be closed;
- make emergency control orders to remove substantial threats to public health, e.g. prevention of distribution and sale of contaminated food.

Food businesses must demonstrate due diligence.

6. Explain what you understand by qualitative and quantitative testing in relation to the selection of food materials. [8]

Qualitative testing of food materials is used primarily to define a problem and generate hypothesis. Qualitative testing will reflect the intended quality of certain defined aspects of a material's specification. Qualitative tests are subjective and therefore difficult to measure (because of this they are often considered less reliable). They consider the aesthetic / organoleptic properties of a food product. Quantitative tests are objective; they use measurable criteria which can be assessed against specific measurable performance criteria. E.g. must be a certain size / weight / contain a particular amount of a specified nutrient (because of this they are often considered more reliable).

7. Describe the important features of a design process used to design and make successful food products. [8]

Responses will need to refer to the principles of a design process and the development of food products – a description of the features of the design process from initial design brief to the completion of a problem solving task. Responses need to refer clearly to a successful process which may be structured into definitive steps or stages in solving problems i.e.

Identify a need through to the summative evaluation.

Discover – identification of the design problem / opportunity. How is it identified?
Consumer pull.

Define – understanding the issues through detailed research and identification of the problem. Responses will need to make reference to how the designer defines the problem and reaches a possible specification which clearly defines the problem.
Credit reference to target market.

Develop – all the associated systems which will be used in developing a product to a successful conclusion, e.g. idea generation and subsequent development – types of modelling, trialling, testing.

Deliver – manufacturing the food product for a specific market.

8. Outline the advantages and disadvantages of one-off production to the manufacturer of a named food product.

[8]

Answers must focus specifically on advantages and disadvantages to the manufacturer. Do not credit answers which focus on the consumer.

Advantages

- high level of satisfaction for workforce resulting in good morale;
- variety of tasks for workforce, including tasks with challenge resulting in lack of boredom, workers more involved in their work;
- 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 /low wastage as food materials purchased specifically for the particular job;

Disadvantages

- expensive in labour costs;
- labour intensive;
- might achieve low profit levels despite premium price because of amount of time uses;
- usually requires high level of skill; might be difficult to recruit staff with appropriate skill set;
- may require staff training;
- not suitable for automation so no scales of production;
- time consuming – requires long lead-in time;
- often requires more storage facilities because of long lead time / stock of part-finished products;
- income may fluctuate as may be less regular;
- money tied up in stock in hand;

9. A food technologist may choose to use a particular fat, based on a number of factors.

(a) Outline the nutritional characteristics of two different named fats. 2 x [2]

Answers may focus on:

- total fat content;
- saturated fat content;
- mono / polyunsaturated fat content;
- hydrogenated fat content;
- vitamin content;
- fortification of particular fats e.g. margarine;
- energy content.

(b) For any one of these fats, describe two properties which make it suitable for use in particular food products. 2 x [2]

Answers may focus on:

- flavour
- shortening
- aeration
- plasticity
- emulsification
- lubrication
- lamination
- solid / liquid at room temperature;
- ability to increase shelf-life of baked products.

10. Evaluate the use of one specific SMART food material in named food products.

[8]

Responses should focus on the characteristics of the material and how these are used in specific food products. 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. Because of its low cost, high protein content and because it will take on the flavours of the meat it is sometimes added to meat products; to bulk them out, reduce the cost and reduce the fat content of a dish. Because of its long shelf-life and low weight it is used in products such as dehydrated sauces.

Other Smart food materials chosen by candidates might include:

Quorn;

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.

SECTION C

*Answer **two** questions from this section.*

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

Each question carries 26 marks.

Level 1 0-9	<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.
Level 2 10-14	<ul style="list-style-type: none"> • The candidate has a basic understanding of the issues associated with the question. • The use of 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.
Level 3 15- 20	<ul style="list-style-type: none"> • The candidate demonstrates a clear understanding of the issues associated with the question. • The use of 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.
Level 4 21-26	<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.

