THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURE

SUPPLEMENTARY EXAMINATION

2015/2016

1. AGA 2110 ANATOMY AND PHYSIOLOGY OF DOMESTIC ANIMALS
2. AGA 3201 PRINCIPLES OF ANIMAL NUTRITION
3. AGA 3212 APPLIED ANIMAL NUTRITION
4. AGA 4532 PIG AND POULTRY PRODUCTION
5. AGA 5321 APPLIED ANIMAL REPRODUCTION
6. AGE 2111 FUNDAMENTALS OF MICRO-ECONOMICS
7. AGE 4142 AGRICULTURAL MARKETING AND PRICING
8. AGF 3042 INSTRUMENTAL METHODS IN FOOD ANALYSIS-THEORY
9. AGF 3100 GENERAL AND FOOD MICROBIOLOGY- THEORY
10. AGN 2110 ANATOMY AND PHYSIOLOGY
11. AGN 2212 PRINCIPLES OF HUMAN NUTRITION
12. AGN 3222 HUMAN NUTRITION
13. AGN 3232 PRINCIPLES OF DIETETICS
14. AGN 4241 NUTRITION DISORDERS
15. AGN 4321 RESEARCH METHODS AND EPIDEMIOLOGY FOR NUTRITIONISTS
16. AGS 2110 FUNDAMENTALS OF SOIL SCIENCE
17. AGS 3711 AGROCLIMATOLOGY
18. AGS 4210 SOIL MINERALOGY AND CHEMISTRY

THE UNIVERSITY OF ZAMBIA

FACULTY OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

SUPPLEMENTARY EXAMINATION QUESTIONS - 2015/16

COURSE: AGA 2110 ANATOMY AND PHYSIOLOGY OF DOMESTIC ANIMALS
DURATION: THREE (3) HOURS

INSTRUCTIONS: CAREFULLY READ INSTRUCTIONS FOR EACH SECTION
ANSWER EACH SECTION IN A SEPARATE ANSWER BOOK
WRITE THE NUMBER OF EACH ATTEMPTED QUESTION

SECTION A

INSTRUCTIONS: ANSWER QUESTION ONE AND EITHER QUESTION TWO OR QUESTION THREE IN THIS SECTION

QUESTION ONE

A. Briefly describe the following terms as used in anatomy and physiology of domestic animals; **[10]**

i. Oviduct
ii. Alveoli
iii. Sigmoid flexure
iv. Tidal volume
v. Melanocytes

B. With respect to domestic animals;
i. Briefly describe three structures accessory to the integument **[3]**
ii. State the chambers through which blood passes in the heart. **[4]**
iii. State one structure found on the right ovary in poultry. **[1]**
iv. What is the function of the crop in poultry? **[2]**

QUESTION TWO

With regard to domestic animals,
i. State the name and function of formed elements found in blood. **[6]**
ii. Name the types of teeth and their function. **[4]**
iii. What are the types of placenta found in domestic animals? **[4]**
iv. Briefly discuss why blood is said to have both ECF and ICF. **[6]**

QUESTION THREE

With regard to the reproductive system of domestic animals,

i. Draw and show four main anatomical features of the female reproductive system. **[6]**
ii. State four organs constituting accessory glands in male animals **[4]**
iii. What is a freemartin? **[2]**
iv. Draw and clearly label a spermatozoon. **[8]**

SECTION B

ANSWER QUESTION ONE AND CHOOSE EITHER QUESTION TWO OR THREE IN THIS SECTION. ALL QUESTIONS CARRY EQUAL MARKS (20). WRITE ALL SECTION B ANSWERS IN A SEPARATE ANSWER BOOK.

Q1. The other means of getting extracellular materials into the cell are phagocytosis and pinocytosis. With the help of diagrams write short notes on;
a) Phagocytosis
b) Pinocytosis

Q2. Epithelial tissue covers the whole surface of the body and is specialised to form the covering or lining of all internal and external body surfaces to perform specialised functions. Briefly describe each of the main functions of epithelial tissue and the area or organ where these functions occur.

Q3. Describe briefly the three basic functions of the nervous system and with the help of a diagram explain how a motor neuron functions.

END OF EXAMINATION

The University of Zambia
School of Agricultural Sciences
Department of Animal Science

AGA 3201: PRINCIPLES OF ANIMAL NUTRITION

Supplementary Examination - 3rd November 2016

Instructions: *Answer all questions and all questions carry **20** equal marks.*

1. A). What are feed additives and why are they important in animal nutrition (8 marks)?
   B). Name and explain the importance of at least four (4) different types of feed additives used in animal nutrition (12 marks)?

2. A). Explain the difference between feed ingredients and nutrients (6 marks)?
   B). Why is it that animals have a requirement for nutrients and not for feed ingredients (4 marks)?
   C). What is the importance of vitamins and minerals in animal nutrition and how do they differ from each other (10 marks)?

3. A). What are the main sources of feed for ruminants (4 marks)?
   B). Explain in detail the fermentation of carbohydrates in the rumen? (6 marks).
   C). What are the end products of carbohydrate rumen fermentation and how are they mobilized from the rumen for further metabolism or excretion (10 marks)?

4. A). Explain the importance of rumen motility in ruminants as far as fermentation of substrates and mobilization of products is concerned (12 marks)?
   B). What are some of the advantages and disadvantages of post-gastric fermentation in pseudo-ruminants when compared with that in ruminants (8 marks)?

5. A). Name and describe the effects of the main types of endogenous anti-nutritional factors that are found in feedstuffs meant for feeding non-ruminants? (12 marks).
   B). How can the effects of each of these anti-nutritional factors be minimized to improve feed utilization and animal performance (8 marks)?

The University of Zambia

School of Agricultural Sciences

Department of Animal Science

2015/2016 Academic Supplementary Examinations

Course: AGA 3212 – Applied Animal Nutrition

Date: 4th November 2016

INSTRUCTIONS TO CANDIDATES: Answer any **five** (5) questions; each question carries 20 equal marks.

Answer each section in a separate answer booklet

SECTION A: Ration Formulation

QUESTION ONE

A). Explain the importance of feed processing in animal nutrition **(12 marks)**?

B). Explain some of the important processing methods used for preparing feeds for non-ruminant animals (**8 marks**)?

QUESTION TWO

A). What do you understand by the term "Nutrient requirements of farm animals" and how are these requirements met **(6 marks)**?

B). Using a Pearson square, formulate a broiler grower ration to have 18% Crude Protein (CP) using Maize meal, Soy beans meal and a Mineral premix **(6 marks)**? The mineral premix is fixed at 2.5% inclusion rate and contains no protein and energy. The nutrient composition of Maize meal, Soya bean meal and the premix are given in Table 1. What are the Energy, Calcium and Phosphorus contents of the diet **(6 marks)**?

C) Based on your knowledge of poultry nutrition is this ration appropriate for the growing chickens **(2 marks)**?

Table 1: Nutrient composition of feedstuffs required for the formulation of the pig grower diet.

Ingredient	**Protein (%)**	**Metabolizable Energy (Mcal/kg)**	**Calcium (%)**	**Phosphorus (%)**
Maize meal	12.0	3400	0.03	0.30
Soy bean meal	44	2900	0.50	0.65
Premix	0.0	0.0	22.0	16.0

QUESTION THREE

A.) Assume you have a 500kg dairy cow that is expected to produce 10 litres of milk with a 3.5% butter fat content each day. The animal is expected to consume 2.5% of its body weight on dry matter (DM) basis. If the animal is consuming grass hay containing about 80% dry matter (DM) and with estimated Total Digestible Nutrients (TDN) and digestible Crude Protein (dCP) concentrations of 480g and 70g per kg dry matter, respectively. How much of this hay is the animal expected to eat each day when expressed on as fed basis **(2 marks)?** What is the concentration of TDN and dCP of this hay when expressed on as fed basis **(4 marks)?**

B.) Assuming the animals needs 600g dCP and 3600g total digestible nutrients per day for maintenance and 60g dCP and 420g TDN for each litre of milk containing 3.5% butter fat. How much milk is this animal expected to produce from consuming the grass hay **(6 marks)?**

C.) Using Maize meal, Wheat bran, Cotton Seed Cake and Di-calcium Phosphate (DCP), formulate a concentrate mixture for milking cows to have 130g crude protein **(4 marks)?** The contents of protein in Maize meal, Wheat bran and Cotton seed cake are 45, 100 and 295g/kg, respectively. The mineral concentrate; DCP does not contain any protein and is fixed at 4% inclusion level. How much concentrate is this cow supposed to consume to increase milk production to expected levels **(4 marks)?**

SECTION B – Livestock and Poultry Feed Ingredients

QUESTION FOUR

Explain at least two characteristics of two feed ingredients that are available in Zambia which below to each of the following classes:

(i)	Energy concentrates	**(4 Marks)**
(ii)	Feed additives	**(4 Marks)**
(iii)	Protein concentrates	**(4 Marks)**
(iv)	Roughages	**(4 Marks)**
(v)	Plant origin protein concentrates	**(4 Marks)**

QUESTION FIVE

In one or two statements, write what you understand by the following terms used in applied animal nutrition:

(i)	Ruminal acidosis	**(4 Marks)**
(ii)	Non-protein nitrogen	**(4 Marks)**
(iii)	Abortifacients	**(4 Marks)**
(iv)	Trace minerals	**(4 Marks)**
(v)	Essential amino acids	**(4 Marks)**

QUESTION SIX

Urea is a cheaper source of protein for ruminants.

