A-LEVEL

Design and Technology: Food Technology

Unit 3 Design and Manufacture (FOOD3)
Mark Scheme

June 2016

Version: 1.0 Final

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SECTION 1

Question 1

01 Eggs have many different physical and chemical functions in food preparation.

Describe the function of eggs in the following:

- **mayonnaise**
- **whisked sponge**
- **Scotch egg**
- **sausage rolls.**

[4 x 3 marks]

Responses may include any of the points below. Any other correct response will be rewarded. In the lower mark bands candidates will not be penalised for not distinguishing between physical and chemical functions, but it is expected that they will do so to gain marks in the top band.

Do not allow colour, flavour or texture as this is not relevant to the question.

Mayonnaise:

Physical

- the emulsifying properties of egg yolk enable two immiscible liquids to be held together in an emulsion.
- Mayonnaise is an example of an oil in vinegar emulsion.
- The oil is suspended in tiny droplets in the vinegar.
- This action thickens the mixture.

Chemical

- The emulsifying agent in egg yolk is called *lecithin*
- One part of the molecule attracts water *(hydrophilic)* and the other does not *(hydrophobic).*
- The molecules of lecithin surround the oil droplets with the hydropilic part of the molecule in the vinegar and the hydrophobic part in the oil droplets

Whisked sponge:

Physical

- When eggs are beaten they become foamy and this serves to aerate the mixture.
- When cooked the foam coagulates and this makes the spongy appearance created by the foam permanent.
- NB – aeration must be explained

Chemical

- The egg white proteins begin to unfold and trap the air bubbles
- Partial denaturation / coagulation of the protein molecules in the egg is caused by slight heat resulting from the action of beating.

Scotch egg

Physical

- The protein in hard boiled eggs has fully coagulated leaving the egg firm to the touch.
- Beaten egg provides a moist dip which enables coatings such as breadcrumbs to be adeherd to the sausage meat. Allow coating as a term.
- The coating will harden and crisp up when fried producing a firm golden brown outer shell to the Scotch egg.
- Egg white coagulates at 60°c and egg yolk at 66°c.

Chemical

- In coagulation the protein chains in the egg unfold and bond to each other, producing a solid mesh of long molecules which contain small pockets of water.
- The egg and breadcrumb coating is solidified as the egg protein chains unfold and are set upon the addition of heat, forming a firm crust.

Sausage rolls

Physical

- Egg can be used to bind together the sausage meat filling, setting as heat is applied.
- Egg can be used to glaze the outside of the pastry, producing a golden finish to the sausage rolls.

Chemical

- Proteins unfold and set when heat is applied producing a firm structure.
- The Maillard reaction takes place when egg is used as a glaze, where the action of dry heat on the protein, in the presence of a glucose molecule results in a desirable brown finish.

Apply the following to each term:

Criteria for marks awarded	Mark
No response worthy of credit	**0**
A limited response which makes only one point worthy of reward. Little or no description.	**1**
Either one function is well described or more than one function described in less depth.	**2**
A description of various physical and / or chemical functions. Good use of technical language.	**3**

02 The Food Standards Agency have recently advised consumers not to wash raw chicken before they cook it so that the risk of spreading bacteria is reduced.

Which three types of food poisoning bacteria are most often found in poultry?

[3 marks]

1. Salmonella
2. Campylobacter
3. Clostridium perfringens (must write both words to get the mark)
4. Listeria Monocytogens (do not have to include monocytogens to get a mark)

Criteria for marks awarded	Mark
No correct answer	0
One correct food poisoning bacteria named	1
Two correct food poisoning bacteria named	2
Three correct bacteria named	3

03 What advice would you give about storing, preparing and cooking chicken safely so that people do not get food poisoning? Justify each piece of advice.

[9 marks]

Allow one mark for each justified or well explained piece of advice.

Safely Store:

- Keep raw chicken away from high-risk food at all times
- Store chilled (5°C or below) or frozen (-18°C or below) to slow down the multiplication of bacteria – allow 1 mark for temperatures, unless they are justified separately, e.g. bacterial growth rate slowed, dormant when frozen, danger zone etc.
- Keep covered in a food safe container at the bottom of the fridge to contain drips below high risk foods to prevent cross-contamination
- Clean the refrigerator regularly
- Disinfect door handles
- Label and use by the use by date
- Read any supplier / manufacturer instructions for storage

Prepare:

- Once food has been defrosted treat like chilled food and use straight away
- Do not splash juices over sinks, worksurfaces etc.
- Wash hands and disinfect door handles, equipment and surfaces after use
- Make sure food spends as little time as possible in the danger zone
- Use colour coded chopping boards and disinfect after use

Cook:

- Ensure food is cooked to the core for 70°C for 2 minutes / 75°C for 30 seconds / 80°C for 6 seconds or 86°C as an instant reading
- Disinfect and clean probe thermometers inbetween useage
- Learn to use visual checks for food being properly cooked e.g recognising colour changes, boiling point etc.
- Ensure hot holding is at the correct temperature of 63°C and that food is above this temperature before it is hot held.
- Stir liquid foods such as curries so there are no cold spots
- Cover and chill rapidly if the chicken is to be eaten cold or stored for future use.

Each of these points need to be justified with points relating to reducing the conditions for growth of bacteria (such as time, temperature etc); avoiding cross contamination etc.

