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UNIVERSITY OF NAMIBIA

FACULTY	AGRICULTURE, ENGINEERING AND NATURAL SCIENCES		
SCHOOL	AGRICULTURE AND FISHERIES SCIENCES		
DEPARTMENT	FOOD SCIENCE AND SYSTEMS		
SUBJECT	FOOD CHEMISTRY		
SUBJECT CODE	F3711SC / AFST 3781		
DATE	JUNE 2025		
DURATION	3 HOURS	**MARKS**	120

SECOND OPPORTUNITY EXAMINATION

Examiner: **Prof KKM Nantanga and Dr W Embashu**

Internal Moderator: **Dr SC Barrion**

External Moderator:

This question paper consists of **FIVE (5)** pages excluding this front page.

Instructions:

- **Answer all five (5) questions**
- **Submit the Word Search**
- **Use of a calculator is allowed**
- **A periodic table is included**

QUESTION 1

a) Discuss what has happened to the piece of chicken shown in Figure 1. Include the causes and the effects on quality and on safety. **[10]**

b) Justify what has occurred at the molecular level in the thawing tomato depicted in Figure 2. **[10]**

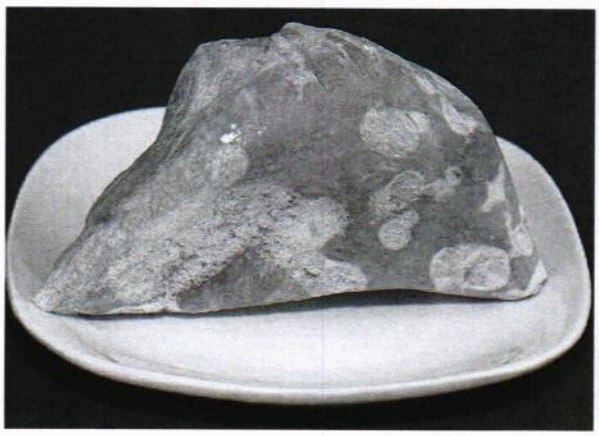


Figure 1: Frozen raw chicken piece



Figure 2: Thawing tomato

QUESTION 2

Examine the data in this table:

Typical Moisture content (%)	**Typical a_w**
88.1; 57; 37; 16; 5.4	0.99; 0.98; 0.96; 0.84; 0.33

a) Assign each of the moisture contents and water activity values to the correct food/beverage in this table: **[10]**

Food or Beverage	**Typical Moisture content (%)**	**Typical a_w**
Bread		
Distilled liquor e.g. Whiskey		
Pasta		
Butter, Unsalted		
Milk, Whole		

b) Based on your correct assignment of the moisture and water activity data, rank the given food/beverages from one with highest shelf-stability to the one with the lowest. E.g. XXX > NNN > GGG ≥ YYY > RRR **[5]**

c) There are several factors which influence fats and oil oxidation. Food and beverages processors based on scientific principles try to control these factors to increase the shelf-life of their products and improve sales' income. Develop a table that provides the factors, their principles, and practical application in the food and beverages industry. **[15]**

E.g.:

Factor	**Principle**	**Application**
Light	Keep it (light) out	Use of opaque packaging [or packaging of Extra virgin Olive oil in tin cans or opaque glass]

QUESTION 3

a) Compare and contrast plant proteins to edible insect proteins. **[10]**

b) Match with the correct answer: **[2]**

i) Product of beta-fructosidase	A. Non-enzymatic browning
ii) Amino acid and sugar sensory characteristic in baked products	B. Forming
iii) Function of proteins used in polony and viennas manufacturing	C. Emulsifiers
iv) A chain of 50 or more amino acid joined together	D. Protein
	E. Syrup
	F. Enzyme

c) State the principle on which meat tenderisers work. **[4]**

d) Give the modes of action for each of the following functional properties of proteins: **[6]**

i) Viscosity
ii) Fat absorption
iii) Gelation

QUESTION 4

SUBMIT THIS PAGE

Name: **Student number:**

Examine the following word search box. In it, there are 18 words (of 4 letters or more) that are directly relevant to this course (Food Chemistry).

