



General Certificate of Education

Design and Technology: Food Technology 5541/6541

FTY6

Mark Scheme

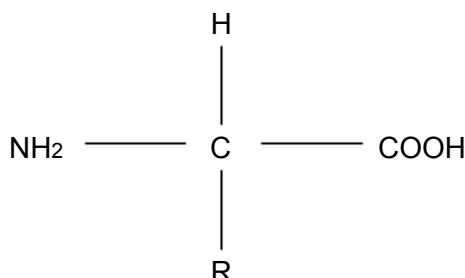
2008 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

1. (a) **What is the general chemical formula for an amino acid? You may use a diagram to explain your answer.**

Amino acids always contain an amino group (-NH₂) and carboxyl group (-COOH). The general formula is:



The R group will vary in each amino acid. The simplest amino acid is when R = H (glycine). Half Mark for elements.

Criteria for marks awarded	Mark range
A limited attempt. There may or may not be a diagram to explain the answer. There will be inaccuracies and some confusion.	0 – 1
A reasonable attempt. The candidate has a good understanding of the chemical formula, but there are a few errors.	2 – 3
A good answer, possibly with some explanation. Accurate chemical formula.	4 – 5

- (b) **Describe how amino acids link together to form polypeptide chains. You may use diagrams to explain your answer.**

Amino acids combine through their amino and carboxyl groups by means of a *condensation reaction*. When they condense together in this way a *dipeptide* is formed and where many combine a *polypeptide* is formed and finally a protein. Sulphurs join. Each amino acid is linked to the next by peptide bonds to build up a chain of hundreds or thousands of amino acids. The link between the amino acids is called a peptide (linkages) bond. *Disulphide bridges*. There are about 20 different amino acids and they are linked in an infinite variety of combinations to make a huge number of different proteins.

Criteria for marks awarded	Mark range
Little understanding of the term evident.	0 – 1
Some understanding. There may be some inaccuracies e.g. in diagrammatic representation.	2 – 3
Excellent description which may be supported by accurate diagram(s).	4 – 5

(c) Explain the process of denaturation, making reference to the chemical structure of proteins.

Proteins have a *primary* structure and a *secondary* structure. The primary structure is the sequence of amino acids in the protein chain. The secondary structure is where the amino acids are further linked by various bonds to give the protein a definite shape, usually in the form of a spiral. The cross linking which takes place is called *disulphide bridge*. This bridge gives dough elasticity. There are other links which contribute to the coiling of chains of acid, e.g. hydrogen bonds. The chains can be changed by a number of agents, such as heat, acids, alkalis, heavy metals, salt and ethanol and violent agitation (e.g. whisking). In *reversible* denaturation there is a slight unwinding of the polypeptide chains caused by slight denaturation but if the protein is removed from the conditions it can regain its original structure. In *irreversible* denaturation the molecule unfolds and this leads to a loss of some of the properties of the protein. In the case of meat and other protein foods, this process can make it more digestible. Irreversible denaturation results in viscosity increasing and solubility being lost (e.g. fried egg).

Criteria for marks awarded	Mark range
A basic answer which only touches upon the main issues. An explanation of denaturation may be given without supporting chemical reference.	0 – 2
The candidate has a fair grasp of denaturation and is able to make reference to the chemical and physical changes which take place, but may be confused and unable to fully explain the process.	3 – 4
A full and fluent explanation which takes account of the chemical structure, the denaturing agents and the physical effects of denaturation upon proteins.	5 – 6

(d) Explain why some proteins have a higher biological value than others.

Proteins are built up of amino acid chains. There are 22 different amino acids. Because proteins vary in the number, type and arrangement of amino acids present in their molecules, the quality of the protein also varies. The quality of protein is expressed as its biological value. Eight of the amino acids are essential for tissue grown in adults: isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. Children need two additional amino acids: arginine and histidine. Protein foods which supply all the essential amino acids are said to have high biological value (animal proteins and soya – though methionine is missing from soya proteins). Those which do not contain all the essential amino acids are said to be low biological value. These proteins compensate for each other's deficiencies if eaten together e.g. nuts and cereals, beans on toast. Allow one mark only for examples.