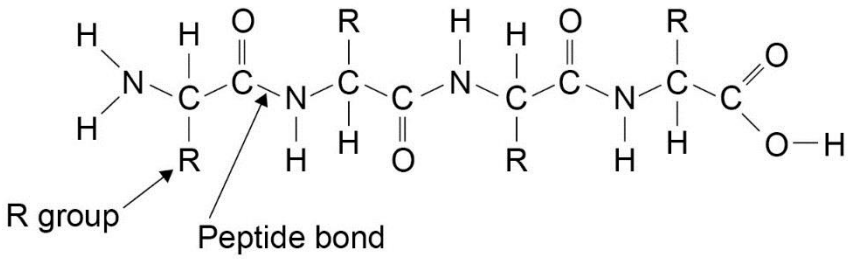
Criteria for marks awarded	Mark range
No response worthy of credit	**0**
Few points worthy of credit. The candidate may not have covered all three areas. Justification may not always be given.	**1-3**
A selection of points made which are relevant and generally justified. All three areas are likely to be covered.	**4-6**
The advice is well considered and the justification covers a range of different points, each separate point being well explained.	**7-9**

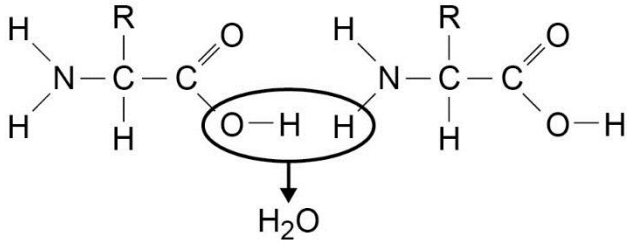
04 How are amino acids combined to form polypeptide chains?

You may use diagrams to explain your answer.

[4 marks]

A typical protein molecule contains about 500 amino acids. These are joined together by *peptide links* which are formed when the *amino* (-NH2) group of one amino acid reacts with the *acidic* (-COOH) group of an adjacent amino acid to form an amphoteric molecule. A molecule of water is eliminated, called *condensation polymerization,* as the peptide link is formed. Two amino acids joined form a *dipeptide.* Longer chains are called *polypeptides.* A protein molecule consists of a single polypeptide chain or a number of polypeptide chains joined by *cross-linkages*.





Criteria for marks awarded	Mark range
No response worthy of credit.	**0**
One point worthy of credit	**1**
The description or diagram shows some understanding and two accurate points are made.	**2**
A reasonable attempt at the description or diagram, which is largely correct, with good annotations and / or explanation. The answer does not cover all areas.	**3**
An accurate and fully annotated diagram or full description, or both with accurate use of scientific terminology, covering the main required areas of knowledge.	**4**

Question 2

05 Fat is essential for good health but fat is often wrongly shown to be something not to eat. Eating healthily is not cutting all fat from the diet. It is knowing how much of each type of fat to eat.

Justify this statement using supporting evidence and examples of your own.

[12 marks]

Any correct and relevant point will be accepted. Reward will be given for clear argument and supporting evidence which might include any of the following areas:

- Chemical structure of fats to include fatty acids and the 3 main groups of fatty acids: saturated, polyunsaturated and monounsaturated.
- The fact that some foods, such as butter, contain a mixture of saturated and monounsaturated fatty acids.
- Carbohydrate (starch and sugars) provides 4kcal (17kJ) per gram. Protein provides 4kcal (17kJ) per gram. Fat is the most energy dense nutrient, providing 9kcal (37kJ) per gram.
- No more than 35% of our total daily calorie intake should come from fats
- Estimated that we should consume 30% saturated fat (max), 6% trans fats (max), 18% polyunsaturated fat (min), 36% monounsaturated fat (min), 9% glycerols.
- Uses of fat in the body – secondary source of energy, energy store, insulation, internal organ protection, source of fat soluble vitamins, source of essential fatty acids. (NB allow up to 4 marks for the functions of fat in the body).
- High intakes of saturated fat may raise blood cholesterol and increase the risk of heart disease and stroke. A diet high in unsaturates is associated with a lower level of blood cholesterol and reduces the risk of heart disease.

- BMI = $\frac{\text{weight (kg)}}{(\text{height in m})^2}$

  Recommended BMI range (adults)

Less than 18.5	Underweight
18.5 to 25	Desirable or healthy range
25-30	Overweight
30-35	Obese (Class I)
35-40	Obese (Class II)
Over 40	Morbidly or severely obese (Class III)

- We are still eating too much of the wrong kinds of fat, and probably too little of some of the healthy types.
- It is no good saying ‘cut down on fat’ because in terms of health not all fats are equal.
- The polyunsaturates carry the essential fatty acids, particularly *linoleic (omega-6s)*and *alpha-linoleic* acid*(omega-3s*) and have the opposite effects of saturates by lowering LDL blood cholesterol.
- Polyunsaturates in high levels can be easily oxidised in the body, especially when used in cooking, producing free radicals which can damage body cells and may help cancers and other diseases to form.

- Trans Fats – fats which have been hydrogenated, often found in blends of oils used in margarines for cooking, take aways and processing. They raise LDL levels and lower HDL levels ('good cholesterol') – the only type of fats to do this.
- Natural saturated fats such as butter or cheese may raise LDL levels but also raise HDL levels
- Monounsaturates are good at reducing LDL levels, they are rich in the antioxidant Vitamin E and are linked with less heart disease and with increased longevity, lower levels of obesity and less cancers.
- Cholesterol is found mainly in foods of animal origin. Two types: LDL and HDL (Low and high density lipoprotein). A surplus of LDL leads to furring of the arteries, heart attacks, strokes and atherosclerosis. HDL actually helps to remove cholesterol from the tissues and delivers it to the liver for excretion.
- A certain amount of cholesterol is required for cell functioning. An upper limit of 300mg a day of cholesterol has been set by the World Health Organisation.

