



FOOD SCIENCE AND TECHNOLOGY

ATAR course examination 2020

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Multiple-choice

15% (15 Marks)

| Question | Answer |
|----------|--------|
| 1 | a |
| 2 | c |
| 3 | a |
| 4 | b |
| 5 | d |
| 6 | b |
| 7 | c |
| 8 | a |
| 9 | d |
| 10 | b |
| 11 | d |
| 12 | d |
| 13 | a |
| 14 | c |
| 15 | c |

Section Two: Short answer

55% (68 Marks)

Question 16

(9 marks)

- (a) Explain the purpose of a HACCP system. (3 marks)

| Description | Marks |
|---|----------|
| Explains the purpose of the HACCP system | 3 |
| Describes a fact about the purpose of the HACCP system | 2 |
| Makes a statement about the purpose of the HACCP system | 1 |
| Total | 3 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • a food safety system • focuses on preventing hazards that could cause food-borne illnesses • applies science-based controls to manage critical control points • discover or identify the sources of potential risks in food systems • can be utilised in any food system used to transform raw materials into food commodities • critical control points are identified and preventive actions or control measures are implemented to eliminate problems before they arise | |

- (b) For each of the steps in the production process shown in the table below, identify
- two**
- actions to consider when creating a HACCP system for the sausage sizzle. (6 marks)

| Description | Marks |
|--|---|
| For each step in the production process: | |
| Identifies two actions to consider | 2 |
| Identifies one action to consider | 1 |
| Total | 6 |
| Answers may include, but are not limited to the following: | |
| Production process | Actions to consider |
| Purchase or delivery of food | <ul style="list-style-type: none"> • use a well-known supplier and check supplier premises for quality or hygiene or storage • be specific about food required and inspect food carefully or check for leakages or tears in packaging or temperature |
| Food storage | <ul style="list-style-type: none"> • store food at correct temperature, cold food needs storage at below 5° C • storage areas should be kept clean, clean up spills immediately to prevent attracting pests • all foods should be covered or in air tight containers to prevent cross contamination or dry goods should be kept in a well-ventilated area out of direct sunlight |
| Food preparation | <ul style="list-style-type: none"> • prepare raw and cooked food separately all equipment should be thoroughly washed and cleaned when handling different foods • keep foods out of the temperature danger zone hot holding temperature is above 60° C or have a thermometer to check temperature of hot foods |

Question 17

(9 marks)

- (a) Identify **two** fat-soluble vitamins. For each vitamin, provide a function in the body and a food source. (6 marks)

| Description | | Marks |
|--|--|--|
| For each vitamin: | | |
| Identifies the vitamin | | 1 |
| Provides a function in the body | | 1 |
| Provides a food source | | 1 |
| Total | | 6 |
| Answers may include, but are not limited to the following: | | |
| Fat-soluble vitamin | Function in the body | Food source |
| Vitamin A or retinol | <ul style="list-style-type: none"> • promotes good eyesight • promotes healthy skin or tissues lining the mouth or nose or lung • resistance to infection • promotes normal growth in children especially bones or teeth | <ul style="list-style-type: none"> • liver • oily fish • full cream dairy foods • green or orange fruit or vegetables |
| Vitamin D or cholecalciferol | <ul style="list-style-type: none"> • absorption of calcium • metabolism of calcium • formation of bones or teeth • absorption of iron or zinc or magnesium or phosphate • decreases gum inflammation | <ul style="list-style-type: none"> • fish liver oils • oily fish • egg yolk • dairy fats |
| Vitamin E or tocopherol | <ul style="list-style-type: none"> • acts as an antioxidant • protects cell membranes from damage • captures free radicals • important in the formation of red blood cells | <ul style="list-style-type: none"> • nuts or seeds • wheatgerm • unsalted margarine • eggs • wholegrains • fish • fruit or vegetables |
| Vitamin K or phyloquinone | <ul style="list-style-type: none"> • blood clotting • bone metabolism • regulates blood calcium | <ul style="list-style-type: none"> • green leafy vegetables • liver • eggs • cheese |