a) Detect only 16 of these words and circle each one that you have detected. **[16]**
Some of the 16 words are: *GONIMBRASIA BELINA*, CARAMELISATION, TRIGLYCERIDES, FERMENTATION, METHIONINE, LIPOLYSIS, CELLULOSE.

b) Select 7 of the detected (given or not given) words. To the best of your knowledge, experience and skills, persuade members of the Khomas Regional Council (politicians) that each of the 10 words that you have selected play key evidence-based roles in the Food and Beverages industry and/or in human nutrition. **[14]**

C	Z	W	I	R	R	X	F	E	L	C	V	Z	P	C	V	J	W	T	R	V	I	G
C	O	L	O	U	R	A	N	T	J	P	Z	E	X	P	V	M	C	R	X	I	N	P
B	Y	S	I	S	Y	L	O	P	I	L	Q	N	W	R	K	A	N	I	O	A	O	X
D	U	A	N	I	L	E	B	A	I	S	A	R	B	M	I	N	O	G	H	T	I	W
K	M	D	W	S	F	Y	W	A	B	Y	O	D	N	I	Y	D	I	L	P	Q	T	M
O	Y	S	B	L	T	M	P	W	Y	M	O	S	E	F	D	I	T	Y	H	N	A	Z
U	U	W	K	H	C	A	E	E	N	H	F	C	O	D	Z	C	A	C	E	I	T	J
F	X	F	Q	E	D	O	R	T	C	Q	P	B	H	O	L	A	S	E	N	T	N	U
J	B	S	H	O	W	Q	P	C	H	T	X	M	A	J	N	C	I	R	O	R	E	E
A	X	A	R	T	Z	I	D	P	H	I	I	Y	L	K	M	I	L	I	L	I	M	L
U	L	L	X	W	B	K	B	I	E	Y	O	N	U	A	Z	E	E	D	A	T	R	Q
N	B	T	E	O	J	G	V	H	J	R	M	N	M	R	F	L	M	E	S	E	E	G
V	E	S	O	L	U	L	L	E	C	G	U	J	I	H	J	O	A	S	E	X	F	E
P	S	J	M	A	L	T	O	S	E	Z	V	C	M	N	B	C	R	E	Z	E	D	I
N	K	P	H	Z	O	B	L	O	T	I	B	R	O	S	E	U	A	Z	H	F	G	P
B	A	B	H	Y	D	R	O	P	H	I	L	I	C	I	T	Y	C	G	V	U	P	Q

Find the following words in the puzzle.
Words are hidden ↑ ↓ → ← and ↘ .

QUESTION 5

Ms Joseph developed the steps in the preparation of 0.1 M NaOH solution that was required in the analysis of Free Fatty Acids in Extra Virgin Olive Oil.

a) Verify that Ms Joseph is correct by identifying the mistakes in the steps. For each mistake, offer the solution. **[4]**

b) Formulate the correct steps for the preparation of 500 mL of 0.1 M NaOH solution. **[14]**

To prepare 500 mL of 0.1 M NaOH solution, you will need to dissolve a specific amount of sodium hydroxide (NaOH) in water.

Therefore, you should follow these steps:

1) For NaOH, the molar mass is 22.99 g/mol (Na) + 15.999 g/mol (O) + 1.008 g/mol (H) = 39.997 g/mol (rounded to 2 decimal places).

2) Calculate the amount of NaOH needed using the formula: mass = Molarity × Volume × Molar mass

3) Plug in the values: mass = 0.01 mol/L × 0.5 L × 39.997 g/mol = 1.99985 g (rounded to 2 decimal places).

4) Measure out 2.00 g of solid NaOH using an analytical balance.

5) Dissolve the 2.00 g of NaOH in approximately 400 mL of distilled water in a 1 L volumetric flask.