(i) With the help of a schematic diagram, described how urea provides proteins to ruminants **(5 Marks)**

(ii) In an event that the animal over ingest urea, explain how urea poisoning occurs and what is the quick action that you would do to save the animal from dying? **(15 Marks)**

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
ANIMAL SCIENCE DEPARTMENT

2015/2016 ACADEMIC YEAR SUPPLEMENTARY EXAMINATIONS

COURSE AGA 4532: PIG AND POULTRY PRODUCTION

DATE OF EXAMINATION: 4th NOVEMBER, 2016

DURATION: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

i. **Answer all questions.**
ii. **Marks for each question are as shown.**
iii. **Write the answers for each Section in separate answer books and mark books appropriately as Section A, B OR C.**

SECTION A POULTRY PRODUCTION

Q1.

i. Write on the developmental stages that an incubated fertile egg passes through from the time it is laid to the time a chick emerges from it. Include the changes that take place inside the egg during each stage. **(20 marks)**

ii. Distinguish a poultry breed from a commercial poultry strain and a commercial hybrid strain. **(6 marks)**

Q2. Explain the variation in protein and calcium content for the different Zambia Bureau of Standards recommended feeds for commercial broilers (chickens reared for meat) and commercial layers (chickens reared for egg production). **(20 marks)**

SECTION B PIG PRODUCTION

Q1 Name and explain the main signs that will indicate that a sow or gilt is on heat. **(12 marks)**

Q2 In piglet management there are essential routine management practices that have to be carried out. List the practices and briefly explain their relevance in good piglet management. **(18 marks)**

Q3 Briefly discuss the importance of herd records in pig production. **(10 marks)**

SECTION C ORGANIC PIG AND POULTRY PRODUCTION

Q1 You are the new inspector certifying organic pig and poultry production in Kanakantapa. You have come to do a standard inspection of Mr Phiri's organic animal husbandry programme. **(14 marks)**

i. Detail him on the main activities you would cover with him on this inspection.

ii. Enlighten him on the recommended origin of animals or birds, disease prevention and control measures for organic production.

END OF EXAMINATION

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

SUPPLEMENTARY EXAMINATIONS: MID-YEAR 2015/16
COURSE: AGA 5321 APPLIED ANIMAL REPRODUCTION
DATE: 03RD NOVEMBER 2016 TIME: 09:00- 12:00 HOURS

INSTRUCTIONS:
- **ANSWER EACH SECTION IN A SEPARATE ANSWER BOOKLET**
- **CAREFULLY READ INSTRUCTIONS FOR EACH SECTION**
- **BEGIN EACH QUESTION ON A NEW PAGE, AND,**
- **INDICATE THE NUMBER OF EACH QUESTION ATTEMPTED**

SECTION A

INSTRUCTIONS: **ANSWER QUESTION ONE** AND **EITHER QUESTION TWO** OR **THREE IN THIS SECTION.**
EACH QUESTION IS WORTH THIRTY [30] MARKS.

QUESTION ONE

A) What is the purpose of the following products or terms in animal reproduction? [20]

i. Sperm Capacitation
ii. Induced parturition
iii. Placentome
iv. PMSG
v. Cystorelin®

B) Profitable animal production enterprises rely on successful reproduction.
i. State two methods used for pregnancy diagnosis? [6]
ii. Explain the reason for choice of methods selected in B] i. above? [4]

QUESTION TWO

A) With regard to maternal recognition of pregnancy (MRP);

i. Discuss two secretory factors responsible for MRP in domestic animals [10]
ii. How does a sow compare with other domestic animals with regard to prostaglandin utilization during MRP? [5]

B) A farmer calls you requesting assistance to establish which of his cows are pregnant.

i. State two methods you would use if the last recorded oestrus was 45 days ago. [5]
ii. What is your rationale for using each of the selected methods? [5]
iii. A cow has 70-120 placentomes. What is the role of these structures? [5]

QUESTION THREE

A) With regard to Animal reproduction;

I. What are transgenic animals? How do these animals differ from those obtained by embryo splitting. [4]
II. Describe the deficiencies in nature that MOET seek to resolve. [5]
III. State two major ovarian structures and name their function. [4]
IV. What is the basis of a laboratory test for pregnancy? [2]

B) Explain how you would assist a farmer resolve the following cases;

a. A persistent corpus luteum. [3]
b. An acyclic postpartum cow. [3]
c. A cow has not returned to oestrus. [3]
d. Semen analysis shows cytoplasmic droplets on some spermatozoa. [3]
e. Poor fertility following progestagen use in beef cattle. [3]

SECTION B

INSTRUCTIONS: ANSWER ANY TWO QUESTIONS IN THIS SECTION
EACH QUESTION IS WORTH TWENTY [20] MARKS

1. Artificial insemination (AI) of farm animals is a very important technique in today's agriculture industry both in the developed and the developing world.

i). What are the current benefits of using AI in Zambia?
ii). What are some of the challenges of using AI under Zambia conditions and how can these challenges be overcome?
iii). In a named livestock specie, discuss how you would collect semen and why you would use this method of semen collection.

2. The capacity of an animal to produce and reproduce differs between species, breeds and strains as a result of genetic factors. However, a complex set of interrelated animal husbandry factors will influence the animal's ability to utilize that capacity for growth, development and production and reproduction. Mention and explain how the different environmental factors affect reproduction in farm animals.

3. If an enterprise is to remain viable, successful reproduction is one of the important management aspects in animal production. What are the environmental factors that negatively affect reproduction in livestock? Suggest remedial measures to these factors.

END OF EXAMINATION – GOOD LUCK – BONE CHANCE

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

SUPPLEMENTARY EXAMINATION FOR 2015/16 ACADEMIC YEAR

AGE 2111 : FUNDAMENTALS OF MICRO-ECONOMICS

TIME : 3 HOURS

INSTRUCTIONS : *ANSWER ALL QUESTIONS*

1) What do you understand by the following concepts?
   a) Marginal Rate of Technical Substitution
   b) Second Degree Price Discrimination
   c) Opportunity Cost
   d) Diminishing returns to scale
   e) Circular flow model ***(25 marks)***

2) Consider a competitive market for which the quantities demanded and supplied at various prices are given as follows:

Price (Kwacha)	***Demand (millions)***	***Supply (millions)***
60	22	14
80	20	16
100	18	18
120	16	20

   a) Calculate the price elasticity of demand when the price changes from K100 to K120.
   b) Calculate the price elasticity of supply when the price is increased from k100 to K120.
   c) Explain the meaning of the elasticity coefficients you have calculated above.
   d) What do you understand by income elasticity of demand and cross price elasticity?
e) What would be the effect on the demand for this good given an increase in consumers' income, given that it is a normal good. ***(25 marks)***

3) Define each of the following terms carefully and give examples where appropriate:

a) Scarcity
b) Marginal Utility
c) Production Possibility Curve
d) Indifference curve
e) Consumer Surplus ***(25 marks)***

4) a) With the aid of a diagram, show how a monopoly determines its price and quantity. Explain how a monopoly can be inefficient. ***(10 marks)***
b) Draw a circular flow model and explain how it works. ***(10 marks)***
c) What is meant by equi-marginal principle? ***(5 marks)***

SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

AGE 4142 – AGRICULTURAL MARKETING AND PRICING
SUPPLEMENTARY EXAMINATIONS – 2015 ACADEMIC YEAR

INSTRUCTIONS

1. Read the questions carefully and answer all.
2. Points for each question are shown in parenthesis. Therefore, allocate your time appropriately.

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1. A producer of broiler finisher has the possibility of discriminating between the Lusaka and Chongwe markets where the demands, respectively, are:

$$Q_1 = 24 - 0.2P_1$$

$$Q_2 = 10 - 0.05P_2$$

Total cost = 35 + 40Q where: $Q = Q_1 + Q_2$

   a) Using a properly labeled graph, define price discrimination and explain **TWO (2)** conditions needed for a producer to gain from it. **(9 points)**
   b) Based on the demand and cost equations above, what price would the producer charge in order to maximize profits with price discrimination between the two markets? **(8 points)**
   c) Based on the demand and cost equations above, what price would the producer charge in order to maximize profits without price discrimination between the two markets? **(4 points)**
   d) As a market analyst, which option of the following two choices would you propose to the producer: (i) implement price discrimination between the two markets, (ii) do not implement price discrimination between the two markets? Explain your answer clearly showing your work. **(4 points)**

2. Price determination and price discovery are concepts that explain how price is established in a transaction.
   a) Explain the difference between these two concepts and use an example for each concept to illustrate your answer. **(5 points)**
   b) Discuss **TWO (2)** types of price behaviour under oligopoly and use an example for each type of behaviour to illustrate your answer. **(10 points)**
   c) Outline and discuss **TWO (2)** alternative price discovery systems. Your answer should clearly explain what each system involves and the advantages and disadvantages of each system you discuss. **(10 points)**

3. Consider the market for beans in Solwezi which has the following excess supply $Q^{XS} = -100 + 0.1P$ and that for Lusaka which has the following excess demand $Q^{MD} = 250 - 0.15P$, where P is the price of beans per ton (Kwacha/ton).
   a) Suppose there was a ban on trade, what would be the price of beans in each market? **(4 points)**
   b) Suppose the ban on trade was now lifted, compute and graphically depict the market clearing conditions and the direction of trade assuming there were no transfer costs. **(10 points)**

c) Who would gain and who would lose as a result of opening up trade between the two districts? Be sure to explain why the identified economic actors would gain or lose. **(6 points)**

d) Now, suppose transfer costs were pegged at a fixed rate of K800/ton of beans. Would trade between the two markets be profitable? Show your work and explain. **(5 points)**

4. Consider the following regression output reporting the relationship between quantity of meat demanded (kg) in Zambia and eight explanatory variables: (1) price of meat in kwacha/kg (P Meat); (2) price of eggs in kwacha/unit (P Eggs); (3) P Dairy in kwacha/litre (P Dairy); (4) price of fats in kwacha/kg (P Fats); (5) price of cereals in kwacha/kg (P Cereals); (6) price of sweets in kwacha/kg (P Sweets); (7) Household income (Income), and; (8) Annual population (Population).

