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

FOOD SCIENCE AND TECHNOLOGY

ATAR course examination 2024

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	d
2	a
3	a
4	c
5	c
6	a
7	a
8	b
9	d
10	c
11	b
12	a
13	d
14	c
15	b

Section Two: Short answer **55% (85 Marks)**

Question 16 **(13 marks)**

(a) Explain how consumers are informed of the presence of allergens in food products. (3 marks)

Description	Marks
Explains how consumers are informed of the presence of allergens in food products	3
Describes how consumers are informed of the presence of allergens in food products	2
States how consumers are informed of the presence of allergens in food products	1
Total	**3**
Answers could include: • food companies are required to list all the ingredients in a food product • food companies are required to list all the ingredients used in processing a food product • there is mandatory labelling of the most common allergens.	
Accept other relevant answers.	

(b) (i) Define the term 'food allergy'. (2 marks)

Description	Marks
Defines the term food allergy	2
Outlines the term food allergy	1
Total	**2**
Answers could include: Definition: • a food allergy is an immune system response to a protein in a food consumed that the body mistakenly believes is dangerous. The body releases antibodies which cause an allergic reaction or anaphylaxis • even a trace amount of an allergen can cause an allergic reaction.	
Accept other relevant answers.	

Question 16 (continued)

(ii) Describe **two** potential consequences for Aisha if she consumes any foods containing eggs. (4 marks)

Description	Marks
For each potential consequence (2 x 2 marks)	
Describes a potential consequence	2
States a potential consequence	1
Total	**4**

Answers could include:

Potential consequences:
- symptoms of an allergic reaction include mouth tingling or difficulty breathing or swelling of the facial area or nausea or abdominal pain or diarrhoea or hives
- immediate emergency first aid would be required as allergic reactions can be fatal if medical treatment is not sought. First aid includes administering an epinephrine auto-injector or Epipen.

Accept other relevant answers.

(c) State **one** modification that could be made to the chocolate cake recipe to enable Aisha to safely consume the cake. Explain why this modification would be suitable. (4 marks)

Description	Marks
States a modification	1
Subtotal	**1**
Explains why the modification would be suitable	3
Describes why the modification would be suitable	2
States why the modification would be suitable	1
Subtotal	**3**
Total	**4**

Answers could include:

Modification:
- replace the egg with ground flaxseed mixed with water or commercial egg replacement powder or chia seeds mixed with water or mashed banana.

Explanation:
- as eggs provide binding properties in a cake, the ingredient will help to bind dry ingredients together, increase the viscosity of the batter and give stability to the mixture. This will result in minimal texture and appearance changes for the finished chocolate cake.

Modification:
- replace the egg with applesauce or yoghurt or buttermilk.

Explanation:
- as eggs contribute moisture to the cake mixture, the ingredient could replace moisture lost with the removal of the egg. This will result in minimal texture and appearance changes for the finished chocolate cake
- the ingredient does not add a strong flavour which may overpower the other ingredients in the cake. This will result in minimal flavour changes in the finished chocolate cake.

Accept other relevant answers.

Question 17 **(9 marks)**

Describe **one** effect of the consumption of functional foods for each of the following and state **one** example of a functional food that assists in achieving or maintaining optimal health.

Description	Marks
For each effect (3 x 2 marks)	
Describes the effect of the consumption of functional foods on health	2
Identifies the effect of the consumption of functional foods on health	1
Subtotal	**6**
For each example (3 x 1 mark)	
Provides an example of a functional food that assists in achieving or maintaining optimal health	1
Subtotal	**3**
Total	**9**

Answers could include:

Neural development:
- functional foods can support neural development through the fortification of foods with folic acid or folate. Adequate consumption of folic acid or folate in the early stages of pregnancy can prevent most neural tube defects, such as spina bifida.

Example:
- all plain, fancy and sweet breads made with yeast or flour mixes or flour for domestic bread making must contain folic acid
- breakfast cereals or fruit juices fortified with folic acid.

Skeletal structure:
- functional foods can support skeletal structure and help to prevent osteoporosis through the fortification of food with calcium or Vitamin D. Calcium or Vitamin D is essential for building and maintaining strong bones.

