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General Certificate of Education (A-level)
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Design and Technology: Food Technology FOOD3

(Specification 2540)

Unit 3: Design and Manufacture

Final

Mark Scheme

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FOOD 3: 2012
MARK SCHEME

General Note: For the long questions which are responses to an article or statement, candidates will be rewarded for each separate point made, including explanations, examples given with justification or clarification, original argument and observations drawn from the material. Reward will only be given to realistic argument which is substantiated. In general terms, one mark is allocated to each new point made or example cited. Repetition of the information given in the article will not be rewarded.

SECTION 1
Question 1

01 Describe the chemical structure of protein, using diagrams and sketches if required.

- Proteins contain the elements *carbon, hydrogen, oxygen* and *nitrogen.* Some contain *sulphur* and some contain *phosphorus.*

- Protein molecules are large. They consist of long chains of amino acids (typically 500 amino acids) chemically combined by **peptide links** (or bonds). (Reward 'amino acids' if mentioned that they are in a chain. No reward for naming amino acids unless it relates to chemical structure. No reward for 'essential amino acids – not relevant).

- Each amino acid molecule contains at least one **amino group (-NH2)** and at least one **acidic group (-COOH).**

- Amino acids show both acidic and basic properties and are said to be ***amphoteric.***

- A peptide link is formed when the amino group reacts with the acidic group of an adjacent amino acid. A molecule of water is eliminated during the formation of the **peptide link** (*condensation polymerization)*.

- Two amino acids joined together form a **dipeptide.** Longer chains are called **polypeptides.** Protein molecules can consist of a single polypeptide chain or a number of polypeptide chains joined by cross linkages

- There are several orders of complexity in the structure of proteins: *primary structure* (the sequence of amino acids in the protein chain) and *secondary structure (*where the amino acids are further linked by various bonds to give it a definite shape, often in the form of a spiral)*.*

- The most important group involved in cross-linking is the SH group, which forms a **disulphide bridge**. Other links are formed between the amino acids which contribute to the coiling of the chain.

- Cross links can also be made by the formation of hydrogen bonds. Cross linking determines the secondary structure (i.e. the shape) of the protein.

- Proteins can be classified into two groups according to the shape of the molecules: **Globular** (as in ovalbumin, haemoglobin, myoglobin and caseinogen), are rounder in shape*.* **Fibrous** (as in gluten, collagen and elastin), are either straight or coiled.

Reward candidates for including accurate diagrams to help answer the question. (At least one mark per diagram). NB diagrams are ***not*** *required, if the answer covers the necessary points.*

Criteria for marks awarded	Mark range
Very little understanding. Only one or two points made. The candidate may not use technical terms.	**0 – 2**
A reasonable understanding. Three or more points are made and some use of technical terms.	**3 – 5**
Excellent understanding supported by correct terminology and a variety of relevant points made.	**6 – 8**

02 Describe the effects of the following on animal protein foods:

Look for technical terminology

Heat

- Globular proteins are affected greatly by heat, whereas fibrous proteins are not.
- Heat causes the secondary structure of proteins to **denature,** where the molecule unfolds and changes shape but the sequence of amino acids remains the same.
- Denaturation breaks the cross-linkages which maintain the shape of the molecule. It is usually irreversible. As a result of denaturation, the properties of proteins alter: they become less soluble and more viscous. The unfolded molecules tend to form clumps, as they bond with each other. This results in the setting or hardening of protein foods, known as **coagulation**.
- Egg-white proteins coagulate at 60°C and the yolk at approximately 66°C.
- The muscle fibre proteins in meat coagulate when heated resulting in the shrinkage of meat during cooking. Collagen is softened at 80-100 degrees C, in the presence of water, and is converted to gelatin. Allow 'increases tenderness' if clarified. Overcooking makes the fibres stringy. Neither elastin nor reticulin are affected by heat.
- Maillard reaction – browning resulting from the reaction of reducing sugars and amino acids. Occurs as the result of heating.
- Heat turns the myoglobin in meat from red to brown.
- Denatured proteins are more digestible as the digestive enzymes can break them down more easily.

Allow credit for terms such as 'setting' / 'hardening' / 'turning solid', but only **once** during the whole answer as this point is naturally associated with denaturation and coagulation.

Acids

- Fibrous proteins are not greatly affected by acid, but globular proteins are.
- Acid can start to make proteins **coagulate**, e.g. starter cultures in cheese and

yoghurt, which consist of lactose-fermenting bacteria. The lactic acid produced by the bacteria is responsible for 'setting' or coagulating the milk, forming a curd.

- It breaks down the tertiary structure of protein, e.g. in meat – the use of acidic marinades (vinegar, lemon juice, wine or even tomato juice). The acid increases the rate at which collagen is converted to gelatin.

- In meringue, addition of lemon juice makes a stronger / denser / more stable foam.

- Acid lowers the temperature of coagulation and gives a firmer set, e.g. in poached egg.

Mechanical action

- This causes denaturation (which can be reversible), followed by **coagulation** (irreversible)**,** (when heated/cooked)**,** such as in the whisking of egg white. The protein molecules unfold and form a reinforcing network around the air bubbles, thus stabilising the foam. Food products such as meringues and soufflés are examples of this effect.

