

THE UNIVERSITY OF ZAMBIA

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SCHOOL OF AGRICULTURE - 2022

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THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
2022 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

JUNE 2022

AEN 4131 FARM STRUCTURES

TIME: THREE (3) HOURS

INSTRUCTIONS:

1. ANSWER FIVE QUESTIONS (THREE (3) FROM SECTION A AND TWO(2) FROM SECTION B).
2. SECTION A AND B SHOULD BE ANSWERED IN SEPARATE BOOKLETS

INFORMATION

1. THIS EXAMINATION PAPER CONTAINS SEVEN (7) QUESTIONS.
 2. ALL QUESTIONS CARRY 20 MARKS.
 3. THE MARKS FOR EACH QUESTION ARE GIVEN IN BRACKETS
-

SECTION A

QUESTION 1

- (i) List any FOUR factors that are considered when building a farmhouse. [4 Marks]
- (ii) Timber is a common building material used in rural and urban areas. Give FOUR factors that make timber a common building material. [4 Marks]
- (iii) Defects in timber may make it unsuitable for its intended purposes. Name TWO examples of timber defects under each of the following categories:
 - (a) Natural defects [2 Marks]
 - (b) Defects due to poor conversion [2 Marks]
 - (c) Defects due to the poor seasoning of sawn timber [2 Marks]
- (iv) There are three major methods of seasoning timber. Name any TWO timber seasoning methods. For each method, give ONE advantage and ONE disadvantage. [6 Marks]

QUESTION 2

- (i) With the aid of sketches define the following:
 - (a) Cantilever beam [2 Marks]
 - (b) Continuous beam [2 Marks]
- (ii) The 6 m long beam shown in Fig. Q2. has a pin support at A and a smooth (roller) support at B.

- (a) Determine the reaction forces at the supports A and B. [4 Marks]
- (b) Showing your calculations, draw the shear force diagram (SFD) and bending moment diagram (BMD) for the beam. [10 Marks]
- (c) Give the value of the maximum shear force and state its location. [1 Marks]
- (d) Give the value of the maximum bending moment and state its location. [1 Marks]

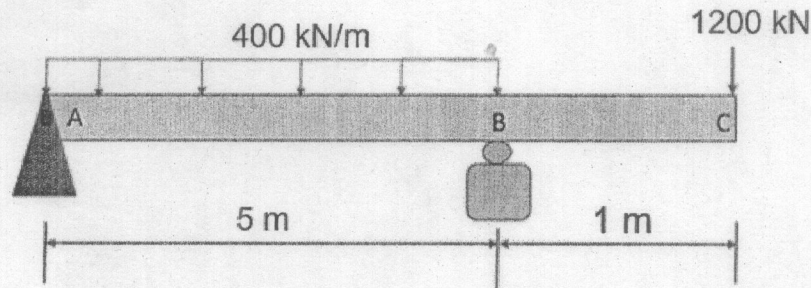


Fig. Q2.

QUESTION 3

- (i) Methods for concrete compaction are associated with its workability.
- (a) Name one major factor that affects the workability of concrete. [2 Marks]
- (b) Name the simple test used to estimate the workability of concrete. [2 Marks]
- (ii) Provided is information about the concrete mix for the work you are supervising as an agricultural building specialist:
- Nominal mix: 1:3:5 (cement : sand : stone)
 - Number of 50 kg bags of cement added: 20
 - Volume of water added: 620 litres
 - Moisture content of sand: 4%
 - Moisture content of stones: 1.5%
 - Bulk density of the sand: 1400 kg/m^3
 - Bulk density of the stones: 1600 kg/m^3
 - Density of water: 1000 kg/m^3

Leaving your answers to **1 decimal place**, calculate:

- (a) The weight of the aggregates. [4 Marks]
- (b) The total weight of water in the mix. [4 Marks]
- (c) The water cement ratio [4 Marks]
- (d) The estimated compressive strength of the concrete using Fig. Q3. [4 Marks]

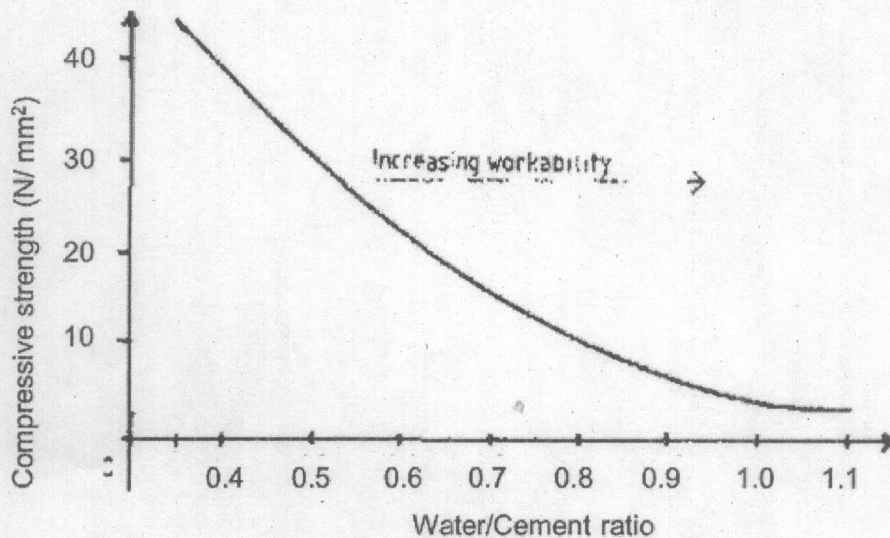


Fig. Q3.

QUESTION 4

- (a) Other than dust, odours, and disease agents, list FOUR factors that affect the quality of the environment in the agricultural building. [4 Marks]
- (b) One mechanism of controlling the environment in agricultural buildings is through ventilation. Give any THREE ways by which ventilation helps to improve the environment in these buildings. [4 Marks]
- (c) Most air enters a farrowing house at 10°C and 60% relative humidity. The fresh air replaces fouled air removed from the house using an exhaust fan. Suppose the exhaust air is leaving the house at a rate of 2 m³/s, the temperature of 25°C and relative humidity of 70%. Assuming the only source of heat were the sows and piglets, the sources of moisture were sows, piglets, feed, pig dung, and water from the drinking points. Using the Psychrometric chart provided (Fig Q4):
 - (i) How much sensible heat from the sows and piglets was added to the air per hour? [4 Marks]
 - (ii) How much latent heat was added to the air per hour? [4 Marks]
 - (iii) How much moisture was added to the air per hour? [4 Marks]

SECTION B

QUESTION 5

A farmer intends to invest in a pig production unit with 100 sows and will practice an eight (8) week weaning period. Each pen should always be occupied except for one week for cleaning and sanitation. The farmer will also practice single-stage finishing of pigs from 12 weeks to 27 weeks. The following periods must also be considered:

Average weaning to conception period of 20 days;

A gestation period of 114 days;

A period of rearing of weaners of 28 days;

Sows are brought to farrowing pens one week before farrowing; and

An extra period of 21 days for the last pig to reach marketable weight.

If ten (10) piglets survive per litter, *determine*:

- (a) the number of farrowing's per year. [4 Marks]
- (b) the number of farrowing pens. [5 Marks]
- (c) the number of servicing/gestation pens. [5 Marks]
- (d) the number of growing/finishing pens assuming each litter occupies one pen. [6 Marks]

QUESTION 6

- a) Write short notes on the following factors affecting the design of a Rural Settlement
 - (i) Cultural practices [2 Marks]
 - (ii) Climate [2 Marks]
 - (iii) Economic activities [2 Marks]
 - (iv) Local materials and labour [2 Marks]
 - (v) Legislation [2 Marks]
- b) Zone planning is a valuable tool when planning a new farmstead. Using the sketch shown in Figure 6:
 - (i) Identify the various zones numbered I to IV [2 Marks]
 - (ii) Describe the facilities that may be found in each of the areas numbered 1 to 5. [8 Marks]

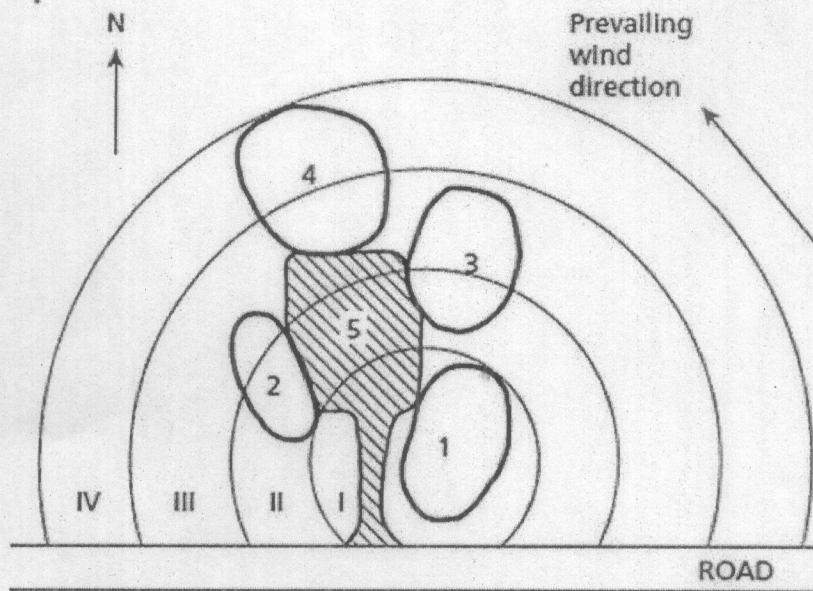


Figure 6. Zone planning for a Farmstead

QUESTION 7

- (a) Briefly discuss the following types of Rural Settlements:
- (i) Clustered Rural Settlements. [5 Marks]
 - (ii) Dispersed Rural Settlements. [5 Marks]
- (b) Outline any **five (5)** factors to consider when undertaking site selection for various buildings on a Farmstead. [10 Marks]

*****END OF EXAMINATION*****

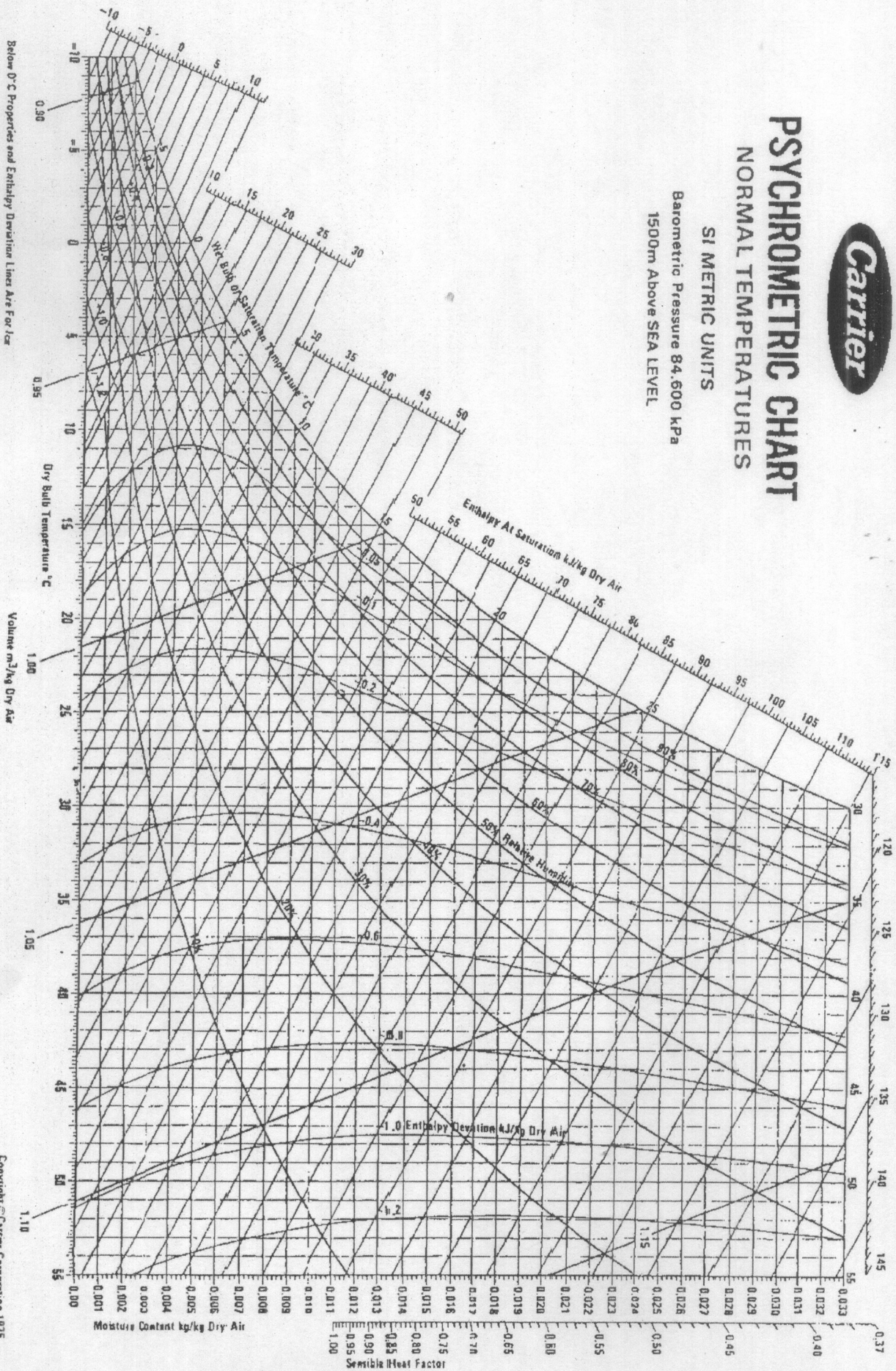


PSYCHROMETRIC CHART

NORMAL TEMPERATURES

SI METRIC UNITS

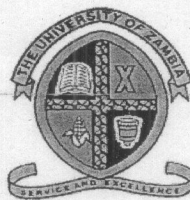
Barometric Pressure 84.600 kPa
1500m Above SEA LEVEL



Below 0°C Properties and Enthalpy Deviation Lines Are For Ice

Volume m³/kg Dry Air

Fig. Q4



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

AGA 3335: PRINCIPLES OF ANIMAL PRODUCTION
FINAL EXAMINATION - JUNE 2022

INSTRUCTIONS:

- ANSWER ANY OTHER FIVE QUESTIONS
- ANSWER EACH SECTION IN A SEPARATE EXAMINATION ANSWER BOOK
- CLEARLY WRITE THE NUMBER OF EACH ATTEMPTED QUESTION
- START EACH QUESTION ON A NEW PAGE
- ALL QUESTIONS CARRY EQUAL MARKS (20 MARKS).

SECTION A

QUESTION ONE

- (a) Chick production output from the hatchery is affected by factors that affect fertility of the eggs supplied by the breeder farm. Discuss at least four factors associated with a breeding flock at the Breeder farm that may affect fertility of the eggs (8 Mark
- (b) With three reasons each, explain the importance of importance of the following when managing poultry;
- (i) Giving electrolytes to day-old chicks immediately they arrive in the brooder house (3 Mark
 - (ii) Debeaking chicks/pullets before commencement of laying (3 Mark
 - (iii) Egg candling (3 Mark
 - (iv) Culling (3 Mark

QUESTION TWO

A farmer intends to rear 300 'Ross 308' broiler chickens. Attached is the nutritional management guide for the strain of broilers. As the extension officer for the area, assist the farmer on the following;

- (i) The total area required in the broiler house needed if the maximum stocking density is 12 birds/m² (2 Mark
- (ii) The radius and circumference of the brooder ring required during the first and second week of brooding (8 Mark
- (iii) If it is assumed that the birds reached 2760g live weight at 42 days of age, mortality rate was 4% in the flock by 42 days of age, the price of broilers in the area is at K34.92/kg live weight, the price of starter, grower, and finisher feeds costed K8.60, K8.20, and K8.18 per Kg respectively, and the total cost of vaccines, electricity/charcoal, electrolytes and labour was K1200, what would be the total production cost for each chicken sold for this flock? (10 Mar

QUESTION THREE

A farmer who has 1800 'Lohmnan Brown' layers was able to collect 1190, 1199, 1203, 1250, 1187, 1298, and 1278 eggs on Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday and Monday, respectively. The average daily feed consumption by the birds on these days were 147, 149, 146, 147, 148, 149 and 148g/day/bird. The market price for the eggs was K57 per tray, and layers mash costed K7.1 per Kg

- (i) Calculate the Average HDEP% for the week
- (ii) Attached shows the weights obtained when the farmer weighed the sampled layers. What is the uniformity of this flock?
- (iii) If all eggs were sold, what would be the gross profit per tray, assuming other costs were negligible?

(4 Marks)

(6 Marks)

(10 Marks)

SECTION B

QUESTION FOUR

With regard to livestock;

- a. Describe the main body cavities
- b. State the types and role of the cells associated with bones
- c. Use shape as a basis to describe the types of bones
- d. What do the abomasum and proventriculus have in common?
- e. State three mechanisms by which testicular temperature is regulated

[6 Marks]

[4 Marks]

[5 Marks]

[2 Marks]

[3 Marks]

QUESTION FIVE

With regard to domestic animals

- a. Use a well-illustrated diagram to discuss hormone synthesis and secretion in male animals
- b. What are the adaptations associated with the respiratory tract?
- c. State the components of the oviduct in birds
- d. Use structure as a basis to briefly discuss the types and role of muscles

[6 Marks]

[4 Marks]

[4 Marks]

[6 Marks]

QUESTION SIX

With respect to domestic animals

- a. How is ventilation in birds different or similar to that found in cattle?
- b. Draw and clearly label the parts of the female reproductive system
- c. What is the function of microorganisms found in the large intestine?
- d. Discuss the different types of respiration.