Example:
- milk fortified with calcium or Vitamin D or orange juice fortified with calcium or margarine fortified with Vitamin D.

Cardiovascular system:
- functional foods can support cardiovascular health through the fortification of foods with plant sterols or fibre or omega-3 to reduce cholesterol or increase HDL cholesterol
- cardiovascular system health can also be supported through foods that have been modified, including foods with reduced saturated fat to maintain healthy cholesterol levels or reduced salt content to maintain healthy blood pressure levels.

Example:
- margarine fortified with plant sterols or omega-3
- white bread with added fibre
- bread or milk fortified with omega-3
- reduced fat dairy products such as yoghurt or cheese or milk
- reduced salt condiments or processed meats or potato chips or breakfast spreads.

Accept other relevant answers.

Question 18 **(11 marks)**

(a) Explain how economic factors can influence food consumption patterns in Australia.
(3 marks)

Description	Marks
Explains how economic factors can influence food consumption patterns in Australia	3
Describes how economic factors can influence food consumption patterns in Australia	2
States how economic factors can influence food consumption patterns in Australia	1
Total	**3**

Answers could include:

- fluctuations in interest rates may determine the household budget that includes the types and amounts of food products purchased
- price control by multinationals greatly affects the cost of living and the food consumers can purchase
- costs of housing (rent, interest rates) consume large percentages of the household budget reducing the amount available for food purchases.

Accept other relevant answers.

(b) Discuss **two** ways, other than an increased preference for sustainably packaged foods, in which environmental factors can influence food consumption patterns in Australia.

(8 marks)

Description	Marks
For each way in which environmental factors can influence food consumption patterns (2 x 4 marks)	
Discusses a way in which environmental factors can influence food consumption patterns	4
Explains a way in which environmental factors can influence food consumption patterns	3
Describes a way in which environmental factors can influence food consumption patterns	2
Outlines a way in which environmental factors can influence food consumption patterns	1
Total	**8**

Answers could include:

- in response to concerns regarding climate change, consumers may choose to consume food commodities which have minimal impact on greenhouse gas emissions. As the transport of food commodities contributes to air pollution, many consumers aim to reduce their carbon footprint by choosing foods with low food miles or foods that are grown and sold in season. There is growing support for buying locally grown or seasonal foods, with large supermarket chains responding to the increased demand. Consumers may also choose to shop at local food markets
- consumers may choose to consume organic food products, avoiding the use of chemicals in food production such as pesticides or insecticides which may have negative effects on soil health or contaminate air or waterways, causing significant impacts throughout the ecosystem
- consumers may reduce their consumption of animal products such as meat or dairy or seafood as consumers become more conscious of the effect of food production on the environment, such as increased greenhouse gas emissions produced from cattle. Many consumers choose to consume sustainably sourced seafood to minimise their impact on marine life or avoid overfishing
- to reduce food waste entering landfill, consumers may only purchase as much food as they need. They may be more selective of how often they dine out at restaurants or consuming takeaway food as a result of the large amounts of food waste produced by food businesses
- consumers may choose to consume minimally processed foods, as food manufacturers are major consumers of non-renewable resources. Generally, the more processing a food commodity undergoes, the greater resources are required such as electricity or fuel or water required for production or packaging or distribution or temperature-controlled storage.

Accept other relevant answers.

Question 19 **(13 marks)**

(a) Define the term 'innovation' and describe its purpose in relation to food product development. (4 marks)

Description	Marks
Defines the term innovation	2
Makes a general statement about the term innovation	1
Subtotal	**2**
Describes the purpose of innovation in food product development	2
Outlines the purpose of innovation in food product development	1
Subtotal	**2**
Total	**4**
Answers could include: Definition: Innovation refers to the implementation of ideas that results in the creation and introduction of new or different or improved food products and technologies that affect the development or production or distribution or marketing or storage of food. Purpose: The purpose of innovation in food product development is to increase availability or range of food for consumers or increase profits for food manufacturers or responds to consumer interests or addresses gaps in the current market.	
Accept other relevant answers.	

(b) Identify **three** innovative developments, other than value-adding, that increase the availability of food. (3 marks)

Description	Marks
Any three of (3 x 1 mark)	
• functional food • genetically modified food • food safety procedures • packaging	1–3
Total	**3**
Accept other relevant answers.	

