Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	PHYSICAL PROPERTIES OF FOOD
COURSE CODE	:	BWD 11802
PROGRAMME CODE	:	BWD
EXAMINATION DATE	:	JULY 2024
DURATION	:	2 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **TWENTY TWO (22)** PAGES

PART A (Multiple-Choice Questions)

There are **SEVENTY (70)** multiple-choice questions in this part. Read each question-and-answer option carefully before selecting the **ONE (1)** best answer. Use the OMR form to answer all questions in this part.

Q1 Which of the following best defines an emulsion?

(a) A gas dissolved in a liquid.

(b) A mixture of two immiscible liquids.

(c) A solution of two soluble substances.

(d) A suspension of solid particles in a liquid.

(1 mark)

Q2 What is the term used to describe the emulsion breakdown process?

(a) Coalescence

(b) Sedimentation

(c) Phase inversion

(d) Homogenization

(1 mark)

Q3 Which instrument is typically used to measure the droplet size distribution in emulsions?

(a) pH meter

(b) Viscometer

(c) Refractometer

(d) Particle size analyzer

(1 mark)

Q4 Which unit of measurement is best used to express surface tension?

(a) Joule

(b) Pascal

(c) Newton

(d) Newton per meter

(1 mark)

Q5 How can the accuracy of measurements be increased with water activity meter maintenance?

(a) By increasing the measurement frequency

(b) By replacing the sample holder with a larger one

(c) By adjusting the sample pH before each measurement

(d) By cleaning and recalibrating the instrument on a frequent basis

(1 mark)

Q6 Which technique is used to determine interfacial tension by measuring the force required to pull a liquid column from a surface?

(a) Drop shape analysis

(b) Pendant drop method

(c) Spinning drop method

(d) Wilhelmy plate method

(1 mark)

Q7 Which rheological quality describes a material's ability to return to its original shape after deformation?

(a) Viscosity

(b) Plasticity

(c) Elasticity

(d) Yield stress

(1 mark)

Q8 Which type of interfacial tension is typically involved in the formation of foam in food systems?

(a) Liquid-liquid

(b) Gas-gas

(c) Gas-liquid

(d) Solid-liquid

(1 mark)

Q9 What is surface tension?

(a) The tension between food particles

(b) The tension in muscles while eating

(c) The tension at the surface of a liquid

(d) The tension between different layers of food

(1 mark)

Q10 Which method is suitable for measuring the viscosity of emulsions?

(a) Titration

(b) Rheometry

(c) Chromatography

(d) Nuclear magnetic resonance

(1 mark)

Q11 Which parameter is used to evaluate foam quality in sensory analysis?

(a) pH

(b) Colour

(c) Texture

(d) Viscosity

(1 mark)

Q12 What is the primary mechanism behind foaming in food?

(a) Denaturation

(b) Emulsification

(c) Gas dispersion

(d) Agglomeration

(1 mark)

Q13 What is interfacial tension?

(a) The tension within a food matrix

(b) The tension between two immiscible phases

(c) The tension caused by temperature fluctuations

(d) The tension between different food components

(1 mark)

Q14 Identify the meaning of foaming in terms of food physical properties.

(a) A method for measuring food texture

(b) A chemical reaction that changes food colour

(c) The temperature at which a food starts to foam

(d) A process of creating bubbles in a liquid or semi-solid food

(1 mark)

Q15 Which instrument is commonly used to measure surface tension in food?

(a) pH meter

(b) Viscometer

(c) Tensiometer

(d) Thermometer

(1 mark)

Q16 Which of the following rheological properties describes a fluid's resistance to flow?

(a) Viscosity

(b) Elasticity

(c) Yield stress

(d) Surface tension

(1 mark)

Q17 Choose the type of emulsion that has the highest interfacial tension.

(a) Nanoemulsion

(b) Microemulsion

(c) Macroemulsion

(d) Pickering emulsion

(1 mark)

Q18 Which of the following food products represents a water-in-oil emulsion?

(a) Milk

(b) Butter

(c) Vinaigrette

(d) Mayonnaise

(1 mark)

Q19 Which physical property of emulsions is responsible for their stability?

(a) Density

(b) Viscosity

(c) Surface tension

(d) Refractive index

(1 mark)

Q20 Which rheological property is crucial for understanding the pumpability of tomato sauce in food processing plants?

(a) Viscosity

(b) Elasticity

(c) Plasticity

(d) Yield stress

(1 mark)

Q21 Identify the type of emulsion used in producing salad dressings.