Criteria for marks awarded	Mark range
No response worthy of credit.	**0**
The points made are simplistic and the response adds very little to the original statement.	**1-3**
There is an attempt to further develop the argument but the points made are basic and the response lacks subject knowledge and understanding. Little in the way of evidence or examples given. Some terms may be confused.	**4-6**
The response moves the argument forward reasonably well. Good use is made of subject knowledge and understanding is clear. Examples and evidence is given. Some subject specific terminology used appropriately.	**7-9**
A well constructed and effectively argued response showing excellent subject knowledge. There is evidence of original thought and very good understanding supported by clear evidence and examples. Excellent use of terminology.	**10-12**

06 Explain why fats and oils might go rancid.

[4 marks]

(i) hydrolytic rancidity

Hydrolytic rancidity is where fats in the presence of water break down to release fatty acids from the glycerol in their constituent triglycerides. The process is accelerated by lipolytic enzymes (lipases) and micro-organisms, especially some moulds. The result is a bitter (rancid) taste and an unpleasant odour. It is found in emulsions such as butter, margarine, cream and occurs in nuts and some biscuits.

(ii) oxidative rancidity

This is the most important type of fat deterioration. It occurs in unsaturated fats and oils and starts adjacent to the double bonds. The reaction is initiated by oxygen. The process of oxidative rancidity is accelerated in the presence of metals (particularly copper and iron), ultra-violet light and high temperatures. Highly reactive free radicals are involved in the reactions. Hard fats are resistant to this form of rancidity. Fish oils are particularly susceptible as they are highly unsaturated.

Criteria for marks awarded	Mark range
No response worthy of credit.	**0**
Little understanding of rancidity.	**1**
The candidate may not fully understand the concept of rancidity and there may be some confusion.	**2**
The candidate understands the principles of rancidity and makes a good attempt at explanation. There may be inaccuracies.	**3**
A clear and well informed response which may identify both forms of rancidity. The explanation is accurate.	**4**

07 How can rancidity be prevented?

[4 marks]

Reward will be given for any of the points listed below. A distinction does not have to be made between the two forms of rancidity.

- Prevented by the use of antioxidants e.g. BHT (butylated hydroxytoluene)
- Oils should be stored in glass containers or a non metal container
- The container should have a tight fitting lid to minimise contact with air (oxygen)
- Store away from light in a cool dark place
- Keep out of contact of metals such as copper and iron
- Keep cool as heat accelerates rancidity
- Keep the fat well wrapped and clean to reduce contamination with moisture or moulds and other micro-organisms, which could lead to accelerated breakdown due to lipolytic enzymes.
- Lipases occur naturally in fats and oils but they can be inactivated by heat treatment.
- They can be produced by micro-organisms present in fatty foods

Criteria for marks awarded	Mark range
No response worthy of credit.	**0**
Little understanding of how rancidity can be prevented from occurring.	**1**
One or two valid points made but there may also be mi-understanding or confusion.	**2**
A good understanding. The points made are generally accurate and well described.	**3**
A full response which shows excellent understanding. The candidate is likely to justify the points made, relating back to the first part of the question.	**4**

08 In relation to fats and oils, what is meant by the following terms:

- **shortening**
- **lubrication**
- **plasticity**
- **medium for cooking and sealing**

[4 x 2 marks]

Any **two** relevant points per term will be rewarded, up to a maximum of two marks per term.

Shortening

- Fats give foods such as biscuits, shortbread and shortcrust pastry their characteristic'short' (crumbly) texture.
- They coat particles of flour and thus contact between the water in the recipe and the proteins in the flour is inhibited.
- When this happens the gluten formation is reduced, keeping the gluten in short lengths so that long elastic strands do not develop.
- Fats such as lard, which are almost pure fats, are best for shortening

Lubrication

- Fats have the capacity to keep foods moist and flexible
- They can be used to extend shelf life by acting as a humectant
- They can be used as basting agents to prevent foods from drying out during cooking, such as the basting of a roast joint.
- Reward will not be given for greasing tins / stopping things sticking

Plasticity

- This refers to substances like certain fats that will change shape when pressure is applied but will remain their final shape when the pressure is removed. They do not return to their original shape.
- They are a mixture of fats which may be liquid and crystaline in structure.
- Margarines are said to have a wide plastic range, meaning that they are spreadable over a range of temperatures, e.g. they will spread straight from the fridge.
- Plastic fats make good shortenings because they coat the flour readily.

Medium for cooking and sealing

- Fats melt when heated over a range of temperatures depending upon the fat (or oil).
- Most melt between 30 and 40°C (known as the slip point).
- Frying usually occurs at 180°C
- Fats and oils help control the temperature of things cooking, e.g. thermostadts on deep fat fryers
- Heat is transferred from the fat or oil to the food rapidly, enabling the outer coating of the food to set and crisp almost immediately, sealing in the juices and preventing the food from drying or falling apart.
- Fats with a high smoke point are best for frying e.g. vegetable oil. Butter is not good as it burns easily, having a slow smoke point.
- Allow using butter as a seal in pate making.

Apply the following to each term:

Criteria for marks awarded	**Mark range**
No point worthy of reward is made.	**0**
The candidate is able to show some understanding of the term. Explanation may be a little confused.	**1**
A very good understanding of the term with a clear explanation. Examples may be given to support the answer.	**2**

Question 3

09 Explain why modified starches have been developed for the food industry. Using examples, describe their working properties.