Criteria for marks awarded	Mark range
Little or no understanding of the reasons and little substance to the answer.	0 – 1
A reasonable understanding of the term. Some attempt at an explanation.	2 – 3
A very good understanding, well explained. Good use of terminology.	4

(e) What are novel proteins? Give examples to support your answer.

Novel proteins are sometimes called meat analogues or meat substitutes. They are new types of proteins that have been developed because of the high cost and inefficient production of protein in animals. Examples include meat substitutes such as textured vegetable protein, made from soya, and quorn made from biosynthesised protein. These proteins are produced by bacteria or fungi growing on suitable substances, usually by a continuous fermentation method. Novel proteins can be manufactured to have a HBV, similar to meat. TVP and quorn can be manufactured in mince form, in steaks, burgers, and sausages. Spun soya is a better form of duplicating meat as it has a more fibrous texture, unlike TVP, which is extruded and heated under pressure, making it somewhat spongy in texture. Allow analogues; half mark for all examples: tempeh, tofu, soya, quorn, wheat and pea protein.

Criteria for marks awarded	Mark range
Little or no understanding of the term and few or no examples given.	0 – 1
A basic understanding of the term. Some examples given. There may be inaccuracies.	2 – 3
A full and well explained answer with relevant examples. Good use of terminology.	4

2. (a) What are the functions of lipids in the diet?

Fat is mainly used by the body as energy. It provides more than twice as many calories per gram as either carbohydrate or protein (9 calories per gram or 37 KJ). If fat surplus to energy is eaten, however, it stores itself inside the body as adipose tissue (fat). This can later be concentrated / converted into energy if needed. Fat is used to provide a protective area around the delicate internal organs e.g. kidneys.

A small amount of fat is also needed because it carries the fat-soluble vitamins (A, D, E and K).

Polyunsaturated fats are also needed because they supply the essential fatty acids (PUFAs). They are called essential because they are the only fats that our bodies actually need from food, as other fats can be manufactured by the body. Ones that cannot be manufactured by the body: Omega 3 sources – oily fish (alpha-linolenic); Omega 6 sources – evening primrose / starflower oils (e.g. linoleic). Do not go into the negative health aspects. Evidence shows that an adequate intake of essential fatty acids may help in prevention or control of all kinds of ailments and conditions such as heart disease, cancers, immune system deficiencies, arthritis, skin complaints, PMS, menopausal symptoms. Some fatty acids have been found to remove the ‘stickiness’ of the blood, therefore helping to prevent CHD and stroke.

Polyunsaturated and to a greater extent, monounsaturated fats have the opposite effects of saturates by lowering LDL blood cholesterol and raising the levels of ‘good’ cholesterol (HDL).

A certain amount of cholesterol is needed for cells to function in the body.

Half mark for provides energy, full mark for more than CHO etc.

Criteria for marks awarded	Mark range
Little or no understanding of the functions of lipids in the body.	0 – 1
A basic understanding of the functions, but there may be areas missing or inaccuracies.	2 – 3
An excellent knowledge and understanding of the functions of lipids in the body.	4 – 5

(b) Explain the following terms:

Fats are formed by the reaction of one alcohol molecule, glycerol and three fatty acid molecules.

(i) Saturated fat

In the formation of fat molecules, some contain only carbon-to-carbon single covalent bonds. There are no double bonds. These molecules are said to be saturated. They are thus not easy to break down. They are found in largest quantities in animal produce such as meat, cheese, milk, cream, butter and lard, but also in manufactured goods such as pastries, cakes and biscuits. Do not allow 'bad for you'

(ii) Polyunsaturated fat

If a fatty acid contains two or more double bonds it is said to be polyunsaturated. Double bonds are a point of weaknesses they can be readily broken down. These lipids are usually liquid at room temperature and include such things as corn oil, sunflower oil, and walnut oil. The PUFAs come into this category (the essential fatty acids), found in these oils and also in foods such as walnuts, mayonnaise, Brazil nuts, sardines, tuna.