(c) Explain **two** ways in which value could be added to an existing food product to enhance its appeal to busy families who are health conscious. (6 marks)

Description	Marks
For each way (2 x 3 marks)	
Explains how value has been added to the food product to enhance its appeal to busy families who are health conscious	3
Describes how value has been added to the food product to enhance its appeal to busy families who are health conscious	2
Outlines how value has been added to the food product to enhance its appeal to busy families who are health conscious	1
Total	**6**

Answers could include:

Additional processing:
- processing commodities to create a new food product adds value by increasing shelf life or for convenience or increasing variety of food for consumers or increasing profits for food manufacturers.

Packaging:
- packaging commodities adds value by increasing shelf life or minimising wastage or allowing for easy and convenient storage/reseal ability or drawing customers in due to appealing packaging or attracting children to pester parents for products by using desirable characters on packaging.

Changes to nutritional value:
- modifying commodities to alter nutritional value adds value by appealing to consumers who are health conscious or have special dietary requirements such as low fat or low sugar or low sodium or lactose/gluten free or high protein or low carbohydrate.

Presentation and service:
- presenting commodities in a desirable way or including service of the commodity adds value due to convenience, as consumers do not need to prepare and serve the food themselves, which saves them significant time. This can be at a restaurant or café or in home dining service or home delivery services. The presentation of the food increases visual appeal of commodity to increase desirability, such as with garnishes or sophisticated plating techniques.

Accept other relevant answers.

Question 20 (9 marks)

(a) Explain the *Australia New Zealand Food Standards Code* requirements for recalling the contaminated strawberries. (3 marks)

Description	Marks
Explains the *Australia New Zealand Food Standards Code* requirements for recalling the contaminated strawberries	3
Describes the *Australia New Zealand Food Standards Code* requirements for recalling the contaminated strawberries	2
Outlines the *Australia New Zealand Food Standards Code* requirements for recalling the contaminated strawberries	1
Total	**3**

Answers could include:

The food businesses that sold the contaminated strawberries are responsible for removing the unsafe strawberries from distribution, sale and consumption. They must act quickly to protect public safety by notifying their local council or the health department that the recall is needed. They must develop a plan, notify trade customers and the general public, notify Food Standards Australia New Zealand (FSANZ) and keep appropriate records.

FSANZ coordinates the recall of the contaminated strawberries; however, they do not have enforcement power to order, force or mandate the food recall. FSANZ will liaise with the food businesses and health department to collate all necessary information. They develop the Food Recall Notice at the request of the food businesses and publish the recall on the FSANZ website and on social media platforms.

Accept other relevant answers.

(b) Describe **three** reasons, other than contamination with foreign matter, why food may be recalled in Australia. (6 marks)

Description	Marks
For each reason (3 x 2 marks)	
Describes a reason food may be recalled in Australia	2
Outlines a reason food may be recalled in Australia	1
Total	**6**

Answers could include:

Microbial:
- contamination with pathogenic microorganisms such as bacteria or viruses or parasites.

Labelling:
- non-compliant labelling or incorrect food ingredients on the ingredient list or incorrect date markings or other food labelling errors.

Chemical/other contaminants:
- contamination with substances such as cleaning products or pesticides or machine oil.

Undeclared allergen:
- due to incorrect labelling or incorrect packaging or contamination of the product by an allergen.

Packaging fault
- where a fault in the food packaging results in contamination (presence of glass/metal) of the food or a potential choking hazard.

Biotoxin
- contamination with biological toxins such as histamine in fish or paralytic shellfish toxin in oysters.

Other
- unsafe levels of additives or presence of a therapeutic drug.

Accept other relevant answers.

Question 21 **(13 marks)**

(a) Identify the food additive responsible for each of the following.

- preventing ingredients from becoming lumpy
- preventing rancidity
- stopping fats from clotting together (3 marks)

Description	Marks
For each food additive (3 x 1 mark)	
Identifies a food additive	1
Total	**3**
Answers could include: • preventing ingredients from becoming lumpy – anti caking agent • preventing rancidity – anti-oxidant/ preservatives • stopping fats from clotting together – emulsifier.	
Accept other relevant answers.	