    - Mechanical pounding, cutting up meat, mincing helps to break up longer muscle fibres. Elastin and reticulin are not affected, but are made easier to eat.

Candidates should be rewarded for each point. Marks may not be evenly distributed amongst each of the three points, but to gain marks in the top band all three areas should be discussed.

Criteria for marks awarded	Mark range
A basic understanding. Candidates may not cover all three areas.	**0 – 4**
A reasonable understanding of all three areas, though there may be mistakes and omissions in some of the areas covered.	**5 – 8**
A good response. The candidate shows a clear understanding in all three areas. Good use of technical terms.	**9 – 12**

03 Compare and contrast the lacto-ovo vegetarian diet with the vegan diet.

- Vegans eat no dairy produce or any kind of eggs, or anything from an animal, including honey. Lacto-ovo vegetarians will eat dairy products, but eggs must be free range. The preference may be for organic and freedom food products.

- Vegans may prefer organic produce and whole foods.

- Calorie consumption is lower than in lacto-ovo vegetarians because their diet contains higher bulk / low calorie foods, e.g. fruit and vegetables.

- Protein content of the vegan diet is about 75% of the non vegan average but still within acceptable limits.

- Vegans need to consume a greater variety of LBV proteins in order to gain the essential amino acids (*complementation).*

- Give credit to candidates who list the essential amino acids: Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan, Valine, (Histidine).

- Vegans gain their essential nutrients from less commonly used ingredients such as Nori Seaweed and Vecon for Vit B12, and soya for essential amino acids.

- Nutrients that may be in shortfall for Vegans are *calcium, selenium, iodine, vitamins B12 and vitamin D, possibly riboflavin.* These are obtained from the following sources (see table):

- Credit any relevant moral, social, ethical and environmental issues, such as sourcing of ingredients, principles which affect choice (e.g. Vegans do not agree with commercial production of honey as it results in bees being killed) etc.

    - Allow 1 mark for any point relating to the possible ill-effects of a baby/child having a vegan diet. (This is not as crucial for lacto-ovo vegetarians, though iron may be a concern.)

NB Quorn is acceptable for lacto ovo vegetarians, but not for vegans as it contains egg. Credit this observation.

Vegan Sources of shortfall nutrients:

Calcium	Fortified soya milk, white bread, baked beans, dried figs, leafy green vegetables, tofu, nuts, muesli, pulses.
Selenium	Brazil nuts, lentils, sunflower seeds, wholemeal bread, cashew nuts
Iodine	Seaweed, Vecon, kelp supplements
Vitamin B12	Fortified breakfast cereals, fortified soya milk, Vecon, fortified bread
Vitamin D	Fortified vegetarian margarines, fortified breakfast cereals, fortified soya milk, sunlight
Riboflavin	Fortified breakfast cereal, soya milk, fortified soya milk, Marmite, Vecon

- Vegans may obtain more than the national average of the following nutrients: *vitamin C, magnesium, copper, folate, beta-carotene, essential fatty acids.* Total fat intake is about 25% lower than average and saturate intake is about 25% lower than average. Carbohydrate intake (nearly 55%) and fibre (NSP) is higher than the national level, including that of lacto-ovo vegetarians.

Reward any valid accurate point and appropriate examples.

Criteria for marks awarded	Mark range
A basic understanding of the lacto-ovo and vegan diet. Only obvious poi.ts and the candidate may not compare or contrast the diets	**0 – 2**
A good understanding, though the answer lacks depth and detail. Some inaccuracies and contrasts may be omitted occasionally.	**3 – 5**
A full and well informed answer showing excellent understanding of both vegetarian diets. Good examples given. Good comparison and contrasts.	**6 – 8**

Question 2
04 Explain the following terms:
Fatty acids

- There are about 40 different fatty acids found in foods and of these there are basically two types: *saturated fatty acids* and *unsaturated fatty acids.* General formula: RCOOH.

- Fats and oils are mixtures of **triglycerides**, which consist of one molecule of glycerol combined with three fatty acid molecules.

- In saturated fatty acids, the hydrocarbon chain is saturated with hydrogen, but in unsaturated fatty acids the hydrocarbon chain is not saturated with hydrogen and therefore has one or more double bonds.

- Unsaturated fatty acids may be either *monounsaturated* (containing one double bond) or *polyunsaturated* (containing more than one double bond).

- Saturated fatty acids include *butyric, palmitic and stearic* (found in milk fat, butter).

- Monounsaturated fatty acids include *oleic* (found in cooking fats and oils).

- Polunsaturated fatty acids include *linoleic and linolenic* (found in vegetable and fish oils).

    - Allow Omega oils if explained or reference to essential fatty acids.

Hydrogenation

- A portion of the vegetable fat used in margarine is hardened by hydrogenation to produce the required plasticity in the final product before it is blended with the water.

- Hydrogenation (hardening) is undertaken to remove some of the double bonds in the fatty acids and effectively to make them more saturated.

- It turns a liquid into a solid by adding hydrogen across the double bonds in the unsaturated fatty acid molecules.

- It is carried out by heating the oil in large sealed vessels under pressure. Hydrogen is bubbled into the oil with finely divided nickel (which acts as a catalyst and is subsequently removed by filtration). The oil blend is mixed with the water phase, which is skimmed milk, soured under controlled conditions to give the right flavour to the product. Salt, vitamins A and D and artificial colouring are then added. The mixture is then mixed to achieve an emulsion and cooled.