(iii) Monounsaturated fat

This is usually liquid at room temperature, found in oils such as rapeseed, olive, groundnut, many nuts and avocados. It is also found in reasonable quantities in dairy produce, eggs, fish, milk and meat. Some fatty acids contain carbon to carbon double covalent bonds. If the fatty acid molecule contains only one double bond, it is said to be monounsaturated. Explanation and understanding of the terms is required, not general information on 'good' / 'bad' fat and foods that contain them.

Allow only one mark for food examples.

Criteria for marks awarded	Mark range
Very little understanding of the terms. An example may be given which is accurate.	1
Some understanding and examples. There may be some inaccuracies.	2
Excellent understanding of the terms, accurate examples and explanations given.	3

(c) Explain why some consumers purchase low fat products.

In general people choose to buy low fat products because they are putting on too much weight. Obesity and diseases associated with it such as CHD and diabetes are making consumers reflect about what they are eating. Some cancers may be related to high fat diets.

Lifestyles are changing and as a result people are not using up as much energy as in previous generations, for the following reasons:

- Changing working conditions: a lot of sedentary jobs (computers etc.).
- The car – people do not walk as much (e.g. drive to out-of-town supermarkets instead of walking to local shops, drive to school / work).
- Central heating. People do not have to burn many calories to keep warm.
- Better incomes and more readily available food, including ready meals.

Manufacturers are promoting 'low fat' or 'lower fat' products. The media keeps this in the public eye. In dietary terms, fat has become the wicked witch of the late twentieth century. Fat is a main component in snack foods. Snacking is part of our culture now, so to compensate, consumers look for low fat products.

Criteria for marks awarded	Mark range
The answer is unoriginal, stating the most obvious points.	0 – 1
A reasonable answer. Several points, with some explanations.	2 – 3
A full and perceptive answer, with a variety of different points, well explained.	4

(d) Describe what is meant by rancidity.**(i) Hydrolytic rancidity**

Hydrolytic rancidity is where fats in the presence of water break down to release fatty acids from the glycerol. The process is accelerated by lipolytic enzymes (lipases) and micro-organism, especially some moulds. The result is aldehydes / butyric acid, 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 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. Oils should be stored in glass containers, away from light and out of contact of metals to prevent fat from becoming rancid. Accept use of anti-oxidants within the answer if it shows understanding of rancidity.

Criteria for marks awarded	Mark range
Little understanding of the term and an inability to distinguish between them.	1 – 2
Some understanding of the terms and there may be an attempt to distinguish between them, although candidates may not actually distinguish. There may be some confusion in the explanation.	3 – 4
A coherent and well explained answer showing excellent understanding of the terms. The candidate is able to distinguish between the two effectively. Only allow if ox and hy rancidity mentioned.	5 – 6

SECTION B: Design and Market Influences

3. (a) Explain why market research is an essential part of product development. Use examples in your answer.

Any relevant, justified point will be credited. It is expected that candidates will make reference to primary and secondary sources of research. However, to gain high marks candidates must venture further than their own coursework experiences, making reference to the industry.

A lot of NPD is inspired by watching what is happening in the market place, looking at what competitors are doing and what new launches are occurring in other sectors which suggests new market trends. World trends are also important to follow.

Other methods might include:

- Shopping – visiting stores and seeing what is on sale.
- Watching advertisements on television.
- Reading trade publications which feature new product development activity.
- Marketplace watch services, where an agency is paid to watch the marketplace at home and overseas.
- Attending food exhibitions.
- Consumer research – asking consumers for their views (questionnaires / surveys).
- Qualitative research – discussion groups.
- Quantitative research – collecting and using relevant data
- Market research forms (contracting out).

