CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the October/November 2012 series

9336 FOOD STUDIES

9336/01 Paper 1 (Theory), maximum raw mark 100

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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CAMBRIDGE
International Examinations

Section A

1 (a) (i) Balanced diet
contains **all** nutrients – in sufficient amounts / correct proportion [1]

(ii) Factors which could prevent a balanced diet
lack of knowledge – do not understand nutrition – poor education –
poverty – protein foods can be expensive – food aid unavailable –
poor transport – not enough money to provide for whole family –
food not available – famine – drought – poor harvest – climate –
lack of skill – may not gain maximum nutrients from food –
nutrients lost during cooking – illness – not able to eat sufficient food –
snacking on sweet foods – no appetite for nutritional meal –
culture – vegans may be lacking in HBV protein, iron etc. –
advertising – convenience foods high in fat, sugar, salt etc. –
influence of family and friends – peer pressure – fast food –
junk foods, ready–made foods – high in fat –
appearance and flavour of food may not be appetising – will not eat –
special occasions / festivals – rich food – high in fat and sugar –
lifestyle – working mothers have little time for cooking –
may not eat sufficient fresh fruit and vegetables –
teenage girls often diet / become vegetarian – anorexia / bulimia –
picky eating – bad eating habits – snacking rather than regular mealtimes –
elderly people may not want to cook – choose easy food –
bread, biscuits etc. – do not want to cook for one –
small amounts of food can be expensive etc.
16 points (2 points = 1 mark) [8]

(b) (i) Reasons to limit salt and sugar in the diet
Salt
fluid retention – may cause high blood pressure / hypertension –
osmotic effect in blood vessels – headaches – kidney disease – strokes –
CHD – daily salt intake 2–3g – max. 6g per day etc.
Sugar
empty calories – provide no other nutrient except sugar –
energy not used is converted to fat – adipose tissue – under skin –
around internal organs – obesity – CHD – varicose veins – haemorrhoids
strokes – lack of self–esteem – problems during surgery – breathlessness –
extrinsic sugar – tooth decay – bacteria in mouth – combine with sugar – form
plaque – produce acid – which erodes enamel –
diabetes – lack of insulin – glucose stays in blood –
instead of passing to cells – lack of energy – use stored fat – weight loss –
may need to have insulin injections to allow sugar to be absorbed
12 points (2 points = 1 mark) [6]

(ii) Ways to limit salt and sugar

Salt

cook without salt – no salt on table – avoid MSG –
make use of herbs and spices for flavour – use potassium chloride –
fewer convenience foods – less crisps – salted nuts etc. –
less bacon and ham – soak ham to remove salt before boiling etc.

Sugar

no sugar–coated breakfast cereals – no sugar in drinks –
use artificial sweeteners – fewer cakes / biscuits – less sweets / chocolate
canned fruit in natural juice instead of syrup – low calorie / diet drinks –
avoid icing cakes – reduce sugar in recipes – study nutritional labels etc.
8 points (2 points = 1 mark) [4]

(c) Importance of NSP in a healthy diet

aids process of excreting solid waste – which is potentially toxic to the body – absorbs water – making faeces soft – and bulky – and easier to expel –regularly – stimulates intestinal muscles – encourages peristalsis –
gives something for muscles to grip –
pushes waste along length of colon – absorbs toxins – lowers cholesterol –if lacking in NSP not enough water can be absorbed – faeces small and hard difficult to expel – discomfort – constipation –
inner lining of colon may become distorted – pouches develop in intestine
faeces collects and is retained by the body – diverticular disease –
may cause varicose veins / haemorrhoids – cancer of colon –
helps slow down release of glucose to bloodstream – aids diabetics –
lowers risk of CHD – and blood cholesterol – helps remove toxins etc.
12 points (2 points = 1 mark) [6]

2 (a) Monosaccharides, disaccharides, polysaccharides

(i) STRUCTURE

monosaccharides

single molecule – $C_6H_{12}O_6$

disaccharides

2 molecules of monosaccharide – $C_{12}H_{22}O_{11}$ –
1 molecule of water lost in the reaction – condensation

polysaccharides

long chains of glucose molecules –$(C_6H_{10}O_5)n$ –
water lost in the reaction – condensation –
can be linear – or branched –
more than one type of monosaccharide joined together