SUMMARY OUTPUT

Regression Statistics	
R Square	0.99
Adj. R Square	0.99
Observations	70

ANOVA

	df	*F*	*Significance F*
Regression	8	1744.1	0.000005
Residual	61		
Total	69		

	Coefficients	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-20513.75	0.000003	-28542.20	-12485.30
P Meat	-13306.31	0.000074	-19568.65	-7043.98
P Eggs	-7430.63	0.070154	-15491.71	630.44
P Dairy	151233.31	0.000002	107663.95	194802.69
P Fats	-5843.09	0.185050	-14559.15	2872.97
P Cereals	-37970.12	0.013007	-67644.96	-8295.29
P Sweets	6799.16	0.148760	-2497.61	16095.94
Income	14.14	0.008064	3.82	24.46
Population	229.36	0.000006	155.28	303.44

a) What is the coefficient of determination of these regression results? Interpret the coefficient of determination in this model. **(3 points)**

b) From these results, do the eight explanatory variables help to explain the variation in the quantity of meat demanded? Explain. **(4 points)**

c) What is the effect of the price of meat (P Meat) on the quantity of meat demanded? Is the relationship statistically significant at 1% confidence level? Explain. **(3 points)**

d) Based on the coefficients on explanatory variables, what commodities/products are meat substitutes? Explain why and state whether the substitutes you have identified are statistically significant at 1% confidence level. **(4 points)**

e) Based on the coefficients on explanatory variables, what commodities/products are meat complements? Explain why and state whether the complements you have identified are statistically significant at 1% confidence level. **(4 points)**

f) From the regression results, write down the prediction equation. **(3 points)**

g) Is meat a normal good? Explain. **(4 points)**

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

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2016 ACADEMIC YEAR FIRST SEMESTER
SUPPLEMENTARY EXAMINATIONS
AGE 4211: INTRODUCTION TO AGRIBUSINESS MANAGEMENT
TIME: THREE (3) HOURS

1. The following financial information for Mulenga Ltd has been provided for the year ended 31 December 2015:
   i. Cash balance brought forward to first July ZMK 2,500
   ii. Sales are ZMK15 per unit and cash is received in the third month.
   iii. Production and sales unit are as follows:

2015	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb
Production (units)	40	50	80	70	80	130	130	150	145	160	170	160
Sales (units)	60	60	75	90	55	140	130	150	150	160	170	150

   iv. Raw materials cost ZMK 4 per unit of production and these are paid in the third month
   v. Wages are ZMK 5 per unit and paid in the same month of production.
   vi. Running costs are ZMK 4 per unit and are paid in month of production.
   vii. Sundry expenses are ZMK 50 monthly.

Required

   a. Draw out a cash flow statement for six months covering July to December 2015 **(20 Marks)**
   b. How much overdraft if any should the business get? **(5 Marks)**

2. Taonga Farm Ltd is a producer of two types of chilies. The following information for the company's first year of operation has been provided

	Red Hot Chilies	Fresh Green Chilies
Total Sales Revenue	K 1,500,000	
Selling Price per Kg		K 160
Variable cost per Kg	K90	
Total Variable cost		K 1,500,000
Fixed Costs	K300,000	K400,000
Sales Units	10,000Kg	12,500 Kg

Required

   a. Calculate the firm's breakeven point volume for each product **(4 Marks)**
   b. Calculate the firm's breakeven point revenue for each product **(4 Marks)**

c. If the company wished to make a profit of K125,000 on each product, how many units of each product should the firm produce **(3 Marks)**
d. Calculate the firm's contribution for each product **(3 Marks)**
e. Calculate the firm's profit for each product **(3 Marks)**
f. Calculate the margin of safety expressed as a percentage **(3 Marks)**
g. Comment on the performance of the two products **(5 Marks)**

3. You and two University friends want to start a business. You choose a partnership.

i) Carefully outline some of the considerations of setting up a partnership **(15 Marks)**

ii) What are some of the specific issues that need to be addressed in your written partnership agreement? **(10 Marks)**

4. a. Outline Maslow's hierarchy of needs. What is the relevance of Maslow's hierarchy of needs to management **((10 Marks)**

b. i) What are the assumptions of theory X and Y? **(10 Marks)**

ii) Considering the two types of managers in (i) above which one is more effective and why? **(5 Marks)**

THE END

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

2014/2015 ACADEMIC YEAR FINAL YEAR SUPPLEMENTARY EXAMINATION

COURSE: AGF 3042
Instrumental Methods in Food Analysis - Theory

Date: Tuesday 1st November 2016 **Time: 09 00 – 12 00 hours**

Duration: THREE (3) HOURS **Venue: Omnia 3**

INSTRUCTIONS TO CANDIDATES:

1. There are two (2) sections in this examination paper, Sections 1 and 2
2. Answer **ALL** questions in **Section 1** and answer any **four (4)** questions in **Section 2**
3. Each question in **Section 1** is allocated marks as shown in **parenthesis**
4. **All** questions in **Section 2** carry equal marks of twenty **(20)** marks each

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SECTION 1: Answer ALL questions in this section in the provided booklet

1. Progression of sucrose on a TGA would show one of the following scenarios about its mass. Which one is true? **(1 mark)**
   a. The mass would remain the same
   b. The mass would be fluctuating throughout the process
   c. The mass would decrease
   d. The mass would increase

2. The relative interaction of a solute with a mobile and stationary phase can be described by: **(1 mark)**
   a. Partition coefficient
   b. Distribution movement
   c. Supercritical coefficient
   d. Partition solubility

3. The refractive index (RI) is measured by one of the following equipment. Which one is it? **(1 mark)**
   a. Polarimeter
   b. refractometer
   c. UV – Vis Spectrometer
   d. Light reflector

4. The following are examples of alkaline earth metals except _____ **(1 mark)**
   a. Calcium
   b. Sodium
   c. Strontium
   d. Magnesium

5. Polyacrylamide gels are prepared by polymerisation of acrylamide monomer and N-N' - methylene bis acrylamide crosslinker in the presence of: **(1 mark)**
   a. APS and β-mercaptoethanol
   b. APS and TEMED

c. TEMED and β-mercaptoethanol

d. Tris Buffer and EDTA

6. Mirrors are a feature of all the following equipment except _____. **(1 mark)**

a. Diffraction grating device

b. Older model UV – Vis Spectrometer

c. Newer model UV – Vis Spectrometer

d. Michelson Interferometer

7. All the following are main components of an GC except _____ **(1 mark)**

a. Oven

b. Detector

c. Injector

d. Pump

8. Which of the following has the shortest wavelength? **(1 mark)**

a. UV

b. γ-rays

c. RF

d. Vis

9. All the methods listed below are non - destructive methods except _____ **(1 mark)**

a. Mass Spectrometry

b. Differential Scanning Calorimetry

c. Near Infra-Red Spectrometry

d. Gas Chromatography

10. In ion exchange chromatography, three types of separations are possible except one. Which is the odd one out? **(1 mark)**

a. Cationic from anionic components

b. Differently sized particles in solution

c. Ionic from nonionic compounds

d. Mixture of similarly charged species

11. Which technique cannot be used for any sugar analyses

(1 mark)

a. Thermogravimetric analysis
b. Polarimetry
c. Isoelectric focusing
d. Refractometry

12. One of the following is a buffer used for RNA electrophoresis. Mark the correct one?

(1 mark)

a. TPE
b. TEMED
c. MOPS
d. TAE

13. Which of the following enzyme is used as immobilised enzymes in ELISA

(1 mark)

a. Horse radish oxidase
b. Acidic phosphatase
c. Alkaline peroxidase
d. Horse radish peroxidase

14.

15. Intensity of colour increases proportionally with the sample concentration in all the following except:

(1 mark)

a. Liebermann–Burchard
b. Flame Photometry
c. Competitive ELISA
d. Indirect ELISA

16. (**True / False**) -CH=CH- will vibrate at a slower frequency than CH_2-CH_2

(1 mark)

17. (**True / False**) An Electron impact is a feature of a Mass Spectrometry

(1 mark)

18. What is the difference between a time domain spectra from a frequency domain spectra? **(2 marks)**

19. State one (1) advantage and (1) disadvantage of a capillary column when compared to a packed column? **(2 marks)**

SECTION 2: Answer any four (4) questions in this section

1. **Figure 1** shows a ray of light (radiation) entering a sample and emerging from the sample in a bid of quantifying the sample. Answer the following questions related to this figure.

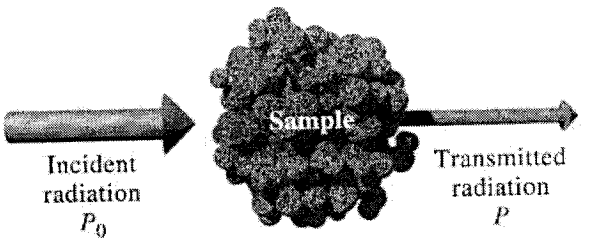


Figure 1: Radiation entering an unknown sample, Sample, and emerging on the other end

a. Describe briefly what you think is happening in the figure and how quantification of the sample can be achieved? **(5 marks)**

b. What analytical technique would be used and briefly describe this technique? **(7 marks)**

c. This figure is related to transmittance and absorbance in (or of) materials as well as a law called Beer's Law. Describe the mathematical relationship of these three (transmittance, absorbance and Beer's Law). [You may use formulas to explain this relationship] **(8 marks)**

2. You are informed that xylose (a sugar) can be analysed by various techniques including HPLC and GC. Discuss the principles of these two techniques and explain why you think each of these can be used to analyse xylose. **(20 marks)**

3. A protein sample was subjected to DSC in its native form and after pressure treating it at 600 MPa. The thermogram of the native protein showed two distinct depressions while the other one of the high pressure treated protein showed only one peak.

   a. Discuss why there was this difference in the themograms (native versus high pressure treated samples) and also what happened to the protein during the pressure treatment **(10 marks)**

   b. To achieve the same effect as pressure treatment, what one (other) thing could you do to the protein to ensure similar results of the pressure results? **(2 mark)**

   c. Draw a typical thermogram showing and labeling all the points on the thermogram. **(8 marks)**

4. NMR and Mass Spectrometry are two techniques that are used in analytical science. Compare and contrast these two techniques. (20 marks)

5. The molecular weight of an unspecified protein, at physiological conditions, is 70,000 Dalton by another technique. The polyacrylamide gel electrophoresis (PAGE) of the protein yields a single band corresponding to molecular weight of 70,000 Dalton. However, in the presence of the reducing agent, β-mercaptoethanol, SDS PAGE shows two bands, corresponding to molecular weights of 30,000 and 20,000 Dalton. Answer the following:

   a. Clearly describe why there is a difference in the results obtained between the PAGE and SDS - PAGE? **(8 marks)**

   b. Clearly explain the reagents (chemicals) used in SDS – PAGE and their roles in the technique **(8 mark)**

c. Describe **one (1)** type of bonding that is likely to exist between the subunits

(1 mark)

d. Describe how the analyst elucidated the weight of the proteins in this SDS – PAGE technique **(3 marks)**

THE END

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

2014/15 ACADEMIC YEAR SUPPLEMENTARY EXAMINATIONS

AGF 3100
General and Food Microbiology (Theory)

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS ONE (1) SECTION
2. ANSWER ALL THE QUESTIONS
3. ALLOCATED MARKS FOR EACH QUESTION ARE INDICATED IN THE BRACKETS.