[3 Marks]

[10 Marks]

[3 Marks]

[4 Marks]

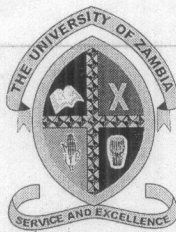
GOOD LUCK

BONNE CHANCE

Performance Objectives - Metric

AS HATCHED						
Age days	Weight for Age (g)	Daily Gain (g)	Average Daily Gain (g)	Cumulative Feed Conversion	Daily Feed Consumption (g)	Cumulative Feed Consumption (g)
0	42					
1	63					
2	74					
3	90					
4	109					
5	134					
6	163					
7	193	30	28	0.76		145
8	228	36	29	0.80	37	182
9	269	41	30	0.84	43	225
10	313	44	31	0.88	50	275
11	362	48	33	0.92	57	331
12	414	52	34	0.95	64	395
13	469	55	36	1.00	72	467
14	528	59	38	1.03	74	541
15	589	62	39	1.05	78	619
16	654	65	41	1.08	85	704
17	722	68	42	1.10	91	795
18	792	70	44	1.13	103	898
19	865	73	46	1.16	110	1007
20	941	75	47	1.19	114	1121
21	1018	78	48	1.22	118	1239
22	1098	80	50	1.24	123	1362
23	1180	82	51	1.26	128	1489
24	1264	84	53	1.28	133	1622
25	1349	85	54	1.30	137	1759
26	1436	87	55	1.33	144	1903
27	1525	89	56	1.35	150	2054
28	1615	90	58	1.37	156	2209
29	1706	91	59	1.39	160	2369
30	1798	92	60	1.41	164	2533
31	1892	93	61	1.43	167	2700
32	1986	94	62	1.45	170	2870
33	2081	95	63	1.46	174	3043
34	2177	96	64	1.48	177	3220
35	2273	96	65	1.50	179	3399
36	2369	97	66	1.51	182	3581
37	2466	97	67	1.53	186	3767
38	2563	97	67	1.54	190	3958
39	2661	97	68	1.56	193	4151
40	2758	97	69	1.58	197	4348
41	2855	97	70	1.59	203	4552
42	2952	97	70	1.61	208	4760
43	3049	97	71	1.63	213	4973
44	3145	96	71	1.65	218	5191
45	3240	95	72	1.67	224	5414
46	3335	95	73	1.69	228	5642
47	3430	95	73	1.71	231	5873
48	3524	94	73	1.73	236	6109
49	3617	93	74	1.76	241	6349
50	3707	91	74	1.78	243	6592
51	3797	90	74	1.80	244	6835
52	3885	88	75	1.82	245	7080
53	3973	87	75	1.84	247	7326
54	4059	86	75	1.87	247	7573
55	4144	85	75	1.89	246	7819
56	4227	83	75	1.91	245	8063
57	4309	82	76	1.93	243	8306
58	4389	80	76	1.95	241	8547
59	4466	77	76	1.97	239	8786
60	4542	76	76	1.99	237	9022
61	4616	74	76	2.01	234	9256
62	4688	73	76	2.02	232	9488
63	4759	70	76	2.04	228	9716

Weight (g)	No. of Birds
850	
900	
950	
1000	X
1050	XX
1100	XXX
1150	XXXXX
1200	XXXXXX
1250	XX XXXXX
1300	XXXXXXXXX
1350	XXXXXXXXXX
1400	XXXXXXXXX
1450	XXXXXXXXX
1500	XXXXXXXXX
1550	XXXXXX
1600	XXXXXX
1650	XXXXXX
1700	XXXX
1750	X
1800	
1850	
1900	
1950	
2000	
2050	
2100	



THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST HALF EXAMINATIONS – JUNE 2022

AGA 4311 - Principles of Genetics

Time allowed: Three (3) hours

Marks: 100

INSTRUCTIONS TO CANDIDATES:

- a. Answer any **five (5)** questions.
 - b. All Questions carry equal marks (20).
-

Q. 1 a. In *Drosophila melanogaster*, a fly that is a triple recessive for three sex-linked genes; ruby, vermillion eye and cut bristles (rb, vr and cb) is crossed with a wild type fly. The F₁ heterozygous daughters are crossed to the triple recessive males. The offsprings fall into the following eight classes:

+	+	+	729
rb	vr	cb	701
+	vr	+	151
rb	+	+	138
rb	+	cb	129
+	vr	cb	122
+	+	cb	17
rb	vr	+	13

- i. Are these genes linked? Justify your answer.
- ii. What is the correct order of the genes?
- iii. What is the map distance between the genes?
- iv. Calculate the coefficient of coincidence.
- v. Calculate the Degree of Interference.

(10 marks)

b. With the aid of clear examples, state the Laws of Inheritance.

(10 marks)

Q. 2 With the aid of clear examples, write notes on the following:

- a. A test cross and its use; **(5 marks)**
- b. Sex determination and linkage; **(5 marks)**
- c. Multiple alleles and Co-dominance; **(5 marks)**
- d. Duplicate Gene Action as opposed to Complementary Gene Action. **(5 marks)**

Q. 3 a. Explain the sequence of events that take place during Prophase I of Meiosis and indicate their genetic consequences.

(10 marks)

b. Given that the genes R, S and T are linkage group with 15% recombination between R and S, and 25% recombination between S and T; and that the Coefficient of Coincidence is 0.6, what are the expected frequency of phenotypes from a test cross whose progeny are 1000?

(10 marks)

Q. 4 a. Answer the following ten (10) multiple choice answer questions:

- i.** How many nucleotides are in 12 mRNA codons?
 - a. 12
 - b. 24
 - c. 36
 - d. 48
- ii.** Which of the following most accurately describes the central dogma of molecular biology?
 - a. Protein to RNA to DNA
 - b. RNA to protein to DNA
 - c. DNA to protein to RNA
 - d. DNA to RNA to protein
- iii.** If a DNA coding strand has the following sequence (5' ACTGTTAC 3'), which of the following is the sequence of the DNA template strand?
 - a. ACUGUUAC
 - b. ACTGTTAC
 - c. TGACAATG
 - d. TGUCUUTG
- iv.** Which of the following does not take part in gene expression?
 - a. Replication
 - b. Transcription
 - c. RNA processing
 - d. Translation
- v.** If a DNA sequence is mutated from AGCTAA to AGCCTAA, what kind of mutation has occurred?
 - a. Deletion
 - b. Substitution
 - c. Point mutation
 - d. Insertion
- vi.** Which of the following is a change in the sequence that leads to the formation of a stop codon?
 - a. Missense mutation
 - b. Nonsense mutation
 - c. Silent mutation
 - d. Deletion mutation

- vii. A DNA molecule can have any of the following but.....
 - a. Deoxyribose sugar
 - b. Deoxythymidine
 - c. Phosphate group
 - d. Cytidine
- viii. Given the DNA antisense strand codon 3' TAC 5', the anticodon that pairs with the corresponding mRNA codon could be.....
 - a. 3' CAT 5'
 - b. 5' AUG 3'
 - c. 3' UAC 5'
 - d. 5' GUA 3'
- ix. Alkyl groups as chemical mutagenic agents bind to.....
 - a. Adenine
 - b. Guanine
 - c. Thymine
 - d. Cytosine
- x. What is the enzyme used during transcription?
 - a. RNA Polymerase III
 - b. DNA Polymerase III
 - c. DNA Polymerase
 - d. RNA Polymerase

(10 marks)

Q. 4 b. Answer each of the following statements as either true (T) or false (F).

- i. There are 64 codons, 3 of which terminate transcription.
- ii. DNA ligase Splits double-stranded DNA open.
- iii. The coding strand of DNA is transcribed into mRNA.
- iv. All DNA in every organism's genome specifies the amino acid sequences of proteins.
- v. All non-coding DNA sections of the DNA are introns.
- vi. Pyrimidines are smaller than purines.
- vii. The 5' end of the coding segment in mRNA is translated first on a ribosome.
- viii. All DNA polymerases can only extend polynucleotide chains; they cannot initiate new chains.
- ix. During DNA replication, the leading strand is synthesized from the 5' end toward the 3' end, whereas the lagging strand is synthesized from 3' toward 5'.
- x. A transition point mutation involves the substitution of a purine for a pyrimidine or vice versa.

(10 marks)

Q. 5 Given a single strand of DNA is,

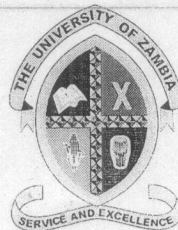
3' TACCTAGAATGTGATGCGCAACGGACCGAGATC 5'

- i. Construct a 5' to 3' complementary (to the provided strand) DNA strand
(2 marks)
- ii. Construct an mRNA chain (mRNA transcript) that would be made from the formed DNA molecule (Note that mRNA transcript is made from 3' to 5' DNA strand)
(2 marks)
- iii. What is the amino acid sequence coded by the formed mRNA sequence?
(3 marks)
- iv. How many different mRNAs could specify the amino acid sequence "met-phe-ser-pro-lue"?
(3 marks)
- v. What is the ratio of G to C in the two strands (both 3' to 5' and 5' to 3' strands) of the constructed DNA molecule
(2 marks)
- vi. State one major difference between the following;
 - a. Purines and Pyrimidines (2 marks)
 - b. Nucleoside and Nucleotide (2 marks)
 - c. Ribose Sugar and Deoxyribose sugar (2 marks)
 - d. Introns and exons (2 marks)

Q. 6 a. Write notes on the following:

- i. Explain how the concepts of mutation and migration would offset the law of Hardy-Weinberg equilibrium in a large random-mating population.
(5 marks)
- ii. Define gene frequencies and genotype frequencies and explain why they are important in the study of population genetics. (5 marks)
- iii. As a geneticist, would you say the goal of selection is to increase favorable genes? Briefly explain your views. (5 marks)
- iv. Describe assortative and disassortative mating. How does disassortative mating affect the frequency of heterozygotes in a population?
(5 marks)

End of Examination



THE UNIVERSITY OF ZAMBIA
THE SCHOOL OF AGRICULTURAL SCIENCES

UNIVERSITY FIRST HALF EXAMINATIONS – JUNE 2022

COURSE AGA 4511 – Beef, Sheep and Goat Production

Time allowed: Three (3) hours only

Marks: 100

INSTRUCTIONS TO CANDIDATES:

- i. Answer any **five (5)** questions.
 - ii. All Questions carry equal marks (20).
-

SECTION A – BEEF PRODUCTION

Q. 1 a. Define the following terms used in beef production:

- i. Bull
- ii. Heifer
- iii. Sire
- iv. cow
- v. In-calf
- vi. Dam

(6 marks)

b. Outline the characteristics of local tropical breeds of cattle that make them more adapted to the local environment compared to the exotic European breeds.

(14 marks)

Q. 2 Zambia's ability to capture the potential economic benefits of expanded beef industry is constrained by gaps in productivity and price competitiveness. The beef industry in Zambia has great potential to becoming a major foreign exchange contributor to the national treasury.

a. Give reasons why the beef industry has great potential for growth in Zambia.

(10 marks)

b. What would it take for the industry to achieve this potential?

(10 marks)

Q.3 In beef production, it is important to always remember that a Bull is half the herd.

a. Explain the meaning of this statement.

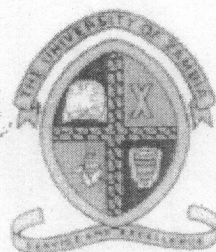
(6 Marks)

- b. What the important factors to consider when selecting a breeding bull?
(8 marks)
- c. When is the best time to first serve heifer and why at this time?
(6 Marks)

SECTION B – SHEEP AND GOAT PRODUCTION

- Q. 4 A farmer group comprising of traditional, extensive and intensive producers in Katete District of the Eastern Province has been convinced to start sheep and goat enterprises in order to meet the high demand for mutton and chevon in the District; in Zambia and for possible export to neighbouring countries. As a sheep and goat expert, prepare detailed notes for a presentation to the farmer group on the sheep and goat breeding seasons used in Zambia.
(20 marks)
- Q. 5 Explain the following in detail to the farmer group comprising of traditional, extensive and intensive producers in Katete District of the Eastern Province:
- i. The causes, symptoms, treatment and prevention of mange in sheep and goats.
(10 marks)
 - ii. Any five (5) constraints associated with sheep and goat production in Zambia;
(10 marks)
- Q. 6 Having been recently appointed as the Farm Manager of an intensive sheep and goat enterprise at UNZA's Liempe Farm, the Vice Chancellor has learned that one of the routine management practices in sheep and goat production is to wean lambs and kids at 5 months of age, explain in detail to the Vice Chancellor any other ten (10) routine management practices that you intend to put in place to ensure that the sheep and goat enterprise operates profitably.
(20 marks)

End of Examination



THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST HALF EXAMINATIONS – JUNE 2022

AGA 4531
INTRODUCTION TO AQUACULTURE

DURATION: 3 HOURS

24/06/2022(am)

INSTRUCTIONS:

- 1) There are two sections in this paper, Section A and Section B.
- 2) Section A has TWO (2) questions. **Answer all questions in this section.**
- 3) Section B has four (4) questions, **answer any three (3) questions in this section.**
- 4) Start answering each question on a separate page.
- 5) Make sure to write your computer number on each page of your answer sheet.

SECTION A (Answer all questions in this section)

1. Explain the following terms as applied in the course Introduction to Aquaculture: **[20 marks in total]**
- | | |
|-----------------------------------|----------|
| a. Swim bladder | [2 mark] |
| b. Alkalinity | [2 mark] |
| c. Mariculture | [2 mark] |
| d. Taxonomy | [2 mark] |
| e. Dioecious | [2 mark] |
| f. Catadromous migration | [2 mark] |
| g. Raceway | [2 mark] |
| h. Biological Oxygen Demand (BOD) | [2 mark] |
| i. Poikilothermic | [2 mark] |
| j. Oviparous | [2 mark] |

2. Culture water determines the success or failure of an aquaculture enterprise to a great extent. This is because fish are totally dependent on water to breathe, feed and grow, excrete wastes, maintain a salt balance, and reproduce. Answer the following: **[20 marks in total]**
- a) Define and discuss any six (6) water quality parameters that affect the growth of fish in a pond. (12 marks)
- b) For each of the parameter discussed in (a), what is the desirable/optimum range required by Tilapia. (6 marks)
- c) Name an instrument that can be used to check the turbidity of pond water. (2 marks)

SECTION B (Choose any THREE (3) questions)

3. As a student who has completed the Introduction to Aquaculture course, you have been invited by an NGO to educate some rural farmers who plan on venturing into fish farming. Discuss the procedures (steps) to follow in construction of an earthen pond. **[20 marks in total]**

4. Mr. Phiri is a fish farmer who wishes to understand the different concepts regarding the aquatic environment. Answer the following: **[20 marks in total]**

- a) Explain to him the characteristics of an aquatic ecosystem and what it comprises of. (10 marks)
- b) Discuss the types of fish migration on the basis of needs. (10 marks)

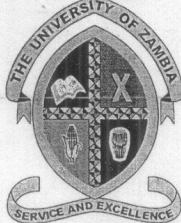
5. Fish biology is important in understanding how best to maximize growth of fish. Answer the following questions: **[20 marks in total]**

- a) Explain how the process of gaseous exchange is achieved in fish. (6 marks)
- b) What are the four (4) sensory organs that are prominent in fish? (4 marks)
- c) Omnivorous fish eat a mixture of various natural foods, although most of them have preferences for certain foods. Give an example of fish which has preference for each of the following:

- | | |
|----------------------|----------|
| i. Zooplankton | [2 mark] |
| ii. bottom fauna | [2 mark] |
| iii. bottom detritus | [2 mark] |
| iv. phytoplankton | [2 mark] |
| v. fruits and seeds | [2 mark] |

6. Discuss the digestive and circulatory system of important culturable fish species. **[20 marks in total]**

**END OF EXAMINATION
GOOD LUCK!**



THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST HALF EXAMINATIONS - JUNE 2022

AGA 5121 – Advances in Animal Nutrition

Time allowed: Three (3) Hours

Marks: 100

INSTRUCTIONS TO CANDIDATES:

- a. Answer any **five (5)** questions.
b. All Questions carry equal marks (20).

SECTION A (RUMINANT NUTRITION):

- Q. 1.** The Farm Manager at the Liempe University Farm would like to compound a feedlot ration for 204 beef steers by making use of on-farm readily available feed ingredients in order to reduce the costs of production. Formulate a dry season feedlot ration for the 304 beef steers by using the Double Pearson Square method. The feedlot ration must contain 13.5% DCP and 75% TDN and must include 10% Rhodes Grass/Silver-leaf Hay mixture, 8% Soyabean Straw, 5% Maize Bran, 2% Sugarcane Molasses, 2% Di-calcium Phosphate, 2% Mineral Premix and 1% Salt, on dry matter basis. The analysis of feed ingredients were analyzed by the University Department of Animal Science Laboratory.

FEED	DM%	DCP%	TDN%	Ca	P
Rhodes/Silver Leaf Hay	92	22.5	58	1.90	0.20
Maize Bran	90	12.5	70	0.07	1.62
Molasses	75	-	85	1.19	0.11
Soyabean Straw	88	25.0	65	0.69	0.06
Di-Calcium Phosphate	-	-	-	26.0	18.00
Limestone Flour	-	-	-	38.0	0.04
Salt	-	-	-	-	-

The analyses of other available feed ingredients are indicated below:

FEED	DM%	DCP%	TDN%	Ca	P
Maize Meal	89	10.0	88	0.03	0.31
Groundnut Meal	95	43.0	90	0.18	3.62
Groundnut Haulms	87	12.0	62	0.07	0.17
Lucerne Hay	90	15.0	60	0.27	0.03

(20 marks)

- Q. 2 a.** How much concentrate mixture consisting of 40% Maize Meal, 30% Cottonseed Cake, 20% Cassava Meal and 10% Cane Molasses should be fed to provide sufficient energy to maintain a 520 kg empty Friesian cow that is losing 0.5 kg body weight per day two weeks post-partum yet the cow consumes 25 kg/day maize silage and produces 25 kg/day milk containing 3.8% butterfat (BF) and 8.6% solids-not-fat (SNF) per kg?