(a) Multiple

(b) Oil-in-water

(c) Water-in-oil

(d) Microemulsion

(1 mark)

Q22 Choose a factor that influences the spreadability of emulsions on food surfaces.

(a) pH

(b) Aroma

(c) Density

(d) Viscosity

(1 mark)

Q23 How does surface tension affect the formation of foams in food?

(a) Lower surface tension promotes foam stability

(b) Higher surface tension promotes foam stability

(c) Surface tension has no effect on foam formation

(d) Surface tension affects only the appearance of foam

(1 mark)

Q24 Which of the following factors significantly affects food surface tension?

(a) Texture

(b) Pressure

(c) pH level

(d) Temperature

(1 mark)

Q25 Which property of emulsions is responsible for their ability to form stable foams on food surfaces?

(a) Density

(b) Viscosity

(c) Surface tension

(d) Refractive index

(1 mark)

Q26 Which rheological property contributes most to the springiness and bounciness of a marshmallow?

(a) Plasticity

(b) Viscosity

(c) Elasticity

(d) Yield stress

(1 mark)

Q27 Which type of emulsion has the lowest interfacial tension?

(a) Oil-in-water

(b) Water-in-oil

(c) Multiple emulsion

(d) Pickering emulsion

(1 mark)

Q28 How does high shear mixing affect foam stability?

(a) No effect

(b) Increases stability

(c) Decreases stability

(d) Depends on the type of food

(1 mark)

Q29 What does foam overrun in ice cream refer to?

(a) The thickness of ice cream foam

(b) The expansion of ice cream during freezing

(c) The temperature at which ice cream foams

(d) The percentage increase in the volume of ice cream due to overrun

(1 mark)

Q30 What is the main factor influencing the stability of food foams?

(a) pH

(b) Pressure

(c) Temperature

(d) Surface tension

(1 mark)

Q31 Which of the following foods is most likely to have a high water activity?

(a) Jam

(b) Crackers

(c) Dried fruits

(d) Hard cheese

(1 mark)

Q32 Which of the following tests is commonly used for assessing the firmness of cookies?

(a) Break test

(b) Tensile test

(c) Extrusion test

(d) Compression test

(1 mark)

Q33 How does the presence of air affect the texture of foam in food products?

(a) Makes it softer

(b) Makes it denser

(c) Makes it lighter

(d) Makes it stickier

(1 mark)

Q34 Which textural property is most relevant for assessing the quality of cooked beans or legumes?

(a) Firmness

(b) Moistness

(c) Crispiness

(d) Chewiness

(1 mark)

Q35 Which rheological property is important for analyzing the flow behaviour of a batter for pancakes?

(a) Elasticity

(b) Viscosity

(c) Plasticity

(d) Yield stress

(1 mark)

Q36 In the production of a crispy potato chip, which rheological property is essential for achieving the desired crunchiness and mouthfeel?

(a) Viscosity

(b) Elasticity

(c) Yield stress

(d) Plasticity

(1 mark)

Q37 How does the accuracy of surface tension measurements impact food research and development?

(a) It enhances flavour profiling

(b) It ensures product consistency

(c) It optimizes ingredient sourcing

(d) It improves shelf-life prediction

(1 mark)

Q38 What is the significance of foam stability in food products?

(a) Enhances aroma

(b) Reduces shelf life

(c) Determines color intensity

(d) Affects texture and mouthfeel

(1 mark)

Q39 Choose a technique that can be used to measure surface tension indirectly in food samples.

(a) Gas chromatography

(b) Bubble pressure tensiometry

(c) Atomic absorption spectroscopy

(d) High-performance liquid chromatography

(1 mark)

Q40 Which of the following methods is commonly used for assessing the elasticity of dough?

(a) Tensile test

(b) Extrusion test

(c) Penetration test

(d) Compression test

(1 mark)

Q41 In a renowned pastry manufacturer's state-of-the-art facility, a dedicated team of food technologists focuses on perfecting the texture of their pie crusts. What texture characteristic is typically desired in a perfectly baked pie crust?

(a) Flakiness

(b) Crispiness

(c) Chewiness

(d) Creaminess

(1 mark)

Q42 Ali recorded a high cohesiveness value in a textural analysis of a newly developed snack bar. Based on this finding, determine the most suitable characteristic for the analyzed snack bar.