Allow marks for the ‘how’ as well as the ‘why’, in the form of examples.

Criteria for marks awarded	Mark range
A basic and limited attempt. The research methods selected are superficial and not very well explained. The answer lacks justification. Few examples given.	0 – 4
The candidate has a reasonable understanding of the research methods used and is able to make some reference to the industry. Examples are used quite well.	5 – 8
A full and detailed account, making use of appropriate examples, which are well explained. Good use of technical terms. Well justified and perceptive answer.	9 – 12

(b) Describe how manufacturers market and promote a new product.

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

It is likely that manufacturers will make use of consultancies to help them make and promote a new product. They will only market and promote a new product once it has passed through the rigors of the NPD process. Once it is deemed to be viable / feasible marketing begins. A project manager is usually appointed to oversee the whole process. The following are some of the things candidates may make reference to:

- Decisions about what the product really is, descriptions, the role it will play, unique selling points etc.
- The product name – a distinctive name, which is not already registered.
- Advertising related to product launch, e.g. free samples, competitive pricing. In-store tasting, money off vouchers.
- Packaging and labelling – well researched designs that comply with legal requirements.
- End of aisle promotions / prominent positioning in the store.
- Flyers, free samples into homes via mail drops.
- TV and magazine adverts.
- Lost leaders.
- Buy-one-get-one-free (BOGOF)

Criteria for marks awarded	Mark range
A basic and limited attempt. The research methods selected are superficial and not very well explained. The answer lacks justification. Few examples given.	0 – 4
The candidate has a reasonable understanding of marketing and promotional methods and is able to give some examples.	5 – 8
A full and detailed account, very well described. The candidate makes use of appropriate examples, which are well explained. Good use of technical terms. Well justified and perceptive answer.	9 – 12

4. (a) Explain the importance of food packaging materials in relation to the following issues:

Any relevant and well justified answer will be credited. Candidates will be expected to justify their responses.

(i) Transportation and protection of food products

Products need to be bound together in large quantities for transportation to make the process manageable. Secondary packaging will be used to hold several products together. These in turn will be packaged, sometimes with giant plastic wrap sheets, for transit. Consignments for transit are stored in pallets to enable them to be stacked high in warehouses. Transit packaging enables large quantities of products to be transported securely and efficiently. Recycled materials can be used for this as it does not come into direct contact with the food.

To protect food products from tampering manufacturers seal lids with plastic collar, which has to be broken. Paper and plastic seals are used on a variety of products which have lids or screw tops. Plastics are used to protect fresh products from moisture loss or cross-contamination, such as salad bags and meat trays. Frozen products are protected from freezer burn or damp conditions by the use of waxed card boxes. Gas flushed containers are used to preserve the life of fresh products such as meat, fish, fruit, salads etc. these containers have to be heat sealed to ensure that the gas does not escape. Secondary packaging is often used to protect the product from squashing or splitting open. Packages are carefully designed for maximum strength e.g. 'Tetrapack'.

Criteria for marks awarded	Mark range
A limited account of the importance of packaging materials in relation to transportation and protection. Simplistic reasoning with few relevant examples.	0 – 2
A reasonable attempt to explain the importance of packaging materials. Some justification and relevant examples provided.	3 – 5
A full and well explained answer, using examples perceptively. Some original thinking evident.	6 – 8

(ii) Preservation of products

The type of material used for packaging will depend upon the method of preservation used.

Candidates will be expected to show some understanding of preservation methods and the underlying principles, in relation to discussion about the importance / function of packaging the materials they identify.