(ii) PROPERTIES

monosaccharides

simplest form / basic unit – sweet taste – water soluble –
end product of digestion – can be absorbed into the bloodstream

disaccharides

water soluble – sweet taste –
broken down to monosaccharides during digestion

polysaccharides

available carbohydrate can be digested into monosaccharides –
then absorbed into the bloodstream after digestion –
unavailable carbohydrate cannot be digested – insoluble in water

(iii) EXAMPLES

monosaccharides
glucose – galactose – fructose (max. 2 examples)
disaccharides
maltose – lactose – sucrose (max. 2 examples)
polysaccharides
available carbohydrate: – starch – glycogen (max. 2 examples)
unavailable carbohydrate: –
linear e.g. amylose – cellulose – NSP (max. 2 examples)
branched e.g. pectin – gum – mucilage (max. 2 examples)
20 points (2 points = 1 mark) [10]

(b) Problems with excess carbohydrates

Glucose
end product of breakdown of carbohydrate – converted to glycogen –
stored in liver – and muscles – as readily available source of energy –
excess converted to fat – stored in adipose tissue – under skin –
or around internal organs – obesity – CHD – diabetes – if there is insufficient insulin –
link to tooth decay – bacteria in mouth combine with sugar – form plaque acids
erode tooth enamel
Dietary fibre / NSP
shorter transit time for food in digestive tract –
interferes with absorption of minerals – e.g. zinc, iron etc. –
due to phytates / phytic acid – slows down rate of sugar absorption – reduces risk of diabetes etc.
10 points (2 points = 1 mark) [5]

(c) Digestion and absorption of carbohydrates

In the mouth – amylase / ptyalin – from salivary glands –
acts on **cooked** starch – converting it into maltose – medium is alkaline –
in duodenum – amylase – from pancreatic juice –
converts starch to maltose – medium is alkaline –
in ileum – intestinal juice –
contains maltase – converts maltose to glucose –
lactase – converts lactose to glucose and galactose –
sucrase / invertase – converts sucrose to fructose and glucose –
completing the breakdown of carbohydrates

absorption occurs along the whole length of the ileum – by villi –
finger–like projections – which increase surface area –
(can show on diagram) – well supplied with blood capillaries –
monosaccharides are absorbed directly into the bloodstream –
pass to liver – via hepatic portal vein –
all monosaccharides become glucose – sent to all cells
14 points (2 points = 1 mark) [7]

(d) Basal Metabolic Rate (BMR)
amount of energy needed – to keep body alive – when lying down – at complete rest – at least 5 hours after a meal – warm – is different for every individual – affected by body size – age – activity of thyroid gland – gender – men require 10–20% more than women of same weight – state of health etc.
energy used for involuntary activities – e.g. breathing – growth – heartbeat – blood circulation etc.
excess thyroid activity increases BMR etc.
6 points (2 points = 1 mark) [3]

3 (a) Recommended Daily Intake (RDI)
average amounts – individual needs vary – used for guidance – an estimate of the requirement – of each nutrient – for healthy living – for efficient running of body processes – involuntary activities – e.g. breathing, heartbeat, blood circulation etc. – level of activity – state of health – age etc.
6 points (2 points = 1 mark) [3]

(b) Comparison of needs of teenage girls and moderately active elderly women

NB – No mark allocated for identifying nutrients.
Must be part of a statement.
(Look for words such as 'more' 'the same' 'less'.)
consider:

protein	growth – repair / maintenance etc.
iron	menstruation – prevention of anaemia etc.
vitamin C	absorption of iron – immune system etc.
calcium	growth of bones / teeth – maintenance – osteoporosis etc.
phosphorus	formation of calcium phosphate
vitamin D	absorption of calcium etc.
energy	depends on level of activity – need for growth etc.
fat	concentrated source of energy – difficult to digest – CHD – obesity etc.
vitamin A	night vision – anti–infective vitamin etc.
riboflavin	release of energy from food etc.
nicotinic acid	release of energy from food etc.
salt	lost in sweat if active – linked to hypertension etc.
sugar	empty calories – tooth decay – diabetes – obesity etc.