- (b) Explain the importance to bone health of exposure to sunlight. (3 marks)

| Description | Marks |
|--|----------|
| Explains the importance to bone health of exposure to sunlight | 3 |
| Describes the importance to bone health of exposure to sunlight | 2 |
| Makes a statement about the importance to bone health of exposure to sunlight | 1 |
| Total | 3 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • the body can make vitamin D in skin that has been exposed to sunlight or sunlight is the best natural source of vitamin D • vitamin D is responsible for the absorption of calcium in the body or helps the body to process calcium • calcium is responsible for the formation of bones • dietary sources of vitamin D are important for people who are not exposed to sunlight | |

Question 18

(8 marks)

- (a) Describe the process of aseptic packaging. Identify **two** benefits of this process. (4 marks)

| Description | Marks |
|---|----------|
| Describes the process of aseptic packaging | 2 |
| Makes a statement about aseptic packaging | 1 |
| Subtotal | 2 |
| For each benefit: | |
| Identifies a benefit of aseptic packaging | 1–2 |
| Subtotal | 2 |
| Total | 4 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • independently sterilising both the food and the packaging • filling the packaging and sealing the product in a sterile environment. | |
| Benefits of aseptic packaging | |
| <ul style="list-style-type: none"> • no refrigeration required until after opening • efficient and stable shape for storage • no preservatives needed, therefore improved health benefits • natural flavour or colour are maintained • resistant to light, therefore the product will have a longer shelf life • nutrient value is maintained • relatively inexpensive to produce packaging • light weight, durable packaging • product has an extended shelf life before opening | |

- (b) Describe **two** reasons why the demand for food products manufactured using high-pressure processing has increased. (4 marks)

| Description | Marks |
|---|----------|
| For each reason: | |
| Describes a reason for using high pressure processing | 2 |
| States a reason for using high pressure processing | 1 |
| Total | 4 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • retains flavour – flavour molecules are not affected so retains its 'just picked' taste • with cold pasteurisation colour is not affected • with cold pasteurisation heat sensitive nutrients are not destroyed | |
| <ul style="list-style-type: none"> • no distortion to the shape of the food, therefore retains sensory properties of appearance • no additives required to preserve the product • 'clean' labelling, which is of benefit to consumers | |
| <ul style="list-style-type: none"> • extended shelf life • shelf stable for longer • deactivates microbes | |

Question 19

(9 marks)

- (a) Explain the difference between a food allergy and a food intolerance. (3 marks)

| Description | Marks |
|--|----------|
| Explains the difference between a food allergy and a food intolerance | 3 |
| Describes the difference between a food allergy and an intolerance | 2 |
| States the difference between a food allergy and a food intolerance | 1 |
| Total | 3 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • a food allergy occurs when the body's immune system responds negatively to a specific protein or identifies the protein as foreign and produces antibodies • an intolerance does not involve the immune system or the body is responding to a specific chemical or combination of chemicals • an allergy requires total avoidance of the allergen or immediate treatment with an epinephrine autoinjector • an intolerance can be managed through reduction in or establishment of safe consumption levels | |

- (b) Describe **three** strategies that can be employed to help manage a diagnosis of a food allergy or intolerance. (6 marks)

| Description | Marks |
|--|----------|
| For each strategy: | |
| Describes a strategy | 2 |
| States a strategy | 1 |
| Total | 6 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • know what you are eating or drinking • read food labels or menus carefully • wear a medical alert bracelet or necklace that lets others know of the food allergy • to ensure people know about the condition if they are unable to communicate. • carry an epinephrine autoinjector • if they are at risk of a severe allergic reaction • when eating away from home make servers or chefs aware of the condition • to be certain that the meal you order doesn't contain any food that may cause a reaction • plan meals and snacks before leaving home • carry allergen-free foods • notify key people of any food allergy • emphasise that an allergic reaction can be life-threatening and requires immediate action • explain food allergy symptoms to key people or teach people how to recognise signs and symptoms of an allergic reaction • write or display an action plan on how to deal with an allergic reaction | |

Question 20

(9 marks)

(a) Explain the term 'phytochemical'.