Marks are awarded according to the four levels within the assessment criteria. These criteria are best fit and if a candidate has most of the aspects within a level then the candidate can be considered for marks towards the higher end of the band. If there are some features that are weak or missing but overall the response matches many of the descriptors then the candidate could be considered for marks in the middle of the level. Candidates may be awarded marks at the bottom of the level if they have most of the descriptors in the previous level and one or two in the next level.

- 11. The price charged for a food product is not simply based on the costs of production. Discuss the factors which influence how the prices of food products are determined.**

[26]

Factors discussed may include:

- Food costs - may depend of quality, whether in season, whether in plentiful / short supply, whether organic / free range / farm assured, Fairtrade;
- Costs of production / manufacturing – may depend on scales of production and economies of scale, level of automation;
- Price to fit the target market / price market will bear - may be in terms of pricing the product sufficiently low to be in line with what the consumer can afford / is willing to pay or possibly pricing the product sufficiently high to give consumer impression of quality;
- Competitors' prices;
- External criteria such as capturing market share e.g. loss leaders;
- Elasticity of demand – how much can the price change as a result of differing demand;
- Product lifecycle;
- Psychological pricing;
- Priced to fit brand image;
- Unique Selling Point e.g. cholesterol lowering products;
 - Celebrity endorsements;
- Quality level of product;
- Portion size;
- Labour costs – may include skill level of workers, availability of workforce, how labour-intensive process is;
- Costs of packaging;
- Costs of transportation, storage, promotion, retailing;
- Profit levels.

12. Discuss the reasons why food technologists and manufacturers may aim to achieve maximum vitamin and mineral content in food products and describe the possible methods used to achieve this. [26]

Reasons to aim to achieve maximum vitamin and mineral content could include:

- to attract customers to buy product / increase sales;
- value added – retailers can charge a higher price for a premium product such as orange juice fortified with calcium;
- improve image e.g. breakfast cereal which is fortified with vitamins and minerals may be viewed more favourably by parents despite having high sugar content;
- to satisfy demands of health conscious market;
- to appeal to specific target groups e.g. parents of young children;
- to be able to make nutritional claims;
- USP – unique selling point which competitor's product may not have;
- legal requirement e.g. margarine is fortified with vitamins A, D and E which are naturally present in butter;
- to replace nutrients lost in processing / storage;
- to make equivalent nutritional value e.g. margarine / butter; white / brown bread;

Ways in which it may be achieved:

- Ingredients - use e.g. fresh fruits and vegetables as quickly as possible as there is deterioration of vitamin content. Nutritional content of meat / milk may depend on the feed given to the animals. Choose foods with naturally higher nutrient content. Use of GM – some GM foods may have higher content of particular nutrients;
- Storage / transportation: use of refrigerated transportation; modifying atmosphere during transportation;
- Processing – there may be some loss of nutrients in processing. Avoid processing which involves high temperatures. There can be vitamin loss in water so minimise processing in water;
- Use of antioxidants to preserve vitamin content;
- Fortification e.g. breakfast cereals fortified with iron, orange juice fortified with calcium.

13. Discuss how food products have been adapted to meet the specific needs of a range of target markets. [26]

Target market may be based on age, gender, health conscious, weight watchers, vegetarian, medical need e.g. gluten free / nut free / diabetic / high cholesterol, environmentally aware, religion / ethnicity etc.

Food products may have been developed in a number of ways. E.g.:

- Fat replacers – reduced calories, reduces risks from diseases associated with high fat diet; however some reports that they can cause anal leakage;
- Sweeteners – reduced calories, better dental health than eating products with sugar, reduced risk of diabetes;
- Reducing amount of salt / using losalt because of impact on blood pressure;
- Cholesterol-lowering spreads – claim to lower blood cholesterol levels. Products are very expensive;
- Probiotics and pre-biotics – claim to balance the level of bacterial activity in the gut and so aid effective digestion and reduce e.g. bloatedness;
- Fortified foods – with various vitamins and minerals. More recently more food products are being fortified with omega 3 and 6. Health benefits have been suggested to include heart health, improved brain development in children;
- Meat analogues e.g. Textured Vegetable Protein with high protein and low fat content; often fortified with various vitamins and minerals;
- GM foods with e.g. increased protein levels. Some people have concerns about the environmental impact of GM technology;
- Removal of some ingredients which could be a choking hazard for young children;
- Avoiding nuts due to risk of allergies;
- Avoiding hard foods for children which could cause damage to teeth;
- Avoiding use of artificial additives;
- Adapting foods to make them more appealing to children and / or parents e.g. calcium enriched orange juice;
- Portion size / nutrient content suitable for age group;
- Speed / ease of preparation for people with busy lifestyles;
- Anthropometrics especially for hand-held foods;
- Ease of opening packaging for children / the elderly.

14. Discuss the factors to be considered when designing and manufacturing sustainable food products.

[26]

Reference may be made to the 6Rs. Issues covered could include:

- Energy efficient production;
- Design systems to use machinery which is versatile;
- Design of premises e.g. use of natural light;
- Using JIT to reduce energy use through storage etc.;
- Water efficiency e.g. using waste water again for e.g. cooling;
- Green energy sources e.g. wind, solar;
- Disposal of waste;
- Sourcing local materials to minimise transportation (food miles);
- Using seasonal produce to e.g. reduce energy use e.g. heating in greenhouses / polytunnels;
- Avoiding food materials transported by air;
- Organic materials;
- Increasing use of vegetarian protein sources as it is a more efficient use of land than meat production e.g. smart materials such as quorn instead of meat which is very land-intensive;
- Minimising use of pesticides etc. by suppliers;
- GM foods developed to e.g. use less water;
- Avoiding use of GM foods because of environmental concerns;
- Avoiding use of growth promoters;
- Avoiding use of endangered fish e.g. cod;
- Using line caught fish;
- Products with longer shelf-life to reduce waste food being thrown away;
- Recycled, recyclable, compostable (biodegradable) packaging;
- Minimal packaging; redesigning packaging to use less material e.g. sleeve rather than box; square tubs rather than round ones;
- Using wood pulp from sustainably managed forests;
- Avoiding use of some plastics;
- Labelling plastics with type to aid recycling e.g. PET, putting recycling labels / symbols on packaging to encourage responsible disposal;
- Stating CO₂ contribution of individual food products on packaging;
- Displaying aeroplane symbol on foods transported by air;
- Reduce portion size to minimise waste;
- Buying food products from more local retailers to cut out the stage of food being sent to a regional distribution centre before dispatch to retailer.

15. Describe the process of quality control and quality assurance and discuss their importance to the food manufacturer, consumer and the environment.

[26]

Quality Assurance is any systematic process of checking to see whether a product being developed is meeting specified requirements. It attempts to improve and stabilise production (and associated processes) to avoid, or at least minimise, issues which led to defects in the first place. It is concerned with putting systems in place to ensure the quality and standardisation of food products. It aims 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 and components, services related to production, and management, production and inspection of processes.

It 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, organisational culture, motivation, team spirit, and quality relationships.

Important to:

- the manufacturer
Principles included in QA are 'fit for purpose' and 'right first time' – mistakes should be eliminated. Enables manufacturer to show due diligence. Contributes to manufacturer's reputation.
- the consumer
A QA system is said to increase customer confidence and a company's credibility, to improve work processes and efficiency and to enable a company to better compete with others.
- the environment
Monitoring emissions to air, land and water and encouraging manufacturing to manage their impact on the environment and reducing and managing waste.

Quality Control covers processes which review the quality of all factors involved in production. It emphasises testing of products to identify defects and report to management who make the decision whether to reject products.

Important to:

- the manufacturer
Quality control methods include dimensional accuracy, quality of ingredients, appearance and finish. The use of CAD / CAM to ensure quality. May decrease costs because of reduced wastage.
- the consumer
Important to the consumer because of confidence in the product or manufacturer, aspects of safety are important to the consumer e, health aspects.
- the environment
Efficiency, producing little waste or emissions, recycling possibilities and consumer safety.