[8 marks]

In the unmodified form, starches have limited use in the food industry. They tend to produce weak-bodied pastes. Starch is therefore 'modified' to enhance or repress its inherent properties as appropriate for a specific use. Modified starches are used in the food industry to improve binding, provide thickening, increase stability, improve sheen and mouth feel, to cloud or disperse and to gel. The result for manufacturers is that they can have better control and flexibility in dealing with formulation of recipes, processing and shelf life.

Cross-linking: In this method of modifying starch, the granule is 'welded' randomly, reinforcing hydrogen bonding and inhibiting granule swell. The result is that tender starches are strengthened so that their cooked pastes are heavier bodied and more viscous. They are less likely to break down with extended cooking times.

Stabilisation: This modification prevents gelling and weeping. It maintains textural appearance. High amylopectin starch e.g. waxy corn starch, should be used when preparing foods for a freeze/thaw process because it does not *retrograde* easily (where the amylose molecules in starches unwind and the gel becomes opaque and like a pulpy sponge). Freeze-thaw stabilised starches will produce pastes that will withstand several freeze-thaw cycles before syneresis occurs. They are also useful for cold temperature storage of other processed foods such as canned gravies and sauces, which require stabilized starches to maintain quality.

Effects of ingredients: Ingredients present during the cooking process, such as acids, can affect the swelling of the granule because they disrupt the hydrogen bonding. Fats and proteins tend to coat starch which affects the finished viscosity of the paste as it delays granule hydration and lowers the rate of viscosity development. The use of pregelatinised starches helps overcome some of these problems.

Effects of time, temperature and sheer: Tolerances can be built into starches through cross-linking to prevent rupture of granules through high temperature and 'sheer' in long exposure to these forces.

Pregelatinised starches: This has been gelatinised and dried by the manufacturer. It develops viscosity when dispersed in cold or warm water without the need for further heating. It can be known as precooked, pregelled, cold water soluble, cold water swelling (CWS) or instant starch.

It is possible that candidates will not respond in the depth and detail above, but they will gain credit for showing understanding of the purpose and working characteristics of modified starches. Allow reward for just one example per type of usage but the reward is for the explanation, not for each example.

Criteria for marks awarded	**Mark range**
No response worthy of credit.	**0**
A weak answer. The candidate has little or no sound understanding of the topic. Examples may be given, but explanation may be lacking.	**1-3**
A good answer. The candidate understands the topic and gives	**4-5**

some examples. There may be little scientific content but explanation shows understanding of the principles.	
A full answer. The candidate has an informed knowledge, including some scientific content. Understanding of modified starches and their uses is clear. Several well described examples given to support the answer.	**6-8**

10 How can you adapt this hospital menu for a patient who needs a diet high in NSP (non-starch polysaccharide)?

Explain your choices.

Breakfast:	Cornflakes and milk, white toast and honey
Lunch:	Macaroni cheese, chocolate mousse
Evening Meal:	Stewed beef in gravy with mashed potatoes and carrots, sponge pudding and custard

[12 marks]

Any correct response will be credited. Key high NSP ingredients are listed below as a guide:

- Peas, beans, lentils, nuts, seeds
- Whole grains, including wholemeal flour, cereals, pasta, brown rice
- Rye, bran, oats, pot barley, corn
- Fruit and vegetables (papaya, mango, blackcurrants, pear, bananas, oranges etc)
- Dried fruits (figs, apricots, prunes) and vegetables

Give credit for creativity and originality in introducing foods rich in NSP. However, marks are to be given sparingly for lists of possible ingredients e.g. one mark per food category where several are provided. Repetition of some foods, e.g. wholemeal varieties of starchy foods, may be rewarded if used appropriately but each course of the meal should demonstrate variety and wide use of different foods rich in NSP.

Criteria for marks awarded	**Mark range**
No point made worthy of credit	0
Only a few basic alterations are made, some of which may not be correct.	1 - 3
The candidate has attempted to adapt the menu with reasonable accuracy but the response is simplistic, with little explanation and little creativity.	4 - 6
A reasonable attempt. Most of the dishes are reviewed and adaptations are generally correct and well explained. Some creativity evident.	7 – 9
A thorough review of the menu. All dishes are adapted correctly and the explanations are clear and well considered. Some originality evident.	10 - 12

11 What effects can cooking and processing have on the vitamin content of foods?

[8 marks]

Any credible point will be rewarded. To gain marks in the higher bands candidates must distinguish between water and fat soluble vitamins. Candidates who are able to identify the separate B group

vitamins will be rewarded, though this is not compulsory. Do not reward general terms such as 'vitamins' as these should be named.
Some candidates may mention fortification of foods, e.g. Folic acid into breakfast cereals or replacing Vitamin C lost during UHT treatment of juices. This is a part of processing and can be rewarded.

Candidates may mention using cooking water to make a sauce as part of the product, thus retaining the water soluble vitamins that have leached out. Reward may be given for this as long as reference is made to the leaching or seeping of the vitamins into the water.

Mention of cooking methods which help to preserve, or minimise destruction of water soluble vitamins such as microwaving, steaming may be rewarded if adequately explained.