(a) A snack bar with high cohesiveness will be difficult to chew

(b) A snack bar with high cohesiveness will stick to teeth and palate

(c) A snack bar with high cohesiveness will easily break into small pieces

(d) A snack bar with high cohesiveness will quickly dissolve in the mouth

(1 mark)

Q43 A pasta manufacturing company is developing a new pasta shape and wants to ensure it has the desired firmness. Which parameter is essential for achieving the desired firmness in pasta?

(a) Oil content

(b) Water content

(c) Gluten content

(d) Protein content

(1 mark)

Q44 A candy manufacturing company is experiencing inconsistency in the hardness of its products. Despite following the same recipe and production process, there are variations in the hardness of the candies produced. The quality department seeks to identify and address the factors that could be contributing to these inconsistencies. Which of the following factors can affect the hardness of candy?

(i) Cooling rate

(ii) Crystallization

(iii) Sugar concentration

(iv) Temperature during cooking

(a) ii only

(b) iii only

(c) i, iii and iv

(d) ii, iii and iv

(1 mark)

Q45 A confectionery company is developing a new caramel candy recipe and wants to analyze its rheological properties for process optimization. What rheological characteristic is typically desired in a caramel sauce to be used as ice cream topping?

(a) High viscosity

(b) Low elasticity

(c) High shear rate

(d) Low yield stress

(1 mark)

Q46 Despite the widespread consumption of yogurt, there remains a lack of standardized methods for assessing its quality based on texture characteristics. This gap hinders both consumers and producers in reliably determining the freshness and overall quality of yogurt products. Which texture characteristic is typically assessed to determine the quality of yogurt?

(a) Crispiness

(b) Chewiness

(c) Tenderness

(d) Creaminess

(1 mark)

Q47 A renowned ice cream manufacturer has been receiving complaints from customers about inconsistencies in the texture of their ice cream products. Some batches are too icy and grainy, while others are overly creamy and smooth. Which factors should be controlled in order to maintain consistency of the ice cream across all batches and avoid customer complaints?

(i) Overrun

(ii) Fat content

(iii) Freezing rate

(iv) Amount of air incorporated during freezing

(a) i only

(b) iii only

(c) i, ii and iv

(d) i, ii, iii and iv

(1 mark)

Q48 A snack food company is developing a new potato chip product and wants to ensure it has the desired crunchiness. Which parameter is crucial for achieving a crispy texture in potato chips?

(a) Oil content

(b) Salt content

(c) Water activity

(d) Moisture content

(1 mark)

Q49 A team of researchers is conducting a study to improve the overall quality of meat products in a local market. One of the critical aspects they are focusing on is the tenderness of the meat, as it greatly influences customer satisfaction and repeat purchases. Identify the key factors that can affect meat tenderness in order to develop effective strategies for improvement.

(i) Marbling

(ii) Fat content

(iii) Cooking method

(iv) Intramuscular fat distribution

(a) i and iv

(b) iii only

(c) ii and iii

(d) i, ii, iii and iv

(1 mark)

Q50 A food manufacturer is developing a new sauce formulation and wants to analyze its rheological properties for quality control. Which rheological parameter is critical for assessing the stability of emulsions in the sauce formulation?

(a) Elasticity

(b) Shear rate

(c) Viscosity

(d) Yield stress

(1 mark)

Q51 A food manufacturer is considering implementing a new drying technique for its products to improve efficiency. How can this plan affect the water activity levels in the final products?

(a) It would have no effect on water activity levels.

(b) It would fluctuate water activity levels unpredictably.

(c) It would increase water activity levels, hence prolonging shelf life.

(d) It would decrease water activity levels, hence improving product stability.

(1 mark)

Q52 You work as a quality control manager in a chocolate manufacturing company. Recently, there have been complaints from customers about the chocolate bars becoming discoloured and developing a gritty texture after a few weeks of storage. Upon investigation, you suspect that water activity might be playing a significant role in these quality issues. Your task is to evaluate the water activity of the chocolate bars and understand its impact on the physical properties of the product to implement necessary quality control measures. Which parameter is indirectly affected by water activity in chocolate bars?

(i) pH

(ii) Colour

(iii) Texture

(iv) Packaging material

(a) i and iii

(b) ii and iii

(c) i, ii and iv

(d) i, ii, iii and iv

(1 mark)

Q53 A food scientist is investigating the role of proteins in foam stability. Determine the property of proteins that contributes to their ability to stabilize foams.

