2024/8096
Web version of 2023/74111

Government of **Western Australia**
**School Curriculum and Standards Authority**

# FOOD SCIENCE AND TECHNOLOGY

# ATAR course examination 2023

# 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.

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**Section One: Multiple-choice** **15% (15 Marks)**

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

**Section Two: Short answer** **55% (78 Marks)**

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**Question 16** **(10 marks)**

(a) Describe **two** environmental issues associated with waste disposal that impact the sustainable production of food commodities. (4 marks)

| Description | Marks |
|---|---|
| For each environmental issue (2 x 2 marks) | |
| Describes the environmental issue and its impact on sustainable food commodity production | 2 |
| Identifies an environmental issue and notes its impact on sustainable food commodity production | 1 |
| **Total** | **4** |

Answers could include:

- improper waste disposal practices release methane into the atmosphere, which can cause more frequent and intense weather events. Extreme weather events can cause soil erosion and therefore nutrient loss, causing crop yields to deteriorate
- soil degradation due to landfill use as a waste disposal method. The practice of landfill can cause leaching of harmful chemicals and toxins into the soil, which can effect soil quality, making it less fertile and less able to support plant growth thereby reducing crop yield
- water scarcity due to dumping waste in bodies of water or failing to properly treat waste water. This can make it more difficult to irrigate crops, reducing crop yields and the overall sustainability of food production
- generation of greenhouse gases, such as methane and carbon dioxide from the decomposition of organic waste in landfills. These gasses contribute to climate change, which can have negative impacts on agriculture
- contamination of soil and water by chemicals and pathogens present in waste. This means water has to have further treatment before use which increases costs and further impacts the environment
- improper disposal of hazardous waste, such as pesticides and fertilisers. This can contaminate soil and water resources, leading to reduced crop yields and the production of unhealthy food products.

Accept other relevant answers.

**Question 16** (continued)

(b) Identify **two** ways by which domestic food waste can be reduced. Describe **one** benefit of each of these practices. (6 marks)

| Description | Marks |
|---|---|
| For each way (2 x 1 mark) | |
| Identifies a way domestic food waste can be reduced | 1 |
| **Subtotal** | **2** |
| For each way (2 x 2 marks) | |
| Describes a benefit of the practice | 2 |
| States a benefit of the practice | 1 |
| **Subtotal** | **4** |
| **Total** | **6** |

Answers could include:

- purchase from farmers' markets to reduce packaging use
- reuse packaging wherever possible
- recycle packaging
- plan meals before shopping
- avoid over-purchasing
- avoid over-catering
- use food leftovers in another meal
- compost organic waste
- monitor the efficiency of refrigerators and freezers.

Benefits:

- the production and processing of food requires much energy, the source of this energy is fossil fuels which contribute to climate change. Purchasing raw ingredients and cooking at home rather than purchase of industrial processed foods will reduce carbon emissions
- when unused food rots in landfill it produces methane gases, this further fuels global warming and climate change. Avoiding over purchasing will reduce the amount of food rotting in landfill and therefore reduce the quantity of methane contributing to global warming
- a large amount of food rots in landfill. The land taken up by landfills could be used more productively for the production of food.

Accept other relevant answers.

**Question 17** **(10 marks)**

(a) Explain the difference between Maria's and Marco's conditions. (3 marks)

| Description | Marks |
|---|---|
| Explains the difference between lactose intolerance and coeliac disease | 3 |
| Describes the difference between lactose intolerance and coeliac disease | 2 |
| States a fact about the difference between lactose intolerance and coeliac disease | 1 |
| **Total** | **3** |
| Answers could include:<br><br>The difference between Maria's and Marco's conditions is that lactose intolerance (a metabolic food disease) is the inability to fully digest lactose, the sugar in milk. Coeliac disease is an autoimmune disorder triggered by the consumption of gluten (a protein found in wheat, or barley or rye). People with lactose intolerance, the small intestine does not produce enough of the enzyme lactase to be able to digest dairy products. | |
| Accept other relevant answers. | |

(b) Explain **one** way in which Marco's condition affects his ability to digest nutrients. (3 marks)

| Description | Marks |
|---|---|
| Explains a way coeliac disease impacts the digestion of nutrients | 3 |
| Describes a way coeliac disease impacts the digestion of nutrients | 2 |
| States a fact about a way coeliac disease impacts the digestion of nutrients | 1 |
| **Total** | **3** |
| Answers could include:<br><br>• coeliac disease is a disease of the small intestine where gluten cannot be absorbed. When people with coeliac disease eat gluten, their immune system attacks the lining of the small intestine. This results in damage and inflammation of the gut, causing flattening of the intestinal villi<br>• the small intestine is responsible for absorbing nutrients from the food we eat. Damage to the lining of the small intestine can impair this process, resulting in symptoms, such as diarrhea, abdominal pain and bloating<br>• the damage to the small intestine can lead to malabsorption. This means that the body is unable to absorb nutrients from food as efficiently as it should. This can lead to deficiencies in various nutrients. | |
| Accept other relevant answers. | |