6) Once the NaOH is completely dissolved, add more distilled water to the flask until the total volume reaches the 500 mL mark.

7) Stopper the flask and mix the solution thoroughly.

Now you have prepared 500 mL of 0.1 M NaOH solution.

Periodic Table of the Elements

1 IA 1A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8	9 VIII 8	10	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 H Hydrogen 1.008																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.933	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.09	35 Br Bromine 79.904	36 Kr Krypton 84.80
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.29
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown

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Actinide Series	89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]

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END OF EXAMINATION!

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FIRST OPPORTUNITY EXAMINATION

Examiner: **Prof KKM Nantanga and Dr W Embashu**

Internal Moderator: **Dr SC Barrion**

External Moderator:

This question paper consists of **SIX (6)** pages excluding this front page.

Instructions:

- **Answer all six (6) questions**
- **Submit the Word Search**
- **Use of a calculator is allowed**
- **A periodic table is included**

QUESTION 1

a) Heat can cause starch gelatinisation and protein denaturation. Compare and contrast the molecular changes and effects of these two (2) processes. State a specific food in which gelatinisation and protein denaturation have occurred, respectively. **[10]**

b) The picture of the package below is not for a margarine.
Defend this statement. **[10]**



QUESTION 2

a) Discuss what has happened to the piece of chicken shown in Figure 1.
Include the causes and the effects on quality and on safety. **[10]**

b) Justify what has occurred at the molecular level in the thawing tomato depicted in Figure 2. **[10]**

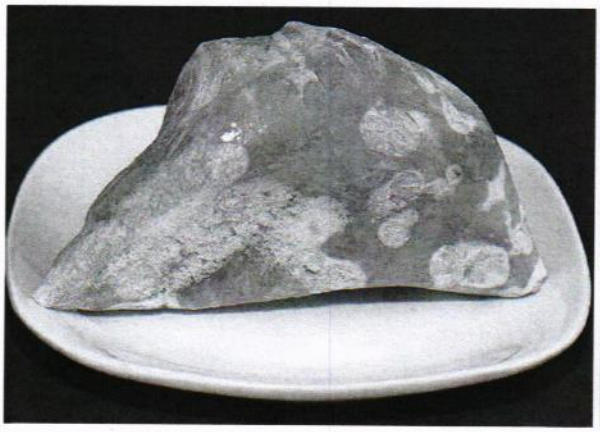


Figure 1: Frozen raw chicken piece



Figure 2: Thawing tomato

QUESTION 3

SUBMIT THIS PAGE

Name: **Student number:**

Assess the following statements/phrases and relate each, by circling, to the most appropriate word in the word search box: **[10]**

a) An enzyme that hydrolyses alpha-1,6 glucosidic bonds

b) The process of breaking starch molecules into their monosaccharide components

c) A compound commonly found in legumes that can cause flatulence in human beings

d) An enzyme that breaks down starch into glucose, playing a crucial role in digestion and various industrial processes like food and beverage production

e) The process of dispersion of the highly viscous gelatinised starch granules and their partial random enzymatic hydrolysis of alpha-1,4 glucosidic bonds

f) Sugar-alcohols

g) Provision of heat energy to the system

h) A group of highly branched heteropolymers made of α-L-Arabinose and β-D-xylose, β-D-mannose, α-D-galactose and β-D-glucose sugars and α-D-4-O-methyl-D-glucuronic, α-D-galacturonic and α-D-glucuronic with small presence of other sugars like α-α-L-fucose and L-rhamnose.

i) One of the five basic taste sensations that is usually pleasing to the taste and typically induced by sugars