(3 marks)

| Description | Marks |
|--|----------|
| Explains the term 'phytochemical' | 3 |
| Describes the term 'phytochemical' | 2 |
| Outlines the term 'phytochemical' | 1 |
| Total | 3 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • contain beneficial substances other than the essential nutrients found in food • occur naturally in many plant foods • are known as non-nutrients as they have not been identified as nutrients • do not provide kilojoules | |
| <ul style="list-style-type: none"> • contain beneficial substances other than the essential nutrients found in food • are not usually destroyed in cooking • biologically active components in food or many are yet to be identified • the foods in which they are contained may be known as superfoods | |

(b) Name **two** phytochemicals. Identify a food source and state the function in the body of each.

(6 marks)

| Description | Marks |
|---|--|
| For each phytochemical: | |
| Names the phytochemical | 1 |
| Identifies a food source | 1 |
| States a function in the body | 1 |
| Total | 6 |
| Answers may include but are not limited to the following: | |
| Phytochemical | Food source |
| Phytoestrogens | <ul style="list-style-type: none"> • soy products • flaxseed • pomegranate |
| Antioxidants | <ul style="list-style-type: none"> • fruits or vegetables • wholegrain cereals • tea • red wine • cacao |
| Probiotics | <ul style="list-style-type: none"> • fermented products • sauerkraut • salami • tempeh |
| | <ul style="list-style-type: none"> • reduce the risk of hormone related cancers such as breast or prostate • prevent osteoporosis • reduce the risk of heart disease • plays a role in reducing the symptoms of menopause |
| | <ul style="list-style-type: none"> • scavengers of free radicals that cause cell damage • may have a role in reducing the risk of cancer or heart disease or ageing or arthritis |
| | <ul style="list-style-type: none"> • promote gut health • may enhance the effectiveness of intestinal bacteria |

Question 21

(9 marks)

Explain how each of the following factors influences food consumption patterns in Australia:

- economic
- environmental
- ethical.

| Description | | Marks |
|--|--|----------|
| For each factor: | | |
| Explains how the factor influences food consumption patterns in Australia | | 3 |
| Describes how the factor influences food consumption patterns in Australia | | 2 |
| Makes a statement about how the factor influences food consumption patterns in Australia | | 1 |
| Total | | 9 |
| Answers may include but are not limited to the following: | | |
| Factor | Descriptions | |
| Economic | <ul style="list-style-type: none"> • income determines the types of foods consumers purchase • low-income earners purchase cheaper foods or high-income earners purchase more expensive foods • in times of natural disasters, foods may become scarce • supply and demand will determine the price of food according to availability | |
| | <ul style="list-style-type: none"> • economic status has a major influence on consumption patterns • Australia has a strong, stable economy • most people are able to choose from a wide variety of foods | |
| Environmental | <ul style="list-style-type: none"> • consumers are becoming more environmentally aware • they will consider waste issues such as packaging or recycling • they will also be aware of reducing food waste that goes to landfill | |
| | <ul style="list-style-type: none"> • consumers who are conscious of the effect of food production on the environment • may choose to purchase organic foods or local foods or foods with low food miles • may reduce their consumption of meat or dairy foods or choose sustainably sourced foods | |
| Ethical | <ul style="list-style-type: none"> • working conditions for people in the food industry in developing countries are often unfair or underpaid • the fair-trade movement advocates for better conditions for workers • the movement promotes the purchase of food products that are produced under fair working conditions | |
| | <ul style="list-style-type: none"> • large multinational companies advertise unhealthy food to children • the negative impact on health is increasing • governments are considering taxes on unhealthy food or controls on the times at which these foods can be advertised | |
| | <ul style="list-style-type: none"> • consumer concerns about animal welfare • animal welfare advocates argue for better conditions for animals • promotion of products from free range producers | |

Question 22

(8 marks)

- (a) Comment on community concern over the potential for the Australian Association of National Advertisers (AANA) Code to regulate the advertising of food and beverage products to children. (2 marks)

| Description | Marks |
|--|----------|
| Comments on the concern | 2 |
| Identifies the concern | 1 |
| Total | 2 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> the AANA Code is self-regulatory not mandatory and is not legally binding on food advertisers it has the potential to influence advertisers to follow the conditions but cannot be enforced | |
| <ul style="list-style-type: none"> the code is not mandatory no consequences for failure to adhere | |