SECTION A

Answer ALL questions

Question 1

Write brief notes on any four (4) of the following:

a) Bacteriostatic and Bacteriocidal antibiotics **[5 Marks]**
b) Gram positive and negative bacteria staining principle **[5 Marks]**
c) Three important applications of recombinant technology **[5 Marks]**
d) Importance of microorganisms in the food processing industry **[5 Marks]**
e) Simple and differential staining techniques **[5 Marks]**

Question 2

Describe the processes that are important in mutation and in vivo recombination in Bacteria and Viruses **[20 Marks]**

Question 3

Bacteria are living organisms that are microscopic and usually unicellular in nature. Describe bacterial reproduction and growth in a liquid medium **[20 Marks]**

Question 4

a) Explain in detail why fresh fish easily spoils **[6 Marks]**
b) As a food microbiologist, recommend to a fresh fish seller at a Local Market two (2) ways of preventing and or minimising fresh fish spoilage **[2 Marks]**
c) Fresh fish is associated with *Salmonella*
    i. List any two types of *Salmonella* antigens **[2Marks]**
    ii. List four (4) common virulent factors of gram negative bacteria such as *Salmonella* **[6 Marks]**
    iii. Explain how lack of refrigeration for several hours and inadequate reheating before serving contribute to development of Salmonellosis **[4 Marks]**

Question 5

a) Food spoils or deteriorates in a number of ways. Describe with examples at least three ways in which food can spoil **[6 Marks]**

b) Explain in detail how sodium chloride function as antimicrobial compounds in food preservation **[5 Marks]**

c) Explain in detail how weak acids function as antimicrobial compounds in food preservation **[5 Marks]**

d) Define acidity pH and pK_a **[4 Marks]**

END OF EXAMINATION

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

BSc Human Nutrition

ANATOMY AND PHYSIOLOGY
AGN 2110

Date: 1st November, 2016 Time: 09.00-12.00hrs

Duration: THREE (3) HOURS Venue: Other Rooms

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS THREE SECTIONS A, B and C

2. ANSWER ALL THE QUESTIONS IN ALL SECTIONS. ANSWER SECTIONS A AND B IN A SINGLE BOOKLET AND SECTION C IN A SEPARATE BOOKLET

3. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS

SECTION A: Choose the best answer **[30 Marks]**

1. _____separates the body into Anterior and Posterior parts.
   A. Sagittal
   B. Frontal
   C. Median
   D. Horizontal

2. According to the terms of relation or position, closer to the origin of a structure and further away from the origin of a structure is termed as _____.
   A. Posterior; anterior
   B. Medial; lateral
   C. Superficial; deep
   D. Proximal; distal

3. According to the terms of relation or position, towards the head and towards the tail (feet) termed as _____.
   A. Superficial; deep
   B. External; internal
   C. Supine; prone
   D. Cephalad; Caudad or superior; inferior

4. A dividing wall or a partition is _____.
   A. Sac
   B. Sinus
   C. Space
   D. Septum

5. A peristaltic rush which results in a failure to absorb enough colon water results in _____.
   A. Constipation
   B. Diarrheoa
   C. Cramps
   D. Flatus

6. Which structure contains the lowest amount of oxygen?
   A. Pulmonary vein
   B. Aorta
   C. Vena cava
   D. Right ventricle

7. The pulmonary semilunar valve prevents a back-flow of blood into the _____.
   A. Pulmonary artery
   B. Right ventricle
   C. Left ventricle
   D. Right atrium

8. The shortest section of the intestines is the _____.
   A. Ileum
   B. Duodenum
   C. Jejunum
   D. Colon

9. The finger-like extensions inside the small intestine are called _____ and increase the surface area.
   A. Microvilli
   B. Villi
   C. Lacteals
   D. lumens

10. The myocardium would be the thickest in the _____.
   A. left atrium
   B. left ventricle
   C. right atrium
   D. right ventricle

11. What is a mature gamete called?
   A. Oogenesis
   B. Ovary
   C. Ovulation
   D. Ova

12. Which cells produce testosterone?
   A. Interstitial cells
   B. T-cells
   C. Sertoli cells
   D. Sustentacular cells

13. In the female, what is the correct term for the production of gametes called?
   A. Oogenesis
   B. Ovary
   C. Ovulation
   D. Oocytation

14. Which of the following is NOT considered part of the male genital duct system?
    A. Rete testis
    B. Tubuli recti
    C. Seminal vesicles
    D. Ductus deferens

15. Which of the following is true about structure of the penis?
    A. Has one corpus cavernosa and one corpus spongiosum
    B. Has one corpus cavernosa and two corpora spongiosum.
    C. Has two corpora cavernosa and one corpus spongiosum
    D. Has two corpora cavernosa and two corpora spongiosum

16. Which one of the following are the earliest cells of spermatogenesis?
    A. Primary spermatocytes
    B. Spermatogonia
    C. Spermatids
    D. Spermatozoa

17. Which of the following is NOT a function of a hormone?
    A. Regulates chemical composition and volume of the internal environment
    B. Regulates metabolism
    C. Regulates glandular secretions
    D. Produces electrolytes

18. Which of the following accessory glands is not paired?
    A. Prostate
    B. Seminal Vesicular gland
    C. Bulbourethral gland
    D. Cowpers glands

19. Fertilization of an ovum by a spermatozoon occurs in the
    A. cervix
    B. fallopian tube
    C. ovary
    D. uterus

20. The adrenal glands consist of _____.
    A. the inner and outer layer of the kidney
    B. the inner medulla and the outer cortex
    C. lower adrenal and upper paradrenal sections
    D. ACTH and BCTH sections

21. Accessory organs of the gastrointestinal tract (GIT)
    A. Form the long tube of the digestive system
    B. An example is the oral pharynx
    C. Has both mechanical and chemical function
    D. Function mainly to soften the food

22. All of the following structures are components of the urinary system except

    A. kidneys
    B. ureters
    C. urethra
    D. gallbladder

23. What structure rests on the superior pole of each kidney?

    A. spleen
    B. transverse colon
    C. adrenal gland
    D. duodenum

24. The outer layer of the kidney, just internal to the fibrous capsule, is the renal

    A. medulla
    B. column
    C. pelvis
    D. cortex

25. Components of a nephron include

    A. a renal corpuscle
    B. proximal and distal convoluted tubules
    C. a nephron loop
    D. all of the above

26. The _____ part of the stomach is the area that is connected to the esophagus.

A. cardiac
B. pyloric
C. fundus
D. body

27. Which of the following maintains the patency (openness) of the trachea?

A. surface tension of water
B. surfactant
C. cartilage rings
D. pseudostratified ciliated epithelium

28. Which respiratory-associated muscles would contract if you were to blow up a balloon?

A. diaphragm would contract, external intercostals would relax
B. internal intercostals and abdominal muscles would contract
C. external intercostals would contract and diaphragm would relax
D. diaphragm contracts, internal intercostals would relax

29. The nose serves all the following functions except _____.

A. as a passageway for air movement
B. as the initiator of the cough reflex
C. warming and humidifying the air
D. cleansing the air

30. The exchange of gases and nutrients between blood and tissues is a major function of:

A. arterioles
B. . arteries
C. capillaries
D. veins

SECTION B

State whether each of the statements is true or false. **[9 Marks]**

1. The epididymis is secretes testosterone
2. The hand is inferior to the arm
3. The ovary has primordial follicles and corpus luteum during the luteal phase
4. The mesovarium is the broad ligament that does not cover the ovary
5. In an anatomical position, the thumb is medial to the ring finger
6. Appendicular portion of the skeleton consists of the arms and the legs
7. A red blood cell is a biconcave disk that has a nucleus
8. The glans penis is homologus to the clitoris in structure
9. The tricuspid valve is located between the right atrium and the right ventricle
10. Pancreas is located behind the stomach, attached to the duodenum
11. The stomach has no endocrine function.
12. The labia minora is homologous to the scrotum
13. The seminiferous tubules produce semen
14. Undescended testis at birth is referred to as cryptorchidism
15. The corpus luteum produces gonadotropin releasing hormone
16. The vagina is about 10cm
17. Atria is the same as auricles
18. Dartos is a muscle that forms part of the scrotal sac deep to the skin

SECTION C [61 Marks]

Question 1

Briefly discuss the implications of having a low packed cell volume. **(2 Marks)**

Question 2

Write short notes on neutrophils. **(4 marks)**

Question 3

Discuss the mechanism of transport of carbon dioxide in the body. in your discussion, use the alveoli as the point of exit and the body tissues as the point of origin. **(8 marks)**

Question 4

Describe the mode of action of any non steroidal hormone of your choice. **(10 marks)**

Question 5

Discuss in detail the disease associated with the Rh system.

(10 marks)

Question 6

Discuss the ovarian cycle with respect to the various hormonal interaction involved. **(18 marks)**

Question 7

Discuss in detail the regulation of sodium. **(9 marks)**

.....END OF EXAMINATION.....

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

2015/2016 ACADEMIC YEAR SUPPLEMENTARY EXAMINATION

COURSE: AGN 2212
Principles of Human Nutrition

Date: Friday 4th November, 2016 **Time: 09.00 – 12.00 Hours**

Duration: THREE (3) HOURS **Venue: OMNIA 2**

INSTRUCTIONS TO CANDIDATES:

1. **This paper consists of Section A and Section B. Answers to each section should be in separate booklets**
2. **Please read the guidance for each section carefully; answer ALL questions**
3. Each question is allocated marks as shown in **parenthesis**

SECTION A

Section A has a total of **ten (10)** questions
Each question carries **4 marks**
Answer **ALL** questions in this section
You should take about **one (1)** hour for this section; allow about **five (5)** minutes for each question

1. Write short notes on mineral-mineral interactions **(4 marks)**

2. Answer the following:

   a. How many kilocalories per gram are there in alcohol? **(1 mark)**
   b. Alcohol has many attributes that elicit different effects on the human body. State **one (1)** attribute for each of the following effects or reactions
   i. Increased urination and shedding of water from cells
   ii. Increased self-confidence, poor decreased judgement and short term amnesia
   iii. Frequent excessive alcohol drinking associated with addiction and dependency

   (3 marks)

3. Define free radicals and explain how they are formed **(4 mark)**

4.

   a. Two carbohydrate metabolic conditions that are associated with milk consumption and can be alleviated by avoidance of milk are _____ and _____ **(2 marks)**
   b. List **four (4)** general symptoms of diabetes mellitus **(2 marks)**

5. Mark the following statement **TRUE** or **FALSE**
   a. Minerals are essential, non-caloric organic nutrients needed in tiny amounts in the diet **(1 mark)**
   b. Water soluble vitamins are more sensitive to heat **(1 mark)**
   c. Vitamin A, D, E, and K are stored in body fat **(1 mark)**
   d. It takes longer to deplete stores of water soluble vitamins **(1 mark)**