- **Metals:** Cans are made from metals (tinplate steel, tin free steel, aluminium). Metal is rigid and non-breakable, ideal to be used as a food packaging material for heat-processed foods. Metals are a good light and oxygen barrier and can stand extremes of temperature. They can thus be used to keep foods fresh, preventing air or ultra violet rays from entering a package e.g. a layer of aluminium is incorporated with layers of paperboard and plastic in the formation of long-life soft drink cartons.
- **Plastics:** Plastics can be used to replace all other packaging types, from bags which can be sealed air tight, through to jars and bottles. Plastic can therefore be used in many preservation methods. Dependent upon the type of plastic used, the material can be subjected to extremes of heat or storage conditions. High density polyethylene terephthalate and polycarbonates are used for bottles; nylons are used for cook-in bags and polypropylene is used for caps and closures.
- **Glass:** glass can be hot filled and acts in a similar way to metal cans. Jamming, bottling and pickling all benefit from this material as scalding hot liquids can be poured into pre-heated glass and then sealed and left to cool, forming a vacuum. It is non-reactive, ideal for acidic solutions. Forming a screw thread in glass means that re-sealable lids and tops can be inserted.

- Paper and Board:** Paper and board can be used to package and seal dry goods as well as liquids. Paper can be used in combination with plastics in laminate composite packaging such as Tetrapack, used for fruit juices and other liquids. Board can also be waxed to make it suitable to withstand the damp conditions of freezing.

Criteria for marks awarded	Mark range
A limited attempt to explain the role that packaging materials play in the preservation of foods. Poor understanding of the principles underlying preservation.	0 – 2
A reasonable attempt to make the link between preservation and packaging materials. Good explanation which may contain some inaccuracies in places.	3 – 5
An excellent explanation. The candidate has a good knowledge of different types of packaging materials and is able to apply this effectively to a sound understanding of the principles underlying preservation.	6 – 8

(b) What factors must be taken into account when calculating the cost of a food product?

Any relevant point made and justified / explained will be credited. A list of points with no justification / explanation will not allow the candidate to score more than two marks. Candidates will be expected to consider any of the following:

- Cost of new product development (allow overheads)
- Factory overheads, including design and maintenance of machinery.
- Wages and insurances.
- Raw ingredients.
- Marketing and advertising.
- Profit margins.
- Legal costs.
- Packaging materials, labelling.
- Transportation and storage
- What people would pay.

Criteria for marks awarded	Mark range
Very little relevant information given. Points made are not explained.	0 – 2
Several relevant points made. Some points may not be fully explained	3 – 5
A comprehensive answer. The candidate provides a wide range of points, which are well explained.	6 – 8

SECTION C: Processes and Manufacture

5. **The majority of food poisoning outbreaks are caused as a result of human error. Discuss this statement with reference to the following issues:**

The principles of Basic Food Hygiene

- Many food poisoning outbreaks are caused as a result of people not following the basic rules of food hygiene, either through forgetfulness, ignorance or through laziness.
- Often people are employed on low wages, working long hours in poor conditions. They may be poorly supervised and thus become lazy in their working practices. They could be badly trained and poorly skilled.
- Cleaning practices could be poor, so build ups of dirt and bacteria could pose a risk.
- Food workers often have to work under pressure of time. They may find it difficult to stop and clear away if demand is high, so cross-contamination could occur.
- Bad practices and cost-cutting could result in sub-standard or out-of-date foods being used when they should be disposed of.

Storage areas could be a source of cross-contamination, as could refrigerators. Workers may not check that the correct position and conditions are being used to store foods. Stock rotation may not occur properly etc.

Systems manufactures put into place to prevent food contamination

- HACCP and Assured Safe Catering are systems which are designed to prevent bad practices from occurring.
- Staff training and supervision is an integral part of these systems.
- Control measures such as time / temperature etc. are monitored to ensure that hazards are controlled and risks minimised.
- Correct use of materials, equipment and cleaning procedures are planned for an implemented.