The following may be used to answer the question:

	DM (g/kg)	ME (MJ/kg DM)
Maize silages	300	9.0
Maize Meal	870	12.5
Cane Molasses	770	14.0
Cottonseed cake	920	12.5
Cassava meal	870	11.0

(10 marks)

- b. Calculate the expected peak milk yield of the cow in Q. 2 a. above.
(1 mark)
- c. If the Friesian cow in Q. 2 a. above was actually in mid-lactation with no live-weight change in her body weight, how much concentrate mixture should she be fed?
(3 marks)
- d. If the Friesian cow in Q. 2 a. above was actually in late lactation and was gaining 0.5 kg per day, how much concentrate mixture should she be fed?
(3 marks)
- e. Using the Rapid Formulation Method, calculate the forage and concentrate dry matter intake of the Friesian cow in Q. 2 a. above?
(3 marks)

Q. 3 Write notes on the following:

- a. Ruminants, unlike monogastrics, are able to subsist entirely on vegetative or cellulosic materials. Micro-organisms, mainly bacteria and some extent protozoa and fungi, ferment/breakdown ingested cellulosic feed materials to soluble products that ruminants makes use of. Discuss the functions of the micro-organisms that are found in the ruminant digestive system and the benefits enjoyed by the ruminant animal.
(10 Marks)
- b. Urea, just like other NPN compounds, is a very useful compound that is incorporated in ruminant rations. However, urea can be deadly poisonous. Write notes on the causes of poisoning, prevention and treatment of urea poisoning in beef cattle.
(10 Marks)

SECTION B (NON-RUMINANT NUTRITION):

- Q. 4** a. Using a Pearson Square, formulate a Broiler Starter Ration to have 1.2% Lysine using Maize meal, Soya Cake, Limestone, Di-calcium Phosphate (DCP) and a Vitamin and Mineral Pre-mix. The Limestone, DCP and the Premix are fixed at 2.0, 1.0 and 0.5% of the ration, respectively? The nutrient composition of the required ingredients are as tabulated in Table 1 below. What is the protein, energy, calcium and phosphorus content of the formulated diet?

(12 Marks)

Table 1: Nutrient composition of feed ingredients used in the formulation of a layers pullet developer.

Ingredient	Lysine%	Crude Protein %	Energy Kcal/g	Calcium (%)	Phosphorus (%)
Maize	0.26	8.5	3300	0.04	0.3
Barley	0.29	11.0	3400	0.03	0.25
Soya Cake	2.69	44.0	2900	0.40	0.65
Limestone	0	0	0	38	0
DCP	0	0	0	24.0	18.0
Premix	0	0	0	0	0

- b. Using algebraic expressions, formulate a pig grower ration to have 18% Crude Protein using Maize, Barley and Soy Bean Meals. You are advised that the Diet is also supposed to have Di-calcium Phosphate and a Vitamin/Mineral Premix that are fixed at 1.5 and 0.3% of the diet, respectively. If the inclusion of Barley is also fixed at 23.0% of the diet, what are the Energy, Calcium and Phosphorus contents of the diet? Assume that the nutrient composition of the ingredients required for the formulation are as indicated in Table 1 above.

(8 Marks)

- Q. 5 a. Explain the difference between apparent metabolizable energy (AME) and true metabolizable energy (TME) and what are the advantages of using TME over AME?

(10 Marks)

- b. Describe in detail the procedures you may need to undertake in order for you to determine the true metabolizable energy of poultry feedstuffs including the precautions needed for you to have reliable results?

(10 Marks)

- Q. 6 a. Explain why we need to monitor feed intake in farm animals and how does one get to measure feed intake over a given period of time?

(10 Marks)

- b. Explain the importance of blending when processing animal feeds and why should we try to process feeds before giving them to animals?

(10 Marks)

End of Examination

The following may be used to answer the questions:

i. $MI = \frac{EVI \times 1.05}{0.62}$

ii. $Kg = 0.0435 M/D$

iii. $MEP = MER - Mm$

iv. $Mm = 8.3 + 0.091 W$

- v. $FD = \frac{DMI (MC - M/D)}{(MC - MF)}$
- vi. $DMI = 0.025 W + 0.1 Y$
- vii. $Eg = \frac{MEP \times 0.0435 M/D}{1.05}$
- viii. $Eg = MEP \times 0.0414 M/D$
- ix. $DMI = 0.025 W + 0.1 Y - 2.5$
- x. $LWG = \frac{Eg}{6.28 + 0.3 Eg + 0.0188 W}$
- xi. $KI = \frac{0.0435 M/D}{1.05} \text{ or } 0.0414 M/D$
- xii. $EVI = 0.0386 BF + 0.0205 SNF - 0.236$



THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS – JUNE 2022

AGC 5331
WEED SCIENCE

TIME: 3 Hours

Marks: 100

INSTRUCTIONS:

- **ANSWER ALL QUESTIONS IN BOTH SECTIONS**

SECTION A: TRUE OF FALSE

[40 marks]

1. 2,4-D is not a post emergence herbicide
2. Herbicides in the liquid form can only either be water soluble or emulsifiable concentrates.
3. Based on physiological action, herbicides may be inorganic, organic or biological
4. Your field is infested with *Datura stramonium*. You can use Fomesafen to control it
5. Carbamates kill weeds through disruption of mitosis
6. Fluridone kills weeds by impairing pigment synthesis
7. Some herbicides can be applied undiluted to the soil
8. Your field is infested with *Cyperus rotundas*. You can use Fluazifop-p-butyl to control it
9. Foliar applied herbicides kill through uptake by lamina.
10. Being a foliar-applied herbicide, glyphosate will be ineffective if applied 4 hrs before the rain as the rainwater will wash away the herbicide
11. Irrigation after herbicide application always negatively affects the efficacy of the herbicide
12. Calibration of the equipment is essential for proper application only when the herbicide is sprayed.
13. Trifluralin is not a pre-planting herbicide
14. In herbicides labeled G or L or AS, the herbicide is bound to very small particles that are suspended in a water base.
15. Band application is not the best method of applying a pre-emergence herbicide
16. Selective herbicides such as perlagonic acid can be used around the field to keep weeds from seeding but must be kept away from the crop.
17. When a herbicide is applied through spot application post-emergence, it is important that the crop has true tolerance to the herbicide
18. Herbicides cannot control aquatic plants in an environmentally friendly manner
19. Pre-emergence herbicides such as clethodin are applied before the weeds or crops have emerged
20. Diquat exerts its toxic effects at point of contact
21. Band application using a boom-sprayer is a quick way of killing weeds pre-emergence
22. Original dry herbicide formulations were called wettable powders (W or WP).
23. Dalapon exerts its toxic effects at point of contact
24. Systemic herbicides such as propanil move from point of application to other parts of the plant where their toxic effects are manifested.

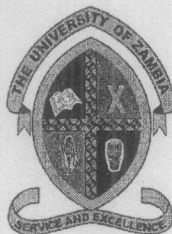
25. Unlike metalochlor, broad-spectrum herbicides will kill all plants
26. Mechanical control of *S. molesta* is best applied when detected is early or small infestations on open water bodies
27. A knapsak sprayer is an important tool for herbicide application and it also needs calibration to improve effectiveness and efficiency during its use
28. A weed declared noxious in one country is likely to be declared noxious in all other countries where it is discovered
29. Herbicides in form of pellets and other dry products can be applied as is or mixed in water
30. *Cyrtobagous salviniae* has been effective in the biological control of some aquatic weeds in some countries
31. Emulsifiable concentrates (E, EC) are products that contain *emulsifiers*, and form temporal oil:water mixtures.
32. *Phytophthora palmivora* is an important biological control agent against *Morrenia odorata*
33. The use of *Puccinia chondrilla* is an important microbial biological control approach as it has led to the control of the notorious brush skeleton weed in wheat.
34. *Echinochloa colonum* can be controlled using glyphosate herbicide, the non-selective contact herbicide
35. *Euphorbia heterophylla* is a perennial weed
36. One of the advantages of using insects to control weeds is that they can be used in locations not easily accessible by humans, such as some parts of wetlands
37. Most herbicides labeled RTU are usually liquid formulations
38. Activator adjuvants only function as stickers, humectants, spreaders or penetrants.
39. In inundative biological control of weeds, an organism is released, reproduces, and disperses on its own in habitats with the target weed
40. Estimates show that in a country such as Zambia, yield losses due to weeds is over 20%

SECTION B

1. Write down the scientific names for the following weeds

[10 marks]

- a. Guinea grass
- b. Oxgrass
- c. Apple of Peru
- d. Black nightshade
- e. Witchweed
- f. Upright starbur
- g. Crowsoot
- h. Yellow nutsedge
- i. Wild oats
- j. Couch grass



THE UNIVERSITY OF ZAMBIA
UNIVERSITY MID-YEAR EXAMINATIONS
2021/22 ACADEMIC YEAR

AGE 3031
INTERMEDIATE MICROECONOMICS

TIME: 3 HRS

MARKS: 100

INSTRUCTIONS:

1. This examination paper has **FIVE (5)** questions. Answer **ALL** questions.
2. Marks for each question are shown in parenthesis. Therefore, allocate your time appropriately.
3. Please be concise when answering the questions and write legibly.
4. Show all your work to earn you partial credit.

1. Mutale views her two internet service providers, MTN and Liquid, as perfect substitutes. Suppose her utility function is represented as follows:

$$u(M, L) = \frac{M}{2} + L$$

where M is the number of gigabytes of MTN internet bundles and L is the number of gigabytes of Liquid internet bundles. Answer the following questions:

- a) Compute and interpret Mutale's marginal utility of MTN bundles. [3 marks]
- b) Compute and interpret Mutale's marginal utility of Liquid bundles. [3 marks]
- c) Compute and interpret Mutale's marginal rate of substituting MTN bundles for liquid bundles. [3 marks]
- d) Suppose Mutale has income (I) which she is willing to completely spend on internet bundles. Derive her Marshallian demands for MTN bundles and Liquid bundles assuming the price of M is P_M and the price of L is P_L . [3 marks]
- e) Now if the price of MTN bundles is K10 per gigabyte, the price of Liquid bundles is K6 per gigabyte and Mutale's income that she is willing to spend on internet bundles is K1000, how many units of bundles will Mutale buy from each internet provider. [8 marks]

2. Consider a consumer with the following Cobb-Douglas utility function:

$$u(X, Y) = \sqrt[3]{X^2 Y}$$

Assuming the price of X is P_X , the price of Y is P_Y and income is M :

- Set up the expenditure minimization problem and derive the Hicksian demand functions for good X and Y . [12 marks]
 - Derive the expenditure function. [4 marks]
 - Derive the indirect utility function using the relationship between the expenditure function and the indirect utility function. [4 marks]
3. Suppose Davis and Shirtliff has the ability to price discriminate between two markets (Lusaka and Kabwe) in terms of selling its booster pumps. The demands in Lusaka (Market 1) and Kabwe (Market 2) are respectively:

$$Q_1 = 10000 - 2P_1$$

$$Q_2 = 15000 - 5P_2$$

Where Q_1 is the quantity of booster pumps demanded in Lusaka, Q_2 is the quantity of booster pumps demanded in Kabwe, P_1 is the price of booster pumps in Lusaka and P_2 is the price of booster pumps in Kabwe.

The firm's total cost function is represented as follows:

$$TC = 1000 + 500Q$$

Where $Q = Q_1 + Q_2$

- Derive the inverse demand for market 1. [2 marks]
 - Derive the inverse demand for market 2 [2 marks]
 - Suppose the firm is able to implement price discrimination, what will be the price of a pump in each market? [10 marks]
 - How much profit will the firm be able to generate from each market if price discrimination is able to work? [6 marks]
4. Suppose a firm has the following Cobb-Douglas production function

$$q = 50\sqrt{LK}$$

- How much output will this firm be able to produce with one additional unit of labour if capital is held constant? [2 marks]
- How much output will this firm be able to produce with one additional unit of capital if labour is held constant? [2 marks]
- Suppose the wage rate is w and the rental rate of capital is r , derive the total cost, marginal cost and average cost functions assuming the firm minimizes costs. [16 marks]

5. Consider a market in which the market demand curve is given by the following function:

$$P = 18 - X - Y$$

Where X is firm 1's output and Y is firm 2's output. Firm 1 has a marginal cost of 3, while Firm 2 has a marginal cost of 6.

- a) Find the Cournot equilibrium outputs in this market. How much profit does each firm make? **[10 marks]**
- b) Find the Stackelberg equilibrium in which Firm 1 acts as the leader. How much profit does each firm make? **[10 marks]**

----- END OF EXAMINATION-----



THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS – JUNE 2022
AGE 3381
RESEARCH METHODOLOGY

TIME: 3 Hours

Marks: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

Question 1

- i. Distinguish between the following terms: *Deductive reasoning* and *Inductive reasoning* [4 Marks]
- ii. Explain the meaning of '*triangulation*' [4 Marks]
- iii. The survey is a popular research design strategy in agricultural economics research [12 Marks].
 - a. Define the term 'survey' (1 Mark)
 - b. When is it appropriate to use a survey (3 Marks)
 - c. Mention *three (3)* data collection tools that can be used in a survey (3 Marks)
 - d. Highlight *five (5)* advantages of a survey (5 Marks)

Question 2

- i. Outline the advice you would give colleagues who are in the process of developing their research proposals on how they should write/structure their problem statement [14 Marks].
- ii. Differentiate between a *Null hypothesis* and *Alternative hypothesis* [6 Marks].

Question 3

One possible source of useful data for research is secondary data [20 Marks].

- i. Highlight the meaning of secondary data and when and how should be used. (4 Marks)
- ii. Outline the advantages and disadvantages of secondary data (10 Marks)
- iii. Briefly discuss three key factors you should consider when evaluating secondary data sources (6 Marks).

Question 4

Distinguish between the following terms [20 Marks]

- i. *Sampling unit* and *Sampling frame* (6 Marks)
- ii. *Non probability* and *Probability Sampling* techniques (14 Marks)

Question 5

The following data shows wheat production, area planted, and yield in Zambia, 2013-2020

Year	Area planted (Ha)	Production (MT)	Yield (MT/Ha)
2013	41,810	273,584	6.50
2014	28,161	201,504	7.20
2015	46,156	309,100	6.70
2016	29,160	221,644	7.60
2017	35,358	279,329	7.50
2018	21,709	171,424	7.90
2019	22,754	151,850	4.72
2020	26,007	191,620	7.32

Source: MoA CFS (2013-2020)

- Which are the variables in this data file? **[4 Marks]**
- Which are the cases or primary units of data in this data file? **[2 Marks]**
- What diagram (s) would you use to emphasize the years with the lowest and highest area planted, production and yield? Give reasons for your choice. **[6 Marks]**
- Which measures of central tendency would you choose to describe the production over the period? Give reasons for your choice. **[4 Marks]**
- Which measures of dispersion would you choose to describe the production over the period and give reasons for your choice? **[4 Marks]**

THE END



THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS – JUNE 2022
AGE 4211

INTRODUCTION TO AGRIBUSINESS MANAGEMENT

TIME: 3 Hours

Marks: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

Question 1

- i. The following is a summary of the condensed financial accounts for Lubinda's horticultural business for the last three years.

Profit and Loss Account for the year ended 31 March	2019 K('000)	2020 K('000)	2021 K('000)
Sales(all on credit)	415	645	885
Less Cost of goods sold:			
Opening stock	35	40	65
Purchases	340	565	805
	<u>375</u>	<u>605</u>	<u>870</u>
Less closing stock	40	65	115
Gross profit	<u>335</u>	<u>540</u>	<u>755</u>
Less expenses	40	50	60
Less Loan interest	-	-	10
Net profit	<u>295</u>	<u>490</u>	<u>685</u>
Balance sheet as at 31 March	2019 K('000)	2020 K('000)	2021 K('000)
Fixed Assets	89	93	101
Current Assets			
Stocks	40	65	115
Trade debtors	52	108	250
Cash at bank	12	6	-
Total Current Assets	<u>104</u>	<u>179</u>	<u>365</u>
Total Assets	<u>193</u>	<u>272</u>	<u>466</u>
Financed by:			
Capital	100	120	146
Add net profit for the year	40	55	60
Less drawings(all on 31 March)	<u>24</u>	<u>35</u>	<u>38</u>
	<u>116</u>	<u>140</u>	<u>168</u>
Loan	-	-	115
Current Liabilities			
Creditors	77	132	178
Bank overdraft	-	-	10
Total Current Liabilities	<u>77</u>	<u>132</u>	<u>188</u>
	<u>193</u>	<u>272</u>	<u>356</u>

Required

- a. Compute the following ratios for 2019, 2020, and 2021 :
- Quick ratio (6 Marks).
 - Gross profit on cost of goods sold (6 Marks).
 - Return on capital employed (6 Marks).

- b. With reference to the ratios above, comment on the profitability and liquidity of Lubinda's horticultural business **(7 Marks)**.
- ii. Mubiana Ltd manufactures Agricultural equipment and machinery. The company has been given an order to produce 2500 valve castings per month. The fixed costs have been estimated to be K10, 000 and the variable costs to be K 15 per casting. Each casting will be sold at K20.

Required

- a. i) Determine the breakeven point for the production of this order **(4 Marks)**.
 ii) What level of profit could be made from this order? **(4 Marks)**.
- b. By investing in a new technology, the scrap rate could be reduced to a reliable level of 2%. However the new technology would increase the fixed costs to K15, 000 but reduce the variable costs to K 12 per casting. Would this investment be worthwhile in profit terms? **(4 Marks)**.

Question 2

- a. Both preference shares and loan capital are forms of finance that require the agribusiness to provide a particular rate of return to investors. What are the factors that may be taken into account by a business when deciding between these two sources of finance? **[15 Marks]**
- b. The first thing that Agribusiness managers must understand about bank borrowing is that the bank desires to make a profit from the transaction while at the same time reducing the risk of the transaction. Therefore, as required by the lending rules, the banker will apply the three C's of lending before finally approving the loan. Specify the *three (3) C's* of lending and describe the significance of each **[6 Marks]**
- c. What is the role of owner's capital (equity) when you want to borrow from the bank borrowing **[2 Marks]**

Question 3

Discuss the factors that influence the choice of the best form of business organization suitable for an agribusiness. Use Sole proprietorship and Corporations as examples, and in the process contrast the two forms of business organization **[25 Marks]**

Question 4

- a. Briefly discuss five major challenges posed to an agribusiness manager by the special nature of agricultural products **[5 Marks]**
- b. What do you understand by effective coordination as a function of a manager? **[5 Marks]**
- c. Outline Maslow's hierarchy of needs and its relevance to management **[5 Marks]**

THE END

THE UNIVERSITY OF ZAMBIA
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION
AGE 4351 BASIC ECONOMETRICS MID YEAR EXAMINATION 2022

INSTRUCTIONS: THERE ARE FOUR QUESTIONS

ANSWER ALL QUESTIONS, 100 MARKS

TIME: THREE (3) HOURS

1. You want to find out how labour (X_1) and capital (X_2) affected copper (Y) production at ZCCM between 2010 and 2013. Using your production economics theory you know that the inputs and outputs are related in a Cobb-Douglas fashion (whose output is given below):

$$Y = -3.338X_1^{1.4988} X_2^{0.4899}$$

R-squared = 0.889, t value for labour coefficient (B_1) = 2.7765, t-value for capital coefficient (B_2) = 4.8005

- With respect to the period under consideration can you interpret what the elasticity of labour demand for ZCCM was? (4 marks)
 - Between labour and capital, which input gave a higher output, explain? (6 marks)
 - Explain what the R-squared entails? (4 marks)
 - Formulate the null hypothesis for testing whether labour significantly affected production. (2 marks)
 - Given the t critical at 95% confidence level of 2.174, test the H_0 formulated in (e) and interpret? (4 marks)
 - Calculate returns to scale and explain whether or not ZCCM experienced constant return to scale during the period under consideration (5 marks)
2. Suppose you want to know the relationship between sales of Kapenta (Y) and advertisement Cost (X), both measured in Zambian Kwacha. You make the following data observations.