- (b) Describe **three** principles of the AANA food marketing code that manufacturers should consider when advertising products to children. (6 marks)

| Description | Marks |
|--|--|
| For each principle: | |
| Describes an advertising code | 2 |
| Makes a statement about an advertising code | 1 |
| Total | 6 |
| Answers may include, but are not limited to the following: | |
| Factual | <ul style="list-style-type: none"> advertising must not mislead or deceive children or be ambiguous the product and its features must be understood by children prices must be accurate and presented in a way that is understood by children must not imply that products are within the reach of every family budget |
| Placement | <ul style="list-style-type: none"> advertisements must not be placed in publications seen as unsuitable for children advertisements must not be directly accessible or in close proximity if seen as unsuitable for children |
| Sexualisation | <ul style="list-style-type: none"> advertisements must not contain sexual imagery advertisements must not imply that enjoyment of the product will increase child sexuality |
| Social values | <ul style="list-style-type: none"> must not contain an appeal to children to urge parents to purchase a product or must not undermine parental authority must not imply that ownership of a product makes the child superior to peers |
| Alcohol | <ul style="list-style-type: none"> advertising to children must not be for, or relate in any way to, alcohol products must not draw any association with companies that supply alcoholic products |
| Food and beverage | <ul style="list-style-type: none"> must not encourage or promote an inactive lifestyle or unhealthy eating or drinking habits must not encourage the use of high fat, high salt, high sugar foods for fund raising or fast-food outlet sponsorship of junior sporting competitions |
| Popular personalities | <ul style="list-style-type: none"> must not use celebrities to advertise a food product must not use familiar cartoon characters or animation to mask the distinction between entertainment and advertising |

Question 23

(7 marks)

- (a) The stomach, liver and large intestine are important components of the human digestive system. Describe the function of each of them in the digestion of food. (6 marks)

| Description | | Marks |
|--|---|----------|
| For each organ: | | |
| Describes the role of the organ | | 2 |
| Makes a statement about the organ | | 1 |
| Total | | 6 |
| Answers may include, but are not limited to the following: | | |
| Organ | Role of organ | |
| Stomach | <ul style="list-style-type: none"> • large bag like organ • muscles that line the stomach grind the food • mixes food with gastric juices or hydrochloric acid to produce chyme | |
| Liver | <ul style="list-style-type: none"> • main function is to process the nutrients absorbed from the small intestine or takes the raw materials absorbed by the intestine and makes all the various chemicals the body needs to function • bile from the liver secreted into the small intestine helps in the digestion of fat • detoxifies potentially harmful chemicals or breaks down and excretes many drugs | |
| Large intestine | <ul style="list-style-type: none"> • final 1.5 metres of gastrointestinal tract or muscular tube • uses peristalsis to move waste from the small intestine or removes food residues or waste from the body or produces no enzymes or some digestion occurs due to bacteria or contains beneficial bacteria for gut health • majority of water is absorbed in the colon or gas is produced | |

- (b) State the purpose of the villi in the digestion of nutrients. (1 mark)

| Description | Marks |
|--|----------|
| Makes a statement about the purpose of the villi | 1 |
| Total | 1 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • absorbs substances flowing through the small intestine • increases the surface area of the small intestine • creates a large surface area over which nutrients can be absorbed | |

Section Three: Extended answer

30% (40 Marks)

Question 24

(20 marks)

- (a) Define the term 'biotechnology' as it applies to food production. (2 marks)

| Description | Marks |
|---|----------|
| Defines the term biotechnology | 2 |
| Makes a statement about biotechnology | 1 |
| Total | 2 |
| Answers may include, but are not limited to the following: | |
| <ul style="list-style-type: none"> • biotechnology refers to any technique that uses living organisms or their components • it can be used to make or modify products or improve plants or animals or develop micro-organisms for special uses | |
| <ul style="list-style-type: none"> • the use of living microorganisms such as animal or plant or protozoa to create new products • with specific characteristics and attributes such as flavour or texture or health benefits for the consumer | |
| <ul style="list-style-type: none"> • biotechnology is the use of microorganisms in food production • to create new food products | |
| <ul style="list-style-type: none"> • biotechnology is the use of organisms such as cells or bacteria • used to develop or make new products | |

Question 24 (continued)

(b) Explain how each of the following examples of biotechnology are applied in food production:

- microorganisms
- yeasts.