(b) In the table below, describe how each factor impacts the production of the mini pavlova. (10 marks)

Description	**Marks**
For each factor (5 x 2 marks)	
Describes how the factor influences the production of the mini pavlova	2
States how the factor influences the production of the mini pavlova	1
Total	**10**

Answers could include:

Factor	**Description**
Equipment	• wipe down all equipment as egg white will not beat up if there is any fat or water present • baking paper will stop the pavlova sticking to the tray • electric beater will produce a foam faster than beating by hand • a preheated oven means that the pavlova begins cooking immediately.
Ingredients	• fresh egg whites have a strong protein structure and the air that is beaten in will be more stable than in older eggs • caster sugar is ultra fine and will dissolve more easily • cornstarch in the cornflour acts as a stabiliser and gives the pavlova some stability • eggs at room temperature will form a foam quicker than eggs from the fridge • vinegar will lower the pH of the egg white and stabilise it preventing the meringue from collapsing too much.
Storage	• store pavlova shell in a cool dry place away from moisture • after decorating with cream and fruit the pavlova can be stored in a refrigerator for a short time • eggs at room temperature.
Processing techniques	• pavlova is baked at a low temperature to make sure it dries out slowly • the initial higher temperature helps the pavlova expand and begins the process of the setting of the crust • an electric beater allows air to be incorporated quickly • low temperatures keep the pavlova from caramelising and keeps it white.
Environment	• cool the pavlova in the oven to prevent the pavlova collapsing • room temperature egg whites will whisk and foam much faster • having a warm kitchen environment means egg whites will be warmer and whisk more easily.

Accept other relevant answers.

Question 22 **(8 marks)**

(a) (i) Define the term 'phytochemicals'. (2 marks)

Description	Marks
Defines the term phytochemicals	2
Makes a statement about the term phytochemicals	1
Total	**2**
Answers may include: • phytochemicals are chemical compounds produced by plant foods such as fruits or vegetables or wholegrains or nuts or seeds or legumes, that provide health benefits such as improved gut flora or protect cells and DNA from damage or reduce inflammation or aid in immune system function or assist in hormone regulation • the chemical compounds in phytochemicals help to prevent adverse health effects or chronic diseases such as cancer or heart disease or eye disease or type 2 diabetes or obesity or neurological diseases.	
Accept other relevant answers.	

(ii) Identify **two** phytochemicals. (2 marks)

Description	Marks
For each phytochemical (2 x 1 mark)	
Identifies a phytochemical	1
Total	**2**
Answers may include: • probiotics • phytoestrogens • antioxidants.	
Accept other relevant answers.	

(b) Describe the role of the **two** phytochemicals identified in part (a)(ii) in promoting health. (4 marks)

Description	Marks
For each phytochemical (2 x 2 marks)	
Describes the role of the phytochemical in promoting health	2
Outlines the role of the phytochemical in promoting health	1
Total	**4**

Answers could include:

Probiotics:

- probiotics are healthy bacteria which provide health benefits when consumed. They colonise the gut with good microorganisms or maintain a positive balance of bacteria in the gut
- an unbalanced gut flora is linked to many diseases, therefore, maintaining gut health will help to prevent diseases such as some cancers or obesity or type 2 diabetes or heart diseases or Alzheimer's disease.

Phytoestrogens:

- phytoestrogens are estrogen-like compounds derived from plant foods that mimic and regulate the function of the hormone estrogen in the body. They help to reduce menopausal-symptoms such as hot flushes or changes in mood. Estrogen helps to maintain normal bone density which decreases in aging women, therefore consuming phytoestrogens can help to prevent bone loss or osteoporosis in aging women
- some breast cancers are estrogen positive and consuming phytoestrogens can help to reduce the risk of these cancers from foods such as soy or tempeh or miso
- phytoestrogens are also antioxidants and therefore help to release free radicals from the body and reduce oxidative stress.

Antioxidants:

- antioxidants are compounds found in foods that neutralise free radicals. Free radicals are compounds that cause harm to body cells and are linked to adverse health conditions such as some cancers or type 2 diabetes or heart disease
- current lifestyle, stress and environmental factors promote free radical formation and increase oxidative stress, which in large amounts can damage cell membranes or DNA, therefore, consumption of foods containing antioxidants will help to reduce this risk
- consumption of foods high in Vitamin A, C and E such as orange-coloured vegetables or berries or nuts and seeds will help to neutralise free radicals in the body and reduce oxidative stress.