**Question 17** (continued)

(c) Describe **two** appropriate dietary modifications she could make. (4 marks)

| Description | Marks |
|---|---|
| For each of two modifications (2 x 2 marks) | |
| Describes the dietary modification | 2 |
| Identifies a dietary modification | 1 |
| **Total** | **4** |

Answers could include:

- consider using plant-based alternatives, such as almond milk, coconut milk, or soy milk, which can be used as substitutes for cow's milk
- be mindful of hidden sources of lactose. Lactose can be found in a variety of foods and products, including baked goods, processed meats, and some medications
- include protein rich foods, including meat, poultry, fish, beans, nuts, and seeds as protein content will be lower when lactose foods are eliminated
- include calcium-rich foods, such as leafy green vegetables, nuts and seeds, and fortified foods like plant-based milks and cereals, as calcium content will be lower when lactose foods are eliminated
- choose lactose-free dairy products. If able to tolerate, include hard cheeses like cheddar and parmesan, which are naturally lower in lactose.

Accept other relevant answers.

**Question 18** **(9 marks)**

For each of the factors below, describe the influence on the distribution of global food resources and outline an achievable solution.

| Description | Marks |
|---|---|
| For each factor (3 x 2 marks) | |
| Describes the influence on the distribution of global food resources | 2 |
| Makes a statement about the influence on the distribution of food resources | 1 |
| **Subtotal** | **6** |
| For each solution (3 x 1 mark) | |
| Outlines an achievable solution | 1 |
| **Subtotal** | **3** |
| **Total** | **9** |

Answers may include:

| Factor | Influence on the distribution of global food resources | Solution |
|---|---|---|
| Population growth and distribution | Any one of:<br>• as the population increases there is greater demand for food, putting pressure on food production and distribution systems<br>• as populations in urban areas grow, there is a greater demand leading to a concentration of food production and distribution. This can lead to imbalances with some areas having an abundance, while others have limited supply. | • governments have been known to limit the number of children permitted per family to prevent exponential population growth<br>• provide incentives to live and work in regional areas to even out the population distribution. |
| Food prices | Any one of:<br>• high food prices can lead to food insecurity and malnutrition. People may not be able to afford to purchase enough food to meet their needs<br>• low food prices may discourage farmers from producing certain types of food, which can lead to a global reduction in the availability of that food<br>• if food prices are high in one country, it may lead to increased imports of cheaper food from other countries, resulting in less global availability of the cheaper food. | • provide subsidies to improve local food production techniques<br>• address the underlying cause, such as conflict or environmental degradation<br>• promote trade through removal of trade barriers and development of fair-trade policies. |

**Question 18** (continued)

| | | |
|---|---|---|
| Demand for meat and dairy | Any one of:<br>• the production of meat and dairy requires large amounts of land, water, and other resources. This can lead to the conversion of land from crop production to livestock production, resulting in fewer plant-based products available for global distribution and destruction of rainforests for farming<br>• high meat and dairy demands can mean a greater import of these items from other countries. This will reduce the amount available for global distribution<br>• production of meat and dairy can lead to increased competition for resources such as water and feed grains. This can impact the availability of these resources for growing crops for human consumption, resulting in fewer plant-based products for global distribution. | • encourage the consumption of plant-based proteins<br>• promote sustainable agriculture practices, such as regenerative agriculture to reduce the negative impacts of animal agriculture and increase crop production<br>• promote trade in sustainably produced meat and dairy products by removing trade barriers<br>• support local, small-scale farmers. |
| Accept other relevant answers. | | |

**Question 19** **(11 marks)**

(a) Describe **four** of the codes in the A*ustralian Association of National Advertisers (AANA) Code for Advertising and Marketing Communications to Children*, that have implications for the marketing campaign for the superfood juice. (8 marks)

| Description | Marks |
|---|---|
| For each code (4 x 2 marks) | |
| Describes an implication of the code on the marketing campaign | 2 |
| States an implication of the code on the marketing campaign | 1 |
| **Total** | **8** |

Answers could include:

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**Question 19** (continued)


Accept other relevant answers.

(b) Explain an effective promotional marketing mix strategy for the superfood juice. (3 marks)

| Description | Marks |
|---|---|
| Explains an effective promotion strategy | 3 |
| Describes an effective promotion strategy | 2 |
| Makes a statement about a promotion strategy | 1 |
| **Total** | **3** |

Answers could include:

- using advertising/marketing techniques to promote the new product, including bright colours or camera angles or children's characters or well known children's fictional characters sponsoring products or catchy jingles/songs, etc. This captures children's attention and creates pester power to persuade parents to try the new superfood juice
- advertising on platforms, and at times, that will capture largest audience, including during popular children's TV shows or on commonly used social platforms, e.g. YouTube or during children's games or sponsorship for children's sports/activities or flyers in the mailbox or posters/billboards. This will ensure the largest volume of children become familiar with the product and pester parents to purchase the new superfood juice
- target promotion towards parents advertising health benefits of product using persuasive, emotive techniques that promise this product will solve their children's fussy eating, including during adult TV shows or in magazines or digital marketing, e.g. sponsored social media adverts, persuading parents they must buy it for their children to ensure they receive a balanced nutritional diet.
- using sales promotion techniques to introduce the new superfood juice, including introductory offers or vouchers or discount codes or loyalty cards or flash sales or free samples or competitions. This will encourage customers to try and develop loyalty to the new superfood juice.