- Hard fats are more hydrogenated (i.e. saturated) than soft fats.

- Hydrogenation can produce fat molecules which are in Trans rather than the normal Cis formation, which has health implications for the consumer. Some countries have banned Trans fats.

Hydrolytic and Oxidative rancidity

- This is the term used to describe the spoilage of fats and oils.

- Rancidity leads to the production of odours and flavours caused by *aldehydes and keytones*, associated with the deterioration of fat.

- Oxidative rancidity occurs as a result of the reaction between unsaturated triglycerides and oxygen from the air can be accelerated by heat, light and copper or iron traces. Lipases occur naturally in fats and oils or can be produced by microorganisms present in fatty foods. Heat processing can inactivate lipases.

    - Hydrolytic rancidity is where the enzymes known as lipases hydrolyse fats, breaking them down into glycerol and fatty acids. Short chain free fatty acids produce the odour.

    - Allow for hydrolytic rancidity being accelerated also by micro-organisms, especially some moulds.

    - Allow the use of anti oxidants to prevent rancidity and reasons for rancidity being undesirable – food spoilage etc.

    - Allow reference to the fact that it occurs in the presence of water.

NB Although the question paper states the question is out of 12, it will be marked in three sections as 3x4.

Criteria for marks awarded	Mark range
A basic understanding of the term. The candidate may not cover The term adequately. There may be errors and confusion in the response.	**0 – 1**
A reasonable understanding of the term, some omissions and inaccuracies, but on the whole the candidate is able to explain it adequately.	**2 – 3**
An excellent response which covers the terms effectively. Very good knowledge and understanding shown. Fluent explanation supported by good use of technical terms.	**4**

05 Using examples, explain how fats and oils can provide physical and sensory variety in food products.

- Fats provide food products with colour, flavour, moistness, good mouth feel.

- Fats can be used in various methods of cooking, which can alter the flavour, colour, texture and aroma of foods. Examples include potatoes deep fried (chips), shallow fried (sauté or potato cakes), baked in oil (wedges) etc.

- Different fats and oils have different properties and thus will affect food products in specific ways, for example butter provides a rich 'buttery' taste and good colour. It has a low flash point however, and cannot be used for deep fat frying due to presence of water. Lard has a higher flash point and can be used to deep fry. Some people prefer the flavour of chips fried in lard to those fried in oil etc.

- Reward candidates who talk about the effects of different fats in pastry, cake and

bread making (flakes, puffs, aeration, shortening, glazing, emulsion etc.) Allow up to 2 marks for explanations about the scientific principles underlying these processes e.g. in shortening, flaky pastry as long as they focus upon fat.

Allow reward for any relevant point, together with an example. Significant points that don't carry an example may be rewarded. If several examples are given to illustrate one point, restrict the reward to one mark for the collective examples as there are only 8 marks in total. It should be the physical / sensory point made that drives the answer.

Criteria for marks awarded	Mark range
A limited understanding of the physical and sensory effects of fats and oils on food products. The answer may be restricted to only one or two points, with few examples.	**0 – 2**
A good understanding of the topic. The answer includes a variety of points with relevant examples. The answer may lack depth.	**3 – 5**
A thorough response which covers a wide range of points, relevant and sometimes original examples may be given. Good use of technical terms.	**6 – 8**

06 Describe current nutritional guidelines and explain how they can be used to promote healthy eating.

- NACNE and COMA (the emphasis on lowering levels of sugar, salt, fat, alcohol and increasing water and NSP. Eating more whole foods etc).

- The 'Eatwell Plate' (part of the 'Balance of Good Health') is a pictorial representation of the recommended types and proportions of the various food groups that should be consumed by an individual. It is an effective way of learning about good nutrient/food balance and those foods that should be eaten in moderation.

- In general terms a balanced diet provides all the necessary nutrients in the appropriate proportions and quantities to meet our needs. The essence of a good diet is to eat a variety of different foods to ensure that the body can easily obtain all the essential nutrients, but in the right quantities for the individual.

- The amount of food taken in each day, in terms of KJ / calories should roughly equal the energy expenditure. Meeting the balance of energy intake in terms of KJ / calories and energy expenditure is important in preventing excess being stored as fat, or conversely, insufficient being obtained, resulting in weight loss.

- Reward can be given for mention of other tools for helping people to plan a balanced diet, such as the Wheel of Good Health, the Food Pyramid and 'Five a Day', as long as these terms are explained in the context of the question.

- Eight Guidelines for healthy living: drink1.2 L fluid per day; don't skip breakfast; eat less salt; sugar and saturated fat; eat more fruit and vegetables; eat more fish; base meals on starchy foods etc.)

- Reward specific measurements e.g. maximum of 6g of salt per day / total calorie intake should be one third starchy foods / correct % of fat and saturated fat as a % of this.

- Reward guidelines for recommended calorie intakes for men (2,500) women (2,000) and children (1500).

- Reward traffic light systems / DRVs / Amounts per portion on food packets / % recommendations per day etc.

- Candidates should be rewarded if they mention the adaptations made by specific groups to ensure a balanced diet, such as vegetarians or vegans.