X	145	170	195	220	251	273	300	330	350	370
Y	18	24	26	23	30	27	34	35	33	40

- Use the ordinary least squares (OLS) method to estimate the relationship between Kapenta sales (Y) and advertisement costs (X) (10 marks)
- Write down the Kapenta sales, advertisement cost function and interpret it (5 marks)
- Test the null hypothesis that $H_0 : \beta_1 = 0$ at $\alpha = 0.05$ where t-critical = ± 1.96 (5 marks)
- Compute R squared and interpret (5 marks)

3. After estimating the following Mincer equation which links earnings (E) to years of schooling (S) and experience (EX), and gender (G):

$$\ln(E_i) = \beta_0 + \beta_1 S_i + \beta_2 EX_i + \beta_3 EX_i^2 + \beta_4 G_i + \beta_5 G_i S_i + \beta_6 G_i EX_i + e_i$$

You get the following output:

	Estimated coefficient	Standard error	t-statistic
Gender (1 = female, 0 = male)	-0.308	0.142	-2.170
Schooling in years	0.092	0.006	14.260
Gender & Schooling interaction	0.012	0.010	1.220
Experience in years	0.044	0.004	10.710
Experience squared in years	-0.001	0.000	-7.280
Gender & experience interaction	-0.005	0.002	-2.340
Constant	0.760	0.098	7.790

- Do earnings increase with the levels of experience and schooling (*disregard interactions*)? Explain (5 Marks)
- What does the negative coefficient on experience-squared entail? (5 Marks)
- Which variable(s) have no significant effect on earnings? (2 Marks)
- What is the effect of an additional year of experience on earnings on males? (6 Marks)
- Are the earnings of females the same as those for males? Explain (7 Marks)

4. Answer in a clear way, the following questions:

- What is Econometrics? (5 Marks)
- Discuss the three (3) steps involved in Econometric Research (13 Marks)
- What do you understand by the term endogeneity problem in an econometric model (5 Marks)
- What are the consequences of the OLS estimators, if the model has endogeneity problems? (2 Marks)

GOOD LUCK!



THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS -- JUNE 2022
AGE 5251

AGRICULTURAL PROJECT PLANNING AND APPRAISAL

TIME: 3 Hours

Marks: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1. a) Explain why preparation and analysis and evaluation phases of the project cycle are important. (6 marks)
b) Explain briefly three problems that are related to poor project analysis. (6 marks)
c) Discuss and describe, with an illustration, the special case that involves the choice of technologies in which selection of one technology rules out its alternatives realizing the same result. (8 marks)
2. a) Define a shadow price in economic analysis? (4 marks)
b) Why are shadow prices important in economic analysis? (6 marks)
c) Discuss briefly the relationship between shadow prices and opportunity cost (OC) as well as marginal value product (MVP). (10 marks)
3. The following investment outlay, operation and maintenance costs (cash outflows) as well as gross benefits (cash inflows) are given for a coffee production and processing project proposal:

Amounts in ZMW' 000				
Year	Investment Outlay	Operation and maintenance	Production Cost	Gross Benefit
1	350	0	0	0
2	200	0	0	0
3	150	0	0	0
4	100	0	0	0
5	100	0	0	0
6	0	50	60	1010
7	0	50	70	1120
8	0	50	80	1130
9	0	50	90	1240
10	0	50	90	1240

- a) Compute the Net Benefit-Investment (N/K) ratio if the opportunity cost of capital is 30%. On the basis of the N/K you obtain, would you recommend the project as good investment? Explain why? (6 marks)
- b) Compute the Internal Rate of Return (IRR). On the basis of the IRR you obtain and given 30% as the opportunity cost of capital, would you recommend the project as good investment? Explain why? (10 marks)
- c) What advantages do discounted measures of project worth have over undiscounted measures of project worth? (4 marks)

4. The following information is given for a combine harvester to be imported into the country: the c.i.f. price is US\$130,000; the import levy is 5% of the c.i.f. price; the handling and clearing charges amount to ZMW20,000 and the transportation to the project site is ZMW10,000. The official exchange rate (OER) is ZMW17.50 to US\$1 and a foreign exchange premium of 20% is estimated.
- Calculate the economic import parity value at the farm gate or project boundary using the conversion factor approach. (6 marks)
 - Calculate the economic import parity value at the farm gate or project boundary using the shadow exchange rate approach. (6 marks)
 - Why is it important to allow for a foreign exchange premium when calculating the economic import parity value? (4 marks)
 - There are items referred to as “tradable but non-traded” and “indirectly traded items”. Explain what these items are and how to value them when carrying out economic analysis of a project. (4 marks)
5. The foreign exchange component and the domestic currency component of a layers' cages production project are as given in the following table:

Year	Foreign Exchange Component (US\$ '000)			Domestic Currency Component (ZMW '000)	
	Value of Production	Investment Cost	Production Cost	Investment Cost	Production Cost
1	0	100	0	950	0
2	0	140	0	900	0
3	0	160	0	800	0
4	150	0	50	750	300
5	300	0	50	0	200
6	400	0	100	0	200
7	500	0	150	0	200
8	500	0	150	0	200
9	500	0	150	0	200
10	500	0	150	0	200

- If the opportunity cost of capital is 30%, compute the domestic resource cost (DRC). If the official exchange rate (OER) is ZMW17.50 to US\$1 and on the basis of the DRC you obtain, is the project favourable? Explain why? (10 marks)
- If there is a foreign exchange premium of 20%, what is the shadow exchange rate (SER)? In the light of the SER you obtain and on the basis of the DRC you obtained in a) above, would you say the project is favourable? Explain why? (5 marks)
- Explain why it is important to estimate the DRC and for what type of projects it should be applied? (5 marks)

END OF EXAMINATION



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION
2020/21 ACADEMIC YEAR FINAL EXAMINATIONS**

**AGF 2015
FUNDAMENTALS OF ORGANIC CHEMISTRY**

Date: 24th JUNE, 2022

Time: 14:00 – 17:00 HRS

Venue: OMNIA 1

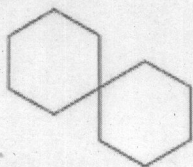
Duration: TWO (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

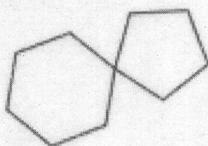
- 1. THIS PAPER CARRIES 60 MARKS AND HAS A TOTAL OF TWENTY (20) QUESTIONS**
- 2. ANSWER ALL QUESTIONS IN SEPARATE BOOKLETS**
- 3. USE ILLUSTRATIONS WHERE NECESSARY**

1. Provide complete IUPAC name for the following structures and specify stereochemistry! (4 Marks)

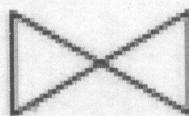
I.



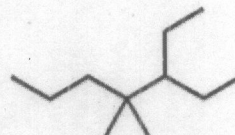
II.



III.

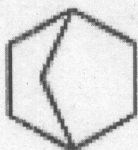


IV.

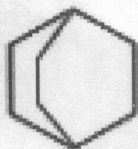


2. Provide complete IUPAC name for the following structures and specify stereo-chemical details, as relevant. (4 Marks)

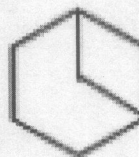
I.



II.



III.

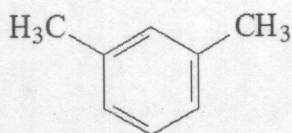


IV.

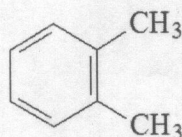


3. Provide complete IUPAC name for the following structures and specify stereo-chemical details, as relevant. (6 Marks)

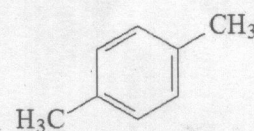
I.



II.



III.



4. For each of the following, provide a complete skeleton structural formula showing all necessary atoms and bonding. (4 Marks)

I. 1,3-dimethylcyclopentane

II. 3,7-dimethyl-4-nonyne

5. Draw the structure of. Take particular care to indicate the three dimensional stereochemical detail properly. (6 Marks)

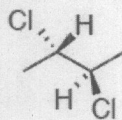
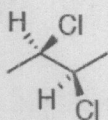
I. (2R,3S)-2,3-dichloropentane

II. (S)-1-bromo-1-chloropropane

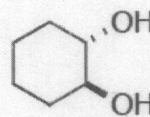
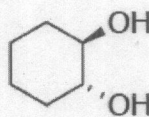
III. 1,3-dichlorocyclopentane

6. Mark the relationships between the following structures as either "same", "enantiomers", or "diastereomers". (2 marks)

I.

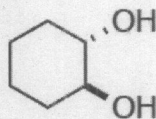
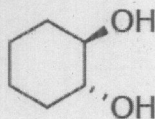


II.

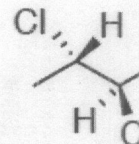
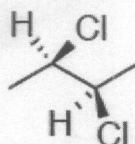


7. Mark the relationships between the following pairs of structures as either "same", "enantiomers" or "diastereomers". (2 marks)

I.

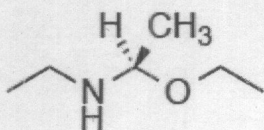


II.

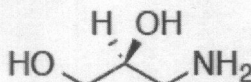


8. Draw and Identify each of the following molecule as chiral or achiral, indicate clearly if the molecule has a chiral center. (3 Marks)

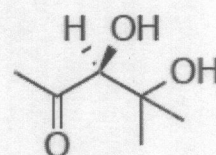
I.



II.

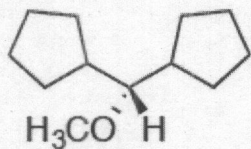


III.

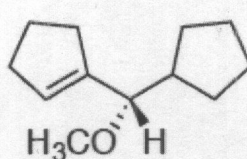


9. Draw and Identify each of the following molecule as chiral or achiral, indicate clearly if the molecule has a chiral center. (3 Marks)

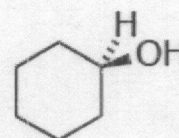
I.



II.



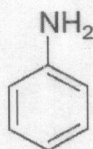
III.



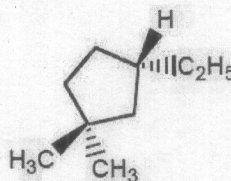
10. Draw as many structural isomers as you can for C_6H_{14} . Be careful not to draw the same isomer twice! I will take off points for duplicating! (5 Marks)

11. What is the complete IUPAC name of the following substance? Specify stereo-chemical details, as relevant. (2 Marks)

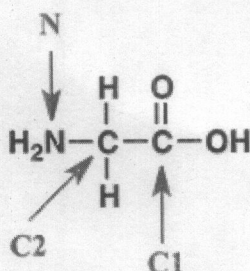
I.



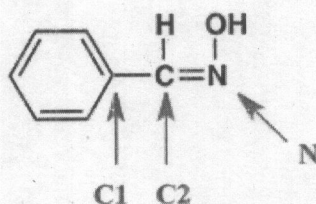
II.



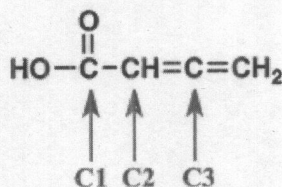
12. Which is the hybridization for C1, C2, and N given the following molecule? (3 Marks)



13. Which is the hybridization for C1, C2, and N given the following molecule? (3 Marks)

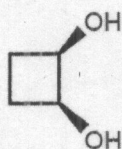


14. What is the hybridization states of C1, C2, and C3 given the following molecule? (3 Marks)

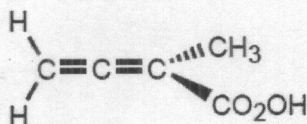


15. Is the molecule shown below chiral or achiral? (3 Marks)

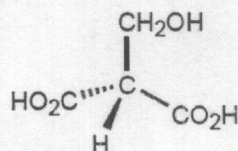
I.



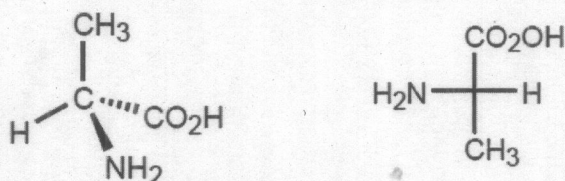
II.



III.

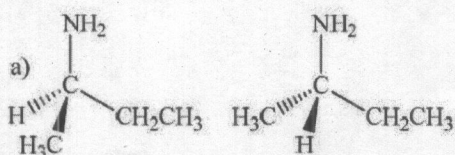


16. Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound? (2 Marks)

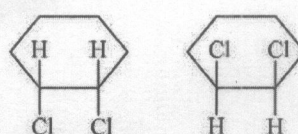


17. State how the two structures in each of the following pairs are related to each other. They may be constitutional (structural) isomers, enantiomers, diastereomers, or the same compound. Identify each of the compounds as either chiral or achiral. (2 Marks)

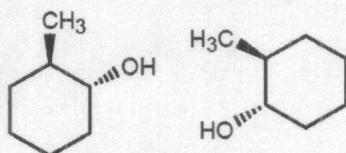
I.



II.

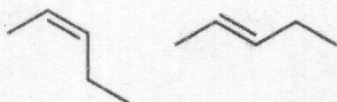


18. Which of the following terms best describes the pair of compounds shown: enantiomers, diastereomers, or the same compound? (2 Marks)

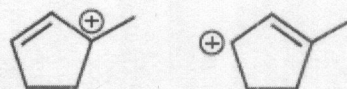


19. For the following pairs, Draw and classify the relationship between each pair as either : the same compound, structural isomers, resonance structures, stereoisomers (specify eg enantiomers, diastereomers, Cis/Trans) (4 Marks)

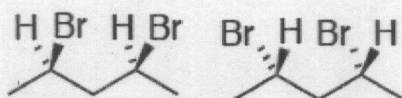
I.



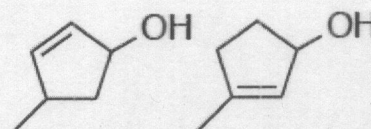
II.



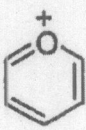
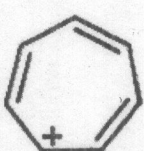
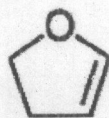
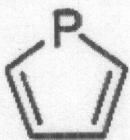
III.



IV.

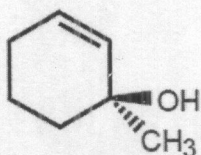


20. Draw and Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (6 marks)

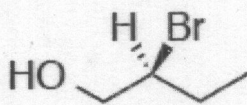
I. 	II. 
III. 	IV. 
V. 	VI. 

21. Draw and Label each asymmetric carbon in the compounds given below as R or S. (4 Marks)

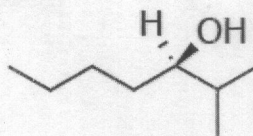
I.



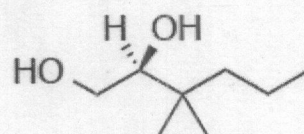
II.



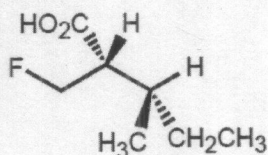
III.



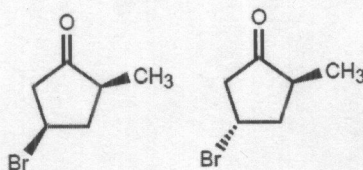
IV.