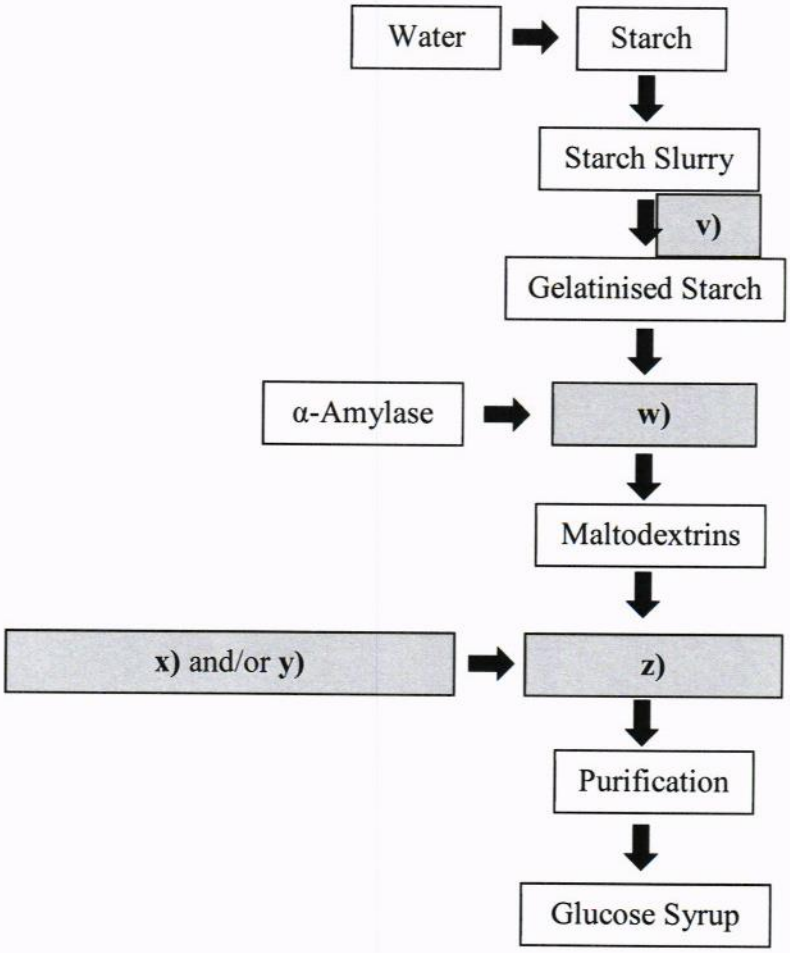
j) An edible subterranean fungus

Q	Z	W	C	N	P	Q	H	V	O	K	P	X	B	I	N	D	M	I	F	U	C	X
K	L	L	B	O	M	T	E	Q	T	G	U	P	L	N	S	H	W	J	M	U	Z	Y
Q	M	I	T	I	O	R	M	D	R	N	L	W	Z	Z	S	C	G	X	D	P	B	Y
U	R	Q	Y	T	H	U	I	D	D	Q	L	R	Q	R	R	Q	F	O	Y	O	J	X
M	V	U	K	A	E	F	C	L	R	D	U	W	A	X	T	S	H	U	G	V	P	Q
G	L	E	X	C	J	F	E	J	Z	C	L	L	S	F	B	T	F	Y	F	Z	F	H
P	T	F	Y	I	N	L	L	Q	P	Q	A	H	O	C	F	E	A	D	V	H	L	Z
T	C	A	K	F	Y	E	L	Y	T	W	N	I	M	J	H	I	W	M	N	E	I	V
O	A	C	F	I	C	L	U	I	R	I	A	I	V	N	X	R	N	Y	Q	A	C	N
S	N	T	V	R	C	E	L	V	H	F	S	S	X	E	D	I	D	O	F	T	M	N
X	W	I	T	A	A	E	O	R	S	M	E	J	I	H	U	K	J	O	S	Z	Y	V
B	U	O	L	H	R	T	S	Q	G	L	U	C	O	A	M	Y	L	A	S	E	P	I
Y	M	N	Q	C	A	U	E	W	M	V	N	A	D	X	K	U	E	T	H	S	R	P
R	P	H	F	C	Q	W	S	J	Z	Y	V	Q	C	O	S	L	O	Y	L	O	P	Y
P	Z	A	W	A	K	K	T	E	E	W	S	D	O	K	K	C	P	U	O	A	C	D
N	O	K	D	S	W	E	E	Z	F	C	F	Z	X	P	W	C	N	W	N	X	B	S

Words are hidden ↑ ↓ → ← and ↘ .