Accept other relevant answers.

**Question 20** **(12 marks)**

Select **two** natural food components. Identify **two** examples of each component and describe the function of each in food processing.

| Description | Marks |
|---|---|
| For each type of natural food component (4 x 1 mark) | |
| Identifies an example of a natural food component | 1 |
| **Subtotal** | **4** |
| For each type of natural food component (4 x 2 marks) | |
| Describes the function of the natural food component in food processing | 2 |
| Makes a statement about the function of the natural food component in food processing | 1 |
| **Subtotal** | **8** |
| **Total** | **12** |

Answers could include:

Functions of natural food components:

Protein
Albumin:
- albumin is a protein found in egg white and when egg whites are beaten, the protein denatures, traps air and forms a foam
- coagulation occurs when application of heat or acid causes protein to clot or set, changing it from a liquid to a solid due to moisture loss
- used as a binding agent for crumbing or in batter, holds ingredients together.

Gluten:
- gluten is the protein of many cereals, high amounts are found in wheat. When gluten is moistened and kneaded the gluten stretches and becomes elastic trapping air
- provides structure allowing a product to hold its shape. Absorbs moisture which is important for binding.

Carbohydrate
Starch:
- starch can thicken mixtures by absorbing liquid when agitated in the presence of heat, this is known as gelatinisation
- dextrinisation of starch occurs when the starch breaks down into dextrins, causing browning.

Sugar:
- sugar dissolved in liquid may crystallise
- sugar is widely used as a sweetener
- when heated, sugar will caramelise, this causes colour and flavour changes
- activator for yeast during fermentation helps to produce carbon dioxide which causes leavening to occur
- tenderises by absorbing liquid in cakes. Sugar stops the flour from absorbing liquid, retarding gluten formation
- sugar helps products to retain moisture, extending the shelf life of baked products
- sugar raises the temperature of coagulation, this prevents curdling and causes products to set slower, giving them a smoother texture.

Fibre
- found mainly in fruits and vegetables. Plays a role in the digestion of food.

**Question 20** (continued)

| |
|---|
| Lipids<br>Fats:<br>• the plasticity of saturated fats makes them effective at aerating mixtures as in creaming butter and sugar<br>• when cream is whipped a film of protein and fat surrounds the air bubbles, the fat partially solidifies and the protein partially denatures forming a stable solid<br>• alters the sensory properties of foods. Adds moisture, tenderness, and a smooth texture to foods.<br><br>Oils:<br>• when oil is added to a mixture and beaten rapidly emulsification will occur<br>• oils are used to prevent oxidation and therefore extend shelf life<br>• fats and oils are both used as cooking mediums to transfer heat. |
| Accept other relevant answers. |

**Question 21** **(11 marks)**

(a) Identify the government legislation responsible for managing work environments and describe its role in the food industry. (3 marks)

| Description | Marks |
|---|---|
| Describes the role of the legislation in the food industry | 3 |
| States the role of the legislation in the food industry | 2 |
| Identifies the government legislation | 1 |
| **Total** | **3** |

Answers could include:

Government legislation responsible for managing unsafe work environments:
- *Occupational Safety and Health Act 1984.*

Role in food industry:
- legislates for the provision of a safe work environment for employers and employees. Minimises or eliminates or controls workplace risks or hazards by having procedures and policies in place that must be followed
- mandates training requirements to assist employers and employees minimise risk of injury or accidents or hazards in the workplace. Implements penalties for employers found to be in breach of OSH requirements.

**Question 21** (continued)

(b) Describe **two** economic and **two** social consequences for the employer of the fast-food restaurant. (8 marks)

| Description | Marks |
|---|---|
| For each consequence (4 x 2 marks) | |
| Describes a consequence for the employer | 2 |
| States a consequence for the employer | 1 |
| **Total** | **8** |

Answers could include:

Economic:
- repercussions due to non-compliance with OSH requirements. This may include fines and possible imprisonment
- low morale and productivity from employees may cause loss of profit
- fines and compensation costs associated with Tom's injury, due to employer negligence
- potential loss of profit, due to poor reputation and fewer customers purchasing from the fast-food restaurant
- potential closure of the business and loss of income for employer, due to possible significant fines or if imprisonment is imposed
- costs of training replacement employees, this incurs monetary costs as well as time and effort
- current employees may quit due to unsafe work environment and lack of sufficient training, business may be unable to operate effectively due to staff shortages
- may be difficult to find replacement employees or be short-staffed due to poor public image, causing business to struggle to function at usual capacity.

Social:
- other employees may feel unsafe in the work environment, this could create low work morale and limited productivity
- if the incident becomes public, there may be a loss of reputation or poor corporate image due to non-compliance with OSH requirements. It may be difficult to find potential employees or be short-staffed due to poor public image
- current employees may quit due to unsafe work environment and lack of sufficient training
- employer may suffer from mental health issues due to guilt and feeling responsible for the incident and fear of potential repercussions.