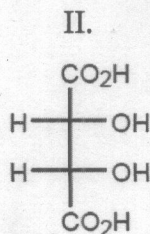
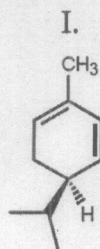
22. Label each asymmetric carbon in the molecule below as having the R or S configuration. (2 Marks)



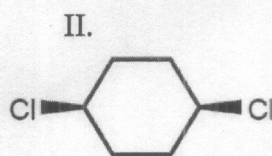
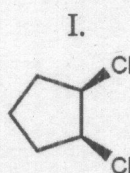
23. Is it theoretically possible to separate the pair of compounds below by distillation? Explain briefly. (2 Marks)



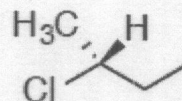
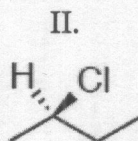
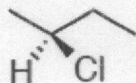
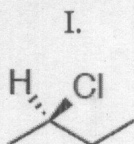
24. How many asymmetric carbons are present in the compounds shown below? (2 Marks)



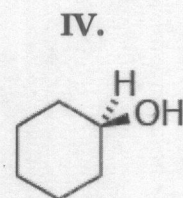
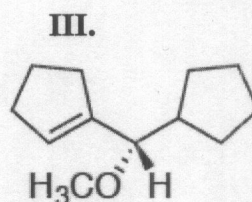
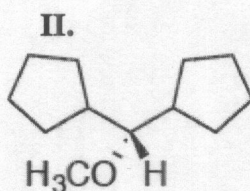
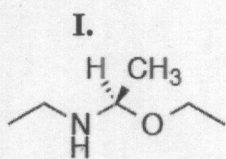
25. Which of the following terms best describes each of the compounds shown below: meso, enantiomers, or diastereomers. (2 Marks)



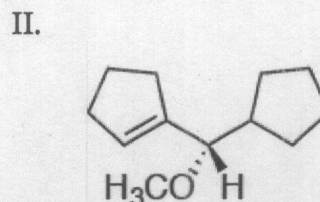
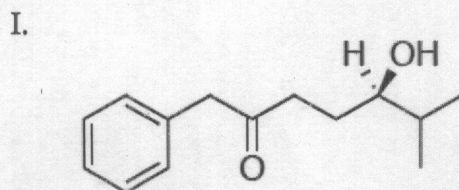
26. Which of the following terms best describes the pairs of compounds shown: enantiomers, diastereomers, or the same compound? (4 Marks)



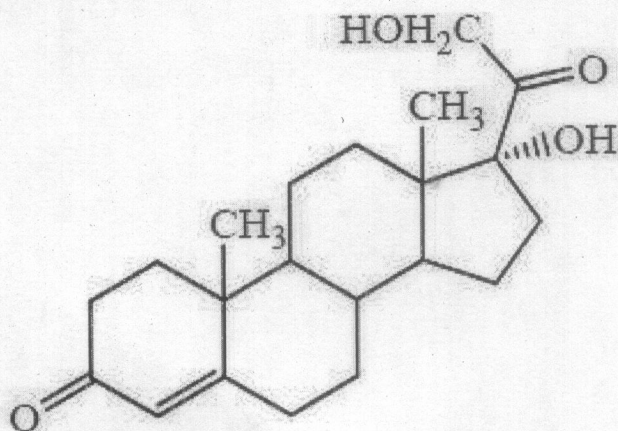
27. Identify each of the following molecule as chiral or achiral. (4 Marks)



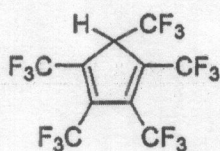
28. Designate the R/S configuration for any chiral centers in the following molecules. (4 Marks)



29. How many chirality centers does the following structure contain? How many stereoisomers having this structure are theoretically possible? (4 Marks)



30. Aromatic compounds are defined as having planar structures, containing a certain number of electrons in a continuous overlapping cyclic arrangement of p orbitals. Give two/ more why the given compound may be non-aromatic aromatic compounds. (3 marks)



END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Food Science and Nutrition

INTRODUCTION TO INFORMATION TECHNOLOGY AND COMMUNICATION
AGF 2401

2021-2022 FINAL EXAM

Date: 21st JUNE 2022
Venue: OMNIA 1
Time: 9:00 TO 12:00 HOURS
Duration: 3 Hours

Instructions

- 1. This examination has one section*
- 2. Section A comprises six [6] questions. Answer any five [5] questions. Each question carries 20 marks.*

Section A

Answer any five questions. Each question carries 20 marks.

Question 1

- a) What is Computer? [2] what are the five things you should consider when buying a laptop? [3]
- b) Write short notes on Central Processing Unit, Second generation computers, Fifth generation computers and Mainframe computers? [12]
- c) What is the difference between RAM and ROM? [3]

Question 2

- a) Explain any five different types of Input devices and five different types of output devices? [20]

Question 3

- a) What is storage? [2] what is the purpose of secondary storage medium? [3]
- b) What is the difference between secondary storage and main memory with examples? [3]
- c) Explain the Solid-state drive with examples? [5]
- d) Why backup is important? How you can create a backup? [5]
- e) What is the difference between CD-R and CD-RW? [2]

Question 4

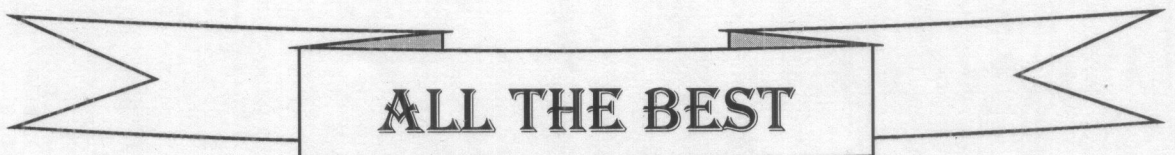
- a) What is a Network? [2] Write any 2 advantages and 2 disadvantages of a Network? [4]
- b) Explain the different devices used in the network? [6]
- c) Describe the different methods of authentication to ensure your login is safe via network? [4]
- d) List the different types of communications? [4]

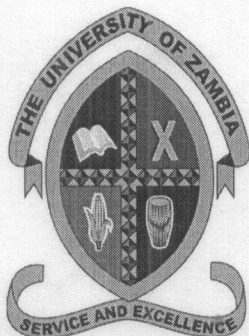
Question 5

- a) What is a Operating system? [2] Describe any 6 functions of the OS? [6]
- b) Explain any three different types of the operating system? [6]
- c) What is a programming language? [2] Explain the different levels of the programming language? [6]

Question 6

- a) Explain about hacking, computer virus, phishing, pharming, spyware? [10]
How you protect your computer from this above threats? [4]
- b) Explain how ICT helps in Medical field, School Management systems, Monitoring and Tracking systems? [6]





**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION**

2021/22 ACADEMIC YEAR EXAMINATIONS

AGF 3021

CHEMICAL TECHNIQUES IN FOOD ANALYSIS - THEORY EXAM

DATE: MONDAY - 13TH JUNE, 2022

TIME: 09:00 – 12:00 HOURS

VENUE: OMNIA 3

DURATION: 3 HOURS

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER HAS A TOTAL OF FIVE (5) QUESTIONS**
- 2. EACH QUESTION IS ALLOCATED A TOTAL OF 20 MARKS**
- 3. ANSWER ALL QUESTIONS**

**QUESTION 1: PRACTICAL QUESTION ON LABORATORY SESSIONS DONE IN
THIS COURSE** **[20 MARKS]**

a) Natural bottled water is very popular nowadays and distributed by various companies in Zambia.

i. Name any **four (4)** varieties of natural bottled water found on the Zambian market.

[1 Mark]

ii. Briefly discuss how natural bottled water is different from tap water or borehole water.

[4Marks]

b) In **part a) ii above**, one of the distinguishing factors between bottled water and tap water can be determined titrimetrically using EDTA.

i. Why is EDTA used in the experiment?

[5 Marks]

ii. Complete the following table:

Indicator Used	Parameter Determined
Murexide	-----
-----	Total hardness

[2 Marks]

iii. In the determination of the concentration of **one** of the minerals in bottled water, 4ml of EDTA was consumed during titration to reach the endpoint.

Calculate the concentration of the mineral in the bottled water. **[8 Marks]**

QUESTION 2

[20 Marks]

- a. Briefly explain the following terms in **not** more than five (5) lines. Use illustrations and / or examples where necessary:
- i. Soxhlet method [1.5 Marks]
 - ii. Sampling [1.5 Marks]
 - iii. Gravimetric factor [1.5 Marks]
 - iv. Q-Test [1.5 Marks]
 - v. Semi-qualitative analysis [1.5 Marks]
- b. In analytical chemistry, reliability requires a mathematical definition and this is given as a complex function of the sample reliability (R_s), method reliability (R_m), instrument reliability (R_i) and data processing reliability (R_{DP}). What is the connection between R_m and R_s ? [7.5 Marks]
- c) In any analysis, a method used may either be destructive or non-destructive. Explain the two (2) terms mentioned in the latter statement and give examples of the methods for each. [5 Marks]

QUESTION 3

- a) In not more than five (5) lines, define and explain the following terms giving examples where necessary.
- i. Semi qualitative analyses [2 Marks]
 - ii. Representative sample [2 Marks]
 - iii. Gross sample [2 Marks]
 - iv. Steps involved in gravimetric analysis [2 Marks]
 - v. Non-destructive analyses [2 Marks]
- b) Briefly define reliability and state its importance in analytical chemistry. Additionally, why is the reliability of the representative sample very critical? Furthermore, briefly discuss the relationship between reliability and the analytical method. [5 Marks]

- c) As a trained Laboratory Analyst, explain the underlying principles of the technique that can be used to determine the ether extract of dried soybean flakes. **[5 Marks]**

QUESTION 4

What is quality assurance? Discuss in detail the activities which are involved in quality assurance. **[20 Marks]**

QUESTION 5

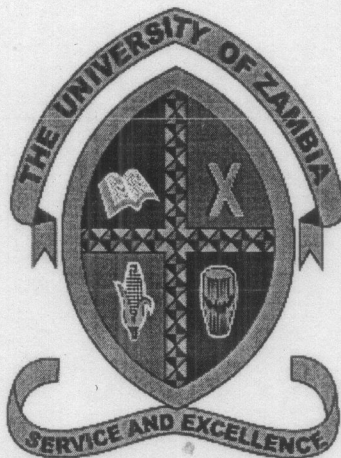
The pH values obtained after analyzing juices using a newly installed pH meter were as follows: 2.23, 2.22, 2.21, 2.22, 2.26, 2.225, 2.215 and 2.214. According to the pH meter manufacturer, the precision of the instrument is supposed to be less than 2% RSD. As a food technologist, can you please clarify this statement made by the manufacturer? **[20 Marks]**

END OF EXAMINATION

Periodic Table of the Elements

1 H Hydrogen 1.01																	18 He Helium 4.00
3 Li Lithium 6.94	2 Be Beryllium 9.01															17 F Fluorine 19.00	10 Ne Neon 20.18
11 Na Sodium 22.99	12 Mg Magnesium 24.31															16 O Oxygen 16.00	18 Ar Argon 39.95
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.88	23 V Vanadium 50.94	24 Cr Chromium 51.99	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.63	33 As Arsenic 74.92	34 Se Selenium 78.97	35 Br Bromine 79.90	36 Kr Krypton 84.80
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.95	43 Tc Technetium 98.91	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.6	53 I Iodine 126.90	54 Xe Xenon 131.29
55 Cs Cesium 132.91	56 Ba Barium 137.33	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.85	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.20	83 Bi Bismuth 208.98	84 Po Polonium [209]	85 At Astatine [209]	86 Rn Radon 222.02
87 Fr Francium 223.02	88 Ra Radium 226.03	89-103 Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [278]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [280]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [289]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]

- Alkali Metal
- Alkaline Earth
- Transition Metal
- Basic Metal
- Metalloid
- Nonmetal
- Halogen
- Noble Gas
- Lanthanide
- Actinide



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND NUTRITION**

**2021/2022 ACADEMIC YEAR
FINAL EXAMINATION**

**COURSE: AGF 3031
Food Chemistry (Theory)**

Date: Wednesday, 22nd June 2022

Time: 09.00 – 12.00 Hours

Duration: Three (3) hours

Venue: FSN 3

INSTRUCTIONS TO CANDIDATES:

1. There are two (2) sections in this examination paper, Section A and Section B. The two sections carry 50 marks each
2. Answer all questions in both sections.
3. The marks allocated are given at the end of each question.
4. Answers to the two sections should be given in separate booklets.

SECTION A

QUESTION 1 (20 marks) (Brief Answers)

- (i) The statement "the higher the water content of a food product, the higher the shelf stability of food product". Is this statement correct? Explain your answer. (2 marks)
- (ii) The iodine number of two lipid samples has been found to be 65 for sample A and 120 for sample B. State and explain the differences between the two samples in terms of:
- Likely state at room temperature (liquid/solid)
 - Susceptibility to deterioration (4 marks)
- (iii) (a) What is lipid polymorphism? What is its importance in food technology? (2 marks)
- (b) What is meant by the solid fat index and what is its importance in food technology? (2 marks)
- (iv) Convert 0.5% protein content into mg protein per kg of a food sample (4 marks)
- (v) (a) Write the structure of the following fatty acid and give an alternative name: 18:3 ω 3 (3 marks)
- (b) A food rich in lipids has been found to go bad when produced without any food additives. Suggest one class of food additives, give an example of a food additive in that class and explain very briefly why you suggested that class of food additives (3 marks)

QUESTION 2 (30 marks)

MWIZA food manufacturing company developed a dry powdered meat product for feeding infants. The dry powdered meat product was packaged in a water and air permeable packaging container. The meat powder has a water/moisture content of 8%, fat content of 5% and a water activity of 0.4 at the given water content. This composition of the powdered meat was measured when the powder was initially stored in a cold room maintained at 4°C and 25% relative humidity. The cold room malfunctioned within a day of storage. The temperature and relative humidity of the cold room increased to 40°C and 90% respectively, a day after it malfunctioned. The company only discovered that the cold room had malfunctioned 14 days later. From a food chemistry point of view, state with plausible reason(s) the changes you would expect on the fourteenth day of storage of the meat powder in the malfunctioned cold room for;

- (a)
- Moisture or water content of the meat powder (2 marks)
 - Water activity of the meat powder (3 marks)
 - Composition of the lipid component of the meat powder. (10 marks)
- (b)
- What sensory quality problems would you expect in the product kept at 40°C for 14 days? (10 marks)
 - What solution(s) would you offer to mitigate the quality problems in 2(b)(i) above (5 marks)

SECTION B

1. Describe the following proteins
 - (a) Globulins (5 Marks)
 - (b) Chroma proteins (5 Marks)

2. You are a Production Manager for a Company processing fresh fruits and vegetables into fruit pieces and cut vegetables. The Company buyer brings you fruits (apples and bananas), which have developed a dark colour. You decide to reject these fruits. Explain the reasons for rejecting the fruits (10 marks)

3. Briefly, describe the importance of carbohydrates in the diet and also describe the danger of under-consuming the carbohydrates (3 marks)
 - (a) What are latent enzymes (1 mark)
 - (b) What is the other name for D-Glucose (1 mark)

4. Name and describe 3 factors which affect enzyme activity (15 marks)

5.
 - (a) Name two milk proteins (2 marks)
 - (b) Name maize and sorghum proteins, respectively (2 marks)
 - (c) Name two proteins of vegetable origin (2 marks)
 - (d) Name two sources of carbohydrates (2 marks)
 - (e) The role of compartmentalization in enzyme studies (2 marks)

.....**End of Exam**.....



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION**

2020/21 ACADEMIC YEAR FINAL EXAMINATIONS

**AGF 3201
TECHNICAL THERMODYNAMICS - THEORY EXAM**

**Date: 14TH JUNE, 2022
Time: 09:00 – 12:00 HOURS
Venue: OMNIA 1**

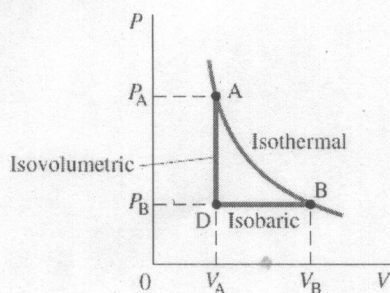
Duration: 3 HOUR

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER HAS A TOTAL OF FOUR (4) QUESTIONS.**
- 2. EACH QUESTION CARRIES 25 MARKS.**
- 3. ANSWER ALL QUESTIONS**
- 4. USE A DIFFERENT BOOKLET FOR QUESTION**

QUESTION 1 [25 MARKS]

- a) Given the PV-diagram below, State whether the work done by the gas in process ADB is $W_{ADB} \leq W_{\text{Isothermal}}$ OR $W_{ADB} \geq W_{\text{Isothermal}}$



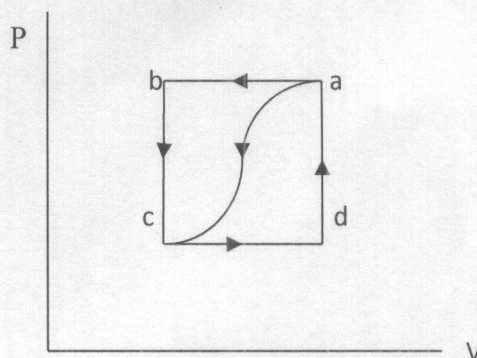
[5 Marks]

- b) Given that an engine, 0.25 mol of an ideal monatomic gas in the cylinder expands rapidly and adiabatically against the piston. In the process, the temperature of the gas drops from 1150 K to 400 K. How much work does the gas do?

[5 Marks]

- c) When a gas is taken from a to c along the curved path, the work done by the gas is $W = -35 \text{ J}$ and the heat added to the gas is $Q = -63 \text{ J}$. Along the path abc, the work done is $W = -54 \text{ J}$.

- What is Q for path abc?
- If $P_c = P_b/2$, what is W for path cda?
- What is Q for path cda?
- What is ΔU_{ca} ?
- if $\Delta U_{cd} = 12 \text{ J}$, what is Q for path da?

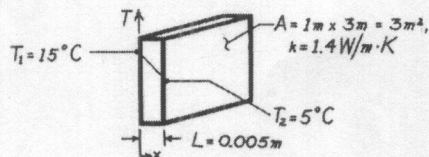


[15 Marks]

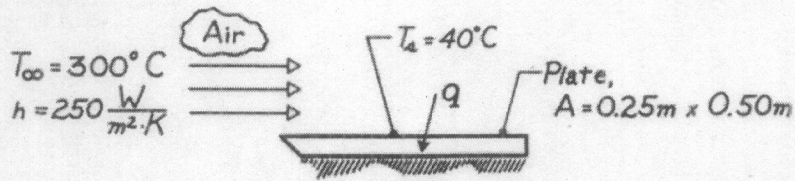
QUESTION 2 [25 MARKS]

- a) The inner and outer surface temperatures of a glass window 5 mm thick are 15 and 5°C, respectively. What is the heat loss through a window that is 1 m by 3 m on a side? The thermal conductivity of glass is 1.4 W/mK.

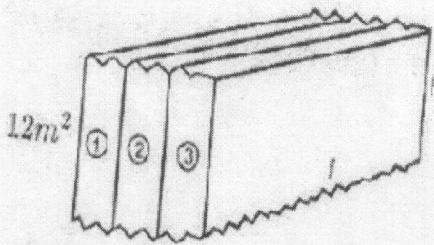
[5 Marks]



- b) Air at 300°C flows over a flat plate of dimensions 0.50 m by 0.25 m . If the convection heat transfer coefficient is $250\text{ W/m}^2\text{K}$, determine the heat transfer rate from the air to one side of the plate when the plate is maintained at 40°C . [5 Marks]



- c) Calculate the rate of heat loss through the vertical walls of a boiler furnace of size 4 m by 3 m by 3 m high. The walls are constructed from an inner fire brick wall 25 cm thick of thermal conductivity 0.4 W/mK , a layer of ceramic blanket insulation of thermal conductivity 0.2 W/mK and 8 cm thick, and a steel protective layer of thermal conductivity 55 W/mK and 2 mm thick. The inside temperature of the fire brick layer was measured at 600°C and the temperature of the outside of the insulation 60°C . Calculate temperature drop across the steel layer ($T_2 - T_3$).



