

**THE UNIVERSITY OF ZAMBIA
THE SCHOOL OF AGRICULTURAL SCIENCES
2004 ACADEMIC YEAR
SECOND SEMESTER FINAL EXAMS**

AGA 322	-	RUMINANT PRODUCTION
AGA 332	-	APPLIED ANIMAL NUTRITION
AGA 342	-	ANIMAL GENETICS AND BREEDING
AGA 412	-	PIG AND POULTRY PRODUCTION
AGA 422	-	GAME RANCHING AND WILDLIFE MANAGEMENT
AGA 442	-	INTEGRATED AGRICULTURE AND FISH NUTRITION
AGC 222	-	INTRODUCTION TO FARMING SYSTEMS
AGC 312	-	CROP PROTECTION
AGC 332	-	PLANT PATHOLOGY
AGC 342	-	PRINCIPLES OF CROP PRODUCTION
AGC 422	-	HORTICULTURAL SCIENCE I
AGC 442	-	PLANT BREEDING
AGC 542	-	ECONOMIC ENTOMOLOGY
AGC 552	-	HORTICULTURAL SCIENCE
AGC 562	-	SEED TECHNOLOGY
AGC 572	-	POST- HARVEST TECHNOLOGY
AGE 442	-	AGRIBUSINESS STATISTICS AND DATA ANALYSIS
AGE 452	-	INTERMEDIATE AGRIBUSINESS MANAGEMENT
AGE 572	-	AGRICULTURAL POLICY ANALYSIS
AGE 582	-	PROJECT MONITORING AND EVALUATION
AGF 332	-	METHODS IN FOOD ANALYSIS I (PRACTICAL)
AGF 342	-	FOOD TECHNOLOGY
AGF 352/BS 482		FOOD MICROBIOLOGY
AGF 362	-	FOOD EVALUATION
AGF 442	-	FOOD PACKAGING
AGF 452	-	METHODS IN FOOD ANALYSIS II
AGF 452	-	METHODS IN FOOD ANALYSIS PRACTICAL
AGF 512	-	TECHNOLOGY OF MEAT AND FISH
AGF 542/ MM 552		PROCESS DESIGN
AGS 322	-	SOIL PHYSICS
AGS 331	-	SOIL SURVEY TECHNIQUES
AGS 422	-	SOIL MICROBIOLOGY
AGS 452	-	PRINCIPLES OF LAND HUSBANDRY
AGS 522	-	SOIL AND PLANT ANALYSIS
AGS 542	-	SOIL GENESIS AND CLASSIFICATION
AGS 562	-	MANAGEMENT OF IRRIGATION AND DRAINAGE
SYSTEMS		

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THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2004 ACADEMIC YEAR - SECOND SEMESTER FINAL EXAMINATIONS

COURSE AGA 322 - RUMINANT PRODUCTION

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:

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

SECTION A - BEEF PRODUCTION:

Q. 1 Write notes on the following:

- a) Discuss the characteristics of the *Bos indicus* cattle that make them more adaptable to rear in a tropical country like Zambia.
- b) What do you understand by the terms “compensatory growth” as opposed to “cyclic growth?”. What are their causes and what are the management practices that may be put in place to prevent their occurrence?

Q. 2 Write notes on the following:

- a) The factors that may affect the calving interval in a beef herd of your choice; and
- b) The merits and demerits of using the Summer Breeding Season by beef producers in Zambia.

SECTION B - DAIRY PRODUCTION:

Q. 3 Milk has been described as ‘nature’s most perfect food’ and the cow as ‘the foster mother of the human race’ because of the universal acceptance of cow’s milk. Write notes on any five (5) physiological factors that may affect the composition of milk on any dairy farm of your choice.

Q. 4 Write notes on the following:

- a) The milk ejection process;
- b) Lactogenesis;
- c) The processes of milk secretion in the udder; and
- d) The farmer/dairyman as the potential source of milk contaminants.

SECTION C - SHEEP AND GOAT PRODUCTION:

- Q. 5** As a Farm Manager on a Sheep and Goat farm, discuss any ten (10) of the lamb and kid routine management practices that you would put in place in order to improve the management of a sheep and goat on the farm.
- Q. 6** The breeding management of sheep and goats determines the profitability of the enterprise. Discuss the breeding seasons that may be used in Zambia with respect to the different levels of management. Indicate the breeds of sheep and goats that would be most suited to rear at the different levels of management.

SECTION D - RABBIT PRODUCTION:

- Q. 7** A non-governmental organisation (NGO) involved in promoting agricultural production in Zambia is encouraging farmers in Lusaka Province to go into rabbit production. As an expert employed by the NGO, discuss any ten (10) reasons to convince a group of interested farmers drawn from Chongwe and Kafue Districts on the advantages of rabbit production over other forms of livestock production in Zambia.
- Q. 8** Write notes on the following:
- a) The factors that may limit the conception rate in breeding does on a rabbit farm of your choice.
 - b) A good breeding routine is an aid to good management. Design a Hutch Record Card to assist an emergent rabbit farmer to keep accurate records.

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2004 ACADEMIC YEAR - SECOND SEMESTER FINAL EXAMINATIONS

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SCHOOL OF AGRICULTURAL SCIENCES

**2004 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

AGA 332: APPLIED ANIMAL NUTRITION

TIME: THREE HOURS

INSTRUCTIONS: ATTEMPT ALL QUESTIONS.

1. Briefly discuss the following:
 - i) the mechanism of urea utilization in a ruminant digestive system
 - ii) mechanisms by which tannins interfere with nutrient utilization in pig and poultry nutrition
 - iii) anti-nutritional factors in soybean meal
 - iv) tallow as an ingredient in livestock feed
 - v) lucerne (alfalfa) induced bloat. (20 marks)
2. Describe how you would go about the process of preparing a good yield of a good quality rhodes grass hay. (20 marks)
3. Discuss poultry manure as livestock feed. (20 marks)
4. Prepare a dairy concentrate that should contain 18% crude protein, 8% millet meal, 12% sorghum meal, 18% sunflower meal and 0.4% salt using ALL the ingredients given below:

<u>Ingredient</u>	<u>% crude protein</u>	
Maize meal	8	
Millet meal	10	
Sorghum meal	12	
Sunflower meal	28	
Soybean meal	40	(15 marks)

5. Formulate a pig feed to supply 14% crude protein, 0.60% calcium, 0.55% phosphorus, 0.60% lysine and 0.40% methionine. Salt must be added to the feed at the rate of 0.25% while vitamin and mineral premixes should be added at a rate of 0.5% each.

To be used in the formulation are the following ingredients with the indicated composition in nutrients:

<u>Ingredient</u>	<u>Composition</u>				
	<u>%CP</u>	<u>%Ca</u>	<u>%P</u>	<u>%Lysine</u>	<u>%Methionine</u>
Sorghum meal	12	0.05	0.28	0.28	0.24
Maize meal	9	0.04	0.27	0.24	0.20
Soybean meal	45	0.25	0.60	3.00	0.65
DCP	-	26	18	-	-
Limestone	-	38	-	-	-

(25 marks)

END OF EXAMINATION

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
ANIMAL SCIENCE DEPARTMENT
AGA 342 ANIMAL GENETICS AND BREEDING**

2004 SECOND SEMESTER UNIVERSITY EXAMINATIONS

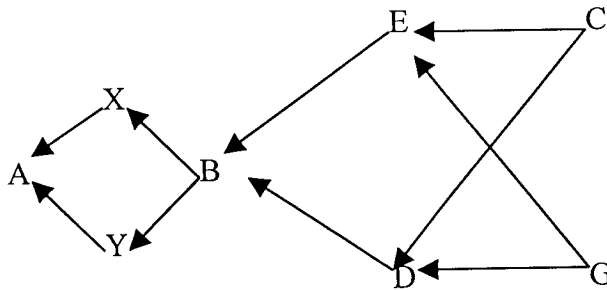
INSTRUCTIONS TO CANDIDATES

Date: 13th December 2004

ANSWER ALL QUESTIONS

1. Define genetics and explain its importance to modern agriculture. **(6 marks)**
2. Differentiate between epistasis and dominance. How do the duplicate dominant epistatic genes operate? **(8 marks)**
3. Differentiate between the following terms:
 - a) Back cross and test cross.
 - b) Linkage and independent assortment. **(6 marks)**
4. The duplicate recessive genes (r_1 and r_2) produce short, velvet like fur called "rex". Two rex rabbits of different homozygous genotypes were mated and produced an F_1 that was then test crossed to produce 64 rex and 6 normal test cross progenies.
 - a) Assuming independent assortment, how many normal and rex phenotypes would be expected among 70 progeny?
 - b) Do the data indicate linkage and why?
 - c) What is the genotype and phenotype of the F_1 ?
 - d) What is the genotype and phenotype of the test cross individuals?
 - e) Calculate the map distance of the genes involved. **(20 marks)**
5. In a population of Friesian cattle at a dairy farm east of Lusaka, the average milk yield is 15 L per day with a standard deviation of 3 L per day. 80 percent of the adult cows are selected to be parents of the next generation based on their own performance. The average milk yield in this selected group is 18 L per day. (i at $80\% = 0.97$).
 - a) The additive genetic variance for milk yield per day is one quarter of the total phenotypic variance. Calculate the expected genetic change from this selection.
 - b) Explain how the selection intensity affect genetic progress made after a generation of selection. **(20 marks)**

6. In a herd of 100 Tuli cattle at Irene Research Station in South Africa, 60 were red, 30 were roan and 10 were white.
- What is the frequency of the red gene in this herd? Calculate the frequency of the white gene in two different ways.
 - If the frequency of the red gene in a herd of Tuli cattle were 1.00, how many would you expect to be roan? How many would be white?
 - Assume the frequency of the red gene in a large herd of Tuli cattle is 0.80, how many individuals should be red? White? Roan?
 - Assume that one calf in each of the 10 000 cattle born in Zambian beef herds has a recessive condition known as hydrocephalus. What is the frequency of the dominant allele? How many are heterozygous (percent) for the recessive gene? (20 marks)
7. a) What do you understand by line breeding as opposed to inbreeding?
- b) Given the pedigree below, work out the coefficient of inbreeding F_x and the coefficient of relationship (r_{ab}). (20 marks)