Accept other relevant answers.

Question 23 **(9 marks)**

Explain **one** example of how each of the following processing techniques is used to control the performance of food.

- application of heat
- addition of salt
- manipulation

Description	Marks
For each technique (3 x 3 marks)	
Explains how the technique is used to control the performance of food	3
Describes how the technique is used to control the performance of food	2
States how the technique is used to control the performance of food	1
Total	**9**

Answers could include:

Application of heat:
- baking is a method of preparing food that uses dry heat, typically in an oven. It is used for baking breads or cakes or biscuits. Heat is gradually transferred from the surface of the food to the centre. Flavour or colour or texture are developed and dextrinisation occurs
- denaturation of protein occurs with the application of heat. When the bonds holding the helix shape are broken and separate denaturation occurs. This results in the tenderisation of meat.

Addition of salt:
- the addition of salt can denature proteins. Salt added during cheese-making will increase the firmness of the curd or protect the cheese from the growth of micro-organisms
- sodium chloride is used as a preservative to regulate the rate of fermentation by slowing the growth of micro-organisms. Salt enhances the positive sensory properties of food.

Manipulation:
- kneading dough develops the gluten in the flour and produces an elastic mixture with good gas retention properties. Kneading also produces fine grain, texture and crumb insufficient kneading results in a dense, tough texture in the finished product
- when egg whites are beaten, air is added. The albumin or egg white protein is denatured. With the addition of sugar the foam is stabilised, forming a meringue.

Accept other relevant answers.

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

Question 24 **(20 marks)**

(a) Identify **two** *Australian Dietary Guidelines* that could assist in preventing the development of anaemia. For each guideline, describe how it could assist Marcelo in achieving a sufficient iron intake. (6 marks)

Description	Marks
For each guideline (2 x 3 marks)	
Identifies a relevant guideline	1
Subtotal	**2**
Describes how the guideline could assist Marcelo in achieving a sufficient iron intake	2
States how the guideline could assist Marcelo in achieving a sufficient iron intake	1
Subtotal	**4**
Total	**6**

Answers could include:

Identification of guidelines:
- to achieve and maintain a healthy weight, be physically active and choose amounts of nutritious food and drinks to meet your energy needs
- enjoy a wide variety of nutritious foods from each of the five food groups every day
- limit intake of foods containing saturated fat, added salt, added sugars and alcohol.

Description of how the guideline could assist Marcelo:
Guideline 1
- portion sizes should be managed to ensure sufficient amounts of nutrients are consumed and to prevent the development of deficiencies. Marcelo should choose vegan foods which provide adequate nutrition, including suitable meat alternatives and other plant-based food sources high in iron to prevent the development of anaemia due to low iron intake.

Guideline 2
- daily consumption of a variety of foods from each food group is essential to ensure all nutritional needs are met, as each food group provides different nutrients. To achieve an adequate iron intake on a vegan diet, it is important that Marcelo consumes suitable alternatives for meat products. Alternatives for meat products that are rich in iron include tofu or nuts or seeds or legumes/beans
- many grain foods are a source of iron, including wheat or quinoa or oats. Vegetables that are high in iron include sweet potato or broccoli or legumes/beans or leafy green vegetables such as kale or spinach. Marcelo should consume different foods each day which are high in plant-based iron to ensure his iron intake is sufficient.

Guideline 3
- vegan foods that may be high in added sugar or fats contribute excess energy to the diet with little nutritional value. Processed meat alternatives are often high in excess fat and sodium. It is important that Marcelo consumes foods to meet his nutritional needs, including foods high in plant-based iron, before including non-essential or discretionary food sources to help prevent the development of anaemia.

Accept other relevant answers.