Checks are made regularly, including microbial testing, pH tests for chemical contaminants etc. Must relate to food poisoning rather than the physical contamination (will accept chemical)

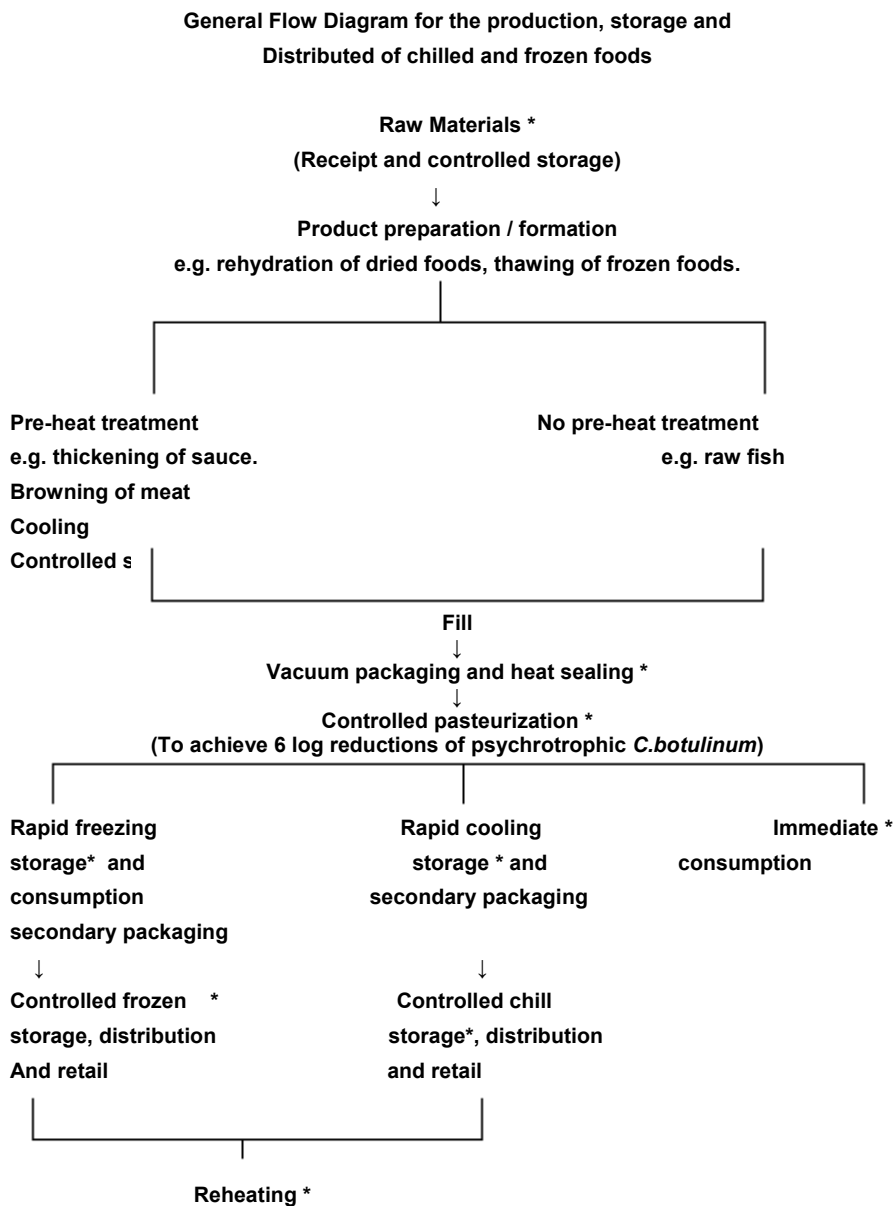
Legislation

- Food safety legislation is in place to protect the consumer, but also to act as a deterrent for improper practices. At worst a business could be closed down and the owner imprisoned. At best, food premises are regularly inspected and given commendations for their good practices. Many food outlets and factories are awarded certificates for good practice and for complying with strict regulations. Inspections can raise morale in the in the food industry if factories or food outlets are found to be meeting their targets and performing well. Positive reports can help businesses to thrive and build a good reputation.
- Inspectors have the authority to demand that owners of food outlets clean up their act and are given a set amount of time to do so. If they do not manage to achieve this can be fined and the premises could be forced to close down. Imprisonment is the ultimate deterrent, though in severe cases if death occurs from negligence, food handlers could face a legal suit.
- 1990 Food Safety Act, 1995 Food Regulations, 1996 Food Handling law