*****End of Examination*****

THE UNIVERSITY OF ZAMBIA

2004 ACADEMIC YEAR SECOND SEMESTER **FINAL EXAMINATIONS**

COURSE AGA 412 –PIG AND POULTRY PRODUCTION

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

- 1. Answer all questions.**
 - 2. All questions carry equal marks.**
-

- Q.1 A pig producing farmer comes to you with the complaint that every year his piggery has high neonatal piglet mortalities during the cold season. What would you suspect to be the cause or causes of the high piglet mortalities? What advice would you give the farmer? What is your explanation, in relation to physiology, for the mortalities? What other factors would cause high mortalities in young piglets?
- Q2. Write in detail on the advantages and disadvantages of early weaning in pig production.
- Q.3 Chemical Disinfectants can be used to ensure a disease free environment for housed birds and animals. Which four (4) chemical disinfectants would you recommend for use in disinfecting pig and poultry houses? Give reasons for your recommendations.
- Q.4 Environmental pollution is an issue of global concern. What air pollutants are produced in the environment of deep litter poultry houses? How are they produced and what measures can be taken to minimize production of these gases? What effects do these gases have on housed chickens?
- Q5. You have bought 1000 point of lay Isa Brown pullets from Hybrid Poultry. How will you determine when to sell off the birds after their laying period is over?
- Q6. Newcastle disease is a major health problem of Zambian village chickens, which sometimes wipes out whole flocks of chickens in villages. Write in detail on the predisposing factors to the development and spread of this disease in village chickens.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE
AGA 422
GAME RANCHING AND WILDLIFE MANAGEMENT

SECOND SEMESTER UNIVERSITY EXAMINATIONS DECEMBER 2004

INSTRUCTIONS TO CANDIDATES

ANSWER ALL QUESTIONS

TIME ALLOWED: Three Hours

1. Define wildlife management and indicate its socio-economic importance to the Zambian society. (10 Marks)
2. List the major biomes of Africa and indicate the main vegetation types found in Zambia. Please use the map of Zambia for illustration. (15 Marks)
3. Laboratory experiments using populations of yeast cells under ideal conditions give an r -value of approximately 0.5/hour. If the number of individual yeast cells in starting population (X_0) is 5, 10, 15, 20, and 25 and these populations are allowed to grow for 1, 5, 10, 18 and 24 hours, calculate the number of individuals in the final population (X_t). (15 Marks)
4. Estimate the growth of a population of impalas, which is started with four animals at Chaminuka Ranch after eight generations. The population parameters are: r -value of 1.0, K is fixed at 100. Draw a graph of this growth curve and explain the pattern observed from this data. (20 Marks)
5. Use the Lincoln Petersen Capture-Mark and Recapture method to estimate the population of wild rabbits in a game ranch located east of Lusaka. The formula for this index is given below.
$$N = nM/X$$
where n is the total number of individuals in the second sample, M is the total number of individuals originally marked in the first sample, and x is the number of marked individuals recaptured in the second sample. 148 rabbits were taken from the ranch and marked. Three months later, a random sample of was taken which yielded 186 rabbits, of which 25 were marked. (15 Marks)
6. Explain the significance of ecological separation when designing a game ranch. (10 Marks)
7. Explain the following terms
 - a) Post-embryonic development
 - b) Home range
 - c) Domicile
 - d) Migration
 - e) Logistic Equation (15 Marks)

******End of Examination******

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER UNIVERSITY EXAMINATIONS

DECEMBER 2004

AGA 442; INTEGRATED AQUACULTURE and FISH NUTRITION.

Time: Three (3) Hours

Instructions: Answer all questions in section 1

Answer 2 questions in section 2

Section I: Answer all questions from this section

- 1) Write short notes on four of the following:
 - a) Main features of a complete feed.
 - b) Factors affecting fish yield in an intensively managed fish pond.
 - c) Unfavourable aspects of rice-cum fish culture.
 - d) Fatty acid deficiency syndromes in fish
 - e) Negative effects of over fertilization in fresh water aquaculture.
- 2) What are the main functions of the alimentary canal in Teleosts?
With the aid of a clearly labeled diagram describe the digestive system of a carnivorous fish.
- 3) What is meant by the term integrated Fish Farming? What are the advantages of using fish-cum duck culture in integrated fish farming.

Section II: Answer two questions from this section

- 4) Distinguish between essential and non essential amino acids. What are the main determinants of gross protein requirements in fish?

- 5) Describe four types of organic fertilizers commonly used in fish farming? Given that a fish pond is to be fertilized using cow dung at 800kg/ha, how many 25kg bags of manure are required to fertilize a 30m x 20m fish pond?
- 6) In relation to the use of waste water, for fish farming, give an annotated brief on three of the following:
- a) Parasites and Diseases
 - b) Public Health Problems
 - c) Organic Waste of animal origin
 - d) Dissolved O² levels in waste water
- 7) What are the main features of an intensive fish farming system? In relation to classification of fish farming systems distinguish between the following:-
- a) Pen culture and cage culture
 - b) Monoculture and Polyculture.
 - c) Blackish water aquaculture and Mariculture.

**THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF CROP SCIENCE
2004 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATION**

AGC 222: Introduction to Farming Systems

Time: 3 Hours

**Instructions: 1. Answer All Questions
 2. Marks As Indicated**

-
- Q1. Suppose you have recently been appointed Farming Systems Agronomist (20)
 for Luapula Province, briefly describe the stages you would follow to initiate
 your farming systems research work.
- Q2. Explain clearly why a farmer should practice the following: (10)
- a. Mixed cropping (5)
 - b. Crop rotations (5)
 - c. Phased planting (5)
- Q3. a. Explain the common methods used to carry –out farming (10)
 systems research work.
- b. Explain the various types of trials used in technology testing, clearly (12)
 stating the objectives for each type.
- Q4. Compare and contrast the Conventional and Farming Systems (20)
 Approaches to technology development and transfer
- Q5. a. What is Participatory Rural Appraisal (PRA) (3)
- b. Describe the techniques used to carry-out a PRA exercise (15)



**THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF CROP SCIENCE

SECOND SEMESTER FINAL EXAM

COURSE: AGC 312 CROP PROTECTION

TIME: 3 HRS

INSTRUCTIONS: ANSWER TWO QUESTIONS FROM SECTION A, ONE QUESTIONS FROM SECTION B AND TWO QUESTIONS FROM SECTION C

PLEASE NOTE: EACH SECTION SHOULD BE IN A SEPARATE ANSWER SHEET

SECTION A PLANT PATHOLOGY

QUESTION 1

- a) How would you go about identifying a plant pathogen which is unknown if you were working in a plant pathology lab [REDACTED]
- b) What is the significance of plant pathology? (10 marks)

QUESTION 2

- a) List 10 plant disease symptoms giving one disease example of each.
(5 marks)
- b) Discuss abiotic disease causing organisms in detail giving examples
(5 marks)
- c) Explain the following:
- | | |
|---------------------------|-----------------------|
| 1. Coenocytic mycelium | 4. Septate mycelium |
| 2. Plant disease triangle | 5. Secondary inoculum |
| 3. Mycotxin (10 marks) | |

SECTION B ENTOMOLOGY

QUESTION 1

Outline the various methods of biological control and discuss in detail the advantages and disadvantages of this method. (25 marks)

SECTION C WEED SCIENCE

INSTRUCTIONS:- ANSWER BOTH QUESTIONS POINTS FOR EACH QUESTION ARE INDICATED

QUESTION 1

Discuss aquatic weeds, their classification, environmental factors affecting their distribution, problems they cause and various control measures that can be used. (20 marks)

QUESTION 2

- a) List (10) common weeds found in the field station from 10 different families by scientific name
- b) Define and discuss weed eradication, weed control and weed management with concrete examples. (15 marks)

END OF EXAM



**THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF CROP SCIENCE

SECOND SEMESTER FINAL EXAM

COURSE: AGC 332 PLANT PATHOLOGY

TIME: 3 HRS

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER THREE QUESTIONS

QUESTION 1

a) Draw and label the following:-

- | | |
|------------------------|-------------------------|
| 1. Arcevalus | 2. Pycnidium |
| 3. Cleithothecium | 4. Perithecium |
| 5. Coenocytic mycelium | 6. Oospore |
| 7. Zygospor | 8. Conidiospore |
| 9. Bacterial cell | 10. Basidium (10 marks) |

b) List 10 disease symptoms giving one disease example of each.
(15 marks)

QUESTION 2

Imagine you are a plant pathologist at Mt Makulu Research Station. The Minister of Agriculture informs you that there is severe outbreak of a fungal disease on maize in Northwestern Province. How would you identify the disease and what control measures are you going to recommend to the farmers? (25 marks)

QUESTION 3

a) Explain in detail the factors that influence plant disease epidemics.
(15 marks)

b) List cultural and biological control methods (10 marks)

QUESTION 4

a) Describe the effect and clinical signs of two of the following mycotoxins on animals:-

i) Aflatoxin, ii) Zearalenon, Trichothenes (10 marks)

c) Explain the plant disease cycle in detail (15marks)

QUESTION 5

- a) Explain the gene-for-gene concept. Illustrate your answer with a diagram
- b) Define the term mycotoxin. Name any two mycotoxins and the fungi that produce them
- c) **Plant diseases** can be classified in several ways. Mention them and give examples
- d) List the seed health testing methods
- e) List the genus of bacteria that are important in agriculture giving one plant disease example of each (25 marks)

QUESTION 6

a) The control of mycotoxins in any commodity may be achieved among others by the following:

- Management
- Action levels
- Decontamination

Discuss each of the above terms in relation to mycotoxin control, giving examples where appropriate. (10 marks)

- b) List the biotic disease causing organisms (5 marks)
 - c) Why are plant diseases important? (5 marks)
 - d) What is the plant disease triangle? (5 marks)
-

END OF EXAM



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF CROP SCIENCE**

FINAL SEMESTER EXAMINATIONS, DECEMBER 2004

AGC 342: PRINCIPLES OF CROP PRODUCTION

TIME ALLOWED: 3HRS

INSTRUCTIONS

Answer all questions

Marks for each question as indicated

Question 1 (20 Marks)

(a) What is:

- i) Crop coefficient?
- ii) Vernalization?
- iii) Photoperiodism?
- iv) Respiratory quotient?