named nutrients – functions – comparisons
suggest 8 nutrients, 8 × 3 points
24 points (2 points = 1 mark) [12]

(c) Many old people suffer from malnutrition

(i) Discussion could include the following:
isolation – immobility – lack of nutritional knowledge
poverty – scarcity of foods – health problems
culture and social habits – lack of skill
lack of cooking facilities – poor access to food etc.
5 well–explained points (5 × 1 mark) [5]

(ii) Remedial suggestions
(should be sensible / possible) – could include:
help with meal preparation from family / friends / neighbours / social services
meals delivered from central point – free or small charge
meeting together in local centre – eating together
talks / social activities with meal ideas
local committee buying food in bulk and distributing – cheaper etc.
5 well–explained points (5 × 1 mark) [5]

4 (a) (i) Importance for energy production

(a) iron
needed for production of haemoglobin – in red blood cells –
which picks up oxygen in the lungs – forming oxyhaemoglobin –
carries it to every cell – to oxidise simple sugars –
and produce energy

(b) vitamin C
aids absorption of iron – converts non–haem iron from plant foods –
to haem iron – reduces ferric form to ferrous form –
more readily absorbed

(c) B vitamins
co–enzymes – linked to the liberation of energy from foods
thiamine / B1 – releases energy from glucose
riboflavin / B2 – release of energy from fats and amino–acids
nicotinic acid – release of energy from carbohydrate foods

(d) iodine
concerned with the production of thyroxine – by the thyroid gland –
which controls metabolic rate – required in minute quantities

Suggest 4 × 4 points
16 points (2 points = 1 mark) [8]

(ii) Effects of a deficiency

(a) iron
anaemia – red blood cells lack haemoglobin –
cannot pick up oxygen – tired / lethargic – pale etc.

(b) vitamin C
scurvy – lethargy – loose teeth – swollen / bleeding gums –
bruising – internal bleeding – death

(c) B vitamins
thiamin – beri–beri – loss of appetite – palpitations – fever etc.
riboflavin – cracked skin around mouth – sore eyes – lips –
swollen tongue
nicotinic acid – pellagra – diarrhoea – dementia – dermatitis

(d) iodine
goitre – swelling of thyroid gland – slow metabolism –
cretinism in new–born if mother deficient during pregnancy

Suggest 4 × 2 points
8 points (2 points = 1 mark) [4]

(b) Importance of energy balance
energy intake and energy expenditure must be the same –
to ensure a desirable body weight – otherwise overweight or underweight –
overweight increases chances of obesity – CHD – breathlessness –
low self–esteem – problems during surgery – lack of mobility etc.
underweight increase chance of weight loss – anorexia – death –
loss of function of body organs – broken down for energy etc.
8 points (2 points = 1 mark) [4]

(c) Protein–energy malnutrition (PEM)

(i) Possible causes
shortage – of carbohydrates – and / or protein foods –
protein used for energy – due to famine – poverty – natural disasters –
war – tribal customs on feeding children when breast–feeding stops –
children weaned onto a diet in which staple food is cassava –
or matoke (green bananas) – low in protein –
tradition for father in family to be given meat or other protein foods –
rest of the family given what remains –
6 points (2 points = 1 mark) [3]

(ii) Short and long term effects
short term
marasmus – in first year of life – muscle wasting – no body fat – pot belly – emaciated
kwashiorkor – poor growth – distended stomach – odoema / water retention – diarrhoea – infections – skin is poor colour – reddish, fine hair – apathy – reduced immunity
long term
poor growth – mental retardation
6 points (2 points = 1 mark) [3]

(iii) Overcoming this type of malnutrition
education
government food supplements
agricultural programmes etc.