VITAMIN CONTENT	COOKING AND PROCESSING EFFECTS
Fat Soluble Vitamins	Largely unaffected by cooking. Stable in water and with heat. Frying foods can increase the fat soluble vitamin content as fat or oil content is increased. Hidden fats in processed food will add to the fat soluble vitamin content. Skimmed milk – fat content is reduced due to skimmimg process so the fat soluble vitamins are similarly reduced. Low fat or ,reduced fat products are likely to have lower fat soluble vitamin content.
Vitamin A (retinol)	Fat soluble so unaffected by most cooking methods. Will dissolve in fats and oils but not in water. Small amounts can be lost during frying or prolonged cooking. During storage retinol in fatty foods can be lost by oxidation.
Vitamin D (cholecalciferol)	It is stable to heat and is insoluble in water. It is therefore unaffected by cooking. As it is only available in a few foods, Vit D is added to spreadable fats and to many breakfast cereals to help prevent deficiency.
Water Soluble Vitamins	Vitamins C and the B group of vitamins will dissolve in water but not in fats. Water soluble vitamins are subject to leaching, oxidation, evaporation and destruction by high temperatures. Cutting fresh fruit and vegetables with a sharp knife damages cells and caused the Vitamin C to oxidise due to enzymic action, thus reducing its content. Drying foods will remove the water soluble vitamins. Processing such as UHT will destroy the Vitamin content e.g. in orange juice. Foods may be fortified with Vitamin C. Vit D is added to spreadable fats and to many breakfast cereals.
Thiamin (vitamin B1)	20% is lost when potatoes are boiled 40% lost when meat is roasted 25% lost when bread is baked Decomposes at high temperatures, particularly in alkaline conditions e.g. if bicarbonate of soda is used.
Riboflavin (vitamin B2)	Only slightly soluble in water and is fairly stable to heat, though less so in alkaline conditions. The overall loss in cooking is small and much less than it is for Thiamine.
Niacin (nicotinic acid)	Water soluble and more resistant to heat than thiamin or riboflavin. Small amounts are lost during cooking by leaching into cooking water and by the loss of juices from cooked meats.
Folate (folic acid)	Readily lost during most cooking processes. It leaches into cooking water and is also destroyed by heat, particulary in the presence of oxygen and alkalis. Large losses of up to 90% may occur when

	green vegetables are boiled. Vegetables should be cooked in a little water for a short time to minimise losses.
Vitamin C (ascorbic acid)	Readily destroyed during cooking. Very soluble in water and therefore leaches out into cooking water. It is readily oxidised. Oxidation is most rapid in alkaline conditions, at high temperatures and on exposure to light, air and traces of metals such as zinc, iron and copper.

Criteria for marks awarded	**Mark range**
No response worthy of credit.	0
Little or no understanding evident.	1 - 2
Some simplistic points are made, but the response may not distinguish between water and fat soluble vitamins or increase of vitamin content as well as loss.	3 - 4
A reasonable attempt. The candidate is able to describe the effects of cooking and processing on vitamins with only a few innaccuracies. Deeper understanding of the effects on individual vitamins may be lacking.	5 - 6
A thorough response which shows excellent subject knowledge and understanding. The candidate considers most, if not all the effects and clearly distinguishes between the types of vitamin as well as distinguishing between cooking and processing.	7 - 8

Question 4

12 The snacking habits of 16 to 19 year olds have led food developers to refer to them as 'the grazing generation'.

Design two different snack products which appeal to this target group, whilst also supporting their nutritional needs.

Describe each idea and justify your choices. You may use annotated diagrams in your response.

[2 x 6 marks]

The two products should be different. Reward will not be given for repeats of information given in the first idea, unless it is presented differently. The ideas could include any of the following information either written in prose or in the form of annotations on the diagrams:

- Be a snack / 'grazing'product – easy to hold, to consume, transport etc.
- Appeal to 16 to 19 year olds – reference to modern trends and ingredient preferences, such as easy to nibble on, does not require preparation or cutlery, can be seen clearly through the packaging, has a tempting and attractive finish, will be filling and keep hunger at bay for longer etc.
- Special dietary needs such as vegetarian / vegan / allergen aware etc.
- Use of sugar replacers or sweeteners may be rewarded if appropriately used and justified.
- Fortified ingredients (e.g. iron or calcium enriched) may be rewarded if used appropriately.
- 5 a Day will not be rewarded unless it is adequately explained and accurately used.

- Recognition of the fact that growth and development are rapid during these years and that the demand for energy and most nutrients is relatively high.
- Should supply protein, starch, some fat (caution with high levels of saturated fatty acids), iron, calcium, magnesium, NSP, Vitamin A and Riboflavin and a range of vitamins and other minerals that may be named. Credit any reference to the function of the nutrients supplied and any specific reference to the needs of the 16 to 19 age range.
- Some teenagers have low levels of some micro-nutrients, including iron, calcium, magnesium, vitamin A and riboflavin
- Caution about high salt and extrinsic sugar levels
- Salt RNI is no ore than 6g per day for adults, less for children.
- Extrinsic sugars – the RNI is no more than 10% of the energy (calorie intake) from food and drink each day – about 70g for men and 50g for women. This varies according to age, size and activity levels. Teenagers of 16 to 19 are likely to have a slightly higher requirement than most adults.
- It is not expected that the product will supply all the nutrients required, but that it will support the daily requirements of nutrients. Credit understanding of the nutritional requirements.
- Credit any reference to the differening nutritional needs of males and females
- Annotated with reference to lifestyle
- Annotated with reference to health issues such as 'traffic light' indicators, 'Five a Day'
- Could focus on small portion size
- Should be original and the two ideas should not be variations of the same theme

Any well designed and annotated or explained idea which meets the criteria will be credited. Drawings are not obligatory as long as the explanation is adequate.

The two ideas should be different. If candidates do not design two distinctly different products, marks must not be awarded twice.

Allow up to three marks for the design idea and justification of the suitability as a snack product.

Allow up to three marks for the nutritional content in relation to the needs of teenagers.