(b) What is soil water potential? How is soil water potential expressed as energy per unit weight and energy per unit mass?

(c) Briefly explain the underlying principles for measuring soil moisture in three of the methods

(d) What is the importance of temperature and water in plant growth

(e) Farmers are faced with a number of constraints in the social, environmental, economic and political areas.

- (i) Name three of the constraints and
- (ii) Briefly suggest how they can be overcome.

Question 2 (20 Marks)

(a) Describe how crop growth factors are integrated into crop water requirements.

(b) Describe the methods for estimating crop water requirements.

(c) Suggest ways in which crop growth factors can be optimized in the small sector agriculture.

(d) How can crop growth factors be optimized in the situation represented in Figure 1?

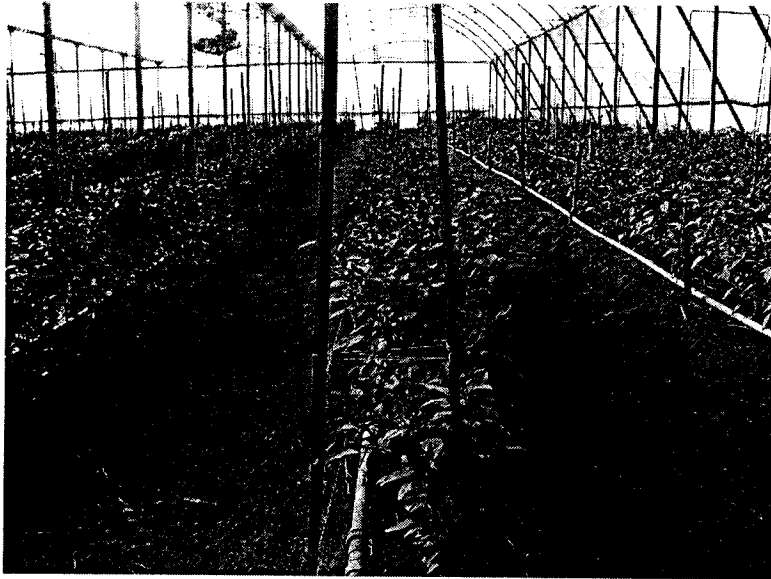


Figure 1.

Question 3 (20 Marks)

The families Leguminosae, Gramineae, Malvaceae and Rubiaceae constitute important crops in the economy of the country.

- (i) Give at least two members of each family.
- (ii) Give their scientific names.
- (iii) Describe their morphological characteristics.
- (iv) What is the economic importance of the crops?

Question 4 (20 Marks)

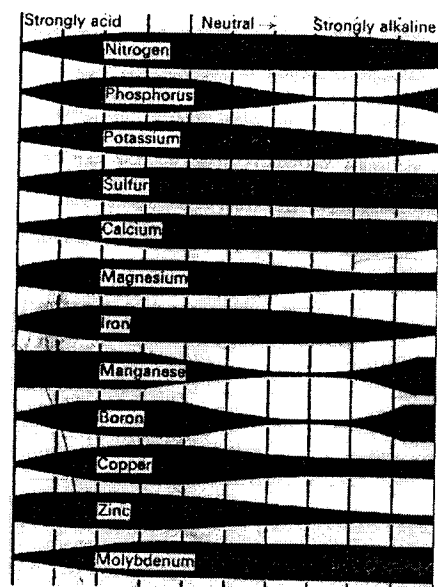
- (a) How does the knowledge of the dynamic balance of water assist to control the quantity and availability of soil water to plants?
- (b) The rainfall over a 10-day period was 11mm. A farmer has irrigated her crop with 7 mm water. Assuming drainage was 2 mm and the water in the soil profile decreased by 5 mm, what was the average daily evapotranspiration?

Q5. (20 Marks)

- (a) What are:
 - (i) Essential elements?
 - (ii) Beneficial elements?
- (b) What is the role of the following elements in plant growth and development:
 - (i) Nitrogen?
 - (ii) Magnesium?
 - (iii) Molybdenum?

(c) Explain Figure 2 below with respect to plant nutrient uptake.

Figure 2.





**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES**

DEPARTMENT OF CROP SCIENCE

DECEMBER 2004 2ND SEMESTER FINAL EXAMINATION

AGC 422 HORTICULTURAL SCIENCE 1

TIME ALLOWED: 3 hours

INSTRUCTIONS:

1. Answer all Questions.
 2. Marks as indicated on the Question Paper.
-

Q1. As an Agricultural Officer, you have been requested to give a presentation to youths engaged in Agriculture on the following:

- a. Farm yard manure, and
- b. Crop rotation in vegetables.

What would your presentation be on each of these topics? **(25 marks)**

Q2. A farmer intends to engage in onion production. Give production recommendations on the following:

- a. Soil and climatic requirements.
- b. Varieties
- c. Seed Rate
- d. Fertilizers
- e. Irrigation and weed control
- f. Harvesting and expected yields.

(25 marks)

Q3. A contract has been awarded to Chimali Nurseries to raise citrus seedlings and maintain the orchard thereafter. Write short notes on the propagation method you would choose. Discuss other uses of the chosen propagation method during this period.

(25 marks)

Q4. The following pests have been identified in various vegetable fields:

- a. Cutworms
- b. Stem borer, and
- c. Oriental cabbage worm.

In a table form, indicate the crop(s) attacked symptoms and control measures to be undertaken for each of these.

(15 marks)

Q5. Auxins are phytohormones that influence developmental changes in plants. Describe their action(s).

(10 marks)

End of Exam

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2004 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS**

AGC 442 PLANT BREEDING

INSTRUCTIONS

Answer **QUESTION ONE** and any other **three (3)** questions. Marks for each question are indicated in brackets

TIME: 3 hours

Q.1 (a) Why would one embark on wide crossing in plant breeding? What considerations determine the use of wide crossing? (15 points)

(b) List the pre- and post-fertilization barriers in wide crossing. Describe in details the consequences of two barriers from each category. (25 points)

Q.2 Write short notes on the following (5 points each):

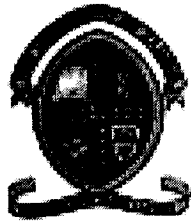
1. Use of incompatibility in plant breeding
2. Yield as a plant breeding objective.
3. Apomixis and its possible uses
4. Mechanisms that enforce crossing

Q.3 Describe in details Recurrent Selection for Specific Combining Ability and Recurrent Selection for General Combining Ability. What are the major differences in the methods and their products? (20 points)

Q.4 (a) What is the significance of Field Plot Technique? (8 points)

(b) Describe Ear-to-Row methods including the original and the modified one. Explain your answer clearly. (12 points)

Q. 5 What are the objectives for maize and wheat improvement in Zambia? Relate each objective to an existing or potential problem in Zambia. (20 points)



THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF CROP SCIENCE

FINAL EXAMINATION

AGC 542 ECONOMIC ENTOMOLOGY DECEMBER 2004

TIME: 2½ HOURS. ANSWER: ALL QUESTIONS. ALL QUESTIONS EQUAL MARKS.

1. Differentiate between intensive and extensive sampling.
2. Outline the major factors that need to be considered when developing a sampling programme for insect pests.
3. Discuss mass culture and release as a method of biological control.
4. Discuss persistence as a required characteristic of insect pathogens and outline why microbial control may play an important role in pest management programmes.
5. Discuss the host selection process in phytophagous insects.

END OF EXAM

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF CROP SCIENCES

SECOND SEMESTER FINAL EXAMINATION

COURSE: AGC 552 HORTICULTURAL SCIENCE

INSTRUCTIONS

1. Answer any four
 2. Time: Three (3) hours
-

1. As a Horticultural Extension worker what advice would you give to a prospective grower intending to establish an avocado orchard?
 2. Compare the open centre and the central leader pruning and training systems?
 3. Describe in detail two common grafting methods. Include in your answer the limitations and the common trees that they are used on?
 4. Write short notes on any two: -
 - Nutrient film technique in hydroponics
 - Juvenility
 - Tissue culture
 5. Write short notes on any two: -
 - a. Green house production
 - b. Use of auxins in horticulture
 - c. Juvenility
-

END OF EXAMINATION

UNIVERSITY OF ZAMBIA

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AGC562 SEED TECHNOLOGY

FINAL EXAMINATION

DATE: MONDAY 20TH DECEMBER 2004

TIME ALLOWED: THREE (3) HOURS 09.00 – 12.00 HOURS

VENUE: SCHOOL OF AGRICULTURAL SCIENCES LECTURE ROOM

INSTRUCTIONS.

Question 1 is compulsory – answer it! Then answer three other questions.
Points for each question are indicated.

SECTION 1: COMPULSORY

Q1. 40 points

- a) Define a seed, seed germination, pure seed and seed vigor from a seed technologists' point of view.
 - b) Differentiate between seed certification and seed legislation
 - c) What are recalcitrant seeds?
 - d) Discuss the various types of seed dressing and also seed pelleting and seed priming.
-

SECTION 2: ANSWER 3 QUESTIONS ONLY

Q2. 20 points

- a) Why are seeds processed and on what factors is processing based? What are the typical stages of seed processing?
- b) Discuss the dilution theory.
- c) What are the differences and similarities between Plant Breeders' Rights and Plant Variety Protection?

Q3. 20 points

- a) Discuss the seed storage needs of various components of the seed industry.

- b) Differentiate between quiescence and dormancy and expand on the various types of seed dormancy and their importance.

Q4. 20 points

- a) Write brief notes on variety evaluation, variety release, variety denomination and variety lists.
- b) Discuss the various phases of seed germination and the differences between hypogeal and epigeal germination.

Q5. 20 points

- a) Fill in the table below:

Certified seed class

Crop	Isolation Distance	Minimum Germination
Sorghum		
Sunflower		
Wheat		
Cowpeas		
Rice		
Cotton		
Groundnuts		
Maize		
Beans		
Soybeans		

- b) Why are field inspections necessary in a seed crop?
- c) What are the components of a seed market? Explain.