Accept other relevant answers.

**Question 22** **(8 marks)**

(a) Explain the process of micro-encapsulation. (3 marks)

| Description | Marks |
|---|---|
| Explains the process of micro-encapsulation | 3 |
| Describes the process of micro-encapsulation | 2 |
| Makes a statement about micro-encapsulation | 1 |
| **Total** | **3** |
| Answers could include:<br><br>The process of micro-encapsulation involves an active ingredient, surrounded by a thin biodegradable shield to form a minute capsule. Once consumed the capsule releases its contents. | |
| Accept other relevant answers. | |

(b) Describe **two** advantages of micro-encapsulation. (4 marks)

| Description | Marks |
|---|---|
| For each advantage of micro-encapsulation (2 x 2 marks) | |
| Describes an advantage | 2 |
| States an advantage | 1 |
| **Total** | **4** |
| Answers could include:<br><br>• will mask the flavour of fatty acids, such as Omega-3 for people who do not eat fish, it is a method of including Omega-3 in the diet<br>• reduces volatility of food substances by providing greater stability from adverse conditions, such as oxygen, light, pH levels<br>• protects probiotic bacteria from degradation in the digestive system and stays viable through to the colon to benefit health as intended<br>• disease prevention and health promotion benefits by encapsulating additional or essential nutrients in commonly consumed foods. | |
| Accept other relevant answers. | |

(c) Identify **one** application of micro-encapsulation in the food industry. (1 mark)

| Description | Marks |
|---|---|
| Identifies an application of micro-encapsulation in the food industry | 1 |
| **Total** | **1** |
| Answers could include:<br><br>• adding Omega-3 to bread, orange juice or yoghurt used in the production of probiotics<br>• milk or fruit juice fortified with iron<br>• confectionery in which colours or flavours are encapsulated<br>• chewing gum with encapsulated flavour molecules to ensure a long-lasting taste<br>• antioxidants added to meat processing to increase shelf life<br>• enzymes used in dough conditioners for increased stability. | |
| Accept other relevant answers. | |

**Question 23 (7 marks)**

(a) Explain the purpose of Nutrient Reference Values (NRV) in relation to dietary intake.
(3 marks)

| Description | Marks |
|---|---|
| Explains the purpose of NRVs | 3 |
| Describes the purpose of NRVs | 2 |
| Makes a statement about NRVs | 1 |
| **Total** | **3** |

Answers could include:

The purpose of NRVs is to indicate the daily amount of nutrients (energy, macro-nutrients, vitamins, minerals) required for good health. Including:

- provides an upper safe level of nutrient intake
- guides the voluntary addition of vitamin and minerals to food by setting safe minimum and maximum amounts of nutrients
- nutritional labelling included on food products assists consumers in making informed choices, e.g. the percentage of Recommended Dietary Intake (RDI) of a nutrient contained in a serving of a particular food
- provides guidance on average requirements for each nutrient consumed, based on scientific evidence, represented in the form of Estimated Average Requirement (EAR), RDI, Adequate Intake (AI), Estimated Energy Requirement (EER) and Upper Level (UL)
- includes additional information for some nutrients that may reduce risk of disease, prevention of deficiencies.

Accept other relevant answers.

(b) Outline **two** advantages and **two** disadvantages of consuming dietary supplements.
(4 marks)

| Description | Marks |
|---|---|
| For each advantage: (2 x 1 mark) | |
| Outlines an advantage of dietary supplements | 1 |
| **Subtotal** | **2** |
| For each disadvantage: (2 x 1 mark) | |
| Outlines a disadvantage of dietary supplements | 1 |
| **Subtotal** | **2** |
| **Total** | **4** |

Answers could include:

Advantages:
- can ensure missing nutrients are obtained which may be lacking in specialty diets, such as vegan or vegetarian
- supplements nutrients in the diet which may be lacking due to allergies or intolerances or malabsorption issues, such as coeliac disease or pancreatitis
- allows sufficient folic acid to be consumed in pregnancy, which is essential to help prevent birth defects, such as spina bifida
- provides essential nutrients for post-partum breastfeeding mothers who may struggle to obtain sufficient nutrients from diet alone
- prevents a variety of diseases and health conditions by ensuring appropriate quantities of nutrients are obtained that may be difficult to consume from diet alone
- allows demographic groups to obtain adequate quantities of nutrients who may be at risk of diseases, such as osteoporosis
- some geographic locations lack access to sufficient healthy food and people residing in these locations may benefit from some supplementation.

Disadvantages:
- supplements cannot replace a balanced diet as they are not wholefoods and do not contain macronutrients
- they may negatively interact with prescription medication by interfering with absorption, making it more difficult to manage medical conditions
- some nutrients can be toxic in large quantities and consuming too much of some vitamins may adversely affect health and wellbeing
- adequate nutrients can be consumed from a balanced diet, supplements are expensive, and it is cheaper to source nutrients from foods
- vitamins in supplements are synthesised, but they do not seem to work as well in the body as naturally occurring vitamins in wholefoods
- food provides a complex source of nutrients which work together to produce positive health benefits, whereas supplements work in isolation requiring various types to produce similar benefits
- supplements cannot provide the benefits of phytochemicals available in foods, which reduce the incidence of heart disease and some cancers
- unlike food, supplements cannot provide satiety due to lack of fibre and no sensory appeal
- supplements are not subject to the rigorous controls of prescription medicines; therefore, consumers could consume toxic quantities of some nutrients or aggravate health complications.