(6 marks)

| Description | Marks |
|---|--|
| For each application of biotechnology: | |
| Explains an application of biotechnology in food production | 3 |
| Describes an application of biotechnology in food production | 2 |
| Identifies an application of biotechnology in food production | 1 |
| Total | 6 |
| Answers may include, but are not limited to the following: | |
| Biotechnology | Application of biotechnology |
| Microorganisms | <ul style="list-style-type: none"> • use of natural microbial fermentation • microorganisms produce yoghurt with new characteristics such as flavour or texture or improved gut health for the consumer |
| | <ul style="list-style-type: none"> • cheese making uses microorganisms, in particular lactic acid or bacteria or mould • some bacteria slowly produce carbon dioxide bubbles in the curd producing • this produces the customary holes in Swiss cheese or microorganisms extend the shelf life of cheese |
| | <ul style="list-style-type: none"> • mould called penicillium is added to blue vein cheese • the mould is extracted from old bread then inserted into the cheese • to create a creamy texture or provide a distinctive appearance and taste |
| | <ul style="list-style-type: none"> • microorganisms used in foods such as vinegar or olives or yoghurt or processed meats • all rely on the action of microorganisms • to make them palatable and nutritious |
| Yeasts | <ul style="list-style-type: none"> • fermentation is a metabolic process in which an organism converts a carbohydrate, such as starch or a sugar, into an alcohol or an acid • bread making converts fermentable sugars into carbon dioxide gas • this causes the dough to expand and rise through respiration |
| | <ul style="list-style-type: none"> • fermentation is a metabolic process in which an organism converts a carbohydrate, such as starch or a sugar, into an alcohol or an acid • beer is brewed through fermentation • this process yeast helps convert the sugars from the barley or grain to alcohol, ethanol and carbon dioxide |
| | <ul style="list-style-type: none"> • fermentation is a metabolic process in which an organism converts a carbohydrate, such as starch or a sugar, into an alcohol or an acid • wine making uses the process of fermentation • the yeast helps convert the sugars from the fruit to alcohol and ethanol |

- (c) Explain how **three** environmental issues impact sustainable production of food commodities. For each issue identify **one** sustainable farming strategy that could be adopted to reduce the impact on the environment. (12 marks)

| Description | | Marks |
|--|--|---|
| For each environmental impact | | |
| Explains the impact an environmental issue has on sustainable production of food commodities | | 3 |
| Describes the impact an environmental issue has on sustainable production of food commodities | | 2 |
| Identifies the impact an environmental issue has on sustainable production of food commodities | | 1 |
| Subtotal | | 9 |
| Identifies a sustainable practice to be adopted to reduce the impact on the environment | | 1 |
| Subtotal | | 3 |
| Total | | 12 |
| Answers may include, but are not limited to the following: | | |
| Environmental issue | Impacts on sustainable production | Sustainable strategies |
| Water use | <ul style="list-style-type: none"> over watering raises level of the water table bringing salt to the surface overwatering contributes to salinity and decreased productivity of the land | <ul style="list-style-type: none"> efficient irrigation, such as drip-irrigation systems controlled and monitored by computer systems deliver exact quantities of water for optimal plant growth use of sensors to monitor soil moisture to determine amount of water needed maintain and repair breaks in water channels and banks to avoid water loss enclose open-channel irrigation systems to prevent evaporation. reuse water, capture run-off in channels and dams, less need for supplementary water |
| | <ul style="list-style-type: none"> poorly timed irrigation systems use more water than necessary about 40% of water used to irrigate crops is lost through seepage and evaporation spray irrigation can drift several kilometres off target. | |
| Land use | <ul style="list-style-type: none"> deterioration in quality of land, loss of nutrients, overuse resulting in unproductive land due to over watering or land clearing or soil erosion or overuse of land for stock or cropping | <ul style="list-style-type: none"> contour farming reduces loss of topsoil crop rotation maintains nutrient level of soil leaving stubble after harvesting to reduce soil erosion reforestation planting windbreaks reduce soil erosion ensure soil quality retained, land recovers, useful for farming long term |
| | <ul style="list-style-type: none"> soil erosion or wearing away of land by weather conditions or deforestation for stock or crops, nutrient rich topsoil is lost, impacts productivity land clearing causes water table to rise | |