- Reward discussion about use of the principle over a period of time, thus, adjusting food intake to compensate for over-indulgence on one day, or nutrient omissions on another, etc.

Any relevant point may be rewarded, including specific examples of how the 'Eatwell Plate' could be utilised in educating young children in schools or adults, e.g. through medical services etc.

Criteria for marks awarded	Mark range
A weak answer which says very little. The candidate may not know what the guidelines are and may not discuss the question adequately.	**0 – 2**
A good response which clearly describes the guidelines and offers some suggestions as to how they can be used.	**3 – 5**
A thorough response which shows excellent understanding of the topic and covers a wide range of points, which are clearly explained. There is likely to be original thinking in the answer.	**6 – 8**

Question 3

07 With reference to micro-organisms, explain how food spoilage occurs.

- The micro-organisms responsible for food spoilage are: **bacteria, moulds and yeast.**

- The conditions required for their growth are: food, moisture, temperature, oxygen (in some cases), pH, time. (Allow a half mark for each of these and a whole mark if they are put into context).

- Enzymes contained within the micro-organisms break down the constituents of the food, resulting in unpleasant end products, for example the smell of stale fish, which is due to a compound called *trimethylamine*, produced by the enzymic breakdown of protein.

    - Allow discussion related to hydrolytic rancidity(if clarified).

- Yeasts are found mainly on plants. They reproduce by *'budding'* and can cause certain foods to ferment, such as fruit juices, particularly orange juice. This renders the juice unpalatable, causing a bitter 'fermented' flavour, a distinct unpleasant aroma and discolouration.

- Moulds grow in a thread like mass (*mycelium)* made up of thin strands called *hyphae.* They can produce a 'mouldy' taste and aroma and discolouration, which can sometimes be formed of bright colours, which are off-putting. Moulds can penetrate down into the food through '*sporulation'* and can produce toxins which could be harmful to health if consumed.

- Bacteria are single-celled organisms that can produce *toxins* which can result in illness (*endotoxins)*, sometimes even when the bacterial cells are dead (*exotoxins).* It is not always possible to tell whether foods is contaminated with bacteria as they are not visible to the naked eye and do not always produce the visual effects and smells that moulds and yeasts produce.

NB Do not reward Physical and Chemical 'Food spoilage', as this is not correct in the context of this question.

Criteria for marks awarded	Mark range
A basic understanding of the topic. Candidates may not mention all three micro-organisms and may be confused as to what food spoilage means.	**0 – 2**
A good response. The answer includes most of the necessary information and the candidate has made some informed points. There may be some errors and omissions.	**3 – 5**
A thorough and detailed response which shows confidence and good use of technical language, correctly applied.	**6 – 8**

08 Describe the use of micro-organisms and enzymes in the production of the following:

Points made must relate to micro-organisms and enzymes (not just general processing). Reward temperatures if they are related to microbial growth. Reward the names of bacteria, even if spellings are inaccurate.

Cheese

- Heat treatment of milk: The milk is pasteurised and then cooled to 31˚C when it is pumped into cheese vats.

- Starter culture added: This is a cocktail of bacteria (usually *Lactococcus cremoris* and *Lactococcus lactis*, which constitute 2% of the total weight. Its function is to sour the milk, converting the milk sugar lactose into lactic acid. The lactic acid acts as a preservative and makes a contribution to the flavour of the cheese.

- Rennet added: Rennet is extracted from the dried stomach of the calf. It contains *rennin*, the enzyme which causes milk to clot. Rennet is added about 30 minutes after the starter has been added. The cheese then begins to set, under controlled temperature. The vegetarian rennet is called chymosin.

- Allow candidates reward for the mention of *mould* (usually *penicillium / P.roquefortii* in hard blue cheeses and *Penicillium camembertii* which produces a white growth as in Camembert and Brie). These moulds are added artificially through insertion on copper wires (blue veined cheeses) or by rubbing the shallow moulds with salt, which allows the mould to grow.

- Enzymes have the function of producing ammonia which gives the characteristic flavour of the blue cheeses and the soft and creamy texture of the white cheeses such as Camembert.

Yoghurt

- Yoghurt is the Turkish name for milk fermented by a lactic acid bacteria starter culture. It is prepared from milk, slightly concentrated, with added milk powder. The bacteria used in fermenting the milk to make yoghurt are *Lactobacillus bulgaricus* and *Streptococcus thermophilus.* They convert lactose into lactic acid. The two organisms must be in equal amounts and one must not outgrow the other or a bitter or too acid product will result.

- The milk is pasteurised for 15 to 30 minutes at temperatures ranging from 85°C to 95°C. This heat treatment has the effect of stabilising the proteins in the milk and creates an almost sterile environment. The milk is cooled to between 40°C and 43°C. This is an ideal temperature for the optimum growth of bacteria.

- Described as 'inoculation', the starter is added and is usually between 0.5% and 2%. The starter is a mixed culture of *Lactobacillus bulgarius* and *Streptococcus thermophilus.* The streptococci grow and ferment the lactose in the milk to give lactic acid and diacetyl, which gives yoghurt its creamy, buttery flavour. This has to go on until a pH of 5.5 is reached and the oxygen level in the mixture is reduced. In these conditions, Lactobacillus bulgarius thrive and they grow to produce the acetaldehyde, which contributes to the characteristic flavour of yoghurt.

