



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Home Economics 5561/6561

HEC6 Food Science and Technology

Mark Scheme

2006 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.

Food Science and Technology

HEC6

Question 1

- (a) Scientific process involved when starch is used to thicken sauces:

Wall of starch grains soften (1) as temperature increases (1) grain swells taking up surrounding liquid – i.e. melted fat and milk (1) until they rupture/burst (1) point of gelatinisation (1) Usually at about 70°C (1)

The process is completed at boiling point. (6 marks)

Scientific process involved when proteins are used to thicken sauces:

Important that eggs are beaten (1) so that egg white protein/albumin (1) does not coagulate (1) before the egg yolk proteins/ovalbumin (1) The proteins are denatured/molecular structure is altered (1) by temperatures between 60-70°C (1) and then follows coagulation (1) making it less soluble (1) resulting in a colloidal gel (1) (7 marks)

Sugar is stirred in after coagulation. If added earlier a thinner sauce results.

- (b) **retrogradation** is when the starch (1) regains its crystalline form (1) water is forced out of the gel structure (1) occurs in frozen (1) starchy products containing a high percentage of amylose molecules (1) (4 marks)

syneresis occurs at high temperatures and involves the loss of water (1) from protein gels/egg custard (1). This happens when they are left to stand for a long period (1) they shrink (1) and separate (1) (4 marks)

dextrinisation is the conversion of starch molecules (1) to dextrans (1) when dry heat (1) is applied, e.g. toast, brown surface of bread/pastry/cakes (1) (4 marks).

Question 2

Candidates are expected to show that they understand that each of these pairs of nutrients interrelate

- (a) Thiamin and Carbohydrate

Thiamin forms an essential part of the co-enzyme system required for the metabolism of carbohydrates releasing **energy**. It also releases energy from fats and alcohol.

Requirements relate to total energy intakes.

An inadequate intake of thiamine means that glucose is only partially oxidised leading to a build up of pyruvic acid. This results in muscular weakness and breathlessness when exercising.

Most important sources are whole grains products – bread contributes almost 25% of thiamin in the diet. Fortunately it is widely distributed in foods – milk, eggs, fruit and vegetables, pork, beef, offal, peas, beans, fortified breakfast cereals and yeast extracts such as Marmite.

It is soluble and therefore much of it can be lost in moist cooking methods unless the water is used to make gravy/sauce.

(9 marks)

(b) Ascorbic acid and iron

Ascorbic acid is essential for the conversion of non-haem (ferric) iron, found in plant foods, to haem (ferrous) iron which is more readily absorbed through the gut. The body cannot absorb the non-haem iron. Ascorbic acid is very unstable – **highly soluble** in water, **readily oxidised**. These 2 issues must be taken into account when preparing and cooking foods containing this vitamin.

An inadequate intake of ascorbic acid can lead to poor levels of iron absorption which can eventually result in anaemia since insufficient oxygen carrying haemoglobin is made. Cannot be stored in the body therefore a daily intake is required.

Methods of cooking which require minimal water and a short cooking time, eg steaming, microwaving, are advisable if a large % of the vitamin is to be retained.

Fresh fruit and fruit juices and green vegetables are good sources of ascorbic acid.

Breakfast – orange juice is rich in vitamin C and this will convert non-haem iron in fortified breakfast cereals or bread to the haem variety. Most effective absorption of iron will take place when foods rich in ascorbic acid and iron are eaten at the same meal.

(8 marks)

(c) Calcium and Vitamin D

Vitamin D is modified by the liver and then by the kidney to form the active substance, calcitriol. Calcitriol acts to maintain the level of calcium in the blood constant. It increases the absorption of calcium. If necessary it also acts on the bones to mobilize calcium when dietary intake is inadequate. Low intakes of Vitamin D will lead to rickets in children and osteomalacia in adults.

Cholecalciferol (vitamin D₃) is produced under the skin by the action of UV rays on 7-dehydro-cholesterol.

Dietary sources include fortified margarines and breakfast cereals, eggs and oily fish.

The vitamin is capable of being stored in the liver and fatty tissues of the body.

(8 marks)

Question 3

(a) Nutritional contribution of meat to UK diet:

- High biological value protein – collagen, myosin and elastin
- Haem iron (red meat)
- Fat including saturated fat – in variable amounts depending on the cut.
- Thiamin (B1)
- Riboflavin (B2)
- Niacin (B3)
- Cyanocobalamin (B12)

(7 marks)

(b) Factors which contribute to the sensory qualities of meat:

- COLOUR is mainly due to **myoglobin**. During storage or ageing of meat myoglobin is converted into brownish-red metmyoglobin. During cooking (above 60°C) myoglobin changes first to oxymyoglobin and then to hemichrome.

- TEXTILE and FLAVOUR is mainly due to the **age** of the animal (determines the length of the muscle fibres), the **cut** of meat (determines the length of the fibres and the amount of fat), the **method of preparation** (use of meat hammer, mincing, marinades) and the method of cooking (determines the **toughness/tenderness**, the amount of **fat**, development of **extractives**).