End of Exam!



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES**

DEPARTMENT OF CROP SCIENCE

DECEMBER 2004 2ND SEMESTER FINAL EXAMINATION

AGC 572 POST-HARVEST TECHNOLOGY

TIME ALLOWED: 3 hours

INSTRUCTIONS:

- 1. Answer all Questions**
 - 2. Use a Separate Answer Sheet for each Section.**
-

SECTION A

- Q1.** What are the components of a quality control program and give reasons for adopting quality control in the production process. **(20 marks)**
- Q2.** Write short notes on the following:
- a. Dark respiration and the relationship to post harvest losses.
 - b. Maturity and harvesting. **(20 marks)**

SECTION B

- Q1.** A grower and shipper of cut flowers wishes to send quality products to the market. As an expert in post harvest handling, what would you advise such a farmer in this regard? **(25 marks)**
- Q2.** Write notes on the following:
- a. Pickling and Fermentation
 - b. Hypobaric systems
 - c. Waxing of horticultural products. **(20 marks)**
- Q3.** Stem end rot is one of the post harvest diseases in storage. Name the causal agents, symptoms and control measures to be undertaken. **(15 marks)**

End of Exam

The University of Zambia
University Second Semester Examinations – December 2004

AGE 442
Agribusiness Statistics and Data Analysis

Instructions: Answer all questions

Time: Three (3) hours

Section A (40 points)

Instruction: There are two questions in this section. Answer both.

1. Answer the following short answer questions

- a) One of the CLRM assumptions is that the variance-covariance matrix is defined as:

$$\text{Var}(\varepsilon) = E(\varepsilon\varepsilon' | \mathbf{X}) = \sigma^2 \mathbf{I}.$$

Explain briefly what this requires of the disturbance ε in one observation in relation to the disturbance in another observation.

- b) If the assumption in (a) is violated,
- i) State the econometric problem(s) you are likely to have,
 - ii) State one test for each of these problems
 - iii) What are the consequences of using the OLS estimator?
 - iv) What estimator(s) would you use? Be sure to state, very briefly, the rationale for your choice.
- c) If you are using 3SLS correctly,
- i) State the CLRM assumption that you suspect to have been violated
 - ii) Explain the circumstances under which 2SLS would not be adequate

- d) Find $(\mathbf{X}'\mathbf{X})^{-1}$, given that $\mathbf{X}' = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 2 & 0 & 3 \end{pmatrix}$.

2. For each of the following statements, state whether it is true (T) or false (F).
- i) Optimization, a core component of mathematical programming, is essential for estimating econometric parameters
 - ii) Econometrics is always the best technique for economic analysis
 - iii) When we regress Y on X , we are interested in testing whether X causes Y
 - iv) When you want to determine whether education is important in explaining household income, then your alternative hypothesis is that education is important
 - v) In econometric analysis you are not allowed to use theories outside the field of economics
 - vi) Econometricians are concerned about perfect multicollinearity because it makes it impossible to perform statistical inference
 - vii) A categorical variable with h categories can be represented in a regression equation by h dummy variables
 - viii) Specifying your regression equation as $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$ instead of the more correct $\hat{y} = \hat{\gamma}_0 + \hat{\gamma}_1 x + \hat{\gamma}_2 w$ could increase chances of Type I error in testing the importance of x in explaining variations in y .
 - ix) Specifying your regression equation as $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$ instead of the more correct $\hat{y} = \hat{\gamma}_0 + \hat{\gamma}_1 x + \hat{\gamma}_2 w$ runs the risk of a biased parameter estimate for the coefficient of x .
 - x) Adjusted R^2 is preferred to R^2 because it can reduce if wrong variables are added
 - xi) If X and Y are independent, then $\text{Cov}(X, Y) = 0$.
 - xii) Skewness and kurtosis are essential to fully describe the normal probability distribution
 - xiii) If a test statistic A yields a more powerful test than test statistic B , then A is more likely to reject a true null hypothesis.
 - xiv) If the estimator is BLUE, then it must be linear.
 - xv) Maximum likelihood estimators require assuming normality
 - xvi) If the errors in the CLR model are not normally distributed, the OLS estimator is not BLUE.
 - xvii) Influential observations should always be omitted.

Section B (60 points)

Instruction: Use the attached edited SPSS computer printout to answer the following question.

3. Suppose as an Agricultural Economist at Mount Makulu Central Research Station you have been asked to determine whether conservation tillage methods have any effect on the maize yields obtainable by smallholder farmers. You conduct a survey of maize fields in Central and Southern Provinces and collect data on variables that you expect to affect yield, including tillage method. You discover that there are 4 tillage methods used in maize fields – ploughing, planting basins (also called potholing), conventional hand hoe, and ripping. In your analysis, you represent the tillage method variable with 4 dummy variables – D_6 , D_7 , D_8 , and D_9 , respectively. The last table in the attached SPSS printout presents full descriptions of these and all other variables included in the regression model.

Answer the following questions based on these attached empirical econometric results.

- a) Explain in one short sentence why all other variables were included in the model when your major interest was specifically the effect of tillage method on yield.
- b) Why do you think one of the tillage method dummies, D_6 , was dropped from the regression model (see attached table)?
- c) Given that ‘planting basins’ and ‘ripping’ are regarded as conservation tillage methods,
 - i. Interpret the parameter estimates for these variables
 - ii. Test whether individually planting basins and ripping have a significant effect on yield. Assume $\alpha = 0.05$.
 - iii. Briefly explain how you would test the hypothesis that conservation tillage methods jointly have a yield effect that is significantly different from that of ploughing.
- d) List other variables in the model that have a significant effect on yield at $\alpha = 0.05$.
- e) List the variables that you think have wrong signs. Explain.
- f) What proportion of the variation in the dependent variable is explained by the postulated model?
- g) What can you say about the statistical significance of the relationship postulated by your model? Show your work and explain your answer.
- h) What can you say about multicollinearity in the model? Explain your answer, very briefly.

Edited SPSS Computer Printout

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.604	.365	.339	1294.87884

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	187692983	8	23461623	13.993	.000
	Residual	326958687	195	1676711		
	Total	514651670	203			

Coefficients

Explanatory variable	Description of explanatory variable	Parameter estimate	Standard error	t	p-value	Collinearity Statistics	
						Tolerance	VIF
Constant	Intercept	875,042	241,985	3.616	0.000		
X ₁	Planting date, number of days after Nov 1	-23.48	6.50	-3.613	0.000	0.81	1.23
X ₂	Quantity of chemical fertilizer applied in kg/ha	-0.29	0.77	-0.379	0.705	0.54	1.86
D ₁	Seed dummy, equal to 1 if hybrid	811.70	254.54	3.189	0.002	0.72	1.40
D ₃	Rotation dummy, equal to 1 if field was under legume-cereal crop rotation	-380.39	210.02	-1.811	0.072	0.89	1.12
D ₅	Residue dummy, equal to 1 if crop residues are left unburned in field	239.90	232.13	1.034	0.303	0.89	1.13
D ₇	Basins dummy, equal to 1 if land prepared with planting basins	1,212.63	269.74	4.496	0.000	0.46	2.19
D ₈	Hoe dummy, equal to 1 if land prepared by conventional hand hoe	650.11	953.41	0.682	0.496	0.93	1.07
D ₉	Ripper dummy, equal to 1 if land prepared by ripping	65.38	300.20	0.218	0.828	0.69	1.45

Dependent Variable: YIELD Yield of maize in kg per hectare

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2004 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS
AGE 452: INTERMEDIATE AGRIBUSINESS MANAGEMENT
TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER FIVE QUESTIONS ONLY. SECTION A IS COMPULSORY (ANSWER ALL THE THREE QUESTIONS), THEN SELECT TWO OTHER QUESTIONS FROM SECTION B. ALL QUESTIONS CARRY EQUAL MARKS.

SECTION A

1. You are an entrepreneur and have just finalized planning for your business. You have decided to sell your plan to the bank in order to get a loan.
 - a) What will the bank /loan official(s) be looking for in your business plan? (3 marks)
 - b) Present a summarized version of your business plan to the bank (17 marks)
2. Managing risk is one of the important decisions an agribusiness manager is faced with when planning for any business undertaking.
 - a) You are proposing to venture into exporting horticultural products. What risks do you envisage and how do you hope to minimize them? (15marks)
 - b) The matrix below outlines three possible plant expansion actions A1, A2 and A3. The figures within the matrix represent profits from each of the courses of action in each of the three different economic environments E1, E2 and E3; where E1 represents expansion, E2 stable growth and E3 recession.

ACTIONS	ENVIRONMENTS		
	E1	E2	E3
A1	5	4	8
A2	13	7	2
A3	9	11	1

Use the Wald / Maximin strategy to choose the possible course of action. Explain your answer (5marks).

3 Agropacks Ltd produces packaging material for agro processing firms that are sold for K100, 000 per box of 50 packs. Its total variable costs per box are K75, 000 while its total fixed costs per month are K 6,250,000.

- a) Determine Agropacks monthly breakeven point in units (5marks).
- b) Determine the Kwacha sales volume required to produce a monthly profit of K 1,250,000 (5 marks).
- c) Highlight the limitations of breakeven analysis as a tool in decision-making (10 marks)

SECTION B

- 4. Discuss the forces influencing competition in an Agribusiness industry, and how these forces may be manipulated to expand the Zambian honey exports to the AGOA market (**20 marks**).
- 5. Entrepreneurship and small business development are important and vital activities in the socio-economic development of all countries and societies. Entrepreneurship is for everyone. No matter what job or position one occupies, there is need to cultivate entrepreneurial characteristics.
 - a) Outline the role of entrepreneurship and small business development in the socio-economic development of Zambia (**5marks**).
 - b) Discuss the motives and challenges of starting and running a new business (**15 marks**).
- 6. Running an agribusiness firm requires you to understand the environment you will be operating in and develop right strategies to compete effectively.
 - a) Explain the role of SWOT analysis as a tool for facilitating strategic choice (5marks)
 - b) List the various forms of governance structures an agribusiness manager may choose from (5marks)
 - c) Why is there a shift from spot/cash market to other forms of governance structures? (5marks)
 - d) Distinguish between vertical integration and diversification (5marks)

GOODLUCK

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2004 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGE 582: PROJECT MONITORING AND EVALUATION

TIME: THREE HOURS

INSTRUCTIONS:

Answer all five (5) questions.