- The inoculated milk is incubated for 4 to 6 hours at 37°C to 44°C or 12 hours at 32°C. The yoghurt is then cooled to 4.5°C, which helps to prevent more lactic acid being formed. This temperature is maintained throughout storage and distribution. Bacteria are still alive, though their activity is reduced, unless the yoghurt is subjected to heat treatment, when they are destroyed.

Criteria for marks awarded	Mark range
A basic answer which is lacking in technical terms. Some areas may be omitted and the candidate may be confused in places.	**0 – 4**
A good answer which covers most of the points. An attempt to use technical terms correctly. Reasonable explanation.	**5 – 8**
A full and detailed response. Very good use of technical terms. The candidate clearly has a good understanding of the topic. Both foods discussed.	**9 – 12**

09 'Food Processing can affect the nutritive value of food'. Discuss.

In general the micronutrients are most affected by food processing, particularly water soluble vitamins and iron. Fat content can also be affected.

- Loss of iron and water soluble vitamins (B group and C) occurs as they dissolve into the processing water which may be discarded.

- Finely chopped fruit and vegetables present a large surface area to water and therefore water soluble vitamins readily dissolve into the water.

- Cutting fresh fruit and vegetables releases enzymes which catalyses the oxidation of Vitamin C (ascorbic acid).

- In certain vegetables, micronutrients accumulate near to the peel and therefore peeling will remove them.

- The use of bicarbonate of soda (sodium hydrogen carbonate) to prevent chlorophyll loss and thus to keep the colour of green vegetables, causes vitamin C loss because it creates alkaline conditions, which is good for the stability of chlorophyll, but not for vitamin C, which is stable in acidic conditions.

- During cooking and processing, losses of up to 75% of ascorbic acid may occur as this nutrient is heat sensitive. Short processes involving small volumes of water incur the smallest losses.

- Vitamin C can be added to blanching water prior to freezing or canning, but these processes, together with dehydration, account for significant vitamin C losses.

- Thiamin (vitamin B1) behaves similarly to vitamin C. Serious losses of thiamin occur when sulphur dioxide or sulphites are used as preservatives, e.g. in frozen chips where sulphur compounds are used to prevent browning.

- Vitamin B2 (Riboflavin) is less water-soluble and can withstand heat but decomposes under alkaline conditions, as does Vitamin B6 (Pyridoxine), which is susceptible to heat and light.

- Milling wheat and cereals such as rice causes the loss of vitamin B1 and B2.

- Losses of the fat-soluble vitamins are very low in food processing, though the use of 'low-fat' foods reduces the presence of these vitamins.

- Fat levels can be increased through cooking methods such as frying and addition of fats or oils to enhance flavor and keeping qualities.

- Skimming milk reduces fat content and in addition the fat-soluble vitamins (A, D, E and K) that the fat contains.

- A positive effect would be the fortification of products with added nutrients.

- In some ethnic products iron will be added through the use of iron cooking pots

- Freezing does not affect the nutritive value of food

    - Reward the point that a lot of processed foods contain very high levels of salt, sugar and fat (including trans fats) in order to make them saleable, so this affects the nutritional profile.

    - Do not allow additives other than fortification with micro-nutrients.

    NB Reward should be given for any relevant point which argues against the question.

Criteria for marks awarded	Mark range
A basic answer which covers only the most obvious points.	**0 – 2**
A good answer which offers some explanation and justification. There may be omissions or some confusion in places.	**3 – 5**
A comprehensive answer which covers the topic well. The points are very well explained and cover a wide range.	**6 – 8**

SECTION 2

Question 4

10 Discuss in detail the issues raised in the article below. (12 marks)

'Our love affair with ready meals is driving an influx of innovative new products, with the independent business analyst reporting that the UK clocked up the highest level – 19% - of all ready meal product launches in Europe in 2009. Alternative sales channels such as independent ready meal stores and internet based home delivery services are also pushing up demand in the mature markets of Europe, particularly in the UK. The high level of product launches combined with the increased level of spend is reflected in the trend for tastier, and more traditional products that claim to be homemade. Specifically Business Insights believes that growth in the market will come from the trend of ready-to-cook rather than ready-to-eat meals. *(Brits eat most ready meals in Europe, 19th May 2010: Food Processing)*

- The food industry in the UK is well established, with several successful research establishments leading the way (e.g. Marlow Foods and Quorn development).
- Consumers in the UK seem to be receptive to new ideas – travel etc.
- Buying ready meals has become a tradition in the UK – working parents, wide ranges available in supermarkets (more than in many other European countries).
- An acceptance that it is OK – time saving – convenient – cheaper than buying fresh ingredients.
- De-skilled cooks and lazy approach to food and cooking, supported by the fact that most homes have a microwave, freezer and easy access to supermarkets.
- A luxury market developing as many people choose not to eat out, but to eat in, making use of the 'ready to cook' ranges, which could be passed off as home cooking.
- A desire to cook and eat traditional British foods, such as cottage pie, spotted Dick etc., which has increased production of these types of ready meal products.
- Use of the internet to buy food e.g.' Tesco on line' is being extended to people ordering ready meals on line. Internet a very popular method of shopping. Many companies jumping on the bandwagon.
- Useful for the elderly (e.g. Wiltshire Foods - bought frozen from a catalogue and delivered to their homes)– a lot of single people in the UK. Other countries have a different attitude to caring for the elderly, tending to bring them into their own homes and home cooking.
- Popularity of ready meal products means a high sale which in turn produces profit that can be use to develop new and more innovative products.
- There is a general view that ready meals are generally viewed as unhealthy.
    - Eating in is now popular because of the economy, drink- driving laws, celebrity chef endorsement / TV advertising. It is generally much cheaper, especially with the 'dining in' meal deals offered by supermarkets.