Question 24 (continued)

(b) Outline **three** differences between fat-soluble and water-soluble vitamins. Explain how this information could help Marcelo manage his Vitamin B12 levels. (6 marks)

Description	Marks
For each difference (3 x 1 mark)	
Outlines a difference between fat-soluble and water-soluble vitamins.	1
Subtotal	**3**
Explanation	
Explains how this information could help Marcelo manage his Vitamin B12 levels	3
Describes how this information could help Marcelo manage his Vitamin B12 levels	2
States how this information could help Marcelo manage his Vitamin B12 levels	1
Subtotal	**3**
Total	**6**

Answers could include:

Differences:

- fat-soluble vitamins are stored in the body's liver, fatty tissue and muscles, whilst water-soluble vitamins are generally not stored in the body and are excreted through urine
- water-soluble vitamins need to be consumed regularly in the diet to prevent deficiencies in the body, whilst fat-soluble vitamins do not need to be consumed as regularly
- fat-soluble vitamins are absorbed more easily by the body in the presence of fat in the diet, whilst this is not necessary for the absorption of water-soluble vitamins
- water-soluble vitamins are generally more vulnerable to nutrient loss in cooking when compared to fat-soluble vitamins, as they are particularly heat sensitive and can be lost with the use wet cooking techniques, such as boiling.

Explanation:

- vitamin B12, or cobalamin, is a water-soluble vitamin. As water-soluble vitamins are generally not stored in the body and are excreted through urine, it is important that Marcelo consumes Vitamin B12 regularly to ensure his body consistently contains sufficient amounts
- food sources of Vitamin B12 are animal-based, which are not eaten on a vegan diet, so people following a vegan diet are more likely to be low in Vitamin B12. Therefore, Marcelo would need regular Vitamin B12 supplementation to ensure he is still receiving adequate nutrition without the consumption of animal-based food products.

Accept other relevant answers.

(c) Explain **two** differences between complete and incomplete proteins. Describe how this information could assist Marcelo in consuming adequate protein in his diet. (8 marks)

Description	Marks
For each difference (2 x 3 marks)	
Explains a difference between complete and incomplete proteins	3
Describes a difference between complete and incomplete proteins	2
States a difference between complete and incomplete proteins	1
Subtotal	**6**
Description	
Describes how this information could assist Marcelo in consuming adequate protein in his diet	2
States how this information could assist Marcelo in consuming adequate protein in his diet	1
Subtotal	**2**
Total	**8**

Answers could include:

Differences:

- proteins are made up of amino acids. There are nine essential amino acids which cannot be made by the body and therefore must be consumed in the diet. Complete proteins contain all nine essential amino acids, whereas incomplete proteins lack at least one essential amino acid
- complete proteins are considered to be high-quality sources of protein, whilst incomplete proteins are considered low-quality. Incomplete proteins can be combined to form complete sources of protein called complementary proteins
- complete protein sources are generally animal-based, whereas incomplete proteins are typically plant-based. However, there are some plant-based complete proteins.

Description:

- a vegan diet does not contain foods from any animal sources, so Marcelo will need to plan his diet to ensure he is consuming all nine essential amino acids in sufficient amounts
- soy or hempseed or chia seeds or quinoa are examples of plant-based complete protein sources and should therefore be consumed more regularly in the diet. For example, Marcelo could sprinkle chia seeds or hemp seeds on meals or use tofu as a replacement for animal-based protein sources or replace rice in meals with quinoa
- incomplete protein sources can be paired together to form complete sources of protein, such as pairing legumes with grains or legumes with nuts. For example, black beans with corn tortillas or hummus with bread or lentils with rice or beans with almonds.

Accept other relevant answers.

Question 25 (20 marks)

(a) Define the process of genetic modification and discuss how the process is achieved in food production. (6 marks)

Description	Marks
Definition	
Defines the process of genetic modification	2
Identifies the process of genetic modification	1
Subtotal	**2**
Discussion	
Discusses how the process is achieved in food production	4
Explains how the process is achieved in food production	3
Describes how the process is achieved in food production	2
Identifies how the process is achieved in food production	1
Subtotal	**4**
Total	**6**
Answers could include: Definition: A process that alters the genetic material of plants or animals by duplicating or removing or inserting one or more new genes to improve its characteristics. Discussion: • identify and isolate a desirable gene from a plant or animal • make a copy of the gene • this gene will then express the desirable characteristic • the gene is then inserted into the DNA of another organism which then demonstrates the trait and passes it to future generations.	
Accept other relevant answers.	