6. The end products of pancreatic lipase activity are _____ and _____ while those of lipoprotein lipase are _____ and _____ **(4 marks)**

7.

a. Explain why water soluble vitamins have to be taken in the diet more frequently than fat soluble vitamins **(2 marks)**

b. List two functions of vitamin C in the human body **(2 marks)**

8.

a. Lipids are metabolized into fatty acids and glycerol. Briefly discuss **one (1)** fate of glycerol and **one (1)** fate of fatty acids in the human body. **(2 marks)**

b. Give **two (2)** names of omega 3 fatty acids and **two (2)** names of omega 6 fatty acids. **(2 marks)**

9. Iron plays a critical role in overall cell function and neural development. Identify **two (2)** causes of iron deficiency and recommend **two (2)** strategies for increasing the amount of iron absorbed from food **(4 marks)**

10. Mark the following statement **TRUE** or **FALSE**

a. A high protein diet may decrease calcium loss in urine **(1 mark)**

b. Fats should comprise not more than 30 % of total calories in a diet **(1 mark)**

c. Aldehyde dehydrogenase is responsible for converting alcohol into acetaldehyde **(1 mark)**

d. Celiac disease is a sensitivity to gliadin **(1 mark)**

SECTION B

Answer Question 1 in a separate booklet and Question 2 and 3 in another booklet

1.

a. List five (5) functions of minerals and five (5) functions of vitamins **(10 marks)**

b. Discuss the significance of vitamin D and calcium in infants and children under the age of 2 years **(10 marks)**

c. Write short notes on

   i. Symptoms and diseases related to vitamin A deficiency **(5 marks)**

   ii. Absorption mechanisms of fat and water soluble vitamins **(5 marks)**

2.

a. Describe in detail the digestion of proteins in the human body **(12 marks)**

b. Briefly two (2) fates of the carbon skeletons of amino acids **(3 marks)**

3. Describe the following terms ensuring that you distinguish **a, b, c, and d** each one from the other clearly:

   a. Glycolysis

   b. Glycogenolysis

   c. Glycogenesis

   d. Gluconeogenesis

(15 marks)

END OF EXAMINATION

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

BSc Human Nutrition

SUPPLEMENTARY EXAMINATION

HUMAN NUTRITION
AGN 3222
2015-16

Date: 2nd November, 2016 Time: 09:00 – 12:00

Duration: THREE (3) HOURS Venue: Omnia 3

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 150 MARKS AND HAS TWO SECTIONS, A & B

2. ANSWER ALL QUESTIONS IN SECTION A AND ONLY FOUR (4) QUESTIONS FROM SECTION B.

3. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS

Section A: (TOTAL 50 MARKS)

Answer ALL questions in this section

1. During infancy exclusive breastfeeding is recommended for the first six months of a child's life. LIST five (5) advantages of breast milk/breastfeeding for either the mother and/or her infant **(5 MARKS)**

2. a. List the FOUR (4) KEY nutrients needed in higher amounts for older adults **(4 MARKS)**
   b. Name the KEY nutrient that is required in lower amounts for older women **(1 MARK)**

3. During pregnancy there is an increased requirement for protein; what is this needed for? **(5 MARKS)**

4. What is the PRIMARY purpose of Food Based Dietary Guidelines (FBDGs) **(5 MARKS)**

5. a. Name the hypothesis which links the intrauterine effect of under nutrition to adult health? **(2 MARKS)**
   b. LIST THREE (3) chronic diseases which are linked to poor intrauterine nutrition? **(3 MARKS)**

6. a. Outline FOUR (4) food sources of Riboflavin **(4 MARKS)**?

   b. List TWO (2) consequences of Vitamin B1 deficiency in infants? **(2 MARKS)**

7. Which vitamins make up vitamin B complex? **(5 MARKS)**

8. What are the functions of antioxidant vitamins and which vitamins do they include? **(5 MARKS)**

9. Explain the role of Vitamin C in preventing Iron Deficiency Anaemia (IDA) **(2 MARKS)**

10. Mention THREE (3) factors that hinder Calcium absorption **(3 MARKS)**

11. Which key nutrients would a pregnant woman require in larger amounts to ensure she provides for her unborn child's.....?
    a) Blood? **(2 MARKS)**
    b) Bones? **(2 MARKS)**

Section B: (TOTAL 100 MARKS)

Answer ONLY four (4) questions in this section

1. **It is essential to work on strategies that promote and facilitate dietary diversification of cereal & tuber-based diets, with foods rich in micronutrient. FAO/Life Sciences Institute propose five strategies to increase dietary diversity through food-based approaches.**

   a) List these FIVE (5) proposed strategies (**5 MARKS**)

   b) Using your answers from *question 1a*, discuss what is involved with each strategy and how it can increase dietary diversity (**20 MARKS**)

2. **Weight gain and atherosclerosis often begin during the adolescent period.**

   a) What is the CAUSE of obesity in humans? (**5 MARKS**)

   b) Adolescents and young adults must establish healthy eating and lifestyle habits to reduce the risks of chronic disease later in life; discuss potential barriers to this **(20 MARKS)**

3. **Josephine weighs 70.5 Kg and she is trying a new diet that provides 1200 calories. She is eating 20% carbs, 50% protein and 30% fat. Assuming that she needs to consume 130g of carbohydrates/day**?

   a) Determine whether Josephine is getting the minimum of 130 grams of carbs/day? **(10 MARKS)**

   b) Given that her recommended allowance for protein is 0.8g/day. Is she consuming more than the recommended 0.8 grams protein/kg or is she getting more than the recommended maximum of 2 g protein/kg per day? **(10 MARKS)**

   c) Explain the consequences of not meeting the recommended allowances for;

   i) Carbohydrates **(2.5 MARKS)**

   ii) Proteins **(2.5 MARKS)**

4. Complete the table below; (25 MARKS)

	Vitamin E	**Vitamin K**
Dietary Sources	i) ii) iii) iv)	i) ii) iii) iv)
Functions	i) ii) iii)	i) ii) iii)
Organs where stored	i) ii) iii)	**i)** **ii)**
Where its absorption takes place		
Consequences of deficiency	i) ii)	i) ii)

5. a) List and explain the THREE (3) components of energy expenditure**?** **(7 MARKS)**

b) Explain how each of the factors below affects the Basal Metabolic Rate (BMR)? **(8 MARKS)**

i) Age

ii) Gender

iii) Exercise

iv) Exposure to cold temperature

c) Briefly define the FOUR (4) forms of energy in the human body **(10 MARKS)**

- End of Examination -

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

BSc HUMAN NUTRITION

PRINCIPLES OF DIETETICS
AGN 3232
2016 END OF YEAR SUPPLEMENTARY EXAMINATIONS

DATE: 04/11/2016 TIME: 09:00h – 12:00h

DURATION: THREE (3) HOURS VENUE: OMNIA 3

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS TWO (2) SECTIONS; SECTION A AND B

2. ANSWER **ALL** QUESTIONS

3. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS

SECTION A – 25 marks

1. Total energy expenditure (TEE) is broken down into three (3) groups.
    a. Define TEE **(1 mark)**
    b. List the three (3) groups that constitute TEE **(3 marks)**

2. Give four (4) reasons for ordering a therapeutic diet **(4 marks)**

3. **T or F:** Diverticulosis is a common feature seen in adolescents **(1 mark)**

4. List three (3) sources from which one can obtain sound nutritional information **(3 marks)**

5. **T or F**: Nephrons are small subunits of the kidneys that drain into the ureter. **(1 mark)**

6. The genetic makeup of Asians has been shown to influence the way that they metabolize alcohol.
    a. Write down the main equation for alcohol metabolism **(2.5 marks)**
    b. Which enzyme(s) are of particular importance to Asians and why? **(3 marks)**

7. **T or F:** A woman with a waist to hip ratio of 0.86 is likely to have a pear shaped body and at low risk of cardiovascular disease **(1 mark)**

8. List two (2) nutrients that are of particular importance in the elderly and why? **(2 marks)**

9. Tagatose, Aspartame and Stevia are all examples of alternative sweeteners. One of these sweeteners is a prebiotic, the other is a sweetener, while another has a structure that is very similar to Neotame (also an alternative sweetener). **(2.5 marks)**
    a. Define the term prebiotic and the sweetener associated with it.
    b. Which one of the sweeteners listed above has a structure that is very similar to neotame?

10. **T or F**: Himalayan salt is a good source of iodine for Vegetarians **(1 mark)**

SECTION B (25 marks each)

Question 1

a) An individual who constantly consumes foods high in trans-fatty acids and saturated fats is found with very high levels of low density lipoproteins (LDL) after laboratory tests.

i. What disease is this person at risk of? **(1 mark)**
ii. What type of diet would you recommend? Describe this diet in detail. **(8 marks)**
iii. What other lifestyle interventions would you recommend? **(3 marks)**

b) B12 deficiency is a common symptom of atrophic gastritis in the elderly.

i. Describe in detail how and why B12 deficiency occurs for this type of infection. Be sure to explain what happens to your food when ingested, all the way to the small intestines. **(8 marks)**

c) Food intolerance is a common feature in the elderly.

i. Give two (2) characteristics of food intolerances **(2marks)**
ii. List three (3) causes of food intolerances **(3 marks)**

Question 2

a. The diagram below shows a nutrition facts label

Nutrition Facts

Serving Size 2 tbsp. (33 g)
Servings Per Container 7

Amount Per Serving

Calories 20 Calories from Fat 10

	% Daily Value*
Total Fat 1 g	2%
Sodium 190 mg	8%
Total Carbohydrate 2 g	1%
Protein 1 g	

Vitamin A 2% • Vitamin C 15%
Iron 10% • Vitamin B6 20%
Vitamin B12 4%

Not a significant source of saturated fat, trans fat, cholesterol, dietary fiber, sugars, and calcium.

* Percent Daily Values are based on a 2,000 calorie diet.

i. How many kcals are in the entire container? **(1 mark)**

ii. In one serving:

a) What is the total number of kcals one would obtain from all the macronutrients? **(4 marks)**

b) How many kcal come from carbohydrates? **(1 mark)**

c) What percent of kcals come from protein? **(2 marks)**

- **1 kcal = 1 Calorie; Be sure to show all your working**

b. It has been reported that vegetarian diets may be nutritionally adequate if they are well planned and a variety of fruits and vegetables are consumed.