Apply the following to each idea:

Criteria for marks awarded	**Mark range**
No response worthy of credit.	**0**
Little response worthy of credit	**1**
The idea may not meet fully with the criteria given.	**2-3**
The idea is clearly described and justified for the teenage market.The criteria is largely met and nutritional understanding is good.	**4-5**
A well planned design which meets the nutritional criteria, is effectively described and the choice justified in relation to teenagers. The idea is likely to be creative and original.	**6**

13 Explain why it is important for food manufacturers to evaluate food products:

- **against their intended purpose**
- **against other similar products.**

[2 x 4 marks]

Any well explained and relevant point will be credited.

Against their intended purpose:

- To ensure that the design brief has been met
- Is the product fit for purpose?
- Does it meet with the approval of the intended consumers?
- To test the design specification– does the product do what it was intended to do?
- Are the systems in place working e.g the New Product Development process / the manufacturing systems / Quality Control systems etc
- Allows for any changes to be made prior to manufacture, reducing loss of profit

Against other similar products:

- It provides a source of comparison or a bench mark for rating own and competitors' products against.
- What are the strengths and weaknesses of the product in relation to other similar ones?
- Is there a unique selling point?
- Competitors' products provide a useful source of information for manufacturers, who carry out 'in house' testing on them. Such tests will include sensory evaluation and identification of ingredients, portion size, packaging, value for money and so on.
- They may show emerging social, cultural and lifestyle trends, gaps in the market, new technologies, new ingredients, new packaging and promotional techniques, new recipe ideas, emerging health and nutritional trends etc.

Apply the following to each.

Criteria for marks awarded	Mark range
No response worthy of credit.	**0**
An attempt to provide a point which indicates some understanding.	**1**
Some basic points are made but explanation is superficial and may be confused.	**2**
Some reasonable points made which are explained quite well. The response may lack depth in places.	**3**
A full response which shows excellent knowledge and understanding of the topic. Clear explanation of valid points.	**4**

14 What must a manufacturer take into account when calculating the selling price of a food product? Explain your answer.

[8 marks]

Any valid and justified point will be rewarded.There are roughly three areas in the food production process where costs are incurred, and these are ultimately passed onto the consumer. These are:

1. Agriculture: expenses associated with farm businesses, such as wages, buildings, machinery etc., the cost of harvesting and the cost of transport).
2. Food Processing: (factory business expenses such as premises, wages, market research etc., costs of machinery, costs of packaging).
3. Food Retailing: (retail business expenses such as rent, clerical support, shop fittings etc., costs of display, costs of sales including tills, staff etc).

- Awareness of: Competitors' pricing; Target client group preferences; place in the market e.g. economy or luxury range; type of product and consumer willingness to pay premium rates for it e.g. basic commodities as opposed to 'treats'; being careful not to compete with their own existing successful brands by under or overpricing pricing the new product.

- In order to ensure that a profit is made, costs need to be worked out at each stage in great detail. All the costs incurred are compiled and compared against sales figures, which need to be thoroughly monitored. In this way each business can calculate the cost per unit of production, whether it be by the kilo (as in sugar produced) or by the packet produced (as in biscuits).

- Costs can be Fixed or Variable. Fixed costs do not change readily. They include such things as wages, heating, lighting, insurance etc. Variable costs vary according to the level of output, e.g. cost of ingredients, running costs of machinery, packaging costs etc. As the number of units of food being processed increases, the fixed costs become less significant in relation to the variable costs. This 'economy of scale' can be further enhanced by negotiating a discount for bulk purchasing.

- Break-Even Point occurs when all the production costs are equal to the revenue gained from the sale of units of the product. In order to make a profit, a selling price must be established such that all the costs of production are exceeded by the revenue from the number of units sold. Break-even point for production will vary according to the volume of production and the price charged per unit.

- Costs associated with new product launches must take into account changes to manufacturing equipment and processes, new technology requirements, packaging etc. On top of this marketing costs have to be considered and then the need to monitor the effectiveness of this through consumer research. Consumer reaction to pricing is an important consideration. Low price does not always make high sales.

Criteria for marks awarded	**Mark range**
No points made worthy of credit.	**0**
Basic points given which are correct but unexplained.	**1 – 2**
Basic points given with some explanation.	**3 - 4**
A reasonable attempt which identifies a range of points with each one explained. Some of the explanation may lack depth or detail and may only focus upon the product itself rather than the wider aspects of costing.	**5 - 6**
A full range of points which are very well explained. Clear	**6 - 8**

evidence of sound understanding of the topic, including reference to the broader picture. The candidate understands that selling price takes account of many varied factors.	

Question 5

15 'Good hygiene systems are not just nice to have 'extras' in food processing companies, they are essential to the smooth running of the business. If just one employee does not follow proper hand hygiene procedures the entire workforce – and the company – will be put at risk.'

Describe six different hand hygiene practices for a person working with food and give reasons why each practice is needed.

[12 marks]

*N.B. For each example allow up to two marks for identification of the practice with good reasoning. Very good responses may merit a third mark, but in order to gain top band criteria marks candidates must identify **six different** practices as specified in the question. It may be possible for a good candidate who has failed to give six examples to achieve the top marks in the second highest band through detailed description and reasoning in the examples they have given.*

If a candidate has interpreted the question in terms of the stages of effective hand washing practice, they will be awarded one mark for the procedure. Subsequent marks will be awarded for the explanation of each stage.

Reward of manufacturer reputation being protected will only be rewarded once.