(b) Describe **three** potential risks to human health resulting from the consumption of genetically modified food. (6 marks)

Description	Marks
For each risk to health (3 x 2 marks)	
Describes a risk to human health resulting from the consumption of genetically modified food	2
Identifies a risk to human health resulting from the consumption of genetically modified food	1
Total	**6**
Answers could include: • effectiveness of antibiotics could be reduced if genes coded for antibiotic resistance cross to humans • people with allergies have no way of knowing if GM foods have been altered with proteins to which they are allergic • vegetarians may be concerned about foods developed through GM if there is the possibility of genetic materials from animals or fish being used in their production as some studies show that there may be a risk of toxic effects.	
Accept other relevant answers.	

(c) Identify **two** examples of biotechnology (other than genetic modification) and explain how each is used in food systems. (8 marks)

Description	Marks
Examples	
Identifies two examples of biotechnology	2
Identifies one example of biotechnology	1
Subtotal	**2**
For each example of biotechnology (2 x 3 marks)	
Explains how it is used in food systems	3
Describes how it is used in food systems	2
Identifies how it is used in food systems	1
Subtotal	**6**
Total	**8**

Answers could include:

Examples of biotechnology:
- microorganisms
- yeasts.

Explanation – microorganisms
- lactic acid bacteria produce lactic acid which helps prevent the growth of harmful microorganisms by producing an acidic environment that prevents the growth of harmful bacteria
- processes carried out using microorganisms are called fermentation processes
- microorganisms play a crucial role in the food industry as they contribute to the production and preservation of various foods
- microorganisms are used in the production of yoghurt and cheese, as well as fermented fish, meat and vegetables.
- microorganisms are used as a strategy for food preservation and also to improve sensory properties and digestibility
- bacteria are used in the production of probiotics which are designed to improve the balance of intestinal flora.

Explanation – yeasts
- yeast is used in baking as a leavening agent converting the sugars present into carbon dioxide and causing the dough to expand and rise as gas bubbles form
- yeast is used in the fermentation process involved in the production of alcoholic products such as beer or wine or cider
- yeast is used in the production of non-alcoholic products such as bread or coffee or chocolate
- the use of yeast in baking and the making of alcoholic beverages has been known since ancient times.

Accept other relevant answers.

Question 26 (20 marks)

(a) Explain the use of **one** packaging technology used in each of the images above.
(6 marks)

Description	Marks
For each packaging technology (2 x 3 marks)	
Explains the use of a packaging technology used	3
Describes the use of a packaging technology used	2
Outlines the use of a packaging technology used	1
Total	**6**

Answers could include:

Active packaging in image 1

- active packaging, a type of 'smart packaging' increases the shelf life of perishable food products and improves the quality of the product by removing undesirable conditions and slowing the rate of microbial growth
- it works with the environment or the contents of the product to ensure quality, or freshness and or longevity by decreasing the level of oxygen or moisture or odour in the atmosphere to prevent oxidation or spoilage of the product
- oxygen absorbers or scavengers or desiccants are added to many packaged food products such as nuts or seeds or wraps or tortillas to absorb oxygen or moisture and increase shelf life and maintain freshness of product
- by absorbing oxygen and/or moisture in packaged food products, the sensory properties of the product will be maintained, improving quality of products for consumers
- active packaging has a function beyond containment of the food product, it senses or measures an attribute of the product, such as oxygen or moisture levels or odour, and responds accordingly by absorbing the excess oxygen/ or moisture/ or odour to maintain quality of product and ensure product safety.

Aseptic packaging in image 2

- aseptic packaging is a process whereby microorganisms are prevented from entering a package during and after packaging occurs. A sterilised package is filled with a sterile product and sealed within a sterile and hygienic environment to prevent unwanted contaminants from spoiling a food product and thus increasing shelf life and safety of a food product
- image 2 is an example of long-life beverage products or tetra paks ® whereby the packaging and the beverage products have been sterilised separately and then assembled in a sterile environment to ensure quality and longevity
- aseptic packaging uses extremely high temperatures to maintain the freshness of the product, whilst also ensuring it is not contaminated by microorganisms
- allows for preservation of food products without the use of preservatives due to the sterilisation process protecting against bacteria, highly desirable to consumers nowadays
- sensory properties and nutritional value are maintained through aseptic packaging to ensure the food products are still desirable to consumers and quality is maintained.