Suggestions must be realistic / possible
3 well–explained suggestions
3 × 1 mark [3]

Section B

5 (a) Economic circumstances
amount of money available for food – budget –
poorer people have to spend a higher proportion of their income on food
status symbol for rich people – smoked salmon, caviar etc. –
high expenditure does not always lead to nutritionally well–planned meals –
cheaper foods can be very nutritious – locally–grown vegetables, fish etc. –
use cheaper sources of HBV protein etc. –
milk, cheese, cheaper cuts of meat etc. – foods in season – special offers poor people may receive government help – free school meals, food aid etc.
poverty limits choice of food – for elderly, unemployed etc. –

(b) Availability of food
depends on where a person lives – foods in season –
different foods available I different countries –
little choice in developing countries – local staple food with variations –
depends on climate and type of land – may not favour rearing animals –
or growing certain crops – country may not have money for food imports –
variety available from other countries –
no money for expensive agricultural developments –
wealthy countries can afford to import food which cannot be produced locally
UK imports citrus fruit, tea, coffee, bananas etc. –
wealthier countries have benefited from technological developments –
new methods of preserving and storing food –
increased availability of dried, canned and frozen foods – unknown in the past
technologists have created many new foods – TVP, frozen meals etc. –

(c) Nutritional knowledge
choice may be affected by its nutritional value – cheaper HBV etc. –
nutritional knowledge depends on education – differs between countries –
nutrition may not be taught to everyone in school – knowledge varied –
packaging may provide nutritional information – people may be more aware
well–publicised dangers of over–consumption of fat, sugar and salt –
increase in obesity, diabetes, CHD in more affluent countries –
publicity campaigns in media – increases awareness and knowledge –
need to know functions of food and examples of food to provide nutrients –
choice must be wise or health will be affected etc.

(d) Marketing methods
choice is affected by how foods are sold – convenience of stores and stalls –
consider hygiene and quality of foods in local shops and markets –
markets and supermarkets offer wide choice – shopper must discriminate –
manufacturers must produce foods people want to buy –
market research to find out consumer preferences –
new products tested in certain areas – to judge consumer appeal –
influenced by portion size – attractiveness of packaging – price –
competition between stores – special offers – loss leaders etc. –
advertising in newspapers and on TV –
once inside shop will buy other products –
methods of displaying goods in store influences customers –
positioning of stock – impulse buys near pay point –
some advertisements appeal to children – sweets, McDonalds etc. –
peer pressure – advertisements may give nutritional information –
breakfast cereal boxes give information – role as educators etc.

(e) Cultural and social habits
choose foods liked by families – conditioning – vegetarian families –
children will follow – may absorb families' attitudes towards food –
food may be used to provide comfort, satisfaction, relief from anxiety –
stress relief – may be a status symbol – choice of particular brands –
family pattern influenced by country and culture –
each culture has its own foods – religious beliefs – cow sacred to Hindus –
Jews must have animals slaughtered in a certain way –
Roman Catholics may not eat meat on Fridays –
dishes associated with festivals –
Christmas cake, turkey for Thanksgiving in USA –
some foods symbolise the occasion – wedding cake –
lifestyle influences choice – meals can be a social occasion with friends –
snacks served at meetings and parties – to make people relax etc.

(f) Environment
may be determined by availability of low–priced, locally–grown food –
rice is staple in China and Japan, potatoes are important in UK –
people migrate and take their beliefs and eating habits with them –
most cities have a variety of types of food and many styles of restaurant –
more mothers employed outside the home – may choose convenience foods
more demand for snack food – may not be good for health –
more people live alone – may tend to snack or buy ready–to–eat food –
contain high levels of fat, sugar and salt –
increase in obesity, CHD, diabetes, hypertension etc.

50 points – at least 4 points from each section
2 points = 1 mark [25]

6 (a) Different types of wheat flour and uses

Stoneground – ground between large stones – nothing added or removed 100% whole grain
Used for bread
Wheatgerm – 70% extraction – treated germ added
Used for bread
Roller milled – steel rollers – can separate into bran, germ, endosperm – produces highly refined flour – mainly starch – fortified in UK – added calcium, iron, thiamine, iron –— loss of NSP, protein, B vitamins – 'improvers' added – e.g. vitamin C to help rising – bleaches to whiten –
Used for all purposes
Wholemeal – 100% extraction – characteristic flavour – gives close texture to bread – fat content causes rancidity – shorter shelf life
Used for bread, scones, pastries
Brown (wheatmeal) – 80–85% extraction – coarse bran removed – gives a better rise to bread
Used for bread, scones, pastry
Strong plain white – 72% extraction – Canadian Spring wheat – high gluten content – 12–15% – high water absorbency – higher in protein
Used for bread, flaky pastry, batter
Soft flour (plain white cake flour) – 7–10% gluten – gives 'shorter' texture from Winter wheat
Used for sauces, cakes, shortcrust pastry, biscuits
Self–raising flour – low gluten content – fixed proportion of raising agent added
Used for cakes, scones
Starch reduced flour – 70% extraction – some starch washed out during production – gluten remains – gives light, open texture
Used for bread and other baked goods
24 points for names, descriptions and uses.
max. 2 examples. for uses for each flour (2 points = 1 mark) [12]