Composite Wall

$$l = 4\text{m} \quad b = 3\text{m} \quad h = 3\text{m}$$

$$\text{Area of rectangular wall } lb = 4 \times 3 = 12\text{m}^2$$

$$L_1 = 25\text{ cm} \quad \left. \begin{array}{l} k_1 = 0.4\text{ W/mK} \end{array} \right\} \text{Fire brick}$$

$$L_2 = 0.002\text{m} \quad \left. \begin{array}{l} k_2 = 54\text{ W/mK} \end{array} \right\} \text{Steel}$$

$$L_3 = 0.08\text{ m} \quad \left. \begin{array}{l} k_3 = 0.2\text{ W/mK} \end{array} \right\} \text{insulation}$$

$$T_1 = 600^{\circ}\text{C}$$

$$T_2 = 60^{\circ}\text{C}$$

[15 Marks]

QUESTION 3 [25 MARKS]

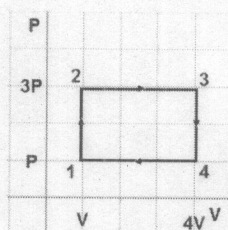
- a) Given that 2500J of heat is added to a system, and 1800 J of work is done on the system. What is the change in internal energy of the system?

[5 Marks]

- b) During a cyclic process, a heat engine absorbs 500 J of heat from a hot reservoir, does work and ejects an amount of heat 300 J into the surroundings (cold reservoir). Calculate the efficiency of the heat engine?

[10 Marks]

- c) The change of the state of an ideal gas is presented by the diagram, An ideal gas is taken through a closed path $1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 1$



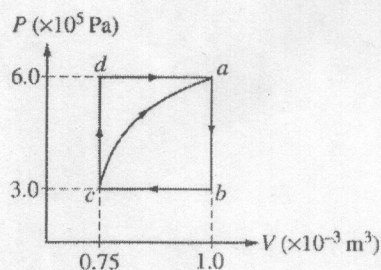
- I. What is the ratio between work done on the gas during the process $2 \rightarrow 3$ and work done on the gas during the process $4 \rightarrow 1$?
- II. What is the net work done by the gas?

[10 Marks]

QUESTION 4 [25 MARKS]

A cylinder with a movable piston contains 0.1 mole of a monatomic ideal gas. The gas, initially at state a, can be taken through either of two cycles, **abca** or **abcda**, as shown on the PV diagram above. The following information is known about this system.

$Q_{c \rightarrow a} = 685 \text{ J}$ along the curved path
 $W_{c \rightarrow a} = -120 \text{ J}$ along the curved path
 $U_a - U_b = 450 \text{ J}$
 $W_{a \rightarrow b \rightarrow c} = 75 \text{ J}$



- a) Determine the change in internal energy, $U_a - U_c$, between states a and c.
- b) Calculate the amount of heat that is either added to or removed for the process abc?
- c) Calculate the amount of work done on the gas in the process cda?
- d) Calculate the amount of heat added or removed from the gas for the process cda?

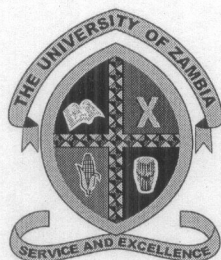
[5 Marks]

[5 Marks]

[5 Marks]

[10 Marks]

END OF EXAMINATION



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND NUTRITION**

2021/2022 ACADEMIC YEAR MID EXAMINATION

**COURSE: AGF 4065
Nutrition**

Date: Friday, 17th June 2022

Time: 09:00 – 12:00hrs

Duration: THREE (3) HOURS

Venue: OMNIA 2

INSTRUCTIONS TO CANDIDATES:

- 1. This paper consists of Section A, Section B and Section C**
 - 2. Please read the guidance for each section carefully; answer ALL questions**
 - 3. Each question is allocated marks as shown in parenthesis**
-

SECTION A [20 Marks]

Answer **ALL** questions in this section

1. Identify any four digestive organs that secrete digestive juices (2 marks)
2. Where does majority of digestion take place and why (2 marks)
3. Which cells in the body are most vulnerable to folate deficiency? (1 mark)
4. What are Trans fatty acids and why are Trans fatty acids considered harmful to nutritional health? (2 marks)
5. Distinguish vitamins from minerals (2 marks)
6. Define limiting amino acid (1 mark)
7. Women with more fat in proportion to muscle have higher resting metabolic rates than men of the same age and weight. True or False (1 Mark)
8. Bitot spots are a sign of nutrient deficiency which can be identified using physical assessments. True or False (1 mark)
9. After birth, growth of a human being is mainly influenced by genetics and (2 mark)
10. Briefly explain how metabolically active tissue, for example, that of an athlete affects the individual's resting metabolic rate. (2 marks)
11. Dietary assessment tools are used to review an individual's usual food intake patterns.
 - a) Give one example of a dietary assessment tool. (2 marks)
 - b) List two advantages of the tool you have mentioned. (2 marks)

SECTION B [40 Marks]

Answer **ALL** questions in this section

1. Currently, sub-Sahara Africa produces more than 4 million tons of crop and animal products. On the other hand government expenditure on health care systems is considered low in this region.

a) Explain how this food production has influenced malnutrition levels in the region. **(5 marks)**

b) Explain how poor access to health care services increases the risk of over nutrition and undernutrition in adolescents. **(5 marks)**

c) Give **three (3)** reasons why this region has not achieved food security. For each of the reasons you have provided, what solution(s) would you recommend. **(10 marks)**

2. Mwape is from visiting a health facility and was told she is at risk of developing multiple chronic dietary diseases.

a) List and briefly describe **two (2)** factors that you can use to determine if an individual is at risk of developing nutrition related diseases. **(6 Marks)**

b) After conducting some dietary assessments, it has come to your attention that Mwape's diet is rich in saturated fats and trans unsaturated fats.

i. What is the relationship between her condition and these two types of fats? **(5 marks)**

ii. Give two examples of dietary sources for each of these types of fats. **(4 marks)**

c) Based on Mwape's situation, what recommendations would you give in order to reduce her chances of developing one or more chronic dietary related diseases? **(5 marks)**

SECTION C**[40 Marks]**

1. The health of the body depends on good nutrition and a healthy and functional GIT
 - a. Identify any three (3) factors that influence food intake, even when most people realize that their food habits affect their health **(3 marks)**
 - b. List any two (2) things that can affect the proper functioning of the gastro intestinal tract (GIT) **(2 marks)**
2. Describe the digestion and absorption (**including site, action, enzymes**) of protein **(10 marks)**
3. Identify three (3) physiological processes that depend on vitamins. Give any two (2) causes of vitamin deficiency in a population **(5 marks)**
4.
 - a. List four (4) minerals that are the major electrolytes **(2 marks)**
 - b. Give two (2) primary functions of electrolytes **(2 marks)**
 - c. Describe the regulatory mechanisms that enable the body to maintain the blood pH level despite the enormous acid load from food consumption and tissue metabolism **(6 marks)**
5. Alcoholic beverages have been a distinctive component of many cultures for thousands of years.
 - a. Explain why alcohol is capable of reaching your brain within minutes and give the feeling of being a stimulant. **(2 marks)**
 - b. Mention the site of alcohol metabolism in the body **(1 mark)**
 - c. Explain why the body makes alcohol metabolism a priority over anything else **(2 marks)**
 - d. List two (2) different types of alcoholic beverages **(1 mark)**
 - e. Give two (2) consequence of excessive consumption of alcoholic beverages **(2 marks)**
 - f. When taken in moderation, give any two (2) positive effects of alcoholic beverages such as wine on the body **(2 marks)**

END OF EXAMINATION



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION**

2021-2022 MID-YEAR EXAMINATIONS

AGF 5241

PLANT DESIGN AND ENVIRONMENTAL MANAGEMENT

DURATION: THREE (3) HOURS

VENUE: OMNIA 2

DATE: 17/06/2022

TIME: 0.900 HRS

INSTRUCTIONS TO THE CANDIDATES:

1. PLEASE READ THE INSTRUCTIONS AND EACH QUESTION CAREFULLY.
2. THIS PAPER HAS **FOUR** QUESTIONS AND EACH CARRIES **25 MARKS**
3. ANSWER ALL QUESTIONS.
4. ALLOCATED MARKS FOR EACH QUESTION ARE INDICATED IN THE BRACKETS

1. As a Plant Design Engineer, you have been tasked by the management of your company to design a compartment for pigs with length 9m, width 5m and height 4m. There are 72 pigs, each of them weigh 60 kg. The compartment should have mechanical ventilation and heat supply or heat withdrawal system. The outside temperature is 10°C and the outside relative humidity is 65%. The floor is to be perfectly insulated.

Physical constants

Specific heat capacity of air $C_{p,air} = 1.005 \text{ KJ.Kg}^{-1}.\text{K}^{-1}$

Heat of Vaporisation of water $\mathcal{E} = 2501 \text{ KJ. (Kg H}_2\text{O)}^{-1}$

Outside CO₂ concentration = $g_{oCO_2} = 0.36 \text{ l.m}^{-3}$

Tolerable inside CO₂ concentration = $g_{iCO_2} = 2.5 \text{ l.m}^{-3}$

Density of air $\rho_{air} = 1.27706 \text{ Kg .m}^{-3}$

K - Values

k_1 = Thermal conductivity for the walls = $1.163 \text{ W. }^\circ\text{C}^{-1}.\text{m}^{-2}$

k_2 = Thermal conductivity for the roof = $0.638 \text{ W. }^\circ\text{C}^{-1}.\text{m}^{-2}$

Some pig related data

Pig weight [kg]	T _{opt} [°C]	RH _{opt} [%]	Sensible heat Prod ⁿ [W/pig]	Latent heat Prod ⁿ [W/pig]	CO ₂ Prod ⁿ l/hr.pig
20	23	60	43	50	16
30	22	60	51	55	19
40	21	62	59	60	21
50	20	65	67	65	23
60	20	65	73	69	26
70	19	68	79	73	27
80	18	70	86	75	28
90	17	70	92	79	30
100	17	70	98	84	32

- a) Is there need to install a gas supplying or withdrawal equipment in the storage compartment (7.5 points)
- b) How much heat supply or withdrawal, Q, is required to get the optimal temperature and humidity inside the compartment (7.5 points)
- c) Suppose there is no heat supply or heat withdrawal system in the compartment, what ventilation rate is required to get the optimal inside temperature? (8 points)

- d) What happens to the dry bulb temperature and relative humidity of the air if the cooling process is done at a constant absolute humidity? **(2 points)**
2. A semi-automated bambara groundnut milling plant has an annual production capacity of 20,000 tons of flour with overall yield of 75%, on mass basis (Kg of product per Kg raw material). An investment of 50,000 USD for a fully automated mill will increase the yield to 90%, and additional operating costs tied to this equipment are negligible. Raw material cost 200 USD/ton and the product sells for 350 USD/ton.
- a) Is the investment into a fully automated mill worth making? Your answer should be justified with figures and available economic criteria for evaluation. **(10 points)**
 - b) In the scope of food processing plant design, what constitute the fixed capital of the project? **(5 points)**
 - c) Using the project cash flow diagram, summarise the phases that a project such as this may follow during its life cycle **(8 points)**
 - d) Define ROR **(2 points)**
3. You see a need to put up a soymilk processing project in Zambia considering the opportunities that currently exist in this sector.
- a) Briefly discuss five important factors for site considerations that may be of concern with regards to this project. **(5 points)**
 - b) Do a brief competitor analysis for this type of business **(5 points)**
 - c) With regard to plant layout, describe briefly five principal factors that will ensure economic construction and efficient operation of the process unit **(5 points)**
 - d) Discuss the structural forces that you may consider important for this type of business **(7 points)**
 - e) Do a brief competitor analysis for this business of soymilk you have decided to venture into. **(3 points)**
4. a) The selection process for the design solution goes through four main stages, briefly outline these stages. **(8 points)**
- b) In doing your market research, you may decide to use primary and secondary data sources. What are the features of each source? Give **two** advantages and **two** disadvantages of each of this data sources **(7.5 points)**

- c) When it comes to setting up a food processing business, environmental forces such as social, political and technological may have an impact on an individual firm, competitors and the whole industry. Briefly discuss these forces. **(7.5 points)**
- d) List two types of research instruments that can be used to gather information when doing a market research. **(2 points)**

END OF EXAMINATION



UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

2022

FINAL EXAMINATION

PROCESSING AND PRESERVATION OF PLANT PRODUCTS

AGF 5615

DATE: 13th June, 2022

TIME: 09.00 – 12.00 HRS

VENUE: FSN 1

INSTRUCTIONS:

1. Students are **NOT permitted** to bring mobile phones and/or any other unauthorized electronic devices or other materials into the examination room.
2. Write your **student number** in the space provided on the answer booklet.
3. Answer **each section** in a separate booklet.
4. All questions carry **equal marks** and the allocated marks are shown for each question.

Section A: Answer All questions

1. Compare and contrast between the physical refining process and the chemical refining process of crude soybean oil with the aid of a flow diagram. Indicate the products and by products of each of the steps. [10 marks]

2. Write short and concise notes discussing the following (5 lines or less than).

- | | |
|--|-----------|
| ii) Whitening during rice processing | [2 marks] |
| iii) Desolventizer toaster | [2 marks] |
| iv) <i>Ipomoea batatas</i> | [2 marks] |
| v) cereal germ | [2 marks] |
| vi) Raffinose and stachyose | [2 marks] |

Section B: Answer all questions in this section

1. On processing of Beet Root and sugar cane for sugar production explain in detail the processing steps that are similar and those that are profoundly different. [20 marks]

SECTION C: Answer all questions

1. Fruit & vegetable technology section

- a. Explain the manufacturing process of canned guava with aid of a flow diagram.

[18 marks]

b. Discuss the preservation principle in freezing and drying. [2 marks]

2. Food fermentation section

a. Illustrate the tempeh manufacturing process using a flow diagram.

[6 marks]

b. The Manager of Moffpego Wineries Ltd approaches you with a problem of their wine white wine being discoloured (brownish colour). Explain the causes of the problem and offer possible solutions.

[4 marks]

c. Explain the following in only 5 lines:

i. Malting

[2 marks]

ii. Sauerkraut

[2 marks]

iii. Sufu

[2 marks]

iv. Beer

[2 marks]

v. Hops

[2 marks]

SECTION D: Answer one question of your choice in this section.

1. (a) What is Cold pressing?

[3 marks]

(b) What is the role of roots and tubers in nutrition

[5 marks]

(c) Legumes are classified into several classes including oilseeds (groundnut, soyabeans) and pulses or grain legumes (kidney beans, peas). What is the major differences/considerations taken into account during the postharvest handling/processing of the two classes?

[4 marks]

(d) Draw a soyabean seed, labelling all the parts.

[3 marks]

(e) What is the composition of soyabeans?

[3 Marks]

(f) What are soyabean isoflavones?

[2 mark]

2. (a) Describe the following, in relation to sugar production

i) Maltodextrins

[3 Marks]

ii) Bagass

[3 Marks]

iii) Crystallization

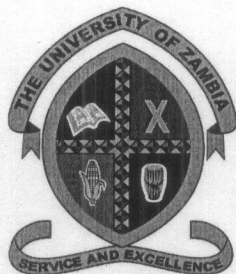
[3 Marks]

(b) Name three spice producing countries in Africa.

[3 Marks]

(c) In your own words explain the significance of consuming spices currently, which was previously not much emphasized upon

[8 Marks]



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND NUTRITION**

2021/2022 ACADEMIC YEAR – MID YEAR EXAMINATIONS

COURSE: AGN 3311 - Nutrition Assessment

Date: Monday, 13th June 2022

Time: 09:00 – 12:00 Hours

Duration: Three (3) hours

Venue: Omnia 1

INSTRUCTIONS TO CANDIDATES:

1. There are five questions in this examination paper.
2. **Question 1 is compulsory. Answer any three questions out of the four remaining questions.**
3. The marks allocated for each question are indicated in parenthesis

Question 1

It is recommended by international organizations to make nutrition risk screening mandatory in health care settings like hospitals. However, there are few facilities in Zambia implementing nutrition risk screening. Answer the following questions in relation to screening;

(a) Define

(i) Nutrition risk

[2 marks).

(ii) Screening

(2 marks)

(b) Why should nutrition risk screening be carried out?

(2 marks)

(c) Identify some of the factors responsible for non-implementation of nutrition risk screening in some facilities in Zambia.

(2 marks).

(d) What are some of the characteristics of a nutrition screening tool?

(8 marks).

(e) Give examples of some screening tools

(4 marks).

Total

(20 marks)

Question 2

Anthropometric measurements include weight, height, length, mid-upper arm circumference and skinfold assessments.

(i) Name the equipment used to conduct;

(a) Weight

(2 marks)

(b) Length

(2 marks)

(c) Mid-upper arm circumference

(2 marks)

(d) Skin-fold

(2 marks)

(ii) Describe the procedure for taking direct weight measurement

(6 marks)

(iii) What are some of the key points to note when locating the mid-point of the arm during mid-upper arm circumference assessment?

(2 marks)

(iv) What is bilateral pitting edema?

(2 marks)

(v) Edema is a form of _____ acute malnutrition

(2 marks)

Total

(20 marks)

Question 3

Assessing for nutrition status is an important outcome of nutrition assessment. Answer the following questions in relation to nutrition status.

- (i) Define
 - (a) Nutrition status (2 marks)
 - (b) Z-score (2 marks)
 - (ii) List some of the factors that can influence nutrition status (4 marks)
 - (iii) Mention some of the commonly used nutrition indicators in children less than five years (6 marks).
 - (iv) What do the following nutrition indices measure?
 - (i) Body Mass Index (2 marks)
 - (ii) Low birth weight (2 marks)
 - (iii) Mid-upper arm circumference (2 marks)
- Total (20 marks)**

Question 4

Nutrition and dietetics students are required to understand the nutrition care process as they will be using it to make sound clinical decisions. Nutrition Focused Physical Assessment is one of the components of the NCP.