1. Describe the components of a typical project monitoring system. Cite appropriate examples to explain the purpose and timing in the application of each of these components. (20 marks)
2. Ex Post Evaluations are often called "impact evaluations". Identify and give a rationale to at least five aspects that an ex post evaluation would focus on when evaluating an agricultural development project. (20 marks)
3. The selection of the indicators that will be used to assess and measure project achievements is critical for the conduct of an evaluation.
 - a) Why is it important to choose appropriate indicators? (5 marks)
 - b) Identify and explain the criteria for effective indicators. (15 marks)
4.
 - a) Identify any five participatory research methods for data collection and explain what they are. (10 marks)
 - b) Identify five characteristics of participatory evaluation and briefly explain what they are. (10 marks)
5.
 - a) Identify and briefly elaborate on the kinds of data collected and analysed in an impact evaluation of an agricultural project. (8 marks)
 - b) Explain the conceptual issues or problems associated with defining and measuring demographic data. (12 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2004 ACADEMIC YEAR SECOND SEMESTER FINAL
EXAMINATIONS

AGF 332 METHODS IN FOOD ANALYSIS I

TIME ALLOWED: THREE HOURS

INSTRUCTIONS

1. There are six questions in this paper.
2. Answer any **four** questions.
3. Questions carry equal marks.

-
1. (a) Name three methods you would use to identify, determine and elucidate the structure of a food sample suspected to contain the following groups: $-\text{CO}-$, $-\text{NH}_2$, $-\text{CH}_3$, $-\text{CH}_2-$, $-\text{C}=\text{C}-$ and $\text{OH}-$ (3marks)
 - (b) In absorption spectroscopy, what materials are used to make cells for the UV, VIS and IR ranges? What are the differences among them? (3marks)
 - (c) Outline one spectrophotometric method for the evaluation of the stoichiometry of a coloured food complex. (5marks)
 - (d) A food sample is suspected to contain cobalt and chromium. The food sample is wet ashed using nitric acid and diluted to a suitable volume. The absorbances of Co^{2+} and Cr^{3+} are additive over the visible spectrum. It is desired to analyze a solution simultaneously spectrophotometrically for both Co^{2+} and Cr^{3+} ; wavelengths of 400 and 505nm are chosen for this analysis using a 1.00cm cell. The results together with some other relevant data are as follows:

$$A_{400} = 1.167$$

$$A_{505} = 0.674$$

Absorptivities, $\text{dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$

$$\epsilon_{\text{Co}400} = 0.530$$

$$\epsilon_{\text{Co}505} = 5.07$$

$$\epsilon_{\text{Cr}400} = 15.2$$

$$\epsilon_{\text{Cr}505} = 5.60$$

Calculate the concentration of Cr^{3+} and Co^{2+} in the food sample.
(14marks)

2. (a) Show that the difference between two absorbance values, $A_1 - A_2$, is equal to the log of the inverse ratio of their transmittances, $\log (T_2/T_1)$. (5marks)

- (b) Outline the calibration methods used in molecular absorption spectroscopy stating briefly the circumstances under which each may be used. (5marks)
- (c) Write a brief essay on the application of fluorescence spectrophotometry to the determination of organic molecules, illustrating your answer with reference to the kinds of molecular structure that fluoresce and derivitisation reactions used to transform a non fluorescent molecule into a fluorescent one. (8marks)
- (d) Describe the various ways by which an electronically excited atom may lose its excess energy. (3marks)
- (e) What is the chemical shift of a proton whose NMR signal is observed at 430Hz downfield from TMS in a spectrometer whose basic resonance frequency for hydrogen is 75MHz? (4marks)

3. (a) A 5.5g food sample containing a trace concentration of zinc dimethyldithiocarbamate pesticide was decomposed by wet ashing and then diluted to 250ml in a volumetric flask (solution A). The analysis was completed by treating aliquots of the solution A as follows:

- (i) 50ml solution A + 20ml ligand solution + 30ml water to give an absorbance of 0.220 at 520nm in a 1.00cm cell.
- (ii) 50ml solution A + 5ml of 5ppm standard Zn^{2+} solution + 20ml ligand solution + 25ml of water to give an absorbance of 0.625 at 520nm in a 1.00cm cell.

Calculate the %Zn in the original food sample. Briefly list possible ligands that could be used to determine zinc at 520nm as above. (10 marks)

- (b) What type of NMR spectra can you expect from the compounds:

- (i) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- (ii) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{NO}_2$
- (iii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCH}_2\text{CH}_3$
- (iv) $\text{CH}_3\text{CH}=\text{CHCOOH}$ (10marks)

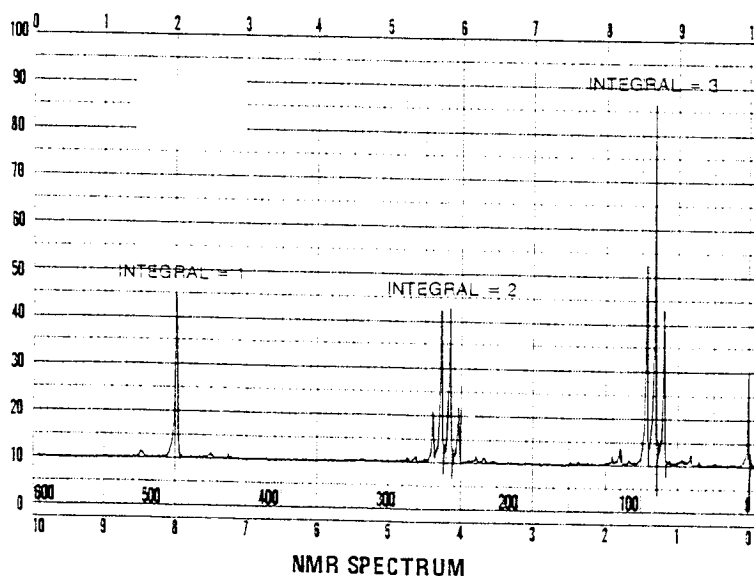
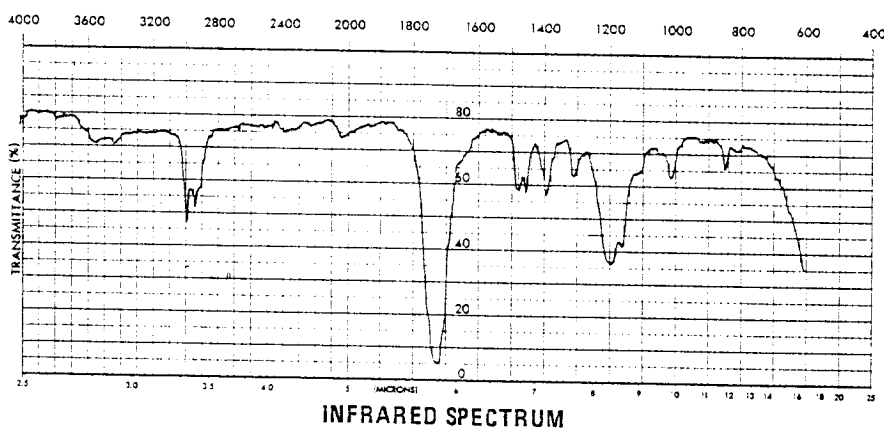
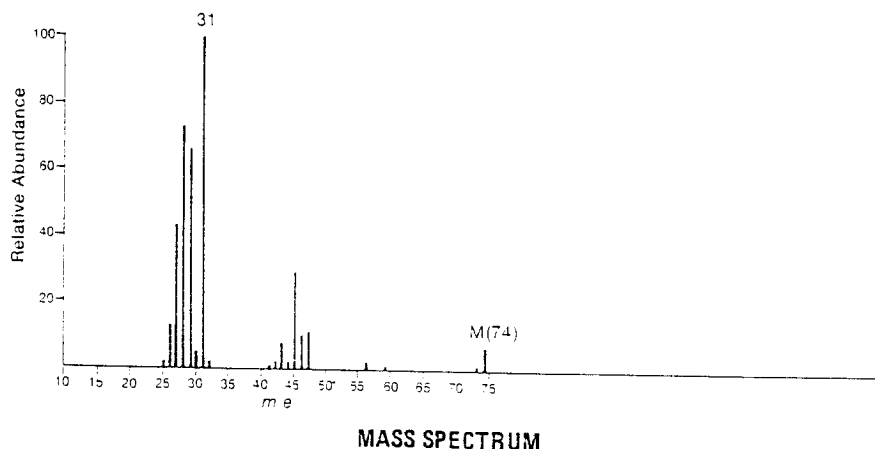
- (c) Predict the relative shape of the NMR spectrum for Methylethyl ketone, (2-butanone). Compare with that for acetone (propanone). Include the number of peaks and their relative areas. (5marks)

4. (a) Many fluorimeters can readily be used as nephelometers. Discuss the modifications required when switching from fluorimetry to nephelometry. (5marks)

- (b) Describe the various kinds of pumps used in HPLC. What are the advantages and disadvantages of each? (5marks)
- (c) In infrared spectroscopy we generally work from 650cm^{-1} to 4000cm^{-1} .
- Calculate the wavelength, λ , for 650cm^{-1} and 4000cm^{-1} respectively.
 - Calculate the energy in J/mole for 650cm^{-1} and 4000cm^{-1} .
 - If one mole of sample absorbs $5 \times 10^2 \text{kJ/mole}$ from what material would you choose the cell from? Calculate and explain. (10marks)
- (d) The ultraviolet spectrum of a food sample shows a primary absorption band at 224nm and a secondary band at 271nm.
- If a solution of the food sample in water, whose concentration is 1×10^{-4} , is examined at a wavelength of 224nm, the absorbance is determined to be 1.30. What is the molar absorptivity of this absorption band?(3marks)
 - If the same solution is examined at 271nm, what will be the absorbance reading ($\epsilon = 1000$)? What will be the intensity ratio, I_0/I ? (2marks)
5. (a) A peptide was admitted to a high resolution Mass Spectrometer and the parent peak mass was measured relative to the parent peak in the spectrum of dibromobenzene (236.8638). The measured ratio of unknown mass/reference mass was 1.001197 ± 0.000002 . Compute the exact weight of the peptide and deduce the molecular formula.
 $[^{12}\text{C} = 12.0000; ^1\text{H} = 1.0078; ^{14}\text{N} = 14.0031; ^{16}\text{O} = 15.9949; ^{79}\text{Br} = 78.9184]$ (7marks)
- (b) With the aid of a diagram outline the basis of electrophoresis. What are the factors that influence the mobility of ions in an electric field?
- Name two materials used in Gel electrophoresis.
 - Distinguish native and SDS-PAGE electrophoresis. What is the latter technique especially suited for? (8marks)
- (b) In SDS - PAGE, what is the relationship between molecular weight and the relative mobility? (4marks)
- (c) The electrophoresis apparatus creates an electric field with positive and negative poles at the ends of the Gel. Protein molecules are negatively charged above their isoelectric point. To which electrode pole of the electrophoresis field would you expect protein molecules to migrate? Explain. (6marks)

6. A food sample was analyzed using UV/VIS, IR, Mass spectrometer and NMR. The results of the analysis are shown below. Study the results and identify the component(s) present. (25marks)

The uv spectrum of this compound shows no maximum above 205 nm. The ir spectrum is obtained on a neat liquid sample.