Question 24(c) (continued)

| Environmental issue | Impacts on sustainable production | Sustainable strategies |
|----------------------|--|--|
| Land use (continued) | <ul style="list-style-type: none"> brings salt to surface, high soil salinity makes plants unable to grow | |
| Chemical use | <ul style="list-style-type: none"> use of chemicals or fertilisers or pesticides or fungicides or herbicides reduce spoilage of crops from infestations improve yield spray drift can occur if not carefully applied contaminating nearby crops and communities. acidity of soil due to poor management or overuse of chemicals contamination of groundwater supplies. chemical run off into water ways, causes contamination kills wildlife or promotes the growth of algae. | <ul style="list-style-type: none"> crop rotation or organic farming methods reduces need for chemicals. careful land-based spraying limits harmful spread of chemicals into waterways and land. aerial spray contractors fly low to ground to spray accurately and avoid spray drifting. Choose low wind days to spray satellite tracking determines correct amount of chemical applied monitor crops to determine if spraying is necessary use natural or organic herbicides or pesticides |

Question 25

(20 marks)

(a) Describe **three** influences on the global food supply.

(6 marks)

| Description | | Marks |
|--|---|----------|
| For each influence: | | |
| Describes an influence on the global food supply | | 2 |
| Identifies an influence on the global food supply | | 1 |
| Total | | 6 |
| Answers may include, but are not limited to the following: | | |
| Influence | Outline of influence | |
| Trade restrictions | <ul style="list-style-type: none"> embargoes or tariffs or subsidies directly affect food imports embargoes limit imports or tariffs increase prices or subsidies transfer price fluctuations from the consumer to the government | |
| Government policies | <ul style="list-style-type: none"> free trade agreements or fair trade provide access to markets | |
| | <ul style="list-style-type: none"> lack of commodities to export developing countries may be disadvantaged | |
| | <ul style="list-style-type: none"> smallholder farmers in developing countries grow cash crops for large corporations in preference to food crops creates seasonal hunger | |
| Ownership concentration within the food industry | <ul style="list-style-type: none"> multinational companies dominating the market limits competition concentration of supermarket ownership in the retail food industry has resulted in reduced bargaining power for farmers | |
| Natural disasters and the potential loss of infrastructure | <ul style="list-style-type: none"> natural disasters such as drought or flood or severe weather events or earthquake impact food availability can create poverty due to loss of income or assets or infrastructure | |
| Land ownership | <ul style="list-style-type: none"> security of tenure or ownership of farming land affects reliability of the global food supply rising prices of land negatively affects consumers or food security | |

Question 25 (continued)

- (b) Explains **three** influences on the distribution of global food resources. For each influence, clarify the effect on the distribution of global food resources (9 marks)

| Description | | Marks |
|---|--|----------|
| For each influence: | | |
| Explains an influence on the distribution of global food resources | | 1 |
| Subtotal | | 3 |
| Clarifies the effect of an influence on the distribution of global food resources | | 2 |
| Makes a statement about the effect of an influence on the distribution of global food resources | | 1 |
| Subtotal | | 6 |
| Total | | 9 |
| Answers may include, but are not limited to the following: | | |
| Influence | Effect on distribution | |
| Production of biofuels | <ul style="list-style-type: none"> there is an increased demand for biofuels which use grain in their production reduces the supply of grain available for food | |
| | <ul style="list-style-type: none"> commercial companies that produce biofuels purchase large amounts of land on which to grow crops for fuel reduces the land available for crops for food production | |
| | <ul style="list-style-type: none"> the use of grain for the production of biofuels raises the price of staple foods makes staple foods more expensive and less available to low income populations | |
| | <ul style="list-style-type: none"> the price of grain for human consumption will increase due to its use for biofuel production will increase the price of meat, poultry and eggs that rely on grain for feed and impact negatively on food security | |
| Population growth and distribution | <ul style="list-style-type: none"> rapid population growth increase in food production and consumption undermined by rapid population growth | |
| | <ul style="list-style-type: none"> migration from rural to urban areas urban residents dependent on income and ability to purchase | |
| | <ul style="list-style-type: none"> croplands and water supply are under strain as human populations increase can lead to destruction or overexploitation of arable land | |
| Food production and distribution | <ul style="list-style-type: none"> food production dependent on water supply and croplands changing the environment has an impact on food production or declining seed diversity deprives farmers of crop varieties better suited to conditions | |
| | <ul style="list-style-type: none"> proliferation of "just-in-time" supply chains little food in reserve if supply chain is disrupted | |
| | <ul style="list-style-type: none"> food production is linked to food safety contamination can occur at any point in the food production chain resulting in an interruption to food supply | |
| | <ul style="list-style-type: none"> profit before people distribution inequality results in food wastage | |