Accept other relevant answers.

**Section Three: Extended answer** **30% (40 Marks)**

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**Question 24** **(20 marks)**

(a) Identify **one** plant-based commodity and describe why it is a suitable meat alternative. (3 marks)

| Description | Marks |
|---|---|
| Describes why the plant-based commodity is a suitable meat alternative | 3 |
| States why the plant-based commodity is a suitable meat alternative | 2 |
| Identifies a protein rich plant-based commodity | 1 |
| **Total** | **3** |

Answers could include:

Suitable plant-based commodities:
- seitan made from the protein portion of wheat has a chewy, meat-like texture
- legumes and pulses (any correctly identified beans, peas and lentils that are high in protein)
- nuts (almonds, walnuts, cashews, pistachios and any other high protein nut)
- grains (quinoa, couscous, oats and any other high protein grain)
- fruit and vegetables (artichokes, avocado, mushrooms and any other high protein fruit or vegetable)
- tofu made from dried soybeans that are soaked in water crushed and boiled
- tempeh made from fermented soya beans.

Description:
- commodity is versatile and can be used in a variety of dishes
- commodity has a high protein content
- similar texture, colour and flavour to meat, appeals to vegan diets/choices
- commodity is low in calories and saturated fat compared to many types of meat, making it a healthier choice for those looking to reduce their intake of saturated fat
- commodity is a plant-based food so it does not require the use of animals for production, this makes it more environmentally friendly with less methane production
- commodity is widely available and relatively inexpensive, this makes it accessible and affordable for those looking to incorporate more plant-based foods into their diet
- tofu and tempeh contain all the essential amino acids making it a suitable replacement for meat.

Accept other relevant answers.

(b) Explain **one** qualitative method of analysis used to evaluate a new plant-based food product, including **two** ways of controlling conditions to ensure that the test is fair and valid. (5 marks)

| Description | Marks |
|---|---|
| Explains a qualitative method of analysis used to evaluate a new plant-based food product | 3 |
| Describes a qualitative method of analysis used to evaluate a new plant-based food product | 2 |
| States a fact about a qualitative method of analysis used to evaluate a new plant-based food product | 1 |
| **Subtotal** | **3** |
| For each way of controlling conditions (2 x 1 mark) | |
| Identifies a way of controlling conditions to ensure that the test is fair and valid | 1 |
| **Subtotal** | **2** |
| **Total** | **5** |

Answers could include:

Descriptive sensory evaluation:
- appearance testing – evaluating the product, including the colour, shape, size and any other visual features
- aroma testing – evaluating the smell of a product, including its intensity and any other olfactory characteristics
- flavour testing – evaluating the taste of a product, including the sweetness, sourness, bitterness and saltiness and any other taste characteristics
- texture testing – evaluating the physical properties of a product, such as the firmness, chewiness, and any other tactile characteristics
- sound testing – evaluating the sound produced by a product when it is handled or consumed, such as the crunch of a potato chip or the pop of a bottle cap
- may evaluate against a similar product to find points of difference or similarities to suggest product enhancement in further development.

Analytical sensory testing:
- difference testing – testing designed to identify the difference between one or more samples
- preferences are provided usually on a hedonic scale that can be measured
- results can be charted using spider graphs and bar graphs
- this enables further analysis to assess the products suitability based on the proposal
- paired comparison – identifying whether two samples are similar or different) or the most different
- triangle test – a three product test to determine which are most similar or which one is the most different.

Methods of ensuring a fair and valid test:
- identification of samples with random codes to prevent prejudice from pre-conceived ideas
- cleansing the palate after each tasting to ensure no carry over of flavours
- ensure people who are unwell with colds and flu are not used as testers so that tasters are able to taste properly
- use individual tasting booths so that other testers cannot influence answers
- complete a sensory record after each sample is tested so the results remain fresh in the tester's mind.

Accept other relevant answers.

**Question 24** (continued)

(c) Explain how each stage of the technology process could be used to create a new plant-based food product that responds to consumer needs. (12 marks)

| Description | Marks |
|---|---|
| For each stage: (4 x 3 marks) | |
| Explains how the stage could be used | 3 |
| Describes how the stage could be used | 2 |
| States a general principle of the stage | 1 |
| **Total** | **12** |

Answers could include:

Investigate:
- the first stage is to investigate consumer needs and preferences. This could involve market research, focus groups, or other methods of gathering consumer feedback
- research different types of plant-based proteins, looking at their cost, versatility, protein content and environmental impact
- research the current market offerings to assess potential competition
- the goal is to identify gaps in the market and understand what consumers are looking for in a plant-based food product
- identify the target market and survey consumers within the target market to determine preferences
- consult with health care professionals for advice on nutrition inclusion
- read labels and ingredient lists when shopping for plant-based meat alternatives
- explore online recipe ideas.