Criteria for marks awarded	Mark range
A limited response. A few basic observations which may only come from personal experience. The candidate may not look beyond the UK.	**0 – 4**
A reasonable attempt to produce observations and to relate the question. There may be omissions and some inaccuracies.	**5 – 8**
A full, detailed and perceptive answer which shows excellent understanding and the ability to discuss fluently.	**9 – 12**

11 Manufacturers are obliged by law to put procedures / systems into place to make food products safe to eat. Describe one or more of these and explain how they are monitored and controlled.

Candidates may not realize that the question is geared towards HACCP and SFBB. However, reward any points which are relevant to these systems. The terms HACCP and SFBB need explanation before they are rewarded. (Don't just give a mark for mentioning them by name). If physical, chemical and biological contamination is mentioned, reward with a mark, but only award three marks if each one is fully explained with an example. Lists of safe practices need to be explained within the context of the question for reward. Controls and/or monitors should be included for two marks per point made.

HACCP stands for Hazard Analysis and Critical Control Point. It enables manufacturers to prove 'Due Dilligence' if taken to court on food safety matters. HACCP is a system designed to break a process down in order to identify any possible hazards (physical, chemical or micro-biological). The potential hazards are then rated according to whether they are low, medium or high risk and controls are put in place to prevent the hazard occurring. The whole system is monitored and records retained. Critical Control Points (CCP's) are identified. At these points, some preventative action must be taken, e.g. a temperature check and details of monitoring and corrective action stated. Process is reviewed after a given period of time.

'Safer Food Better Business' This is a food safety management system which has been developed to help small catering businesses such as restaurants, cafés and takeaways comply with food hygiene regulations introduced in January 2006.

This system has been developed by the Food Standards Agency, working with catering businesses, to be practical and easy to use.

It helps food businesses to:

- comply with food hygiene regulations
- show what they do to make food safely
- train staff
- protect their business's reputation
- improve their business, such as by wasting less food
- provide a paper system for recording.

The areas it covers include:

Cross contamination: Personal hygiene, Cloths, Separating foods, Pest control,

Maintenance, Food allergies, Physical and chemical contamination

Cleaning: Cleaning effectively, Clear and clean as you go, Your cleaning schedule, Chilled storage and display, Chilling down hot food, Defrosting, Freezing

Cooking: (Cooking safely, Foods that need extra care, Reheating, Ready-to-eat foods, Checking your menu, Hot holding)

Management: (Training staff, Suppliers)

The Law: FOOD SAFETY Act 1990: Credit any references to the law, which are relevant to the question.

Any other relevant and well explained point will be credited.

NB: Don't allow marks for 'quality' points e.g. size, shape, colour. This question only refers to food safety.

Criteria for marks awarded	Mark range
A basic understanding of the topic. Only a few points are made, which may not extend beyond the realms of common sense.	**0 – 3**
A good answer which covers the main procedures and justifies their importance. There may be some confusion or omissions.	**4 – 7**
A full answer which covers all the procedures in some detail. The question has been well understood by the candidate and the response is well substantiated, with relevant examples.	**8 – 10**

12 Describe the following short-term food preservation methods and give an example of the use of each:

Modified atmosphere packaging (MAP)

- Modified Atmosphere Packaging is also called Controlled Atmosphere. It is a method of storage where the oxygen level can be lowered or the carbon dioxide level or nitrogen levels increased. In this form of packaging, the packs are gas flushed, reducing food spoilage and prolonging shelf life. (Allow 1 mark per gas, only if its function is explained e.g. nitrogen to prevent rancidity in fatty foods such as nuts. If all three gasses are mentioned but not explained, allow one collective mark).

- Oxygen is required in packaging raw meat to preserve its red 'bloom'. If oxygen levels are too low, bacteria will respire anaerobically, producing toxins.

- MAP has to be used in conjunction with temperature control in storing fresh foods (below 5°C). It is a very good medium for storing fresh fruits, vegetables, meats and fish. Spoilage is reduced and shelf-life is increased. It usually works by decreasing oxygen or increasing CO_2 or nitrogen.

Vacuum packaging

- The food is placed in plastic packaging and the air around the food is then sucked out and the plastic bag sealed.
- The food is now in **anaerobic** conditions.
- Once the package is opened the food needs to be stored in appropriate storage conditions.
- Bacon, coffee and fish are most commonly packaged in this way.

Allow only one mark for examples of foods preserved by each method.

Criteria for marks awarded	Mark range
A basic understanding which gives only the most obvious points.	**0 – 2**
A reasonable answer, which shows understanding but lacks depth and detail about the underlying principles.	**3 – 4**
A full answer showing excellent understanding of the two methods and the principles underlying them.	**5 – 6**

Question 5

13 The following are commonly used to preserve foods. Giving food examples, explain how they inhibit microbial growth:

- **Sugar**
- **Salt**
- **Vinegar**
- **Smoke** **(4 x 3 marks)**

- The preservation of foods by these methods depends upon the **antimicrobial action** of the added ingredient.