(b) Choice of flour for rich cake

soft flour – low gluten content – to give tender crumb – forms framework of cake – when gluten sets – self–raising flour – contains correct amount of chemical raising agent – plain flour must have chemical raising agent added – raising agent affects finished texture – light and open texture – wholegrain flour gives colour and a rougher texture – but a heavier result white flour usually used etc.
6 points (2 points = 1 mark) [3]

(c) (i) Reaction of chemical raising agent during baking
bicarbonate of soda (sodium carbonate) – alkali –
cream of tartar – or tartaric acid – or acid sodium pyrophosphate – acid –
baking powder –
releases carbon dioxide – with moisture – and heat –
mixture of acids can be used in baking powder –
different rates of releasing carbon dioxide –
gives a constant even rise during baking –
amount of carbon dioxide released controlled by law – gas released –
mixture stretches – as gas expands – pushes up mixture –
protein coagulates – from gluten and egg in mixture – risen shape sets
10 points (2 points = 1 mark) [5]

(ii) Other changes when cake is baked
fat melts – absorbed by starch in flour – trapped air released into mixture –
liquid converted to steam – evaporates – gases expand – cake rises –
trapped air expands – starch gelatinises – protein in egg coagulates – gluten sets –
forms framework – sugar caramelises –
starch dextrinises on surface – to give brown colour – cake shrinks slightly – crust
forms – with dry heat – Maillard reaction –
between amino group on a protein chain –
and carbonyl group of a reducing sugar –
(or reaction between protein and sugar) –
brown compounds formed – giving appetising flavour etc.
10 points (2 points = 1 mark) [5]

7 (a) Enzymes
protein – catalysts – speed up chemical processes – specific –
produced by all living cells – break down plant and animal tissue –
work best at 25°C – 35°C – destroyed at 60°C – inactive below 0°C
6 points (2 points = 1 mark) [3]

(b) (i) Digestion of protein
in stomach – rennin – clots milk – in young children –
acid conditions – HCl – pepsin –
breaks long chains of amino acids into peptones / peptides / polypeptides –
in duodenum – trypsinogen – from pancreatic juice – converted to trypsin –
by enterokinase – from intestinal wall – continues breakdown of protein –
from peptones to amino–acids – in ileum – erepsin –
completes breakdown into amino acids
10 points (2 points = 1 mark) [5]

(ii) Food spoilage
autolysis – destruction by own enzymes –
enzymes in micro–organisms produce unpleasant end results –
e.g. smell of rotten fish –
enzymes in cells bring about browning when cell wall is damaged –
e.g. in apples – blanching destroys enzymes – protein denatured at 60°C –
enzyme activity slower in freezer – enzymes which attack fat are still active –
fatty foods have shorter shelf–life in freezer –
enzyme activity within cells causes ripening – changes in colour – flavour –
and texture – heating / cooking destroys enzymes – stops further spoilage etc.
10 points (2 points = 1 mark) [5]

(iii) Destruction of vitamin C in green vegetables
Ascorbase – in cell walls – acts on vitamin C – when cell wall damaged –
e.g. by cutting – neutralises vitamin C – ascorbase denatured by heat –
protein – put green vegetable into boiling water – add in small amounts –
to keep water temperature high – and retain vitamin C
8 points (2 points = 1 mark) [4]

(iv) Tenderising meat
proteases naturally present in meat – break down connective tissue –
during hanging – glycogen converted to lactic acid –
acid conditions ideal for enzyme activity – soften muscle proteins –
flesh becomes tender – as muscle fibres fall apart –
papain – from papaya – bromelin – from pineapple – ficin – from figs –
enzymes – which encourage breakdown of protein –
texture can become too soft – and mushy – if over–used etc.
8 points (2 points = 1 mark) [4]