Devise:
- once consumer needs have been identified, the next stage is to devise a concept for a new plant-based food product
- this could involve brainstorming ideas for new ingredients, cooking methods, flavours, or packaging
- the goal is to create a unique and innovative product that meets consumer needs and preferences
- experiment with different plant-based alternatives
- narrow down commodity and recipe options by eliminating products that do not suit the product proposal
- devise a shortlist of ideas and justify why they meet the product proposal
- devise a prototype recipe that will be used
- be precise in measurements and devise the method using clear concise steps
- devise a list of assessment criteria to test whether the product has met the proposal and determine the evaluation procedure to be used.

Produce:
- after a concept has been developed, the next stage is to produce the prototype of the new plant-based food product
- this could involve sourcing ingredients and testing the product in a small batch
- the goal is to produce a high-quality product that meets the needs of consumers and can be produced on a larger scale
- at this stage the product would be manufactured using the final formulation
- make one product in accordance with the chosen recipe
- accurately measure all ingredients and be precise on cooking times and temperatures
- keep detailed notes on any changes made during production so that the results are repeatable.

| |
|---|
| Evaluate:<br>• once a prototype has been produced, the next stage is to evaluate the product<br>• this could involve taste testing, sensory testing, or other forms of consumer feedback<br>• the goal is to gather feedback from consumers and make any necessary improvements to the product before it is launched<br>• test the product against the devised assessment criteria and critically analyse the data gathered<br>• if aspects of the product do not meet the proposal, make recommendations for change<br>• justify the recommendations against the initial design brief and consumer preferences and repeat the technology process. |
| Accept other relevant answers. |

**Question 25** **(20 marks)**

(a) Describe how the consumption of **one** functional food could assist Ben's cardiovascular system by having a positive effect on his health. (2 marks)

| Description | Marks |
|---|---|
| Describes a functional food that assists the cardiovascular system | 2 |
| Outlines a functional food that assists the cardiovascular system | 1 |
| **Total** | **2** |

Answers could include:

- wholegrains (e.g. wholemeal bread or pasta or oats or brown rice or quinoa) are high in dietary fibre. These keep arteries healthy or maintain steady blood pressure or reduces vascular low-density lipoprotein (LDL) cholesterol deposits, all preventing cardiovascular disease (CVD)
- fish or other seafood or nuts and seeds (e.g. flax or chia or walnuts) or plant oils (e.g. canola or soybean or flaxseed oils) or fortified omega 3 foods (e.g. certain eggs or yoghurt or juice or milk or soy beverages) are high in omega-3 fatty acids. These improve heart health or reduce triglycerides or reduce blood pressure or increases high-density lipoprotein (HDL) (good) cholesterol and lowers risk of CVD
- antioxidants (e.g. blueberries or sweet potato or spinach or capsicum or tofu or nuts and seeds) release free radicals from the body. Oxidation produces free radicals that damage cell membranes, which are linked to CVD. Antioxidants neutralise free radicals, therefore reducing risk of CVD
- reduced sodium or reduced fat modified foods (e.g. salt reduced margarine or reduced fat milk or no added salt processed foods) are lower in sodium and fat. High sodium and fat foods are linked with heart disease. Lower sodium and fat foods can improve heart health and reduce risk of CVD.

Accept other relevant answers.

(b) Describe **three** ways in which the AGHE can assist Ben to reduce his risk of developing osteoporosis as he ages. (6 marks)

| Description | Marks |
|---|---|
| For each way (3 x 2 marks) | |
| Describes a way the AGHE can reduce risk of osteoporosis | 2 |
| States a way the AGHE can reduce risk of osteoporosis | 1 |
| **Total** | **6** |

Answers could include:

- consumption of foods from the milk, yoghurt, cheese and/or alternatives, mostly the reduced fat food group is high in calcium, which is needed for increased bone density. Maximum bone strength and density are reached in adulthood. The body removes calcium deposits in the bones, if there is not enough calcium consumed. Eating high calcium foods will strengthen bones and prevent bone resorption, reducing risk of osteoporosis
- consumption of food from the vegetables and legumes/beans food group, especially green leafy vegetables, are high in calcium and vitamin K. Poor vitamin K intake is linked with low bone mass. Eating foods high in vitamin K and calcium will improve bone density, reduce fracture risk and osteoporosis
- consumption of foods from the lean meats and poultry, fish, eggs, tofu, nuts and seeds and legumes/beans food group, particularly salmon, tuna and sardines, are high in vitamin D. Vitamin D is required to absorb calcium and deposit it into the skeleton, strengthening bones and preventing osteoporosis
- consumption of foods from the lean meats and poultry, fish, eggs, tofu, nuts and seeds and legumes/beans food group are high in protein. Protein is essential for optimal bone mass during growth and preserves bone and muscle mass with aging. Low protein intake lowers insulin-like growth factor 1 (IGF-1), which enhances bone formation, reducing osteoporosis risk
- consumption of foods from the grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties food group that are fortified with calcium and vitamin D. Fortified cereal foods allow for easier consumption of calcium and vitamin D, which are typical foods in a western diet. Consuming high calcium and vitamin D foods will increase calcium absorption, strengthen bones and prevent osteoporosis
- consumption of foods from the fruit food group, particularly figs, citrus fruits, dried fruits and fortified fruit juice have varying amounts of calcium and vitamin C. Figs with their high calcium content, dried fruit/citrus fruits with its high vitamin C and fruit juice fortified with calcium and vitamin D have all been proven to prevent bone loss and improve bone density, preventing osteoporosis.