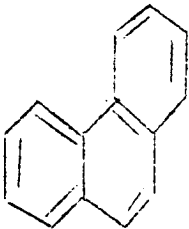
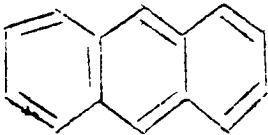


END OF EXAMINATION

TABLE 2-3 A Simplified Correlation Chart

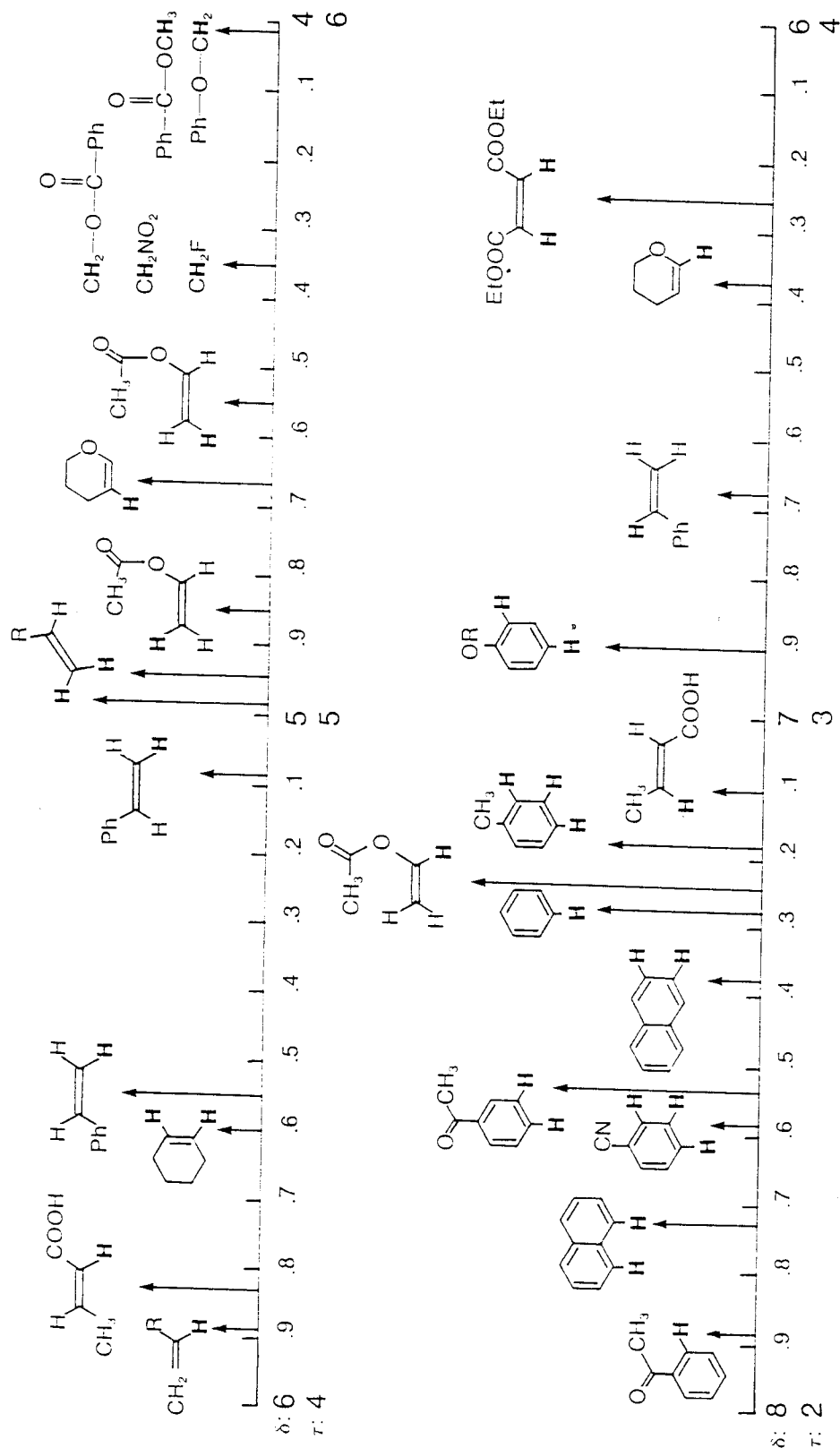
Type of Vibration			Frequency (cm ⁻¹)	Wavelength (μ)	Intensity
C-H	Alkanes	(stretch)	3000-2850	3.33-3.51	s
	-CH ₃	(bend)	1450 and 1375	6.90 and 7.27	m
	-CH ₂ -	(bend)	1465	6.83	m
	Alkenes	(stretch)	3100-3000	3.23-3.33	m
		(out-of-plane bend)	1000-650	10.0-15.3	s
	Aromatics	(stretch)	3150-3050	3.17-3.28	s
		(out-of-plane bend)	900-690	11.1-14.5	s
	Alkyne	(stretch)	ca. 3300	ca. 3.03	s
	Aldehyde		2900-2800	3.45-3.57	w
			2800-2700	3.57-3.70	w
C-C	Alkane	not interpretatively useful			
C=C	Alkene		1680-1600	5.95-6.25	m-w
	Aromatic		1600 and 1475	6.25 and 6.78	m-w
C≡C	Alkyne		2250-2100	4.44-4.76	m-w
C=O	Aldehyde		1740-1720	5.75-5.81	s
	Ketone		1725-1705	5.80-5.87	s
	Carboxylic Acid		1725-1700	5.80-5.88	s
	Ester		1750-1730	5.71-5.78	s
	Amide		1670-1640	6.00-6.10	s
	Anhydride		1810 and 1760	5.52 and 5.68	s
	Acid Chloride		1800	5.56	s
C-O	Alcohols, Ethers, Esters, Carboxylic Acids, Anhydrides		1300-1000	7.69-10.0	s
O-H	Alcohols, Phenols				
	Free		3650-3600	2.74-2.78	m
	H-Bonded		3500-3200	2.86-3.13	m
	Carboxylic Acids		3400-2400	2.94-4.17	m
N-H	Primary and Secondary Amines and Amides	(stretch)	3500-3100	2.86-3.23	m
		(bend)	1640-1550	6.10-6.45	m-s
C-N	Amines		1350-1000	7.4-10.0	m-s
C=N	Imines and Oximes		1690-1640	5.92-6.10	w-s
C≡N	Nitriles		2260-2240	4.42-4.46	m
X=C=Y	Allenes, Ketenes, Isocyanates, Isothiocyanates		2270-1950	4.40-5.13	m-s
N=O	Nitro (R-NO ₂)		1550 and 1350	6.45 and 7.40	s
S-H	Mercaptans		2550	3.92	w
S=O	Sulfoxides		1050	9.52	s
	Sulfones, Sulfonyl Chlorides, Sulfates, Sulfonamides		1375-1300 and 1200-1140	7.27-7.69 and 8.33-8.77	s
					s
C-X	Fluoride		1400-1000	7.14-10.0	s
	Chloride		800-600	12.5-16.7	s
	Bromide, Iodide		< 667	> 15.0	s