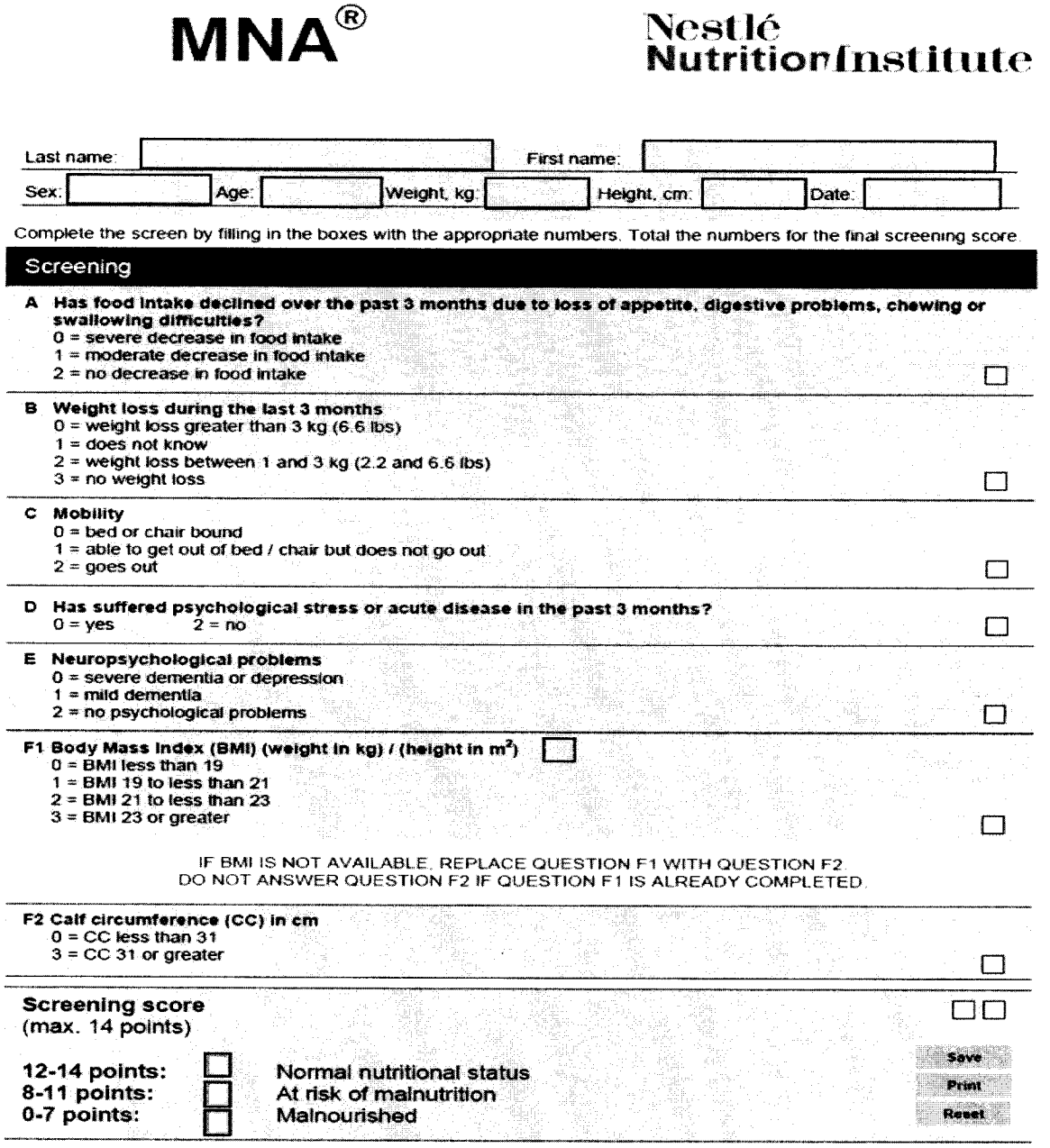
i. Describe the benefits of a vegetarian diet during adolescence and the nutrients of concern in this age range. Why are the nutrients you have listed of concern? **(6 marks)**

ii. Provide five (5) points to consider when planning a vegetarian diet? **(5 marks)**

iii. How would the consumption of a vegetarian diet help in the prevention of osteoporosis? **(6 marks)**

Question 3

The figure below shows a screening tool recommended by ESPEN



MNA®

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3 kg (6.6 lbs)
1 = does not know
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F1 Body Mass Index (BMI) (weight in kg) / (height in m^2) ☐
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2.
DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.

F2 Calf circumference (CC) in cm
0 = CC less than 31
3 = CC 31 or greater ☐

Screening score ☐☐
(max. 14 points)

12-14 points: ☐ Normal nutritional status
8-11 points: ☐ At risk of malnutrition
0-7 points: ☐ Malnourished

Save Print Reset

a) What screening tool is this and who does it target? **(2 marks)**

b) Mr. Kangoki of Kuku Compound is 69 years old. He reports that over the last three (3) months his appetite remained the same and was still eating well. However, his weight has dropped from 83 kg to 79 kg from his last checkup three (3) months ago. Mr. Kangoki is still very active and mobile with no psychological problems but tends to forget things a lot (mild dementia). His BMI is 22.

i. What is Mr. Kangoki's nutritional status? Indicate the score and how you got to this answer. **(5 marks)**

ii. Mr. Kangoki has a waist to hip ratio of 0.80. **(3 marks)**

i. What type of body shape does he have?

ii. Describe the type of fat that he is most likely to have.

iii. From your answer in ii. do you think that Mr. Kangoki's BMI is a true representation of his current health status? Why? **(3 marks)**

c) Taurine is one of the nutrition considerations in a vegetarian diet.

i. What are the two main sources of taurine? **(2 marks)**

ii. In which age group is taurine most essential and why? **(4 marks)**

iii. What would you recommend to a vegetarian pregnant woman with regard to taurine requirements? Give a reason for your answer. **(2 marks)**

b. Define glycemic index (GI) and list three (3) factors that may affect the GI of food **(4 marks)**

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

BSC HUMAN NUTRITION

NUTRITION DISORDERS AGN 4241
2016 END OF YEAR SUPPLEMENTARY EXAMINATIONS

DATE: 03/11/2016 **TIME: 09:00H – 12:00H**

DURATION: THREE (3) HOURS **VENUE: OMNIA 3**

INSTRUCTIONS TO CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS
2. ANSWER FIVE (5) OUT OF SIX (6) QUESTIONS
3. EACH QUESTION CARRIES EQUAL MARKS

Question 1

a. In nutrition science, what is marasmus? (**1 mark**)
b. Give an outline of the characteristics of marasmus (**4 marks**)
c. Studies suggest that marasmus represents an adaptive response to starvation. Explain the term "adaptive response" (**1 mark**)
d. Provide an outline of how children adapt to energy deficiency (**5 marks**)
e. Discuss the possible causes of marasmus (**4 marks**)
f. What are the typical signs and symptoms of marasmus (**5 marks**)

Question 2

Coronary Heart Disease (CHD) is becoming increasingly important in Zambia and this has in part been attributed to the escalating obesity levels. Several risk factors exist and these include modifiable, non-modifiable and intermediate causes.

a) Give one (1) example of each risk factor listed above and explain why they are risk factors for CHD **(6 marks)**
b) Define atherosclerosis and plaque buildup **(4 marks)**
c) Why is LDL cholesterol considered a "bad" lipoprotein in the progression of atherosclerosis? **(5 marks)**
d) **T or F:** Flaxseed, red wine and avocado are all heart healthy foods **(1 mark)**
e) **T or F:** Coconut oil is a vegetable oil and therefore contains high levels of monounsaturated fatty acids **(1 mark)**
f) Which vitamin has been shown to reduce LDL-C? **(1 mark)**
g) How do plant sterols and stanols lower LDL-C in the diet? **(2 marks)**

Question 3

a. Define the term "malnutrition" (**2 *mark***)
b. Give reasons why there is "NO" accurate figures on world prevalence of protein energy malnutrition (PEM) (**2 marks**)
c. What is the first and most important manifestation of PEM? (**2 marks**)
d. Describe how a child manifesting with PEM presents. (**12 marks**)
e. Reports suggest that in some regions such as Africa and South Asia numbers of malnourished children is on the increase. Provide reasons for such a scenario. (**2 marks**)

Question 4

a. Name two (2) hormones produced by the thyroid gland **(2 marks)**
    i. Which particular hormone is known to reduce in concentration during pregnancy? **(1 mark)**
    ii. Describe two (2) methods of salt iodization **(6 marks)**

b. One way of preventing niacin deficiency is to consume a diet rich in the amino acid tryptophan.
   i. Why is tryptophan so important for niacin? **(1 mark)**
   ii. Give two (2) examples of foods rich in tryptophan **(1 mark)**
   iii. Which non-communicable disease has been associated with niacin and why? **(4 marks)**
c. List five (5) reasons why coca-cola has been associated with low bone mineral density in elderly women **(5 marks)**

Question 5

a. With the help of specific examples, distinguish between micro and macro nutrients (**4 marks**)
b. What is the overriding similarity between under nutrition and over nutrition (**2 marks**)
c. With the help of specific examples, explain the tern "hidden hunger" (**2 marks**)
a. It is said that "micronutrient deficiencies are difficult to recognize and that Symptomatic cases often represent a tip of the iceberg. Using specific examples, explain what this statement implies (**4 marks**)
b. Discuss the full impact of micronutrient deficiencies on children (**4 marks**)
c. Describe the effects of micronutrient deficiencies on an individual's life (**4 marks**)

Question 6

a) Describe in detail the three (3) main types of diabetes **(10 marks)**
b) What are the three (3) main steps of carcinogenesis? **(3 marks)**
c) Angiogenesis is considered the final stage of metastasis.
   i. Define the terms angiogenesis and metastasis **(3 marks)**
   ii. Which vitamin supplement has been shown to reduce the progression of angiogenesis in cancer survivors? **(1 mark)**
d) List three (3) AICR recommendations for cancer prevention **(3 marks)**

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

2015/2016 ACADEMIC YEAR

SUPPLEMENTARY EXAMINATION

BSc Human Nutrition

COURSE: AGN 4321

RESEARCH METHODS AND EPIDEMIOLOGY FOR NUTRITIONISTS

Date: 3rd NOVEMBER 2016 Time: 09.00 – 12.00 HRS

Duration: THREE (3) HOURS Venue: OMNIA 2

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. SPEND ABOUT ONE HOUR ON SECTION A AND TWO HOURS ON SECTION B.

4. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN BRACKETS.

Section A

Question 1

Briefly describe the following study designs; and give two strengths of each.

a. Ecological studies (2.5 marks)
b. Cohort studies (2.5 marks)

Question 2

The data in the table below were derived from a randomized controlled trial in middle-aged men and women of the effects of a daily supplement of 1mg folic acid for 5 years on the risk of developing dementia. 1000 people took part, 500 randomised to the folic acid group, 500 randomised to the control group. Calculate the relative risk of developing dementia if randomized to the treatment compared with the placebo group. Interpret your findings.

	Dementia	No dementia	Total
Folic acid	25	475	500
Placebo	75	425	500
Total	100	900	1000

Question 3

Suggest two confounding factors that may occur in the following case control studies:

a. the association between fruit consumption and lung cancer (2.5 marks)
b. dietary fat intake and the risk of breast cancer (2.5 marks)

Question 4

Define cumulative incidence and calculate the cumulative incidence of diabetes (as %) if 750 adults develop diabetes out of a total population of 800,000 over a 5 year period.

Question 5

a) National data from the UK relating to alcohol consumption and incidence of coronary heart disease gave a Pearson correlation coefficient of 0.9.

i. Draw a graph to show this relationship.

ii. Do the findings show that alcohol consumption causes coronary heart disease? Explain your answer. (5 marks)

Question 6

List five criteria necessary to demonstrate causation in epidemiological studies. (5 marks)

Question 7

Explain what is meant by BIAS in human research. State two types of bias and suggest a specific example of each type of bias. (5 marks).

Question 8

a) Give an example of an exposure that is a:

i. binary variable (1 marks)

ii. continuous variable (1 marks)

b) Explain how a continuous variable could be expressed as a binary variable, with an example. (3 marks)

Question 9

i. Name any four databases that one can access through the research4life programmes (4 marks)

ii. List any four examples of digital repositories you can use to access scholarly content (4 marks)

Question 10

What research designs would be preferable when investigating the following topics?

a. Effect of vitamin A supplementation in reducing cataracts in children under 5 years in a given community (1 mark)

b. Dairy products, calcium intake, and breast cancer risk (1 mark)
c. Prenatal influences on disease in later life (1 mark)
d. Diet and diabetes in migrants to USA (1 mark)
e. Assessment of the association between sun exposure and skin damage in beach volleyball players (1 mark)

Section B

Answer all questions. All questions are worth 20marks.

Question 1.

a. Explain three threats to internal validity in experimental design (8 marks)

b. Briefly explain the following sampling procedures and suggest an example of a situation where each of them can be applied. (6 marks)

i. Stratified random sampling

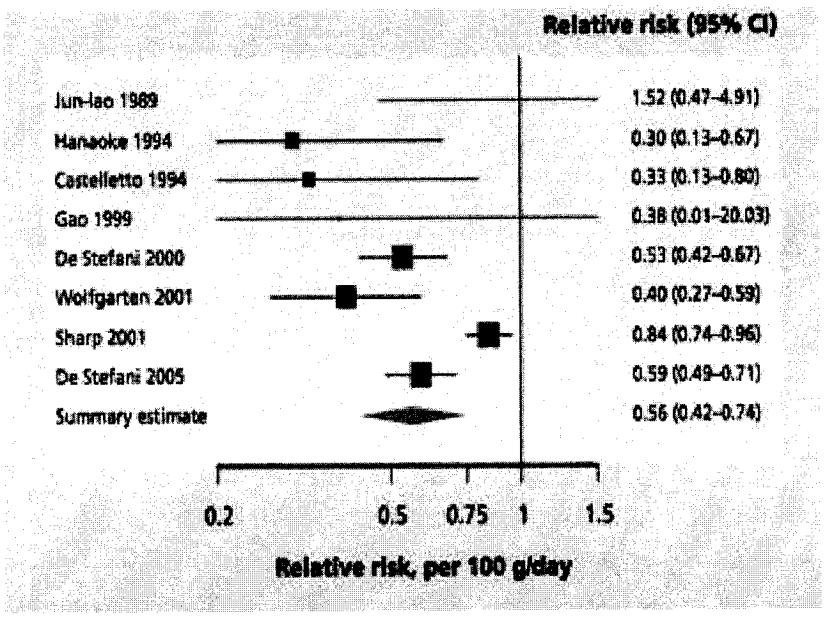
ii. Snowball sampling

iii. Simple random sampling

c. Explain any three data collection techniques that could be utilized to collect data dietary practices and nutritional status of UNZA students. (6 marks)

Question 2.

The following figure is a **Forest Plot** showing findings from a meta-analysis of case-control studies examining association between fruit consumption and oesophageal cancer. Study the figure and answer the questions below.



a. Suggest a hypothesis that these studies set out to test. (2 marks)

b. How many studies are included in the analysis? (2 marks)

c. Choose one study. Cite the author and year of that study and state the relative risk and 95% confidence intervals of that study. Interpret the findings of that study, relating fruit consumption to risk of oesophageal cancer, in as much detail as you can. (4 marks)

d. What do you understand by the size of the black squares? (2 marks)

e. In as much detail as possible explain what the 'summary estimate' tells us. (4 marks)

f. Suggest another study design to test the hypothesis you have proposed. Briefly describe what you would do. (6 marks)

Question 3

a. Briefly explain the various steps in the research process (12 marks)

b. Provide four (4) distinctions between qualitative and quantitative research approaches (8 marks)

Question 4

The World Health Organization (WHO) and the Ministry of Health in Zambia have asked you to conduct a study on breast feeding and health status of children aged 18 months.

a. State two possible objectives for this study (2 marks)
b. Suggest one hypothesis for the above study. (2 marks)
c. What would be the target population for this study? (2 mark)
d. Name one study design that is appropriate for this study and give reasons for your answer. (2 marks)
e. Assuming that stratified sampling method will be used in sampling, what would be the appropriate strata? (2 mark)
f. What would be the appropriate sampling unit? (2 mark)
g. What sampling frames are available? (2 mark)
h. Given the national breast feeding rate of 73%, and assuming an attrition rate of 10%, calculate the sample size for this study; at 95% confidence level and margin of error of 0.05. (4marks)
i. Name two techniques that could be used to collect data for this study. (2 mark)

UNIVERSITY OF ZAMBIA
SUPPLEMANTARY EXAMINATION -2016
AGS 2110
FUNDAMENTALS OF SOIL SCIENCE

DURATION: 3.0 hours
INSTRUCTIONS: Answer all Questions **MARKS**: 100

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1. Define the following terms: (18 marks)

a. O horizon
b. Incongruent weathering
c. Active acidity
d. Parent material
e. Sodic Soil
f. Macronutrient
g. Permanent wilting point
h. Mineralization
i. Compound Fertilizer

1. Indicate whether the following statements are true or false (15 marks)

a. Sandstones are metamorphic rocks
b. $(NH_4)_2(HPO_4)$ is a Compound fertilizer that contains more nitrogen than Compound D.
c. Humus has a higher CEC than vermiculite
d. Frost wedging is one of the chemical weathering reactions
e. The E horizon usually overlies the B horizon
f. A loamy sand contains more sand than a sandy loam
g. Reddish colours are usually an indicator of good drainage in the soil
h. $CaCO_3$ had a higher Acid Neutralizing Value than $MgCO_3$
i. The bioavailable form of P to plants is H_3PO_4
j. A soil with a CEC of 3.2 meq/100g can hold 830 mg Ca in exchangeable form per kilogram

2. Answer the following questions briefly and concisely (25 marks)

   a. List the 5 factors of soil formation (4 marks)

   b. Define the groups of soil microorganism found in soils based on their source of carbon and source of energy (4 marks).

   c. Briefly describe how the Effective cation exchange capacity of a soil is measured in the lab. (6 marks)

   d. List the six macronutrients obtained from the soil by plants, indicate their classification by the fertilizer industry and indicate their bioavailable forms. (5 marks)

   e. Define the major components of the total water potential of an unsaturated soil and describe how each component can affect the availability of water to plants. (6 marks)

3. A soil layer has the following soil physical properties.

Depth	Sand	Silt	Clay	ρ_b	ρ_s	FC	PWP
(cm)	----------(%)----------			(-----g.cm^{-3}---)		(-------g$H_2$0.g soil^{-1}-----)	
0 – 25 cm	73.0	10	17	1.54	2.65	0.108	0.068

Answer the following questions. (18 marks)

a. Plot the textural class of this soil on the USDA textural triangle attached. (2 marks)

b. What is the total mass of soil particles in 1 hectare of this layer? (4 marks)

c. How much rainfall is required to wet this soil to a depth of 20 cm if the initial moisture content is 0.04g$H_2$0 /g soil and all the rainwater enters the soil and remains in this layer? (4 marks)

d. What is the water holding capacity of 1 ha of soil layer in liters? (4 marks)

e. What mass of the fine earth fraction of this soil at field capacity is required to supply 50 kg of sand? (4 marks)

5. Selected properties of soil from the Copperbelt are presented in the table below.

Depth cm	pH $CaCl_2$	Bd g.cm^{-3}	Ca^{2+} meq/100g	Mg^{2+} meq/100g	K^+ meq/100g	Na meq/100g	ECEC meq/100 g	Org C %	Tot N %	Avail P mg/kg
0-20	4.40	1.55	0.40	0.20	0.10	0.10	2.8	0.8	0.046	4.4

Answer the following questions. (24 marks)

a. What is the aluminium saturation of this soil? (3 marks)
b. What is the agronomic interpretation of the pH of this soil? (2 marks)
c. If the EC of the saturated extract of this soil is 0.3mS/cm, what is the sodicity and salinity status of this soil? Give reasons to support your answer. (2 marks)
d. How much agricultural lime with a neutralizing value of 95 % would be required to reduce the aluminium saturation of this soil to 10 % for a 2 Lima plot of this soil? (Note 1Lima= 0.25 ha). (5 marks)

e. A farmer wants to grow a crop of wheat with a nutrient requirement of 140 kg N/ha, 26 kg P/ha and 108 kg K/ha. Would this soil be able to supply adequate amounts of N, P and K, if 3 % of total N is mineralized in one season and is available to the crop, and all the exchangeable K and available P is available to the crop in one season? Show all the calculations to support your answer. (12 marks)