Hand hygiene practices may include any of the following (reasoning is not given in every case here, but will be related to cross contamination and transfer of bacteria, physical and chemical contaminants):

1. Hands should be kept clean at all times and washed properly in hot water. Washing procedures should be thorough, following guidance provided on posters or in training. Reasoning – to ensure that hands are properly cleaned and bacteria count reduced.
2. Unperfumed soaps should be rinsed away and a spirit sanitiser applied after drying.
3. Disposable paper towels should be used to dry hands.
4. Taps should be automatic so that they are not a source of cross contamination.
5. Nails should be kept short and clean to control the risk of microbial contamination from bacteria in dirt beneath the nails.
6. No nail varnish, jewellery or false nails to be worn as these can chip and flake or detach and fall into food causing physical and biological contamination.
7. Strong scented tolietries such as hand creams, perfumes should not be used on hands as they can taint the flavour of the foods.
8. Hand cuts or wounds should be covered with a waterproof and brightly coloured plaster.
9. Fingers should not be used to taste food and saliva can be transferred to the food via the fingers.
10. Fingers should not be licked to help separate food packaging materials.
11. Bad habits such as nail biting and sucking fingers should be avoided.
12. Hands should not be used to pick noses or ears or to scratch any part of the body whilst food is being handled.
13. If disposable gloves are worn, good hand hygiene practices should also be applied to them as they too could be a source of contamination if not kept clean or disposed of when dirty.

14. Jewellery such as bangles or decorative rings should not be worn as they can result in microbial contamination.
15. Bacterial contamination via the hands with bacteria such as staphylococcus aureus, salmonella, clostridium perfringens,escherichia coli, shigella sonnei, listeria monocytogenes, norovirus, typhi. Any other correct bacteria will be credited.

Criteria for marks awarded	Mark range
No points worthy of credit	**0**
Some evidence of understanding with little or no reasoning.	**1 – 3**
A limited number of points are made with some reasons, or six points with no reasons. There may be some repetition.	**4 – 6**
A range of different points with reasoning. The response may not include six points and some of the reasoning may lack depth.	**7 – 9**
Six different points are made with well considered reasons. The answer is detailed and there is evidence of good subject knowledge and originality.	**10 - 12**

16 Food spoils because of the microbial action of yeasts, moulds and pathogenic bacteria. What conditions do these microbes require for optimum growth?

Explain why each condition is important.

[12 marks]

*Any of the points made below may be rewarded. Candidates do **not** have to include all six conditions. Reward should be given for clear explanation and good use of terminology.*

*Do **not** give a mark for one word responses that are not explained e.g. 'moisture'.*

Allow more than two marks for any of the conditions below if well explained.

Conditions required for microbial growth:

1. Time – under optimum conditions bacteria can double every 10-20 minutes. Yeasts and moulds also require time to reproduce. This is why food should be removed from optimal conditions and stored appropriately in order to slow down microbial growth. Safe dates should be observed to minimise food spoilage over time.
2. Warmth – bacteria generally multiply between 5°C and 63°C (danger zone). Freezing -18°C where micro-organisms are dormant. Micro-organisms are generally destroyed at 72°C The average ideal temperature for rapid bacterial multiplication is 37°C (body temperature). Moulds and yeasts also thrive well at these temperatures.
3. Moisture – bacteria need water to live and to multiply as do moulds and yeasts. Freezing removes the available water (as it is turned to ice) and thus microbes cannot access the moisture they require for growth. Dehydrating foods such as milk powder and storing it in airtight packaging helps slow down microbial growth as the available moisture is removed.
4. Nutrients – bacteria need similar food to humans and can multiply to great numbers on high protein foods such as meat, meat products, poultry, eggs, milk and milk products, fish and seafood. Yeats and moulds require sugars, often found in naturally sweet foods or through the enzymic breakdown of starches.
5. pH – a neutral pH is preferable. The lower the pH the harder it is for microbes to survive. This is why pickling is an effective method of preservation. The minimum pH for growth is 4.5 (bacteria); 2.5 (yeasts); 1.5 – 2.00 (moulds)

6. Oxygen – some microorganisms are anaerobic and do not require oxygen to multiply but most do, so gas flushing packages (modified atmosphere packaging) or removing air as in vaccuum packaging or canning etc. Helps to prevent microbial growth.

Enzymes are also responsible for food spoilage, working in conjunction with microbial activity. Enzymes work well in largely the same conditions as microorganisms.

Candidates may take each of moulds, yeasts and bacteria separately as each type will require slightly different conditions for growth. This knowledge should be rewarded.

Candidates may refer to the positive and controlled use of bacteria, yeasts and moulds and the conditions required for their growth such as blue cheese, yoghurt, fermentation - where conditions for optimum growth are used to positive effect in food production. If the points made are in line with the question one mark may be awarded.

Criteria for marks awarded	**Mark range**
No points made worthy of credit	**0**
Evidence of some basic understanding	**1-3**
A few correct points are made but explanation is superficial and there will be omissions and inaccuracies.	**4-6**
A reasonable attempt. Many of the conditions are listed with some accurate explanation and use of terms. There may be errors and some areas may lack detail.	**7-9**
A full and well informed response. Most of the conditions are listed and the explanation is thorough and accurate.Excellent use of technical terms.	**10-12**

17 Why is traceability so important for the food industry?

[4 marks]

Any relevant and justified point made will be rewarded. Candidates may include any of the following in their response:

- the term may apply to food or product in to a factory or food or products out of a factory. To be able to trace where foods have originated from or where they have been supplied to.
- The term ‚'Field or Farm to Fork' with an explanation.
- the need for manufacturers to show 'Due Diligence' in order to protect themselves from litigation.
- to be able to rapidly trace any product that is thought to be unsafe o consumers to eat.
- to make product recall possible.
- for the manufacturer's own records, in line with HACCP and quality controls.
- to use as means of identifying food suppliers with the best quality food.
- to identify problems and to be in a position to act upon them rapidly.
- to identify possible sources of contamination, or to eliminate suppliers from suspicion of supplying contaminated food.