| Influence | Effect on distribution |
|---------------------------|--|
| Food prices | <ul style="list-style-type: none"> • the price of food is increasing or volatile while food supply remains stable • the price of food is not determined by the ability to produce food at a global level |
| | <ul style="list-style-type: none"> • oil fuels modern food production • as oil increases in price consumers worldwide are paying more for food |
| | <ul style="list-style-type: none"> • increased demand from large countries such as China or India • when demand increases so do prices |
| Demand for meat and dairy | <ul style="list-style-type: none"> • grain products can be produced relatively cheaply compared to livestock • the grain used as feed for livestock would be better used to feed humans |
| | <ul style="list-style-type: none"> • raising of livestock requires large amounts of land • many more people can be fed from a given area of land producing grain rather than livestock |
| | <ul style="list-style-type: none"> • intensive production of meat, eggs and milk is more environmentally demanding than agricultural production • damage to the soil and waterways impacts on the availability of land to produce crops and reduces yield |
| | <ul style="list-style-type: none"> • production of livestock requires significant amounts of water for the animals and fertilisers to produce grain for feed • use of these resources for this purpose is unsustainable as they could be better used to increase agricultural production for human food supply |
| Land ownership | <ul style="list-style-type: none"> • land not owned locally • results in food not being distributed locally |

Question 25 (continued)

- (c) Identify **one** strategy that might be adopted to counter the effect of inequitable food supply. Explain why the strategy would be effective. (5 marks)

| Description | | Marks |
|--|--|----------|
| Identifies a strategy | | 1 |
| Subtotal | | 1 |
| Explains the strategy | | 4 |
| Describes the strategy | | 3 |
| Outlines the strategy | | 2 |
| States a fact about the strategy | | 1 |
| Subtotal | | 4 |
| Total | | 5 |
| Answers may include, but are not limited to the following: | | |
| Strategy | How the strategy is effective | |
| Reduce food waste | <ul style="list-style-type: none"> a high proportion of the world's food is wasted before it is consumed most waste happens when food spoils in grocery stores or in refrigerators or through inefficient preparation or consumer over purchase or as a consequence of inefficient storage or processing facilities food waste not fit for human consumption may be composted while other waste can be recovered to be consumed reducing food waste keeps food out of landfill or reduces household food bills or reduces disposal costs or redirects food to those in need | |
| Grow crops for human consumption | <ul style="list-style-type: none"> arable land is being used for biofuel and feed production or more than a third of crop kilojoules are fed to livestock raising cattle for meat results in the least kilojoule for kilojoule transfer to people crops grown to create biofuels or feed livestock reduce food available to people pasture raise beef or switch to chicken or pork to reduce crops fed to animals | |
| Grow water wise crops | <ul style="list-style-type: none"> rice and sugar cane are among the crops that need the most water invest in research and development of crops which require less water or are drought resistant or plant crops that use less water improve irrigation systems to prevent wastage provide economic incentives for change, based on regional differences | |
| Increase productivity of aquaculture | <ul style="list-style-type: none"> • • • • <p style="text-align: center;">For copyright reasons this text cannot be reproduced in the online version of this document, but may be viewed at the link listed on the acknowledgements page.</p> | |
| Promote a more sustainable diet | <ul style="list-style-type: none"> meat and milk consumption are increasing • <p style="text-align: center;">For copyright reasons this text cannot be reproduced in the online version of this document, but may be viewed at the link listed on the acknowledgements page.</p> <ul style="list-style-type: none"> educate populations in kilojoule efficiency when making food choices or replace animal-based products with vegan alternatives or add plant-based whole foods or limit red meat consumption • <p style="text-align: center;">For copyright reasons this text cannot be reproduced in the online version of this document, but may be viewed at the link listed on the acknowledgements page.</p> | |

Question 26

(20 marks)