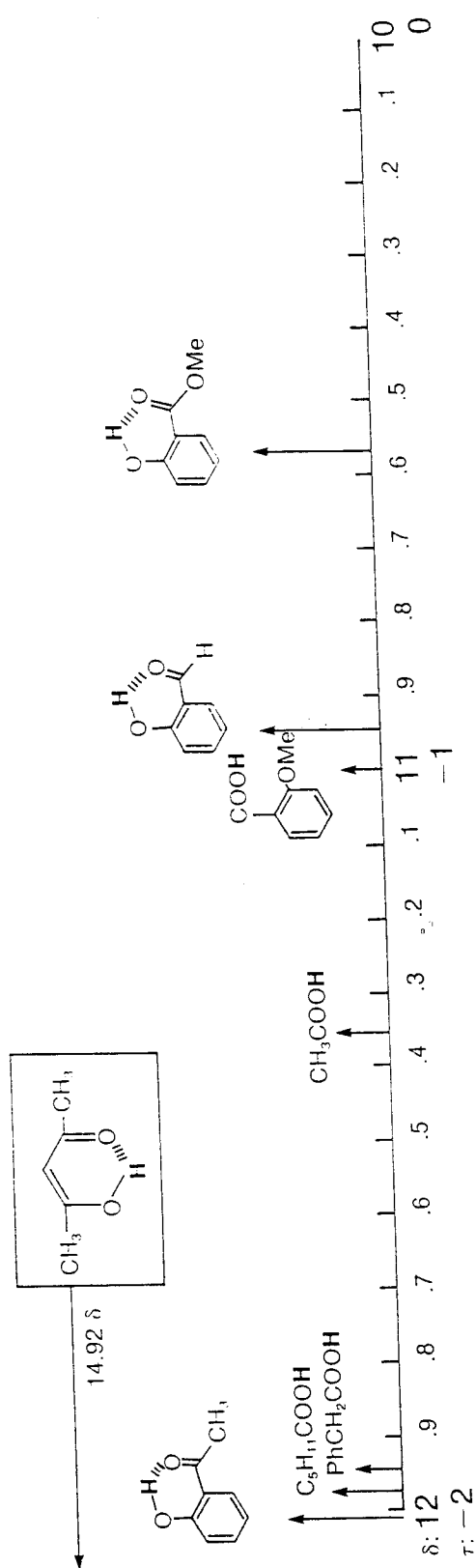
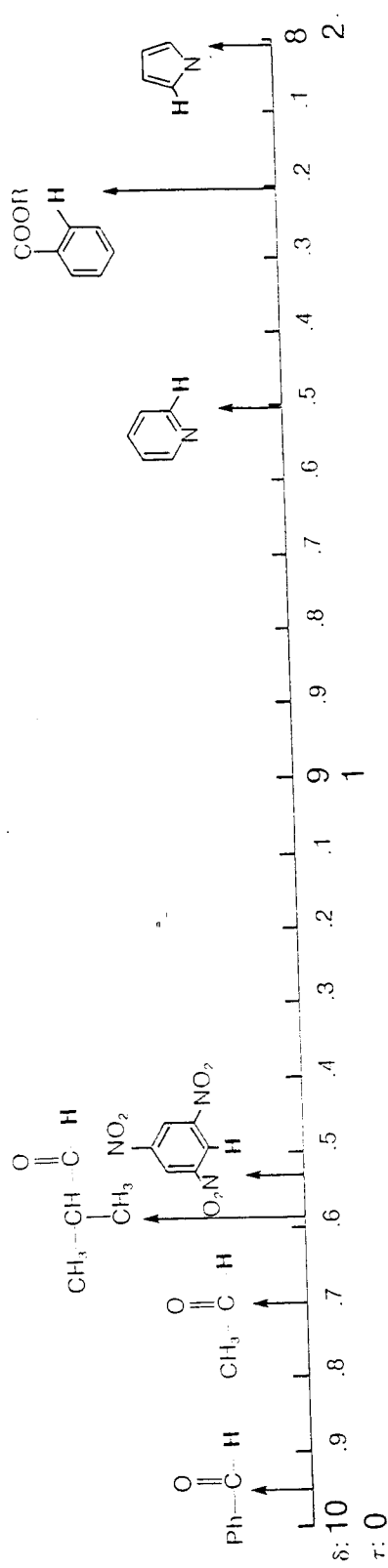
ULTRAVIOLET-VISIBLE ABSORPTION FOR π ELECTRON CHROMOPHORES

Name of chromophore	Formula of chromophore	Example	λ_{max} , nm	ϵ
Oxygen	$\text{O}=\text{O}$	O_2	~ 100 to ~ 180	-(gas)
Ozone	$\text{O}=\text{O}^+-\text{O}^-$	O_3	~ 200 to ~ 270	-(gas)
Nitroso	$-\text{N}=\text{O}$	NO_3^-	203	1×10^4
		NO_2	~ 290 to ~ 360	-(gas)
Mn=O	$\text{Mn}=\text{O}$	MnO_4^-	227	1.6×10^3
			525	2.2×10^3
Carbonyl	$\text{C}=\text{O}$	$(\text{CH}_3)_2\text{C}=\text{O}$	166	1.6×10^4
Ethylene	$\text{C}=\text{C}$	Ethylene	160	2×10^4
		2-Hexene	193	10^4
Acetylene	$\text{C}\equiv\text{C}$	Acetylene	173	6×10^3
Polyene	$\text{H}(\text{HC}=\text{CH})_n\text{H}$	Butadiene	217	2×10^4
		Hexatriene	268	3.5×10^4
		Benzene	254	2×10^2
Benzene		Salicylic acid	308	4×10^3
		Acetylsalicylic acid	280	1.5×10^3
Phenanthrene		Phenanthrene	251	5×10^4
			293	1.5×10^4
Anthracene		Anthracene	253	1.5×10^5
			340, 357, 375	all 9×10^4

ULTRAVIOLET-VISIBLE ABSORPTION FOR n ELECTRON CHROMOPHORES

Name of chromophore	Formula of chromophore	Example	λ_{max} , nm	ϵ
Carbonyl	$\text{C}=\text{O}$	$\left\{ \begin{array}{l} \text{Acetone} \\ (\text{C}_6\text{H}_5)_2\text{C}=\text{O} \end{array} \right.$	$\left\{ \begin{array}{l} 270 \\ 330 \end{array} \right.$	$\left\{ \begin{array}{l} 18 \\ 180 \end{array} \right.$
Carboxyl	$\text{R}-\text{C}=\text{O}(\text{OH})$	Acetic acid	204	60
Nitro	$\text{O}^--\text{N}^+=\text{O}$	NO_3^-	300	7.5
Nitroso	$-\text{N}=\text{O}$	Nitrosobutane	$\left\{ \begin{array}{l} 300 \\ 665 \end{array} \right.$	$\left\{ \begin{array}{l} 100 \\ 30 \end{array} \right.$
Thiocarbonyl	$\text{C}=\text{S}$	$\left\{ \begin{array}{l} \text{CS}_2 \\ (\text{C}_6\text{H}_5)_2\text{C}=\text{S} \end{array} \right.$	$\left\{ \begin{array}{l} 318 \\ 620 \end{array} \right.$	$\left\{ \begin{array}{l} 108 \\ 70 \end{array} \right.$
Iminethine	$\text{C}=\text{N}$	$(\text{C}_6\text{H}_5)_2\text{C}=\text{NH}$	340	125
Azo	$\text{N}=\text{N}$	$\text{C}_6\text{H}_5-\text{N}=\text{N}-\text{C}_6\text{H}_5$	448	425





THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

2004 ACADEMIC YEAR SECOND SEMESTER FINAL

EXAMINATIONS

AGF 332 METHODS IN FOOD ANALYSIS I PRACTICAL

TIME ALLOWED: THREE HOURS

INSTRUCTIONS

Answer **all** the questions. Marks are shown in [] brackets.

1. Describe how you would use an atomic absorption spectrophotometer to determine copper in a chosen food sample. Given that the detection limit for copper at 324.7nm using the flame method is $2\mu\text{g/L}$, outline an analytical method based on atomic absorption spectrophotometry for the determination of copper at a concentration of $0.5\mu\text{g/L}$ in an aqueous food sample. [10]
2. (a) A client has brought a food sample labeled F 01 for copper determination at your facility. Study the sample carefully and design a protocol of how you are going to analyze the sample for the required analyte.[6]

(b) Using your designed protocol, analyze the sample as requested by your client.[14]

(c) Calculate the amount of copper in the sample using the calibration method [10]

END OF PRACTICAL EXAMINATION

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

2004 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGF 342: FOOD TOXICOLOGY

INSTRUCTIONS:

TIME: THREE HOURS

ANSWER ANY FIVE QUESTIONS.

1. (a) What are cyanogenic glycosides? Discuss the distinct cyanogenic glycosides that have been identified, their sources and how the glycosides are toxic to man. **(7 marks)**
(b) Phytoestrogens are oestrogenic chemicals produced by plants, what is an oestrogenic chemical? List the major chemical classes of phytoestrogens, their beneficial and adverse effects. **(6 marks)**
(c) What are phytoalexins? Discuss the phytoalexins found in the pea and sweet potato. **(15 marks)**
(d) What are psychoactive substances? List three (2). **(2 marks)**
(e) Excessive intake of naturally occurring nitrate in foods and feed leads to toxicity. Elaborate. **(5 marks)**
2. (a) *Clostridium perfringens* causes food intoxication, what is food intoxication? Discuss the toxin(s) it produces and the mechanism of food intoxication. **(15 marks)**
(b) A number of natural toxins occur in the eggs of fish (roe). Discuss two (2) of these toxins. **(15 marks)**
(c) List any three (3) groups of viruses that cause food infections. Indicate their source of contamination and the disease/symptoms they cause. **(5 marks)**
3. (a) What are preservatives? List three (3). What are the chemical forms in which they are used and the foods into which they are added? **(10 marks)**
(b) What are non-nutritive and special dietary sweeteners? List three (3). Discuss the characteristics of each of the three (3). **(9 marks)**
(c) Define nutrification. List the pre-requisites used to justify one of the nutrification processes. **(10 marks)**
(d) List two (2) vitamins that are added to foods. State the chemical forms in which these particular vitamins are used and the foods into which they are added. **(6 marks)**
4. (a) Insecticides can be persistent or non-persistent. Discuss these two characteristics as well as the degradation route (s) they follow. **(10 marks)**

- (b) List the properties of mercury that make mercury important to man. (6 marks)
- © What are the sources of mercury pollution? (4 marks)
- (d) List the major allergens found in peanut. What are the characteristics of (i) any two of the allergens found in peanut and (ii) the allergens found in rice? (10 marks)
- © What are transgenic foods? There is concern about the safety of these foods. Explain. (5 marks)
5. (a) Wastewater can be conveniently considered according to the physical, chemical and biological nature of the impurities. Discuss each type of impurities. (13 marks)
- (b) What is (i) Biological Oxygen Demand, (ii) Chemical Oxygen Demand? What is the difference between them? (11 marks)
- © What are lipid oxidation products? Give two examples. (8 marks)
- (d) What are the methods of minimising exposure to lipid oxidation products? (3 marks)
6. (a) Iron, copper, zinc and manganese are essential trace elements. What are essential trace elements? What are the biological functions and sources of these trace elements? (20 marks)
- (b) What are intentional food additives and their acceptable functions? List the functions that are not acceptable. (10 marks)
- © What are the solutions to lead pollution? (5 marks)
7. (a) What does the general procedure of a bioassay involve? (5 marks)
- (b) Define the terms (i) Direct assay; (ii) Indirect assay; (iii) Minimum Lethal Dose and (iv) LD₅₀. (4 marks)
- © What were the mandates of the Food and Agricultural Organisation (FAO) and the World Health Organisation (WHO) when they were set up? (4 marks)
- (d) What are the differences between vertical and horizontal principles in food legislation? (2 marks)
- (e) What conditions would lead to *Vibrio parahaemolyticus* food infection? The *V. parahaemolyticus* produces toxins that can be divided into groups, list the groups and discuss their characteristics. (12 marks)
- (f) What two species of *Campylobacter* may cause food infections and what are the sources of contamination? (8 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2004 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS
AGF 352/BS 482: FOOD MICROBIOLOGY

INSTRUCTIONS:

- 1. TIME: THREE (3) HOURS**
 - 2. ANSWER ALL QUESTIONS**
 - 3. ANSWER EACH QUESTION IN A SEPARATE ANSWER BOOK**
-

1. Explain in 5 lines.

- I. Peptidoglycan
- II. Halophilic bacteria
- III. Psychrotrophes
- IV. Aflotoxins
- V. D-Value
- VI. Bacteriocins
- VII. Homoeviscous adaption
- VIII. Lactoperoxidase system
- IX. Radappertization
- X. *E.coli* O157(EHEC)

(20 Marks)

2. *Clostridium botulinum* is a pathogenic microorganism causing food poisoning in humans.