Accept other relevant answers.

(b) Define 'modified atmosphere packaging' (MAP) and explain **one** benefit of its use in food packaging. (5 marks)

Description	Marks
Definition	
Defines modified atmosphere packaging (MAP)	2
Makes a general statement about modified atmosphere packaging (MAP)	1
Subtotal	**2**
Explanation	
Explains benefit of its use in food packaging	3
Describes benefit of its use in food packaging	2
Outlines benefit of its use in food packaging	1
Subtotal	**3**
Total	**5**

Answers could include:

Definition:
Modified atmosphere packaging (MAP) involves altering or regulating the internal atmosphere of packaging. The humidity, oxygen and nitrogen content inside the packaging can be altered to prevent food spoilage due to oxidation, significantly increasing the shelf life of food products.

Explanation of benefit:
- prevents food spoilage due to minimising microbial growth
- extends shelf life and maintains freshness of food products
- reduces need to use artificial preservatives to extend shelf life of food products, which is of significant importance to many consumers nowadays
- versatile for many different food products such as meat/seafood trays, packaged salads, pasta/rice/chip packets
- can allow gases naturally produced by food products, that would ordinarily cause spoilage to escape food packing using on-package valves which allow undesirable gases to escape at the same time as blocking external gases from entering.

Accept other relevant answers.

Question 26 (continued)

(c) Describe **three** different types of MAPs used in the food industry and identify **one** food example for each. (9 marks)

Description	Marks
For each type of MAP (3 x 3 marks)	
Describes the use of MAP in the food industry	2
Outlines the use of MAP in the food industry	1
Subtotal	**6**
Identification	
Identifies a food example	1
Subtotal	**3**
Total	**9**

Answers could include:

Barrier specific:
- creates a barrier between the food and environmental factors that cause food spoilage, such as moisture, oxygen and light, maintaining the freshness, quality, flavour and appeal of product for consumers
- allows some gases into packaging at different rates and excludes others
- external water vapour, humidity and oxygen cannot permeate this packaging easily, extending the shelf life of the product
- fresh food produces moisture, which can cause changes to the gases inside the packaging, gas flushing can prevent spoilage of these products due to barrier films which controls the atmospheric gases by blocking foreign properties
- barrier specific packaging can have anti-fogging properties for transparent food packaging, allowing consumers to inspect the contents before purchasing.

Food examples:
- packaged salad mixes or pre-cut fruits or carton meat or seafood pouches or cheese packaging.

Gas flushing:
- food packaging is flushed with specific gases, most commonly nitrogen or carbon dioxide gas, that are specifically designed to maximise shelf life of food products, increase product integrity and protect against discolouration
- due to the heavier composition of nitrogen and carbon dioxide gas, they flush the oxygen out, the packaging is then sealed, trapping the nitrogen/carbon dioxide inside
- manufacturers replace the oxygen in packaging with nitrogen gas mixes before sealing to slow down deterioration
- correct packaging materials must be used to ensure the product can also breathe and not perish or become soggy
- gas flushing creates a cushion-like puffer to protect fragile food products from being damaged.

Food examples:
- dry potato chips or popcorn or dry pasta or rice or packaged meat.

Vacuum:
- removing all air from inside food packaging prior to sealing, creating a vacuum around the food product
- ensures freshness, reduces deterioration and slows down microbial growth
- a flexible plastic film packaging is used to protect and create a tight seal around the food product
- a vacuum seal machine is used to suck and remove all oxygen from packaging, pulling it in intimate contact with the food product and extending shelf life
- preserves food product without artificial preservatives due to removing oxygen, a common cause of food spoilage.

Food examples:
- cheese or meat and seafood or pre-cut fruit and vegetable or yeast or ground coffee beans.

Accept other relevant answers.

ACKNOWLEDGEMENTS

Question 20(b) Adapted from: Food Standards Australia New Zealand. (2023, December 20). *About Food Recalls: Why is Food Recalled?*. Retrieved July, 2024, from https://www.foodstandards.govt.nz/foodrecalls/about-food-recalls
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