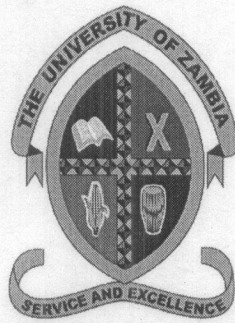
- (i) List and briefly discuss the components of the nutrition care process (4 marks)
- (ii) Mention some of the techniques used when conducting Nutrition Focused Physical Assessment (4 marks)
- (iii) What are some of the areas to focus on when assessing for muscle mass?
(6 marks)

- | | | |
|--------------|---|-------------------|
| (iv) | Mention other conditions associated with edema | (4 marks) |
| (v) | What do the letters SS mean in the acronym PASS | (2 marks) |
| Total | | (20 marks) |

Question 5

As a dietetics student, you may have come across terms such as dietary diversity score and 24-hour recall methods. Answer the following

- | | | |
|--------------|--|-------------------|
| (i) | Define dietary diversity scores? | (3 marks) |
| (i) | Give examples of dietary diversity scores. | (4 marks) |
| (ii) | Explain the differences in dietary diversity scores mentioned above. | (4 marks) |
| (iii) | What are some of the strengths of the dietary diversity scores? | (4 marks) |
| (iv) | Mention some tools used to assess dietary intake of clients | (2 marks) |
| (v) | In brief, explain the 24-hour recall methodology | (3 marks) |
| Total | | (20 marks) |



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION**

BSc HUMAN NUTRITION PROGRAMME

AGN 4321: RESEARCH METHODS AND EPIDEMIOLOGY FOR NUTRITIONISTS

VENUE: OMNIA 1 AND 2

DATE 17 JUNE 2022

DURATION (THREE HOURS)-14:00 TO 17:00 HR

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER HAS TWO SECTIONS: SECTION A AND B**
- 2. ANSWER ALL QUESTIONS IN BOTH SECTIONS IN THE BOOKLETS PROVIDED.**
- 3. ANSWER EACH QUESTION ON A SEPARATE PAGE**

SECTION A: RESEARCH METHODS

Question 1 (20 marks)

- a. Briefly explain the following sampling procedures and suggest an example of a situation where each of them can be applied. **(12 marks)**

- i. Stratified random sampling
- ii. Quota sampling
- iii. Simple random sampling

- b. State and briefly explain any four methods used to collect data in qualitative studies

(8 marks)

Question 2 (20 marks)

- a. Using appropriate examples identify and briefly describe **main classes** of research designs.

(8 marks)

- b. Using an appropriate study design, explain how you can establish the association between maternal age and child growth?

(12 marks)

Question 3 (10 marks)

Define literature review and explain its importance in research methods. **(10 marks)**

SECTION B: NUTRITIONAL EPIDEMIOLOGY (50 MARKS)

Question 4

In a prospective study of coffee consumption and Coronary Heart Disease, intake of 6 or more cups of coffee per day was associated with Relative Risk (RR) of 1.55 (95% CI, 1.12 to 1.9). Stratifying the data by smoking the results were as follows: smokers RR=1.3 (95% CI, 0.52 to 1.5) and Non-smokers RR 0.75 (95% CI, 0.30 to 1.12).

- a) Interpret both the stratified and un-stratified results of the above study (8 marks)
- b) Identify the possible study design that may have been used in the research above, give reasons for your choice (7 marks)

Question 5

- a. Results from the Zambia STEPS Survey (2017) conducted by WHO and Ministry of Health indicates that 10% of adults aged 18-69 are not physically active (Having < 150 minutes of moderate-intensity activity per week, or equivalent). The STEPS results also demonstrate an increase in overweight and obesity in the same age group. Describe reverse causality using the STEPS results above. (8 marks)
- b. Differentiate the following terms, as used in Nutritional Epidemiology: (12 marks)
 - i. Incidence and prevalence
 - ii. Exposure and outcome
 - iii. Random error and systematic error
 - iv. Systematic review and meta-analysis

Question 6 Bradford hill prescribed 9 criteria for judging whether an association is causal.

- a. List the nine (9) criteria. (9 marks)
- b. State the criteria among the ones listed in (a) that is critical for establishing a causal association and explain what it means? (2 marks)
- c. For the following scenarios, state the relevant criteria which applies;
 - i. Continuous smoking causes tissue damage, which overtime results in growth of cancerous cells. (1 mark)
 - ii. Risk ratio of lung cancer for cigarette smokers as compared to persons who did not smoke cigarettes were 20.2, 10.0, 12.0, 15.9, 4.9, 11.7 and 4.6 in seven cohort studies. (1 mark)
 - iii. Review of literature identified 26 case-control studies and 7 cohort studies that had investigated the association between cigarette smoking and increased risk. (1 mark)



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

2021/22 ACADEMIC YEAR FINAL EXAMINATIONS

AGN 5421 – FOOD SERVICE AND MANAGEMENT SYSTEMS

Date: MONDAY, 20th June, 2022

Venue: Other Rooms

Time: 09.00 – 12.00 hrs

Instructions:

Answer **all** questions in Section A and Choose any four questions in Section B

Allocated marks are shown in brackets at the end of each question.

SECTION A : MULTIPLE CHOICE- QUESTIONS

[20 marks]

Mark on the question paper and submit the question paper.

1. How can a food handler reduce or eliminate the risk of food contamination?
 - A. Washing their hands after using the restroom
 - B. Taking medication after visiting a sick friend
 - C. Storing cleaning products in easy-to-reach locations in the kitchen
 - D. Rinsing knives and cutting boards with hot water when moving between preparation items

2. Ready-to-eat food should NEVER be handled with bare hands in what situation?
 - A. Ready-to-eat food should never be handled with bare hands, regardless of the situation
 - B. When there is'nt a proper hand-washing station available
 - C. When food is being served to a high-risk population
 - D. When the food will be cooked to at least 140°C

3. When should a delivery be inspected?
 - A. After all products have been placed in their appropriate storage areas
 - B. When staff has time to inspect the delivery correctly
 - C. Immediately upon receiving the delivery
 - D. When the specific staff responsible for inspecting deliveries is available

4. Why is it advisable to only remove the amount of food you can prepare in a short period of time from the freezer?
- A. To prevent time-temperature abuse
 - B. To prevent cross-contamination
 - C. To prevent excess food waste
 - D. To reduce clutter and mess on food preparation surfaces
5. Performing procedural checks every shift to identify problems, and comparing and analysing temperature logs each week are examples of which principle in the HACCP system?
- A. Principle 5 – Establish Corrective actions
 - B. Principle 6 – Verifying that the system works
 - C. Principle 7 – Establishing monitoring procedures
 - D. Principle 8 – Establishing record keeping procedures
6. At which part of the flow of food is Food Safety the biggest concern?
- A. Purchasing, receiving & storing
 - B. Preparation, cooking, reheating & serving
 - C. Holding & cooling
 - D. All of the above

7. An employee is coughing and complaining of experiencing vomiting and diarrhoea. How should the situation be handled?
- A. Send the employee home immediately, and require a note from their doctor before they return to work
 - B. Have the employee wash dishes instead of preparing food
 - C. Have the employee complete cleaning tasks until they feel better
 - D. Have the employee wear gloves and a mask at all times while working
8. A customer calls to report that they contracted a foodborne-illness after they ate at your establishment. What information should you get from the customer?
- A. General contact information and a description of what food and drink the customer consumed
 - B. A list of any foods the customer has eaten since being in the establishment, including food not prepared by your staff
 - C. The contact information for the hospital or doctor's office where they were treated
 - D. The names or descriptions of any staff members the customer came into contact with while at the establishment

9. Name the major foodborne pathogenic microorganisms that can cause foodborne-illness:
- A. Norovirus, Salmonella Typhi, E. Coli, and Lactobacillus
 - B. Bacteria, Viruses, Parasites, and Fungi
 - C. Yeast, Mold, Toxins, and Acid
 - D. *Listeria monocytogenes*, *clostridium perfringens*, Norovirus, salmonella, E.Coli 0157:H7 and campylobacter
10. When comparing young children to healthy adults, the following is true:
- A. Their risk of foodborne illness is higher
 - B. They are only susceptible to foodborne illnesses during their first 12-24 months before their immune systems fully develop
 - C. They consume lower quantities of food than adults, making them less prone to foodborne illnesses.
 - D. Their risk of foodborne illness is the same as healthy adults
11. Which of the following is true of a traditional budget?
- A. It uses an existing budget as a foundation for determining future costs.
 - B. It is not adjusted for inflation.
 - C. It is used primarily for physical plant renovation.
 - D. It accounts for yearly depreciation.

12. Factors which may negatively affect a manager's ability to provide an effective employee performance review include:

- A. Use of objective standards to evaluate performance
- B. The tendency to evaluate an employee on his/her "best trait"
- C. Focusing on concerns of interest to the employee
- D. Asking questions that stimulate interaction between manager and employee

13. A manager has observed an employee stealing cleaning supplies. What is the first thing the manager should do to resolve the situation?

- A. Ask other staff members to observe the employee and report suspicious behavior.
- B. Speak to the employee privately and issue an oral warning.
- C. Suspend the employee for two weeks without pay.
- D. Change the delivery time for the cleaning supplies.

14. Profit and loss statements:

- A. Break down labor, equipment, and operational costs
- B. List current assets and liabilities
- C. Provide records of revenue and expenses for a specific time period
- D. Are needed only to prepare income tax returns

15. A foodservice worker with an open sore on his hand is most likely to transmit:

- A. Listeria
- B. Salmonella
- C. Staphylococcus
- D. Campylobacter

16. A food handler who is chopping vegetables removes his disposable gloves in order to assist a co-worker load a shipment of carrots into the refrigerator. When he is finished helping his co-worker, he rinses his hands in cool water and puts the gloves back on. What should the food handler have done differently in this situation?

- A. Use hand sanitizer before putting the gloves back on.
- B. Wash his hands with warm water and soap in the food preparation sink before putting the gloves back on.
- C. Wash his hands with warm water and soap in the hand-washing sink and replace the gloves with new ones.
- D. Wash his hands with warm water and soap and forget the gloves.

17. What branch of accounting deals with the managing of various government levies?

- A. Income accounting
- B. Cost accounting
- C. Tax accounting

D. Financial accounting

18. Which of the following describes the purpose of an independent audit?

A. To prepare correct financial reports.

B. To explain what is contained in the three main financial statements

C. To verify the material accuracy and truthfulness of financial reports

D. To perform ongoing verification of business operations and transaction recording process.

19. Documents used to predict volumes of business per service unit are called

A. Purchase orders

B. Service records

C. Income and Expense records

D. Cash receipts

20. Figures used in the preparation of the Statement of operations are not taken from

A. Beginning and ending Inventory figures

B. Cash ledger

C. Income disbursements

D. Statement of cash flows

Section B Answer any four (4) questions

1. a) Records deemed essential for a foodservice operation include those used to collect data on the major phases of the operations. These records may be classified by function.

- i. List the six (6) major functional categories. **[6 marks]**
- ii. Give three examples for each of the types of records kept for any two of the functional categories listed in (i) above. **[6 marks]**
- iii. Explain in detail the disadvantages of the conventional food service system. **[6 marks]**

b) TRUE OR FALSE

- iv. The ready-prepared system ensures that the food service business will not worry about delayed deliveries that may arise in the commissary due to transportation truck breakdowns. **[1 mark]**
- v. A social aim for a profit-making food service establishment includes catering food to young single ladies for convenience. **[1 mark]**

2. a) Discuss the advantages of the ready prepared food service system

[6 marks]

- b) What are some of the steps and important considerations of the purchasing process in a food service establishment? **[8 marks]**

- c) List the many factors that affect decisions regarding equipment selection.

[6 marks]

3. a). Prepare an income statement from the following transactions for May 2022.

Cost of goods sold	K108 000
Food Sales	K201 000
Salaries	K30 000
Taxes	K6000

[10 marks]

- ii. List and describe three Generally Accepted Accounting Principles (GAAP)

[3 marks]

- b) What is a material safety data sheet?

[1 mark]

- c) State six (6) personal hygiene practices that must be observed in a food processing establishment.

[6 marks]

4. What are the main objectives and general provisions of the recently enacted Food Safety Act of 2019?

[20 marks]

5. a) What are the objectives of food safety systems in a food service institution?

[2 marks]

- b) Compare and contrast food safety with food quality.

[3 marks]

- c) i) What is Listeriosis?

[2 marks]

- ii) Who are the most at risk individuals for listeriosis?

[3 marks]

iii) What are the symptoms of Listeriosis? **[4 marks]**

iv) What foods are typically involved in outbreaks of listeriosis?
[2 marks]

v) The environmental hygiene that is important in a food establishment involves a number of factors. Name four of these factors
[4 marks]

6. a) What is the correct handwashing procedure? **[5 marks]**

b) A well-defined marketing program includes four elements, namely product, place, price and promotion. Discuss each of these elements in detail.
[15 marks]

- END -



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
BSC HUMAN NUTRITION

AGN 5531 FOOD AND NUTRITION SECURITY
END OF YEAR EXAMINATION

DATE: 22ND JUNE, 2022

TIME: 09:00 – 12:00

DURATION: THREE (3) HOURS

VENUE: FSN 1

1. THIS PAPER CARRIES 100 MARKS
2. ANSWER ALL QUESTIONS
3. ANSWER EACH QUESTION ON A SEPARATE PAGE IN THE BOOKLETS PROVIDED.
4. MARKS FOR EACH QUESTION ARE INDICATED IN PARENTHESES

Question 1: The most recent (2020) Global Food Security Index results ranks Zambia on position 105 out of 113 countries, showing high levels of food insecurity in the country.

a) As a food and nutrition security officer, you are very conversant with household food insecurity among households. Briefly describe any five main causes of food insecurity among households in Zambia. (10 marks)

b) For each of the identified cause in (a), identify a possible sustainable solution. (5 marks)

Question 2:

Describe the four dimensions of food security and provide two indicators for each that can be used to assess food security at individual level. (10 marks)

Question 3:

Briefly describe the five main methods used for measuring food security. (20 marks)

Question 4:

Using relevant examples, discuss the effects of Russian-Ukraine war on household food and nutrition security (20 marks)

Question 5

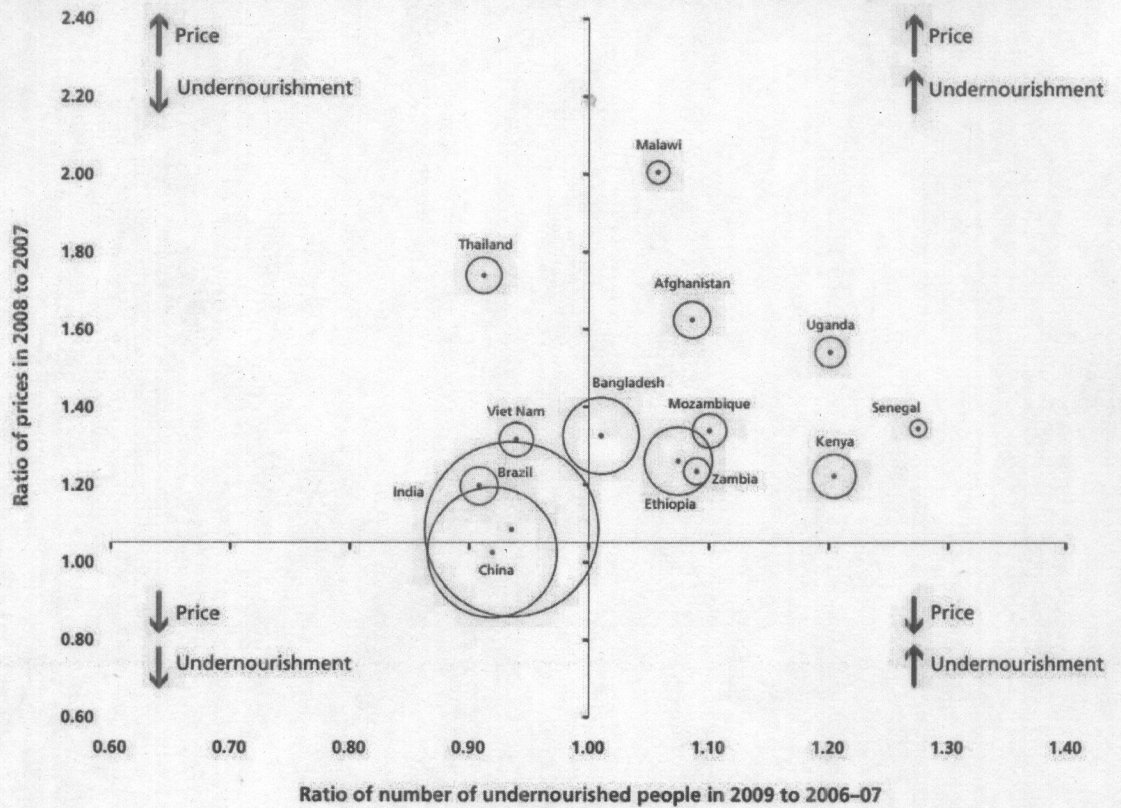
Using the Unicef Conceptual framework of malnutrition, describe the consequences of household food insecurity among children under the age of five. (15 marks)

Question 6: Based on the 2018 Zambia DHS, what is the proportion or prevalence of:

- a) Stunting among children under the age of five in Northern Province? (1 mark)
- b) Children aged 6–23 months who receive a minimum of 5 out of 8 food groups (1 mark)
- c) What is the proportion of children age 6–23 months who are receiving a minimum acceptable diet. (1 mark)
- d) What is the prevalence of exclusive breastfeeding among children under the age of six months? (1 mark)
- e) What is the proportion of women of reproductive age (WRA) who are anemic? (1 mark)

Question 7: Using the figure below (difference in resilience to food price shocks), answer the questions below:

Differences in resilience to food price shocks across countries



- Describe the information in the figure above. (10 marks)
- Using relevant examples explain the position of Zambia in the figure (5 marks)



THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS – JUNE 2022

AGS 4221 - SOIL AND PLANT ANALYSIS

TIME: 3 Hours

Marks: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1. State whether the following statements are True (T) or False (F). [9 Marks]
 - a. Plant analysis is preferred to soil testing as a technique for plant nutrient diagnosis because it measures the total amount of a particular nutrient.
 - b. In the critical range of the crop response curve, addition of nutrients results in yield increase at an increasing rate.
 - c. A 20 cm soil layer with a bulk density of 1.4 g/cm^3 containing 0.1% N, has the potential to supply 2600 kg N/ha.
 - d. One of the criteria for an element to be considered essential is that it should be derived from the soil.
 - e. Phosphates associated with Aluminium are typically found in soils with pH greater than 7.
 - f. The method that is used in Zambia to extract the micronutrients iron, copper, boron and zinc from soils uses diethylenetriamine pentaacetic acid – triethanolamine (DTPA-TEA).
2. You are working as an Agronomist in the Ministry of Agriculture in Solwezi District of North-Western Province. A farmer reports to your office that they have observed differences in the growth of the crop on their field. On one side of the field, the crop appears green and healthy, while the other part of the field, the crop appears yellow and stunted. When you visit the farm, you notice that the yellowing is mostly in younger leaves and the midrib and veins of the leaves being affected more, whereas the older leaves remain green. Answer the following. [26 Marks]

- a. Which plant macronutrient would you suspect to be deficient in this soil? Give reasons to support your answer. [5 Marks]
 - b. Which other two plant macronutrients show similar symptoms of yellowing as the one identified in 2a? How do these symptoms differ from those of the nutrient identified in 2a? [6 Marks]
 - c. Briefly describe how you would collect and prepare plant samples from the field for laboratory analysis. [7 Marks]
 - d. Which laboratory method for determining plant available phosphorus would you use if the soil sample collected from the field with poor crop growth has a pH of 4.7? Give reasons to support your answer. [3 Marks]
 - e. If the available P content in the soil before planting the crop was 6 mg/kg soil, would this soil meet the nutrient requirement for the crop that needs 20 kg of P per hectare? Assume a 20 cm plough layer with a bulk density of 1.3 g/cm³. Show your calculations. [5 Marks]
3. The organic matter content in 8 soil samples was determined using two methods, namely, the Walkley and Black (Dichromate) method and the Loss on Ignition (LOI) method. The results of this study are shown in Table 1 below.