QUESTION 4

Based on Question 3 or your knowledge, select five (5) of the words that best fit (v) to (z) in the glucose syrup production process shown below: **[20]**



QUESTION 5

a) Match (one to one) with the correct answer in the following table: **[2]**

i) Essential amino acid	A.	Water binding
ii) Enzyme used in juice making	B.	Lysine
iii) Enzyme responsible for browning in bananas	C.	Amylase
	D.	Pectinase
iv) A functional role of food proteins in food systems	E.	Phenolase
	F.	Alanine

b) State the principle on which meat tenderisers work. **[5]**

c) Discuss the role of amylases in beer brewing. **[7]**

d) State the solubility of the following based on Osborne classification: **[4]**

i) Albumins

ii) Globulins

iii) Prolamins

iv) Glutelins

e) Discuss the quality of mushrooms' proteins. **[10]**

See Question 6 on the next page

QUESTION 6

Mr Eudes evaluated the steps in the preparation of 0.1 M NaOH solution that was required in the analysis of Free Fatty Acids in Extra Virgin Olive Oil. He found that there were material mistakes in the steps of **both** groups.

a) Verify that Mr Eudes is correct by identifying the mistakes in the steps of Groups A and B. For each mistake, offer the solution. **[8]**

b) Formulate the correct steps for the preparation of 500 mL of 0.1 M NaOH solution. **[14]**

Group A	Group B
To prepare 500 mL of 0.1 M NaOH solution, you will need to dissolve a specific amount of sodium hydroxide (NaOH) in water. Therefore, you should follow these steps: **1)** For NaOH, the molar mass is 23.99 g/mol (Na) + 15.999 g/mol (O) + 1.008 g/mol (H) = 39.997 g/mol (rounded to 2 decimal places). **2)** Calculate the amount of NaOH needed using the formula: mass = Molarity × Volume × Molar mass **3)** Plug in the values: mass = 0.1 mol/L × 0.5 L × 39.997 g/mol = 1.99985 g (rounded to 2 decimal places). **4)** Measure out 2.00 g of solid NaOH using an analytical balance. **5)** Dissolve the 2.00 g of NaOH in approximately 400 mL of distilled water in a 500 mL volumetric flask. **6)** Once the NaOH is completely dissolved, add more distilled water to the flask until the total volume reaches the 0.5 mL mark. **7)** Stopper the flask and mix the solution thoroughly. Now you have prepared 500 mL of 0.1 M NaOH solution.	To prepare 500 mL of 0.1 M NaOH solution, you will need to dissolve a specific amount of sodium hydroxide (NaOH) in water. Therefore, you should follow these steps: **1)** For NaOH, the molar mass is 22.99 g/mol (Na) + 15.999 g/mol (O) + 1.008 g/mol (H) = 39.997 g/mol (rounded to 2 decimal places). **2)** Calculate the amount of NaOH needed using the formula: mass = Molarity × Volume × Molar mass **3)** Plug in the values: mass = 0.1 mol/L × 500 mL × 39.997 g/mol = 1.99985 g (rounded to 2 decimal places). **4)** Measure out 2.00 g of solid NaOH using an analytical balance. **5)** Dissolve the 2.00 g of NaOH in approximately 400 mL of distilled water in a 500 mL beaker. **6)** Once the NaOH is completely dissolved, add more distilled water to the flask until the total volume reaches the 500 mL mark. **7)** Stopper the flask and mix the solution thoroughly. Now you have prepared 500 mL of 0.1 M NaOH solution.

Periodic Table of the Elements

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37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.29
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