Accept other relevant answers.

**Question 25** (continued)

(c) Identify **one** macronutrient and its food source from Ben's morning tea and lunch. Describe **two** phases of mechanical digestion and **three** phases of chemical digestion of this macronutrient, as it moves through the digestive tract. (12 marks)

| Description | Marks |
|---|---|
| Identifies a macronutrient | 1 |
| Identifies food source | 1 |
| **Subtotal** | **2** |
| For each phase of mechanical digestion: (2 x 2 marks) | |
| Describes a phase of mechanical digestion for identified macronutrient | 2 |
| States a phase of mechanical digestion for identified macronutrient | 1 |
| **Subtotal** | **4** |
| For each phase of chemical digestion: (3 x 2 marks) | |
| Describes a phase of chemical digestion for identified macronutrient | 2 |
| States a phase of chemical digestion for identified macronutrient | 1 |
| **Subtotal** | **6** |
| **Total** | **12** |

Answers could include:

Carbohydrates from English muffin, chocolate biscuits, wrap or rice crackers:

Mechanical:
- mouth – chewing food into smaller pieces creating bolus
- oesophagus – peristalsis occurs throughout the digestive tract, the oesophagus makes wave like muscle contractions, pushing the bolus into the stomach
- stomach – churning of food or bolus to form a thick liquid known as chyme which moves through the digestive tract
- small intestine – peristalsis continues in the small intestine, contractions push the chyme through the digestive tract.

Chemical:
- mouth – enzymes in saliva (amylase or ptyalin) begin to break down starch into maltose
- stomach – addition of gastric juices, containing hydrochloric acid and enzymes, churn food to break it down into a thick liquid known as chyme
- small intestine – pancreatic amylase or intestinal cells break down carbohydrates into glucose (simplest form of carbohydrates) which are absorbed through the villi in the small intestine into the blood stream.

Protein from ham, cheese, chicken or chocolate milk:

Mechanical:
- mouth – chewing food into smaller pieces creating bolus
- oesophagus – peristalsis occurs throughout the digestive tract, the oesophagus makes wave like muscle contractions, pushing the bolus into the stomach
- stomach – churning of food or bolus to form a thick liquid known as chyme which moves through the digestive tract
- small intestine – peristalsis continues in the small intestine contractions push the chyme through the digestive tract.

| |
|---|
| Chemical:<br>• stomach – addition of gastric juices, containing hydrochloric acid and enzymes, churn food to break it down into a thick liquid known as chyme<br>• stomach – enzyme pepsin breaks down protein into peptides<br>• small intestine – enzyme trypsin or protease or proteolytic enzyme or peptidase or proteinase breaks down protein into single amino acids (simplest form of protein) which are absorbed through the villi in the small intestine into the blood stream.<br><br>Lipids from cheese, chocolate biscuits, avocado or chocolate milk:<br><br>Mechanical:<br>• mouth – chewing food into smaller pieces creating bolus<br>• oesophagus – peristalsis occurs throughout the digestive tract, the oesophagus makes wave like muscle contractions, pushing the bolus into the stomach<br>• stomach – churning of food or bolus to form a thick liquid known as chyme which moves through the digestive tract<br>• small intestine – peristalsis continues in the small intestine, contractions push the chyme through the digestive tract.<br><br>Chemical:<br>• stomach – addition of gastric juices, containing hydrochloric acid and enzymes, churn food to break it down into a thick liquid known as chyme<br>• small intestine – bile emulsifies fat into small globules<br>• small intestine – enzyme lipase breaks globules down into fatty acids and glycerol (simplest form of lipids) which are absorbed through the villi in the small intestine into the blood stream. |
| Accept other relevant answers. |

**Question 26 (20 marks)**

(a) Describe the food safety legislative requirements of the *Food Act 2008* (WA) for a high-risk food business. (2 marks)

| Description | Marks |
|---|---|
| Describes the legislative requirements | 2 |
| Makes a statement about the legislative requirements | 1 |
| **Total** | **2** |
| Answers could include:<br><br>It is a legislative requirement that all high-risk food businesses develop and implement a food safety program that includes all stages of the production process. The food safety program must be kept on the premises in written form. | |
| Accept other relevant answers. | |