(a) Low solubility

(b) Hydrophobicity

(c) Strong covalent bonds

(d) High molecular weight

(1 mark)

Q54 You are tasked with assessing the water activity levels in a variety of snack foods produced by your company. The management of XY company has noticed an increase in customer complaints regarding the shelf life and quality of their snack foods. Suspecting that water activity might be a contributing factor, you have been assigned to investigate and address this issue. Which quality defects might occur in snack foods due to high water activity?

(i) Staling

(ii) Softening

(iii) Mold growth

(iv) Accelerate flavour loss during storage

(a) ii only

(b) iii only

(c) i, iii and iv

(d) i, ii, iii and iv

(1 mark)

Q55 You are a food technologist working for a company that produces dehydrated soup mixes. Recently, there have been concerns regarding the quality and shelf life of the soup mixes, particularly related to moisture content and water activity. Your task is to investigate the impact of water activity on the stability and safety of the dehydrated soup mixes and to propose solutions to improve their quality and shelf life. Which quality defects might occur in dehydrated soup mixes due to high water activity?

(i) Clumping

(ii) Rancidity

(iii) Colour fading

(iv) Decelerate rehydration

(a) ii only

(b) iv only

(c) i, ii and iii

(d) i, ii, iii and iv

(1 mark)

Q56 A food processing company is encountering challenges with maintaining consistent texture across its product line. Some of its food items are too tough, while others are too soft or mushy, leading to customer complaints and decreased satisfaction. The company aims to identify the key factors that influence the texture of food during processing, storage, and transportation, in order to optimize its production processes and ensure consistent quality across all products. Which of the following factors influence the texture of food?

(i) Temperature

(ii) Moisture content

(iii) Size of the food particles

(iv) Sound produced when eating

(a) iv only

(b) i and ii

(c) iii and iv

(d) i, ii and iii

(1 mark)

Q57 A food scientist is studying the relationship between fat content and foam stability. In this study, which parameter would be most appropriate for quantitative measurement and subsequent statistical analysis?

(a) Foam density

(b) Odor intensity

(c) Colour intensity

(d) Transparency index

(1 mark)

Q58 You are a product developer for a snack company looking to launch a new line of fruit-inspired treats. Your team is debating which texture profile would best replicate the crispness of an apple in one of your potential products. Your challenge is to conduct consumer taste tests and market research to determine which texture is most appealing to the target customers. Which of the following textures would be associated with a crisp apple?

(a) Gooey

(b) Chewy

(c) Creamy

(d) Crunchy

(1 mark)

Q59 In the production of soft drinks, the formation and stability of foam are critical factors influencing consumer satisfaction and product quality. However, the methods for foam analysis vary widely, ranging from visual inspection to sophisticated instrumental techniques. Given this diversity, there is a need to identify the key properties typically measured in foam analysis that most accurately reflect foam stability, texture, and longevity. This understanding will guide the selection of appropriate analytical methods and aid in the development of strategies to enhance foam quality in beverage production. Which property is typically measured in foam analysis?

(i) pH

(ii) Density

(iii) Viscosity

(iv) Drainage rate

(b) i and ii

(c) iii and iv

(d) i, ii and iii

(a) ii, iii and iv

(1 mark)

Q60 Developing a novel plant-based whipped topping for vegan desserts poses the challenge of achieving long-lasting foam stability comparable to traditional dairy-based options. Which of the following is a method to enhance foam stability in the plant-based formulation, ensuring satisfactory texture, mouthfeel, and shelf life while meeting consumer expectations for taste and sustainability?

(i) Addition of sugars

(ii) Increase in temperature

(iii) Use of mechanical agitation

(iv) Incorporation of hydrocolloids

(a) i and ii

(b) iii and iv

(c) i, iii and iv

(d) i, ii, iii and iv

(1 mark)

Q61 You are a quality control manager at a company that produces dried fruit snacks. One of the recurring issues your team faces is inconsistency in shelf life across different batches of dried fruits. You suspect that water activity might be a key factor influencing this variability. Your task is to conduct a series of experiments to investigate the relationship between water activity and shelf life in dried fruits. By systematically controlling water activity levels and monitoring product quality over time, you aim to uncover the precise impact of water activity on shelf life. Your findings will provide information on necessary adjustments to production processes and storage conditions to ensure consistent quality and maximize the shelf life of your dried fruit products. Determine how water activity can affect the shelf life of dried fruits.

(i) Higher water activity in dried fruits extends shelf life by reducing microbial growth.

(ii) Lower water activity in dried fruits enhances shelf life by minimizing moisture content.