(v) Making bread with yeast
diastase – in flour – changes starch in flour to maltose – feed yeast –
maltase – and invertase – produced by yeast – convert maltose to glucose
zymase – produced by yeast – converts glucose – to carbon dioxide –
and alcohol /ethanol – releases energy – used by yeast for fermentation
8 points (2 points = 1 mark) [4]

8 (a) (i) Adding colour to food during cooking and presentation
colour adds interest – making it look attractive – and palatable –
stimulates digestive system – mouth–watering effect –
food not of the expected colour do not tempt people to eat –
e.g. strength of tea and coffee judged by colour –
colour of cooked meat is an indication of 'doneness' –
too much red colour in cooked meat does not appeal to many people –
freshness and ripeness indicated by colour

dry methods of cooking add colour – grilling – roasting – frying –
toasted bread and baked foods are browned –
dextrinisation of starch – Maillard browning –
meat changes from red to brown during cooking –
myoglobin to hemichrome –
use of spices – e.g. turmeric, paprika, saffron etc.
use of herbs – e.g. parsley, coriander, rosemary etc.
eggs add yellow colour – e.g. to cakes –
glaze on baked foods to brown – e.g. bread, sausage rolls etc.
lemon / orange rind – jam – fruit syrup – fruit – vegetables –
coffee – chocolate – cocoa – pistachio nuts etc.

garnishes and decoration are used to make foods attractive before serving
e.g. parsley, sliced hard boiled egg, tomato slices, lemon butterflies etc.
cherries, angelica, toasted almonds, walnuts etc.
20 points (2 points = 1 mark) [10]

(ii) Adding colour during manufacture
processing tends to remove – or change food colour –
manufacturers add colours to achieve the expected colour of a food –
to attract customers – and sell more products –
children especially attracted to bright colours
margarine would be white but a yellow colour added since margarine is a butter substitute –
colours used can be natural – or synthetic –
natural – chlorophyll, riboflavin, turmeric, cochineal, caramel, carotenes, beetroot, saffron, paprika etc.
synthetic – azo dyes and coal tar dyes e.g. tartrazine, sunset yellow, brown FK etc.

Manufacturers want canned peas to be green rather than grey and raspberry jam to be red rather than a brownish colour because they wish to sell their products.
BUT
People are concerned about synthetic colours – many now known to be toxic
Some coal tar dyes are carcinogenic –
synthetic colours are stringently tested – given an E prefix if accepted by EU
some people think they should not be used at all –
could be long–term damage to health –
some are allergic to certain colourings – or sunset yellow is used –
found in sweets, drinks etc.
synthetic dyes cheaper and easier to obtain than natural colours –
saffron is very expensive etc.
10 points (2 points = 1 mark) [5]

(b) (i) Change from red to brown in red meat
main muscle pigment in myoglobin – changes to metmyoglobin –
myoglobin is denatured and oxidised –
ferrous iron – converted to ferric iron
and resulting metmyoglobin is brown
6 points (2 points = 1 mark) [3]

(ii) Non–enzymic browning
Maillard reaction – when foods are roasted, baked or grilled –
NH_2 – from amino–acids / protein / protein amino group –
CHO / carbohydrate – from a reducing sugar / glucose / lactose /galactose
form brown melanoidins
The formation of the indigestible brown colours involves a loss of nutrients –
Mainly the IAA lysine, tryptophan and arginine
6 points (2 points = 1 mark) [3]

(iii) Causes and prevention of enzymic browning
Cause – enzymes catalysing the oxidation of polyphenol compounds
cut cell surfaces – + oxygen – + enzymes –
e.g. polyphenoloxidases or polyphenolases – gives oxidised polyphenol –
further oxidation gives melanoidins
Prevention – enzymes denatured by heating – texture and flavour change
lowering the pH – by dipping in acid juice / lemon – vitamin C – vinegar –
use of sugar syrup – helps to exclude oxygen – also use salt solution –
prepared potatoes are coated with potato whitener – or soaked in water –
sulphite and tartarate solutions – sulphur dioxide used commercially
8 points (2 points = 1 mark) [4]