- Sugar reduces microbial activity due to its dehydrating effect. The water available to the microorganisms is reduced by **osmosis** as the sugar solution is more concentrated than the **cytoplasm** inside the cells of the microorganism. Therefore water passes out of the cell and the cell becomes dehydrated.

- Salt is used often in solution as **brine.** This method is used in preserving meats, such as ham or bacon, and is known as **curing**. Many foods are stored in brine solutions, in cans or jars or sealed sachets, such as olives, tuna fish. The solution is usually 25% sodium chloride, 1% potassium nitrate and 0.1% sodium nitrate. The salt content acts in the same way as the sugar, through the action of osmosis.

- Vinegar **(acetic acid)** can be used to pickle foods such as vegetables or eggs. The lowered pH provides unfavourable conditions for microorganisms to reproduce. Most microorganisms grow bets if the pH of the food is between 6.6 and 7.5 (neutral). Bacteria are less acid-tolerant than moulds and yeasts.

- Smoke contains antimicrobial substances which reduce food spoilage. The preservative effect comes from *phenols and acids and aldehydes* in the smoke (which produce a thin tar like film over the surface). It also causes surface dehydration of the product, and the high temperature and lack of oxygen if 'hot smoked' can kill some microbes. Smoking is often used on foods which have already been cured (partially dried through the use of salt). Foods that are preserved through smoking are normally meat, fish, and cheese.

Reward any relevant point and allow one mark only for examples of foods preserved by each of the four methods.

Don't reward 'kills microbes': candidates need to explain why and how for a mark.

Criteria for marks awarded	Mark range
A basic answer which covers the most obvious points.	**1**
A good answer which shows some understanding of the principles, but lacks detail and may be inaccurate in places.	**2**
A full and detailed answer which shows excellent understanding of the principles involved. Good use of technical terminology.	**3**

14 Packaging fresh foods and food products is a major factor in food production. Discuss. (8 marks)

Candidates should discuss the importance of packaging materials in relation to keeping / protecting the food. Use of words such as 'water-proof' / air-tight / stackable / moldable / see-through are good indicators of their understanding of the properties of packaging materials.

- Food hygiene – people handling fresh foods before purchase, causing damage and transfer of bacteria. The need to prevent wastage and food spoilage, for the producer and consumer alike.
- Packaging design is vital for the five P's (Preservation, presentation, prevention of tampering, protection, promotion). Any discussion relating to these points.
- The food industry relies heavily upon the work of packaging designers, providing employment and income when good designs are patented and sold to other companies and parts of the world.
- The desire for fresh soft fruits – numerous recipes that contain them, bright colours and sweet, sharp taste, five a day, phyto-chemicals, anti-oxidants, nutritional value.
- Issues relating to the environment, such as raw materials to produce packaging, air miles if foods are to be transported across the world, recycling, biodegradable etc.
- Consumer expectations – the fact that consumers are now used to effective packaging for delicate foods. They want to be able to see the food before they buy it; they want it to be stored correctly, easy to transport home and store in a fridge or freezer.

Reward any relevant point or example. Allow 1 mark only for any comment related to waste / recycling issues.

NB: Some candidates may answer this question by only referring to factories.

Criteria for marks awarded	Mark range
A basic response which states little more than the obvious.	**0 – 3**
A good response which shows understanding, but the candidate misses some opportunities and does not explore many different lines of discussion.	**4– 6**
A full and detailed answer which is original and creative.	**7 – 8**

15 Describe how ICT is used in food production and distribution. (8 marks)

- ICT is used for stock control, ordering, production schedules, production analysis and traceability.
- It is also used to hold information about complaints from customers to aid quality assurance.
- ICT is used in the design of HACCP plans and in critical path analysis.
- It is also used in association with staff employment, payrolls etc.
- In retailing it is used to promote products, in pricing and in the production of till receipts.

Allow marks for such things as:

- Design of systems to control times, temperatures, scanners, correct weights.
- Packaging design, date stamping, micro-biological predictions.
- Distribution records, traceability, calculations.
- Design of products, labels, recipe formulations, research and marketing etc.

Candidates are to be rewarded for any correct point and examples given which substantiate the answer.

There may be confusion between ICT and CAD / CAM. Strictly speaking in this context candidates should not confuse CAD/CAM with ICT, though they are closely related. The candidate may gain some credit if CAD and CAM are used in connection with ICT within the answer.

Criteria for marks awarded	Mark range
The candidates' understanding of 'ICT' may be inaccurate or superficial. There may be some confusion between CAD / CAM and ICT.	**0 - 2**
A reasonable answer. The candidate understands the concept but is unable to provide much more than a basic explanation. The answer may lack depth and detail, but some good points are made.	**4 – 6**
A full response that demonstrates a sound knowledge and understanding of the implications of the question. The candidate is able to explain the use of ICT thoroughly, providing examples and opening the explanation to include topical or original instances.	**7 - 8**

Question 6

16 Describe the source of infection and the symptoms of food poisoning for each of the following:

- **Salmonella**
- **Campylobacter**
- **Staphylococcus aureus** **(12 marks)**

** In marking, stick to the information on the table below. Don't allow 'stomach cramp' if it is 'abdominal pain' and don't allow vague terms such as 'upset stomach' or 'stomach ache' etc.