(b) Name the food safety system used in the food industry. Explain the purpose of the system and describe **two** reasons why it is of benefit to food producers. (8 marks)

| Description | Marks |
|---|---|
| System | |
| Names the food safety system used in the food industry | 1 |
| **Subtotal** | **1** |
| Explanation | |
| Explains the purpose of the system | 3 |
| Describes the purpose of the system | 2 |
| Makes a statement about the system | 1 |
| **Subtotal** | **3** |
| For each reason (2 x 2 marks) | |
| Describes the reason | 2 |
| Identifies the reason | 1 |
| **Subtotal** | **4** |
| **Total** | **8** |
| Answers could include:<br><br>Food safety system:<br>• HACCP or Hazard Analysis Critical Control Point.<br><br>Purpose of the system:<br>• to ensure that food sold to consumers is safe for consumption<br>• to identify potential hazards associated with food production and preparation<br>• to develop mechanisms to eliminate or control these hazards.<br><br>Reasons why it is of benefit to food producers:<br>• there is more profit because there is less waste. Because there is less waste, less work must be re-done<br>• the product has an advantage over the competition because hazardous practices have been removed or reduced<br>• it is a preventative approach to food safety rather than a response to hazards when they occur<br>• consumers feel confident to purchase the product because food safety at all stages of the production system has been assessed and controlled<br>• profits are increased. | |
| Accept other relevant answers. | |

(c) Define the term 'critical control points'. Describe **three** critical control points in the production and service of the buffet barbecue. State **one** corrective action that could reduce the risk to food safety at each control point. (10 marks)

| Description | Marks |
|---|---|
| Definition | |
| Defines the term critical control points | 1 |
| **Subtotal** | **1** |
| For each critical control point (3 x 2 marks) | |
| Describes the critical control point | 2 |
| Identifies a critical control point | 1 |
| **Subtotal** | **6** |
| For each corrective action (3 x 1 mark) | |
| States a correct action relevant to the scenario | 1 |
| **Subtotal** | **3** |
| **Total** | **10** |

Answers could include:

Definition:
- Critical control points are located at any step where hazards can be either prevented or eliminated or reduced to acceptable levels in the production, storage and processing of food.

Food purchasing:
- growth of microorganisms due to inadequate temperature control practices
- growth of microorganisms as salad ingredients may be unwashed
- growth of microorganisms due to use of out-of-date products
- labelling of foods not checked on delivery.

Action:
- suppliers must maintain acceptable temperature control standards to avoid food spoilage. Store fresh food at 0 to 4° C or frozen foods below −18° C
- ensure all salads are washed prior to preparation
- check use-by and best before dates on delivery
- use a first in first out stock rotation system.

Food storage:
- growth of microorganisms due to refrigerator not working properly
- growth of micro organisms and/or infestation, due to incorrect storage of dry ingredients.

Action:
- store fresh food at 0 to 4° C or frozen foods below –18° C. Use a calibrated thermometer to check refrigerator and/or freezer every two hours
- dry ingredients stored in sealed containers, elevated from the floor and away from walls.

**Question 26** (continued)

Food production:
- microbial growth due to ineffective procedures used for cooking, reheating and thawing
- cross contamination in salads, due to raw and cooked foods and meats being prepared using the same utensils
- growth of microorganisms due to salad ingredients not being washed properly
- allergen and anaphylaxis risk due to inadequate procedures in place for foods containing allergens.

Action:
- have separate areas for the preparation of raw and cooked foods that are subject to cross contamination
- initiate hand washing procedures
- all cooked food to reach a core temperature of 75° C
- frozen food to be thawed at a maximum of 5° C
- salad ingredients should be thoroughly washed
- clearly label allergen preparation and service areas.

Food transport:
- microbial growth due to possible temperature variations during delivery
- microbial growth due to inappropriate storage for perishable and non-perishable items.

Action:
- food must be transported in temperature-controlled conditions
- refrigerate food following delivery
- check all containers for damage on delivery, quarantine or dispose of any contaminated product
- quarantine and dispose of any contaminated product.

Service and display of food:
- microbial growth due to cross contamination of hot and cold products during service
- food displayed outdoors may be exposed to heat causing increased microbial growth.

Action:
- cross contamination is avoided by the separation of service areas
- serve hot foods at 65° C, check hourly
- serve cold foods at a maximum 5° C, check hourly.

Accept other relevant answers.

## ACKNOWLEDGEMENTS

**Question 19(a)** Adapted from: Australian Association of National Advertisers. (2023). *Codes & Self-Regulation: Children's Advertising Code.* Retrieved August, 2023, from https://aana.com.au/self-regulation/codes-guidelines/aana-code-for-advertising-marketing-communications-to-children/

**Question 23(a)** Dot points 1–3 adapted from: Food Standards Australia New Zealand. (2018). *Regulatory Nutrient Reference Values*. Retrieved August, 2023, from https://www.foodstandards.gov.au/consumer/nutrition/Pages/nutrient-reference-values.aspx
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**Question 26(c)** Dot point 1 adapted from: Australian Institute of Food Safety. (2019). *What is a Critical Control Point?* Retrieved August, 2023, from https://blog.foodsafety.com.au/what-critical-control-point

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*Published by the School Curriculum and Standards Authority of Western Australia*
*303 Sevenoaks Street*
*CANNINGTON WA 6107*