Table 1: Soil organic matter content analysed using the dichromate and LOI methods of determining soil organic matter content

Sample #	Dichromate (%)	LOI (%)
1	2.3	2.7
2	2.5	2.8
3	3.4	3.2
4	2.2	2.6
5	2.5	2.4
6	2.1	2.5
7	1.8	1.9
8	1.6	1.8

- a. Plot the readings on a graph, where LOI is on the y-axis and dichromate is on the x-axis. [4 marks]
- b. Using the graph plotted in part (a), formulate an equation to predict a value in LOI using values from the dichromate method. [4 marks]

- c. Calculate the organic matter content of a soil given that the value in the dichromate method is 2.6 %. [4 marks]
 - d. List any two advantages and two disadvantages of the LOI method of determining soil organic matter content. [4 marks]
 - e. Calculate the organic matter content of an oven-dry soil sample with an initial weight of 2.5 g given that it loses 40% of its weight after further heating at 550° C for two hours. [4 marks]
4. Explain how you would determine the lime requirement of a soil if you are provided with the following materials – laboratory space and glassware, a soil sample, a pH meter and a lime sample. [10 marks]
- 5a. Define the following terms: [6 marks]
- i. Stratified random sampling
 - ii. Mineral soil
 - iii. Eluviation
 - iv. Bt horizon
 - v. Composite sample
 - vi. Lithosequence
- b. Soils develop as a result of the interaction of 5 factors which result in 4 major groups of soil forming processes. Answer the following: [9 marks]
- i. List the factors of soil formation [3 marks]
 - ii. List and define the four (4) major groups of soil forming processes that lead to the formation of soil horizons. [6 marks]
- 6a. A farmer whose farm is next to a limestone processing plant is seeking help to determine the distribution of limestone dust coming from the limestone processing plant on his % ha field. The limestone processing plant is located in the direction the wind that blows towards his farm originates. Because limestone dust is known to raise the soil pH, you are requested to map the pH of the surface soil (0-5 cm) on the 5 ha plot. Briefly describe how you would

go about collecting samples from this field. Indicate the sampling method you would use and justify why you would use this method. [5 marks]

- b. Soil samples were collected from the top (0-20 cm) depth of a farmer's field for evaluating the fertility status of the soil. A summary of selected properties are presented in Table 2.

Table 2. Summary of selected properties from farmer's field.

Sample ID	Sand %	Silt %	Clay %	pH 0.01M CaCl ₂	OM %
1	81	6	13	5.65	0.96
2	81	6	13	5.61	1.12
3	81	6	13	5.40	1.36
4	79	7	14	5.63	0.96
5	81	5	14	5.70	2.56
6	81	6	13	5.79	2.48

Answer the following questions: [20 marks]

- Calculate the mean percentages of sand, silt and clay in this field and use the mean values to determine the textural class of the soil in the field using the attached USDA Textural triangle. [4 marks]
- Calculate the mean, and coefficient of variation of the soil organic matter in this field and then classify the degree of variability of organic matter in the field. [6 marks]
- How much would it cost to determine the mean value of the soil pH in this field with an allowable error of 2.5 % or 0.025 at a confidence level of 95 % ($Z=1.96$) if the cost of measuring the pH of one sample is K25.00? Show the calculations that led to your final answer. [7 marks]
- Would a soil sample with a pH value of 4.80 be considered an outlier in the above field, if the pH is normally distributed in this soil? Show necessary calculations to support your answer. [3 marks]

END OF EXAMINATION

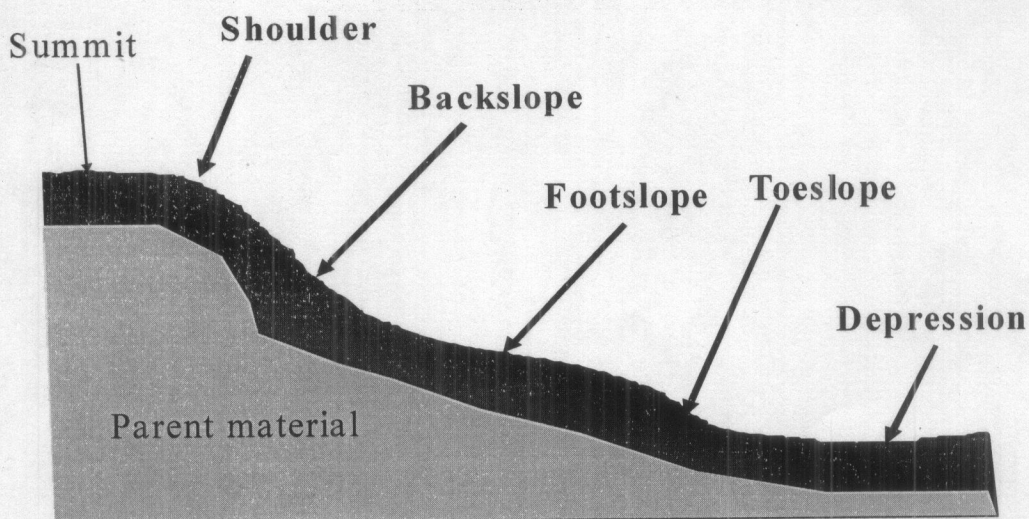
THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS – JUNE 2022
AGS 5121
SOIL GENESIS AND CLASSIFICATION

TIME: THREE HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS

TOTAL MARKS: 125

1. Refer to the figure below showing 6 topographic positions in a landscape with a uniform parent material



- a. What would be the expected distribution of calcium carbonates in terms of depth in the different topographic positions? (3 marks)
- b. In each of the 6 topographic positions, name the soil forming processes that may be characteristic of that position and explain why (6 marks)

- c. The figure above is an expression of a catena. Define a catena and explain its significance in both soil formation and soil survey (4 marks)
 - d. As you might have noticed on your visit to the field station, the northern part has a higher elevation compared to the southern part meaning that the landscape descends southwards. Assuming you are conducting soil observations from the north to the south, what changes would you expect to find in terms of the following soil properties? (8 marks)
 - i. soil color,
 - ii. soil depth,
 - iii. soil drainage,
 - iv. soil texture
 - e. In the topographic positions indicated above, where would you expect to find the following: (4 marks)
 - i. Redoximorphic features (Soil mottling)
 - ii. High water percolation
 - iii. Histosols
 - iv. Entisols
2. Vertisols are commonly occurring soils in southern Zambia:
- a. Explain their genesis (5 marks)
 - b. Explain their morphological, chemical and physical properties (5 marks)
 - c. Explain productive potential and use (5 marks)
3. What are the major soil forming processes involved in the formation of the following diagnostic horizons:
- a. Mollic epipedon (5 marks)
 - b. Anthropic epipedon (5 marks)
 - c. Spodic horizon (5 marks)
 - d. Argillic horizon (5 marks)
 - e. Oxidic horizon (5 marks)

4. A soil is classified as: Clayey, Kaolinitic, Isohyperthermic, Typic Oxisol:
- Present its morphological, chemical, physical and biological properties (5 marks)
 - What are its fertility attributes beneficial to arable cropping (5 marks)
 - What the management challenges in arable cropping in this soil (5 marks)
 - Suggest a management package for optimizing arable land productivity (5 marks)
5. Present the major characteristics of the following soils and suggest a package of remedial measures for arable cropping for each one of them:
- Natrustalf (4 marks)
 - Duriaquods (4 marks)
 - Plinthudults (4 marks)
 - Calciusterts (4 marks)
 - Eustrtox (4 marks)
6. You have been invited to an international conference to give a presentation of the soils of Region I of Zambia. Prepare your presentation by highlighting the following:
- Climatic characteristics of Region I (5 marks)
 - Major soil forming processes active in Region I (5 marks)
 - Major soil types of Region I and their chemical and physical characteristics (5 marks)
 - Remedial measures for sustaining land productivity (5 marks)

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS – JUNE 2022

AGS 5131
Soil Survey and GIS Techniques

TIME: 3 Hours

Marks: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1. a) Calculate the resolution of a map that has a scale of 1:300,000? [5 Marks]
b) With a suitable example, briefly explain what you understand by a provisional legend as used in soil survey and mapping. [10 Marks]
2. One can generally distinguish three soil maps which are listed below. For each of the map types provide a brief description indicating at least one advantage of using it as a form of soil representation. [15 Marks]
 - a) Area class polygon soil maps [5 Marks]
 - b) Point soil maps [5 Marks]
 - c) Continuous field maps [5 Marks]
3. With the aid of a schematic diagram and/or relevant equations, discuss the differences between conventional soil mapping and digital soil mapping. [10 Marks]

4. You have been given a task by a client to survey a 10,000 ha farm whose intention is to produce wheat, maize, paprika and Lucerne as a fodder crop. [25 Marks]

- a. What method of soil survey would you use? (Explain why) [5 Marks]
- b. At what scale would you map his farm? (Explain why) [5 Marks]
- c. What would be the most appropriate map units for such a survey? [5 Marks]
- d. Explain the main steps you would undertake in the process of soil survey? [10 Marks]

5. Assume that a soil unit has been defined on the basis of sand content. The sand content in a certain map unit is measured at 5 randomly selected points as shown below: [20 Marks]

Point 1-----15 %

Point 2-----12%

Point 3-----24%

Point 4-----30%

Point 5-----8%

- a. What is your comment on the accuracy of this mapping given that the maximum soil variability should not exceed 10%? [5 Marks]
- b. Explain what soil variability is and its significance in soil mapping [5 Marks]

- c. What is the appropriate way of expressing soil variability in a soil survey? [3 Marks]
- d. What are the major causes of soil variability within mapping units? [7 Marks]
6. Explain briefly, the following units classified after a survey and land capability classification. [10 Marks]
- a) IIw2
 - b) IIIs3
 - c) Ie3
 - d) IIc3
 - e) IVe4
7. Explain the importance of the main soil survey report. [5 Marks]

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS- JUNE 2022
AGS 5411: SOIL MICROBIOLOGY

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

TIME ALLOWED: 3 hours

Total marks: 100

SECTION A: SHORT ANSWERS

{40 Marks}

1) Indicate whether the following statements are True (T) or False (F) [20 marks]

- a. Differential media contain special agents that make colonies of organisms visible and easy to count whilst selective media contain agents that promote the growth of one organism whilst inhibiting growth of competing organisms.
- b. Combining agricultural lime with manure in one application gives a better crop response to lime on acidic soil because organic matter buffers the soil.
- c. The transformation of NH_3 to NH_4^+ is an oxidation process.
- d. The presence of a red pigment in crushed root nodules of legume plants is an indication of *effectiveness* of *Rhizobia* in the process of biological nitrogen fixation (BNF) while a large number of small nodules indicates *ineffectiveness* of the *Rhizobia* strain on the legume plant.
- e. Algae are most suited for isolation and growth in broth rather than on agar media because they are chlorophytic and therefore photosynthetic organisms.
- f. A soil with a C:N ratio of 15:1 and contains 2.5 % soil organic matter contains more N than a soil with 100 mg N per kg.
- g. The bacteria that causes cholera, *Vibrio cholera* has a reported generation time of only 40 minutes and reproduces by binary fission. Starting with 10^2 colony forming units (CFU) in 1 cm^3 of contaminated water, in 24 hours the culture density could reach more than 10^9 CFUs.

- h. One cm^3 of a fertile soil could contain as many as 10^8 CFU of bacteria and so given a volume of $1 \mu^3$ per cell of bacteria this represents 10 % of the soil volume.
- i. Isotopes of an element such as ^{14}N and ^{15}N have the same number of neutrons but different number of protons in their atomic nucleus.
- j. Binary fission is the mechanism of reproduction in Eukaryotes and mitosis is the mechanism in Prokaryotes.
- 2) Choose the most appropriate response to each of the following statements **[20 marks]**
- a) The nitrogenase enzyme that is essential for biological nitrogen fixation contains the following chemical elements [2 marks]
- A. Iron and zinc
 - B. Iron and molybdenum
 - C. Molybdenum and zinc
 - D. Zinc and phosphorus
- b) The microbial decomposition of organic matter is a process that is mainly carried out by [2 marks]
- A. Photosynthetic bacteria
 - B. Photoheterotrophs
 - C. Chemoheterotrophs
 - D. Photoheterotrophs and chemoheterotrophs
- c) Which of the following agronomic practices can promote biological nitrogen fixation in the soil [2 marks]
- A. Liming acidic soil
 - B. Addition of nitrogen rich substrate
 - C. Application of ammonium nitrate fertilizer
 - D. Addition of carbon rich substrate
- d) The conversion of dinitrogen gas to mineral forms of nitrogen is a high energy process in which two ATP molecules are consumed for every nitrogen gas molecule. Which plant nutrient element has a direct role in the provision of energy for this process? [2 marks]
- A. Nitrogen
 - B. Calcium
 - C. Phosphorus
 - D. Potassium

- e) Which of the following agronomic practices can promote both nitrification and biological nitrogen fixation in the soil [2 marks]
- A. Soil aeration
 - B. Addition of nitrogen rich substrate
 - C. Application of ammonium nitrate fertilizer
 - D. Addition of carbon rich substrate
- f) Which one of the following statements is not true about biological nitrogen fixation [2 marks]
- A. Biological nitrogen fixation can take place in a wide range of environments because the essential microorganisms have a great diversity of metabolism
 - B. High levels of ammonium and nitrate depress biological nitrogen fixation
 - C. High levels of ammonium and nitrate promote biological nitrogen fixation
 - D. The major group of N-fixing-microbes is bacteria known as diazotrophs, which use atmospheric N as a sole source of N.
- g) What is the name bacterium commonly used in commercial soyabean inoculants? [2 marks]
- A. *Rhizobium leguminosarum*
 - B. *Rhizobium japonicum*
 - C. *Bradyrhizobium japonicum*
 - D. *Bradyrhizobium leguminosarum*
- h) What is the most appropriate method of isolating symbiotic nitrogen-fixing bacteria? [2 marks]
- A. Direct isolation
 - B. Enrichment cultures
 - C. Plant traps
 - D. Polymerase chain reaction
- i) Which of the following factors is the most important factor in nitrogen mineralization from a substrate [2 marks]
- A. Nitrogen content
 - B. Carbon content
 - C. The C/N ratio
 - D. All of the above

j) You are provided with two substrates, ONE and TWO, each with C/N ratios of 10:1 and 15:1, respectively. Which of the two substrates would decompose faster? [2 marks]

- A. ONE
- B. TWO
- C. Not enough information given
- D. I do not know

SECTION B: SHORT ESSAYS**[60 marks]**

- 1) Briefly discuss the application of Soil Microbiology in the production of soybeans.
[10 marks]
- 2) Nitrification is a two-step process involving separate groups of bacteria. **[20 marks]**
 - a) Write a balanced chemical equation for each of the two steps in the nitrification process and give the name of the microorganism at each step. **[6 marks]**
 - b) Discuss the two major factors that affect the rate of nitrification. **[4 marks]**
 - c) Explain the importance of nitrification in crop production and discuss any two soil management challenges associated with the process and propose mitigation measures for each one of them? **[6 marks]**
 - d) Briefly discuss the effect of nitrification on biological nitrogen fixation **[4 marks]**
- 3) One agronomic application of soil microorganisms is in enhancing crop productivity through use of living microorganisms called bio-fertilizers. Answer the following questions: **[15 marks]**
 - a) What are referred to generally as bio-fertilizers? **[2 marks]**
 - b) Give THREE examples of commercially marketed bio-fertilizers in Zambia. **[3 marks]**
 - c) Discuss the claimed advantages of bio-fertilizers over conventional inorganic fertilizers. **[5 marks]**
 - d) A combination of *Rhizobium* and *Mycorrhizae* into one single inoculum is reported to be more beneficial for biological nitrogen fixation in plants than *Rhizobium* alone. Explain why the combination inoculum would be better on acid soils of low fertility. **[5 marks]**
- 4) One important aid to the study of microorganisms is their classification. Answer the following questions in this regard: **[15 marks]**
 - a) Explain why only heterotrophic microorganisms such as bacteria are pathogenic. **[3 marks]**
 - b) Describe in what ways actinomycetes are similar to but also different from fungi. **[6 marks]**
 - c) Microorganisms are invisible to the naked eye. Describe THREE biochemical ways which can be used to adduce indirect evidence of the existence of microbes in the environment. **[6 marks]**

END OF EXAMINATION!