- (a) Identify **two** functional properties that may have a negative impact on the performance of food products. (2 marks)

| Description | Marks |
|---|----------|
| Identifies two functional properties that may have a negative impact on the performance of food products. | 2 |
| Identifies one functional property that may have a negative impact on the performance of food products | 1 |
| Total | 2 |
| <ul style="list-style-type: none"> oxidation rancidity | |

- (b) Explain the function in food processing of each of the following natural food components: (6 marks)
- gluten
 - sugar.

| Description | Marks |
|--|---|
| For each natural food component: | |
| Explains the function in food processing | 3 |
| Describes the function in food processing | 2 |
| States a function in food processing | 1 |
| Total | 6 |
| Answers may include, but are not limited to: | |
| Food component | Function on food processing |
| Gluten | <ul style="list-style-type: none"> gluten is the protein found in wheat or barley or rye that gives flour products their structure when moistened and manipulated the proteins that make up gluten stretch, become elastic and trap air when heated the gas rises and the water turns to steam causing the dough to rise |
| Sugar | <ul style="list-style-type: none"> during mixing sugar tenderises baked products by absorbing moisture this limits the uptake of water by the flour which retards gluten development resulting in tenderisation |
| | <ul style="list-style-type: none"> sugars are used in food processing to provide sweetening or flavouring as sugar is heated volatile chemicals are released these chemicals produce a characteristic caramel flavour |
| | <ul style="list-style-type: none"> creaming of butter and sugar causes air to be incorporated tiny air pockets in the mixture expand when heated this helps produce products with good volume and an aerated texture |
| | <ul style="list-style-type: none"> sugar has water attracting properties this increases the softness in baked products it also increases shelf life by preventing baked products from drying out |
| | <ul style="list-style-type: none"> sugar affects the colour of baked products causing browning the Maillard reaction occurs when sugar or starch and a protein are present in the mixture and heat is applied caramelisation occurs when sugars are heated to high temperatures |

Question 26 (continued)

- (c) Identify **three** functional properties of food in the pie recipe. Explain how each determines the performance of the ingredients in the pie. (12 marks)

| Description | | Marks |
|--|---|-----------|
| For each functional property: | | |
| Identifies the functional property | | 1 |
| Subtotal | | 3 |
| Explains how the functional property determines the performance of the ingredients in the pie | | 3 |
| Describes how the functional property determines the performance of the ingredients in the pie | | 2 |
| States how the functional property determines the performance of the ingredients in the pie | | 1 |
| Subtotal | | 9 |
| Total | | 12 |
| Answers may include, but are not limited to the following: | | |
| Functional property | How the performance of the ingredients is determined | |
| Aeration | <ul style="list-style-type: none"> air is incorporated into the dough by sifting or kneading when exposed to heat the air expands and rises this causes the texture of the dough to become crisp | |
| | <ul style="list-style-type: none"> beating egg white causes air to be incorporated into the mixture this produces a foam continued beating will result in the foam holding its shape and becoming a meringue | |
| Gelatinisation | <ul style="list-style-type: none"> when a mixture of a starch and a liquid is exposed to heat and agitated the starch granules burst and absorb the liquid this causes the mixture to thicken or gelatinise | |
| Coagulation | <ul style="list-style-type: none"> coagulation occurs when denatured protein separates from other nutrients and solidifies or clots heat causes protein to coagulate and lemon juice will assist the process by lowering the temperature required or sugar increases the temperature required for coagulation coagulation will cause the filling to thicken | |
| Caramelisation | <ul style="list-style-type: none"> when the sugar in the meringue is exposed to high temperature caramelisation occurs causing the meringue to brown and giving a distinct flavour | |
| Denaturation | <ul style="list-style-type: none"> beating egg white causes denaturation of the protein in the egg as denaturation occurs air is trapped causing large air bubbles continued beating causes the bubbles to become smaller and the foam is stabilised with sugar to become shinier and finer in texture | |
| | <ul style="list-style-type: none"> heat causes protein to denature lemon juice will assist the denaturation process denaturation allows coagulation to take place and the filling to thicken | |
| Dextrinisation | <ul style="list-style-type: none"> when starch is cooked it becomes browner and sweeter dry heat enables the pastry to brown and become firm the dextrinised pastry allows the tart to hold its shape | |

ACKNOWLEDGEMENTS

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