Criteria for marks awarded	Mark range
No points made worthy of credit	**0**
Evidence of some basic understanding	**1**
A few basic points are made with little or no explanation.	**2**
Several points are made and there is some explanation.	**3**
A good response. Relevant points are identified and well explained.	**4**

Question 6

18 How can food manufacturers make their factories more energy efficient?

[10 marks]

Factories are encouraged through various Government grants and through public pressure to consider the environment. It is in their interests to make their manufacturing processes as efficient as possible. Ways of doing this could be:

- To work with reusable energy sources such as solar power, sonar power, wind power.
- To recycle supplies of waste hot water for heat transfer into heating or washroom systems.
- To create an attractive environment around the factory for locals and workers to enjoy
- To use natural light effectively, to cut down on the need for electricity
- Insulation of buildings to reduce energy loss
- To adopt modern day manufacturing processes that emit low levels of noise
- To create a pleasant working environment within the factory to reduce stress levels for workers and to increase their productivity
- To adopt effective systems of health and safety to protect workers
- To recycle waste materials and use recycled packaging materials wherever possible
- Regular monitoring and checking of production processes which check excess energy wastage
- Regular servicing of equipment
- Food waste materials recycled as bio-fuels
- Use output from refrigerators to heat buildings

Criteria for marks awarded	Mark range
No response worthy of credit.	**0**
A limited answer. The candidate has a weak understanding of the topic and is only able to cover the most basic and obvious points.	**1-3**
A reasonable answer which shows a good understanding. The answers contain examples and some good ideas are expressed. There may be some confusion or repetition in places.	**4-6**
An excellent answer demonstrating originality and good understanding of the issues. Examples are given to support the response and good use is made of technical language.	**7-10**

19 How might a new food product be effectively launched?

[8 marks]

Any relevant method, which is appropriate and well described will be credited:

- Decisions about what the product really is, descriptions, the role it will play, unique selling points etc.
- The 4 P's: price, place, product, promotion.
- Advertising related to the Product Launch, e.g. free samples, competitive pricing, in-store tasting, money off vouchers.
- End of aisle promotions / prominent positioning in the store.
- Flyers, free samples into homes via mail drops.
- TV, billboard and magazine adverts (one mark maximum)
- Celebrity endorsements
- Loss leaders
- Correct pricing strategy
- Buy-one-get-one-free (BOGOF)
- Manufacturers will trial in certain areas (regional trials) first to gain a response to a product and ensure the target market has been identified and tested
- Use of digital techniques
- Smart phones and Apps
- Internet advertising
- Reward card information

Criteria for marks awarded	**Mark range**
No points worthy of credit.	**0**
Only a few points worthy of credit	**1 - 2**
Some basic points made with superficial explanation	**3 - 4**
A good range of relevant points made with explanation which may lack depth and detail in places.	**5 – 6**
A full and well explained response which includes a wide range of ideas, some of which may be original. Good knowledge and understanding of the topic.	**7 - 8**

20 **Some processing and preservation methods change the physical and sensory qualities of the food.**

Which methods of preservation are best for maintaining these original characteristics? Explain your answer.

[10 marks]

Any relevant method, which is appropriate and well described will be credited:

- Modified atmosphere Packaging (gas flushing)
- Vacuum Packaging
- Cook Chill
- Freezing
- Pasteurisation
- Irradiation
- UHT for fruit juices only (not milk)

*Do not allow the more destructive methods such as canning, drying, jamming, pickling, salting, smoking etc. as these methods generally **do** affect the original characteristics. In some instances foods may not be affected but candidates must make this clear e.g. in some cases*

such as canned sweetcorn, the characteristics may be little changed, but in many fruit and vegetables, such as peas or strawberries, they are significantly affected.

Reasons:

- Depends upon the type of food being preserved e.g. canning is quite a harsh method because of the high teperatures used, but for some foods such as soup, corn, tomato puree, tuna fish etc it can be very effective.
- Modified atmosphere – no changes to flavour, colour, texture or aroma as the process is only altering the gasses the food is surrounded by.
- Vacuum packaging – just removing the air. Food may be a bit flattened so texture may be affected, but generally the flavour is unaltered and the aroma is maintained in the airtight package.
- Cook chill is as near to the home made as possible. Re heating is done immediately prior to consumption so minimal alteration is made to the food which has been pre prepared and then chilled.
- Freezing – most flavours, aromas, colours and textures are maintained. Depends on the food (e.g. strawberries don't freeze well) and on the speed at which the food is frozen or length of time in the freezer.
- Pasteurisation – the milk is taken to the lowest temperature required to destroy pathogenic bacteria (72°c minimum) for a very short period of time. The sugars do not have the correct temperature to caramelise, the fats remain unaffected and the protein does not coagulate. Therefore sensory and physical characteristics are very little different to that of raw milk.
- Irradiation – no physical or sensory effects due to ionising radiation to destroy bacteria.
- UHT – little change to fruit juices (but milk is affected due to caramelisation of lactose)

Criteria for marks awarded	**Mark range**
No response worthy of credit.	**0**
Limited knowledge of the topic. A few basic points are made but the answer lacks depth and detail.	**1 – 3**
A reasonable attempt. Several accurate points are made and explanation is sound.	**4 – 6**
A full and well explained response which shows excellent knowledge and understanding of the topic.	**7 - 10**