During **cooking** the **muscle fibres shrink, squeezing out the extractives** and the **fat melts** adding **flavour** and **moistening** to the muscle fibres. Collagen in the connective tissue is converted into soluble gelatine thus tenderising the meat. Moist methods of cooking result in a greater breakdown of connective tissue (found in relatively large amounts in cuts of meat which are more worked) than dry methods. (12 marks)

Criteria bands to be used.

10+ marks – high level response – this should be a detailed reference to each of the 3 factors which contribute to the sensory qualities of meat. For full marks the candidate must be able to differentiate between tough and tender meat.

Candidates will use relevant technical terms

5 – 9 marks – candidates refer to 2 of the sensory qualities in considerable detail and may refer to the third sensory quality. Only candidates who appreciate the difference between tough and tender meat should achieve full marks in this band.

1 – 4 marks – candidates will make generalised comments about some of the sensory qualities using simple language.

(c) Some consumers prefer meat analogues for the following reasons:

- they are low in fat/kilocalories
- higher in fibre than meat
- Quorn has much higher levels of calcium than meat
- virtually free from saturated fatty acids
- no cholesterol
- for religious reasons/vegetarians
- they don't like the idea of eating animal flesh
- no waste

(6 marks)

Question 4

(i) Role of micro-organisms in food spoilage

Bacteria, yeasts and moulds are the main agents of microbial spoilage.

Food (substrate), moisture, oxygen, correct pH, warmth and time are the factors which encourage food spoilage. Microbes, given some or all of these conditions can cause food spoilage.

- Lactic acid bacteria cause milk to sour
- growth of mould (a form of fungi) – spores settle and grow on the surface of bread, meat and cheese
- certain moulds, e.g. the one that grows on peanuts produces harmful aflatoxin which causes illness and can result in death.

- yeasts can cause spoilage by fermenting sugary foods such as jams and fruit juices resulting in a sour taste. (9 marks)

Criteria Bands

8 – 9 marks – detailed response using relevant technical terms and at **least** 3 food examples

4 – 7 marks – demonstrates a sound understanding of the role of microbes in food spoilage. Candidates at the higher end of this band will have used some technical terms

1 – 3 marks – simplistic response demonstrating a basic understanding of the role of at least one microbe in food spoilage.

(ii) Beneficial effects of microbes in food production

- useful bacteria are used to make cheese and yoghurt
- yeasts are single-celled fungi which ferment sugar to produce CO₂ which helps bread to rise and turns grapes into wine, hops into beer and to make vinegar
- moulds are used to produce blue cheeses (6 marks)

Criteria Bands

5 – 6 marks candidates give a detailed response which demonstrates a high level of understanding of the benefits of microbes in food production. At least 3 examples must be given to achieve full marks

3 – 4 marks sound understanding demonstrated. At least 2 examples needed for top marks in this band.

1 – 2 marks basic understanding demonstrated with at least one example for full marks in this band.

(b) Procedures necessary for the **hygienic preparation, cooking and storage** of food for infants:

- breast milk is ideal because it is sterile and at the right temperature
- expressed milk should always be refrigerated (1-5°C)
- bottles and teats should be sterilised before use
- hands should be washed in hand-hot soapy water and dried on a disposable towel before preparing any infant food to reduce the risk of cross-contamination
- home-made food which is to be refrigerated or frozen must be cooled rapidly (cold water and ice cubes) to reduce the opportunity for bacteria to grow and multiply. Containers to be used for freezing food must have been rinsed in very hot or boiling water
- tap water should be boiled for the first 6 months to reduce the chance of infection
- a sterilized plastic spoon and baby dish should be used
- eggs should be cooked until firm to reduce the risk of salmonella poisoning
- as a general rule, foods should be thoroughly cooked
- use different coloured chopping boards for preparing raw meat and vegetables to avoid cross-contamination
- only use the freshest of food/use foods before their use-by-date
- use coolbags when transporting food for picnics, family outings etc

All of the usual rules for hygiene should be observed. Candidates must address the preparation, cooking and storage of food when explaining the procedures for hygienic preparation of infant food. Better candidates will name specific foods as well as explaining the reasons for the procedures. High quality

answers will appreciate the reasons for wanting to avoid gastro-enteritis which can be fatal as infants quickly become dehydrated. (10 marks)

Criteria Bands

9 – 10 marks – a detailed and high level response which covers preparation, cooking and storage of food for infants. Candidates will have a very clear understanding of the principles of hygiene and appreciate fully the reasons for procedures. There will be relevant use of technical terms.

5 – 8 marks – candidates have a sound understanding of the principles of hygiene and are able to transfer these to the given scenario (prep/cooking/storage of food for infants) At the top end of this band, it is expected that candidates will have dealt with two of these in detail. There should be some use of relevant technical terms.

1 – 4 marks – candidates demonstrate a basic understanding of the principles of hygiene and discuss the scenario in general terms. At least one of the areas (preparation/cooking/storage) should be addressed in some detail to achieve full marks in this band.