END OF EXAMINATION

SOIL SCIENCE IS FUN

COMPUTER NUMBER: _____

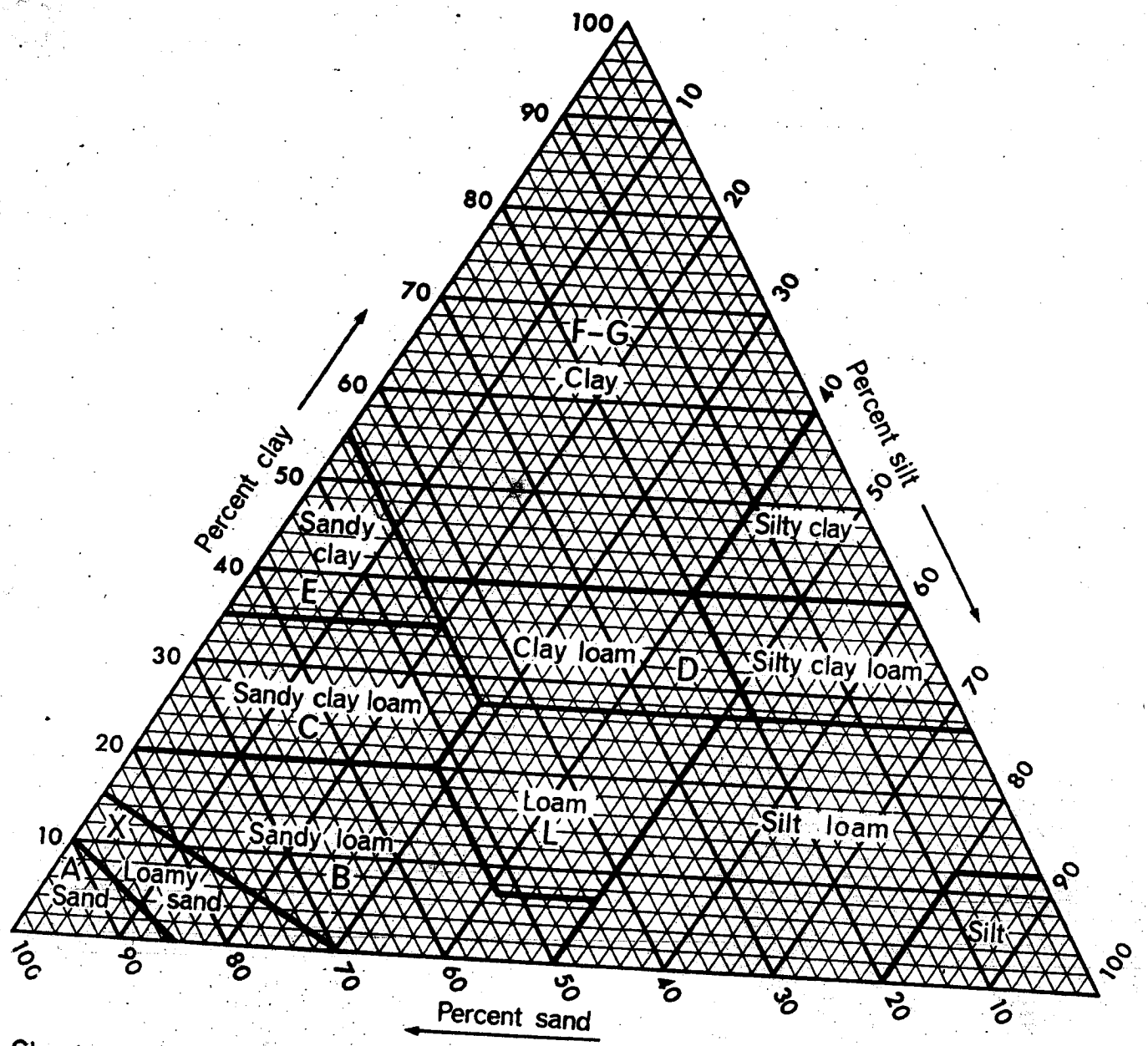

Chart showing the percentages of clay (below 0·002 mm.), silt (0·002-0·05 mm.), and sand (0·05-2·0 mm.) in the basic soil textural classes.

UNIVERSITY OF ZAMBIA

UNIVERSITY SUPPLEMENTARY EXAMINATIONS – NOV, 2016

AGS 3711: AGROCLIMATOLOGY

Time: Three (03) Hours

Instructions: Answer All Questions

Non-programmable calculators are allowed

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1. In trying to address some of the challenges facing most countries, the United Nations set out sustainable development goals. One of the goals is to 'Take agent action to combat climate change and its impact'.
   a. What do you understand by climate change?
   b. What is being done to attain this goal in Zambia?
   c. What are the implications of climate change on agriculture?

2. A table below shows meteorological parameters for Lusaka, 15.5° S and 28.5° E, on 30th October 2016. [30 Marks]

Parameter	
Daily maximum air temperature	33 °C
Daily minimum air temperature	20 °C
Mean relative humidity	58 %
Expected clear sky shortwave radiation	25 MJ m^{-2} d^{-1}
Shortwave radiation	21 MJ m^{-2} d^{-1}
Average wind speed at 2 m	2 m s^{-1}
Surface albedo	0.3

Calculate,

a. Mean saturation vapour pressure
b. Net radiation
c. Sunrise and sunset

3. Discuss at least five applications of meteorological data to agriculture.

4. Energy and energy transfer in the atmosphere are fundamental to understanding climate.
   a. Describe the physical structure of the earth's atmosphere.
   b. Briefly describe the processes of energy transfer and radiation depletion in the atmosphere.
   c. How does climate affect agriculture?

Constants and equations

$\sigma = 5.7\ (10)^{-8}\ \text{W m}^{-2}\ \text{K}^{-4}$

$\gamma = 0.0662\ \text{kPa}\ ^{o}\text{C}^{-1}$

$$\alpha = \frac{R_r}{R_i}$$

$$d_r = 1 + 0.033\cos\left(\frac{2\pi}{365}J\right)$$

$$J = 275\frac{M}{9} - 30 + D - 2$$

$$RH = \frac{e_a}{e_s}(100)$$

$$R_{ns} = R_s(1-\alpha)$$

$$R_{nl} = \sigma\left(\frac{T_{\max}^4 + T_{\min}^4}{2}\right)\left(0.34 - 0.14\left(\sqrt{e_a}\right)\right)\left(1.35\frac{R_s}{R_{so}} - 0.35\right)$$

$$J = 30.4M - 15$$

$$\delta_s = 0.409\sin\left(\frac{2\pi}{365}J - 1.39\right)$$

$$\omega_s = \cos^{-1}[-\tan(\varphi)\tan(\delta_s)]$$

$$N = \frac{24}{\pi}\omega_s$$

$$e_o = 0.6108e\left[\frac{17.27T}{237.3+T}\right]$$

$$R_l = \varepsilon\sigma T^4$$

$$R_n = R_{ns} - R_{nl}$$

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
SUPPLEMENTARY EXAMINATION NOVEMBER 2016
AGS 4210
SOIL MINERALOGY AND CHEMISTRY

Duration: 3 hours
Instruction: Answer all Questions: **Marks: 100**

1. Define the following terms: (9 marks)
   a. Short range order mineral
   b. Dioctahedral 2: 1 layer silicate
   c. Congruent chemical weathering
   d. Plane of symmetry
   e. Birefringence
   f. Heavy mineral

2 Quartz (SiO_2), muscovite ($KAl_2(Si_3\ Al)O_{10}(OH)_2$) and goethite (FeOOH) are common minerals in Zambian soils. Below is a summary of the crystallographic properties of these three minerals.

Properties	Quartz	Muscovite	Goethite
a (Å)	4.913	5.2	4.59
b(Å)	4.913	9.0	9.94
c(Å)	5.404	10.0	3.02
α (°)	90	90	90
β (°)	90	101	90
γ (°)	120	90	90
ρ_s ($g.cm^{-3}$)	2.65	2.7-2.8	4.3
nω	1.544	-	-
nε	1.553	-	-
nα	-	1.552	2.260
nβ	-	1.582	2.393
nγ	-	1.587	2.409

Answer the following questions: (26 marks)

a) To which crystal systems do the three minerals belong? Give reasons to support your answer. (3 marks)
b) If the minerals occur in the sand fraction, upon separation using bromoform (specific gravity of 2.89 g/cm^3), in which density fraction would goethite occur? Give reasons to support your answer. (2 marks)
c) If a crystal of quartz is adjacent to a crystal of goethite in a thin section and one is observing the becke-line, towards which mineral would the line move if the sample is brought out of focus by increasing the distance between the sample and objective lense? Give reasons to support your answer. (3 marks)
d) What is the birefringence of quartz? (2 marks)

e) Calculate the axial ratio of goethite (3 marks)
f) Draw a schematic diagram of the structure of muscovite showing all the planes where the elements that appear in its chemical formula occur. (4 marks)
g) Describe the properties of muscovite in terms of its (i) source of negative charge (ii) magnitude of negative charge or CEC (iii) specific surface area (iv) ability to expand and contract. (9 marks)

3. Answer the following questions briefly and concisely: (15 marks)

   a. The main X-ray diffraction peaks for goethite are 4.18 Å, with a peak intensity of 100 %; 2.69 Å, with a peak intensity of 35 % and 2.45 Å, with a peak intensity of 50 %. If you analyzed goethite using a Diffractometer with Cuk_α radiation, with $\lambda = 1.542$ Å, calculate the 2θ values at which the three peaks would occur on the diffractogram. Then sketch a diffractogram showing the positions of the three peaks and also reflecting the relative intensities of each peak. (9 marks)

   b. DTA and TGA and two methods sometimes used to study minerals. Describe the principles behind the use of these two methods. (6 marks)

4. List ten causes of soil acidity (10 marks)

5. The ability of a soil to buffer pH changes is an important chemical property. Answer the following: (20 marks)

   a. Define the term buffering and on a Q/I graph, plot the graph of a well buffered soil and a graph of a poorly buffered soil. (10 marks)

   b. Explain the mechanisms of pH buffering at pH values of less than 4.5 and at pH values greater than 8.0. (10 marks)

6. Adsorption processes are important in soils. Answer the following questions: (20 marks)

   a. Define the term adsorption (4 marks)

   b. Describe two major types of adsorption (6 marks)

   c. Distinguish the description of ion adsorption according to Langmuir and Freundlich. (10 marks)

END OF EXAMINATION