Type of infection	Source	Symptoms
Salmonella	Raw poultry, eggs, meat, raw milk, animals, insects and sewage. Human and animal gut, shellfish from polluted water.	Abdominal pain, vomiting, diarrhoea, Fever
Campylobacter	Milk, meat and poultry, animals, sewage, untreated water.	Abdominal pain, diarrhoea (sometimes bloody), nausea, fever
Staphylococcus aureus	The human body (skin, nose, mouth, cuts and boils,) raw milk, cold meats, dairy products and anything touched by hand.	Cramps, abdominal pain, vomiting, low temperature

***** Allow one mark for each correct source and one mark per symptom (a maximum of two marks per source, two marks per symptom).***

Criteria for marks awarded	Mark range
A basic understanding. The question is partially answered, with possible errors.	**0 – 4**
A good answer. The main points are covered, though there may be omissions and errors. All three infections are covered.	**5 – 8**
A detailed and accurate answer. The candidate has excellent knowledge and understanding. Few, if any errors.	**9 – 12**

'A high proportion of adults in the UK (66%) are worried about the influence drinks companies have on young children; with 29% of respondents in favour of banning all advertisements for carbonated or sugary soft drinks. Despite this, more than half of parents (51%) have let their children drink Coca-Cola in the last year, 40% of parents have served their children Ribena and 57% have served Robinson's, including Squash, Barley Water and Fruit Shoots. 34% of parents have given their children bottled water over the past year'.
(*Health risks associated with soft drinks worry UK consumers' 18th June 2010)*

17. It is thought by many that the media encourages young children to consume unhealthy drink products. Discuss in detail the issues raised in the article above. (10 marks)

- Family lifestyles have a great effect upon children. Many spend a lot of time in front of screens and will be inevitably influenced by what they see.
- Parents may not be concerned about advertising – they may feel confident in their upbringing of their children not to see it as a threat.
- Children are influenced by their peers and will copy each other to keep in with the crowd.
- Many parents have not taken on board the warnings against sugary soft drinks and the effects.
- Water is increasingly becoming more common, though some parents may mistakenly think that they are not being good parents if they only provide water.
- Some children are growing up to prefer water to sugary and carbonated drinks, so in another ten years time the percentages may change.
- Economic circumstances may influence purchase of sugary and carbonated drinks in favour of water.
- Effects include dental caries, obesity, type two diabetes and adverse effects brought on through high consumption of carbonated drinks (bloating, wind, hyperactivity, giddiness etc.)
- Additives, including sweeteners found in these drinks can have adverse effects such as hyperactivity or the laxative effect if too much synthetic sweetener is consumed. The 'diet' drink can sometimes be as dangerous as the sugary drink if consumed regularly.
- Many don't want to think that these drinks have any bad effects if taken in small amounts, but forget that they can slowly become a regular part of a person's diet.
- There are some concerns about the effects on health of carbonated water if it is done cheaply, as many are.
    - Media techniques such as TV / celebrity endorsement / Father Christmas or

children drinking these products, so children think they must be good / International names e.g. Coca Cola / End of aisle promotions / BOGOFF / Money off coupons / pester power / children not knowing the nutritive value of foods. Any points such as these, well explained or argued can be rewarded.

Criteria for marks awarded	Mark range
A basic response which goes little further than the obvious.	**0 – 3**
A good response which covers several points. Arguments are communicated well and the candidate shows understanding of the issues.	**4 – 7**
An excellent response. The candidate fully answers the question, making appropriate reference to the text. Some original points are likely to be made, covering a wide range of relevant issues.	**8 – 10**

18 Describe the process of irradiation and any concerns regarding its use as a method of preservation. (6 marks)

- This is a method of preservation where ionising radiations are applied to foods to kill bacteria (gamma rays / beams of electrons).
- There is said to be no risk of residual radioactivity and this process should not be confused with radioactive contamination or radioactivity, though some consumers are still concerned about possible, yet undiscovered effects.
- Opponents of food irradiation sometimes state that large-scale irradiation would increase processing, transportation, and handling times for fruits and vegetables thus contributing to a negative ecological balance compared to locally grown foods.
- Food labeling regulations are not consistent across the world, so consumers may not be 100% sure that they are consuming non-irradiated foods.
- Irradiation has the potential to reduce microbial spoilage, insect damage and the need for chemical additives to improve keeping qualities, flavour etc. Often used in prawns, strawberries and potatoes (to prevent them sprouting).
- It is expensive to carry out and as yet is only permitted in the UK for use with some vegetables, spices and poultry products.

Criteria for marks awarded	Mark range
A limited understanding of the term.	**0 – 2**
A generally good understanding. There may be some inaccuracies and omissions.	**3 – 4**
A full and detailed answer, which is likely to include technical terms and clear explanation.	**5 – 6**

Converting marks into UMS marks

Convert raw marks into marks on the Uniform Mark Scale (UMS) by using the link below.
UMS conversion calculator: www.aqa.org.uk/umsconversion