Criteria for marks awarded	Mark range
Some basic and superficial points made. The candidate may find it difficult to provide responses in all three areas. Explanation and justification is minimal.	0 – 8
A reasonable response. The candidate is able to provide information in all areas, with explanation. There is evidence of some original thought, through some points may not be relevant.	9 – 16
A full and detailed answer. The candidate is able to respond with confidence. Original thought is evident and excellent explanations are given for points made. The candidate is fully able to respond in all three areas.	17 – 24

6. (a) **Examine the flow diagram above and in your answer booklet, explain where the *critical points* of the system are and *why* they are critical**

The 9 critical control points are indicated on the chart below. Candidates should identify them and explain why they are critical. Any well explained answer will be credited with two marks. * = control points (x 9)



Criteria for marks awarded	Mark range
The critical control point has neither been identified nor explained.	0
The critical control point has either been identified, but not explained or incorrectly identified but well explained, sufficient to be rewarded.	1
The critical control point has been identified and explained.	2

Allow one mark if a valid control is given.

(b) Describe the process of pasteurisation, giving examples of foods preserved by this method.

This is the most common method of heat treating milk in the U.K. The usual method is to heat the milk for 15 seconds to a temperature of 72°C and then rapidly cooled to 10°C. this method is sometimes referred to as HTST (High Temperature Short Time). The other form of pasteurisation is the Holder process where the liquid is heated to 65.6°C for 30 minutes, then rapidly cooled to below 10°C. the flavour and appearance of milk heat treated by this method is not spoilt and it will keep up to 5 days if kept cool. The aim is to reduce the pathogenic bacterial content. It is a short term method of preservation, which destroys many, but not all, of the spoilage organism in the food.

Pasteurisation is now used extensively in the production of many different types of food, notably ready meals. It is also used for fruit juices, thin soups, sauces, cream, liquid egg, ice-cream mix, beer and wine.

Criteria for marks awarded	Mark range
Little understanding of pasteurisation. The candidate is able to give some examples of foods preserved by this method but is confused about the process.	0 – 2
A reasonable attempt at describing the process of pasteurisation. Relevant examples are given. Some knowledge of temperatures and times involved.	3 – 4
An excellent understanding of pasteurisation. Good use of technical terms, a wide range of examples and accurate knowledge of times and temperatures. Some candidates may recognise both.	5 – 6

Quality of Written Communication

The following marks are allocated to the quality of the candidate's written communication. Make a separate assessment of the candidate's overall ability as demonstrated across the paper using the criteria given below.

<i>Performance Criteria</i>	Marks
The candidate will express complex ideas extremely clearly and fluently. Sentences and paragraphs will follow on from one another smoothly and logically. Arguments will be consistently relevant and well structured.	
There will be few, if any, errors of grammar, punctuation and spelling.	4
The candidate will express moderately complex ideas clearly and reasonably fluently, through well-lined sentences and paragraphs. Arguments will be generally relevant and well structured. There may be occasional errors of grammar, punctuation and spelling.	3
The candidate will express straightforward ideas clearly, if not always fluently. Sentences and paragraphs may not always be well connected. Arguments may sometimes stray from the point or be weakly presented. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.	2
The candidate will express simple ideas clearly, but may be imprecise and awkward in dealing with complex or subtle concepts. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling may be noticeable and intrusive, suggesting weaknesses in these areas.	1