(iii) Water activity influences the texture changes of dried fruits during storage.

(iv) Water activity has no effect on the oxidation of natural sugars in dried fruits.

(a) ii only

(b) ii and iii

(c) i, iii and iv

(d) i, ii, iii and iv

(1 mark)

Q62 You are a beverage scientist working for a major soft drink company, specializing in the development of carbonated beverages. Your role involves analyzing the surface properties of different types of beverages to understand their physical characteristics and quality better. How does surface tension affect the formation and stability of foam in carbonated soft drinks?

(a) It leads to surface corrosion

(b) It inhibits foam formation and stability

(c) It promotes foam formation and stability

(d) It has no effect on foam formation and stability

(1 mark)

Q63 A manufacturer is developing a new salad dressing and wants to ensure it has good emulsion stability. Which property of oil-in-water emulsions contributes to their stability?

(a) High density

(b) Low viscosity

(c) Small droplet size

(d) High interfacial tension

(1 mark)

Q64 A food technology startup is pioneering 3D food printing for personalized culinary experiences. They are facing stability issues with their edible ink emulsions, which is affecting printing precision and food quality. They require a reliable measurement technique to analyze droplet size distribution, which will ensure consistent printing and advancing innovation in 3D food printing. What measurement technique would be most suitable for analyzing droplet size distribution to assess the stability of the emulsion?

(a) pH titration

(b) Colorimetric analysis

(c) Dynamic light scattering

(d) Conductivity measurements

(1 mark)

Q65 A food manufacturer is developing a new ice cream flavour and wants to ensure it has a smooth and creamy texture. Which of the following factors is critical for achieving proper overrun in ice cream production?

(a) Low fat content

(b) Slow freezing rate

(c) High sugar content

(d) High air incorporation

(1 mark)

Q66 A bakery wants to produce gluten-free bread with a similar texture to traditional wheat bread. When comparing the texture of gluten-free bread with traditional wheat bread, which instrument would be most appropriate for conducting quantitative texture analysis?

(a) pH meter

(b) Rheometer

(c) Texture analyzer

(d) Sensory evaluation

(1 mark)

Q67 A food scientist is investigating the role of pH in emulsion stability. Which statistical analysis method would be most relevant for correlating pH with emulsion properties?

(a) T-test

(b) Chi-square test

(c) Linear regression

(d) Analysis of Variance

(1 mark)

Q68 In the development of a new food product formulation, it is crucial to understand the interfacial tension between various components such as oil and water phases, emulsifiers, and additives. However, current methods for measuring interfacial tension in food research vary in accuracy, cost, and complexity. Thus, there is a need to identify the most suitable method for measuring interfacial tension in food research that balances precision, practicality, and affordability. Which of the following methods is used to measure interfacial tension in food research?

(i) Drop shape analysis

(ii) Pendant drop method

(iii) Atomic force microscopy

(iv) Conductivity measurement

(b) i and ii

(c) i and iii

(d) iii and iv

(a) i, ii and iii

(1 mark)

Q69 A food technologist is working on improving the texture of a protein-based meat alternative product to match the sensory preferences of consumers. They need to identify a measurement technique that can provide quantitative data on the texture attributes. This data will be used for statistical analysis to optimize the formulation and processing parameters of the product. Which measurement technique would provide quantitative data for statistical analysis of the texture attributes?

(a) Aroma analysis

(b) Texture profiling

(c) Visual inspection

(d) Sensory evaluation

(1 mark)

Q70 You are working for a company specializing in developing innovative food preservation methods. Your role involves analyzing the surface properties of different liquids used in food preservation to understand their efficacy in inhibiting microbial growth and extending shelf life. You are particularly interested in studying how surface tension impacts factors such as liquid coverage, antimicrobial activity, and barrier properties in food preservation solutions. How does surface tension affect the coverage of liquid preservatives on the surface of fruits and vegetables?

(a) It leads to surface corrosion

(b) It has no effect on coverage

(c) It inhibits uniform coverage

(d) It promotes uniform coverage

(1 mark)

PART B (Subjective Questions)

This part contains **ONE (1)** subjective question. Answer the question in the answer booklet provided.

Q71 As a food scientist working for a leading spread manufacturing company, you have been tasked with improving the quality and consistency of their peanut butter products. However, you have noticed variations in texture and mouthfeel across batches, which may be attributed to differences in geometric properties. Explain the significance of geometric properties in determining the physical qualities of peanut butter.

(10 marks)

- END OF QUESTIONS -