- (i) Describe the type of food poisoning caused by *Clostridium botulinum*
- (ii) Describe the mode of pathogenicity, symptoms, and foods associated with *Clostridium botulinum*.

(20 Marks)

3. By nature of its state and composition, a food product in general has interior factors, which are inherent in it (Chemical and physical characteristics of the food), which will affect the growth of spoilage and pathogenic microorganisms. Describe these Factors and how they affect the growth of spoilage and pathogenic microorganisms.

(20 Marks)

4. Describe the effects of freezing (and freezing temperature) as a preservation method on microorganisms.

(10 Marks)

5. As a Production Manager in a Meat Processing plant (From Slaughter to cuts), you are asked to make recommendations on the choice of preservation method(s) for the fresh meat (Carcass and Packs). Apart from Chilling and Freezing describe the choice of preservation method(s) and the mechanisms of the lethal effects on both pathogenic and spoilage microorganisms.

(20 Marks)

END OF EXAMINATION, GOOD LUCK

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
FOOD SCIENCE AND TECHNOLOGY DEPARTMENT

SECOND SEMESTER EXAMINATION DECEMBER 2004

FOOD EVALUATION AGF: 362

INSTRUCTIONS: ANSWER ANY FIVE QUESTIONS OF YOUR CHOICE.

ALL QUESTIONS CARRY 20 POINTS

DURATION OF THE EXAMINATION: 3 HOURS

1. (a) Name and describe the seven roles of a sensory analyst (**10 Points**)

(b) Define the role of sensory evaluation (**3 Points**)
(c) What makes objective methods using instruments more reliable than using human beings. (**2 Points**)
(d) In consumer tests name 5 demographics that should be considered when selecting sample subjects (**5 Points**)
2. On product controls explain the significance of the following (**20 Points**)
 - (i) Materials
 - (ii) Preparation procedures
 - (iii) Product sampling
 - (iv) Sample presentation
3. (a) What constitutes a panel? What determines the type of people selected to be part of the panel, and how many people make up a panel. (**6 Points**)

(b) There are 8 important criteria used for selecting panellist name and describe them and explain why they are deemed important in food evaluation (**14 Points**)
4. (a) Explain why the entrance and exit areas can affect the sensory results if not properly planned and constructed (**3 points**)
(b) In sensory evaluation what constitutes the preparation area. What should be found and not found in this place. (**8.5 Points**)
(c) What must the storage area in sensory evaluation have and why? (**8.5 Points**)
5. (a) What are difference or discriminatory tests? When are they used and when should they be not used. (**2 Points**)
(b) Name and describe two commonly used difference tests explain in detail when they are used and mention their advantages and disadvantages. (**18 points**).

6. (a) Define the following (10 Points)

- (i) Range
- (ii) Mean
- (iii) Mode
- (iv) Median
- (v) Interquartile Range

(b) From the following sample of numbers 21, 20, 25, 23, 23, 21, 25, 26, 24, 24. calculate the mean, standard deviation, and variance of the population from which the sample was drawn. (10 Points)

7. A taste panel in Product Development Department tested a tomato sauce for Aroma using the following scale of 1-9 (20 Points)
SCALE

1	Extremely dislike
2	Dislike very much
3	Dislike
4	Slightly Dislike
5	Neither dislike nor dislike
6	Slightly like
7	Like
8	Like very much
9	Extremely like

Made the following scores on five samples as shown in the table below:-

Find the number of respondents for each sample. Is this number sufficient for this kind of evaluation? Give reasons for whatever answer you give.

Calculate in percentages and interpret your results and according to your calculations which sample was preferred most and which one was the least preferred. Explain how you arrived at your answer

What should the product development team advise the people in management concerning the result and the status of the panel.

TABLE SHOWING SCORES MADE BY R&D PANNELISTS

SCALE

SAMPLE	1	2	3	4	5	6	7	8	9
A	8	1	4	6	4	7	2	1	2
B	1	3	4	6	7	7	3	2	3
C	2	3	1	5	7	7	2	9	8
D	2	1	3	5	7	7	2	9	8
E	8	6	3	4	3	2	1	3	2

8. (a) What do the following mean? And when are they used in sensory evaluation. (8 Points)

- (i) Nominal Scale
- (ii) Ordinal scale

- (iii) Interval and Ratio scale
 - (iv) Line scale
- (b) Give the scope and application of the Simple difference test. What makes it particularly different from the Triangle and Duo-trio tests? Where is it effective and what are its limitations? **(12 Points)**

For 6 B

$$s^2 = \frac{\Sigma(X - \bar{X})^2}{N - 1} = \frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N - 1}$$

$$s = \sqrt{\frac{\Sigma(X - \bar{X})^2}{N - 1}} = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N - 1}}$$

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
FOOD SCIENCE AND TECHNOLOGY DEPARTMENT

SECOND SEMESTER EXAMINATIONS - DECEMBER 2004

FOOD PACKAGING (AGF 422) THEORY PAPER

INSTRUCTIONS: - ANSWER ANY 5 QUESTIONS OF YOUR CHOICE, ALL QUESTIONS CARRY 20 POINTS

DURATION: - 3 HOURS

1. (a) Some properties of plastic resins can be determined by the molecular structure. Name and describe 3 such properties and describe why and how each one is significant in the packaging of food products **(10 Points)**.

(b) What are degradable plastics? Explain and describe 3 mechanisms used to make these degradable plastics. Explain how these help in keeping the environment clean **(10 Points)**
2. (a) Describe the mechanism of corrosion, why is it important to contain this in metal packaging materials **(5 Points)**
(b) From what are these coloured glasses made from **(5 Points)**
 - (i) Black
 - (ii) Purple
 - (iii) Blue
 - (iv) Turquoise
 - (v) Red
(c) Mention and describe 3 Electrochemical reactions which occur in our day-to-day lives. What is significant about these reactions, advise how they can be spotted and contained. **(5 Points)**
(d) Describe how you would spot a food containing can that had undergone corrosion? What would you do to this can? **(5 Points)**
3. (a) Name and Describe in detail the 3 methods that are used in the pulping process of making paper. From which process does paper for packaging foodstuffs come from? Why cant paper be recycled for ever? **(10 Points)**

(b) Explain why the paper making industry is one of the industries that pollute the environment. Explain what should be done to control and avoid pollution from this industry **(10 Points)**

4. (a) Define container and Window glass. Describe what is involved in the conversion of metals to silicates in the glass making industry **(5 Points)**
 (b) Why are the following used as components in glass making process? **(10 Points)**
 - (i) Quartz
 - (ii) Boron
 - (iii) Lead
 - (iv) Barium oxide
 - (v) Potassium silicates
 (c) What is the Solvay Process what is it used for and why is it significant? **(5 Points)**
5. (a) Define Migration. What is involved in Global and Specific Migration? When is the determination of Global and Specific Migration essential? **(4 Points)**
 (b) Migration does occur in some packaging materials and it can be classified and grouped accordingly. Name and describe 3 groups of such and in your answer also describe the foods involved and the packaging materials involved **(10 Points)**.
 (c) Explain how these are made and give an example of each **(6 Points)**
 - (i) Polycondensates
 - (ii) Polymer compounds
6. Milk was stored using 3 different packaging materials at 4°C in an illuminated corner of a supermarket shelf. It was stored in paperboard, transparent bags and PE bottles upon examination the milk was found to have some defects. These bordered on nutrient quality defects and improper heat application defects. What was wrong with this milk? How would you ascertain that this milk had the mentioned defects? What would be your advice to the Shop owner? **(20 Points)**
7. (a) What are the packaging principles governing fresh meat and cured meat packaging **(5 Points)**.
 (b) What are laminates? Name 5 types of laminates used in packaging What is their most important attribute and why should this be so. **(5 Points)**
 (c) Name 3 packaging materials used for packaging fresh milk and 3 used for packaging cheese. Describe the packaging materials they are made from. **(10 Points)**
8. (a) Why is the sterilisation of plastics different from that involving glass? Name and describe 6 sterilisation methods employed in sterilising plastics for packaging foods. Describe the major problems of sterilising plastics **(10 Points)**
 (b) What type of packaging materials would you use for the following foods and explain why you think this packaging material is suitable for this particular foodstuff. **(10 Points)**.
 - (i) Potato crisps
 - (ii) Milk Chocolate bars
 - (iii) Soup mixes (dry)
 - (iv) Fresh Irish Potatoes
 - (v) Fresh Bread Standard Loaf

THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2004 ACADEMIC YEAR SECOND SEMESTER FINAL
EXAMINATIONS
AGF 452 METHODS IN FOOD ANALYSIS II

TIME ALLOWED: THREE HOURS

INSTRUCTIONS

1. There are six questions in this paper.
2. Answer any **four** questions.
3. Questions carry equal marks.

-
1. (a) Explain what limit of detection and limit of quantitation of an instrumental method of analysis mean. A blank sample gave the following readings: 0.01, 0.02, 0.05, 0.013, 0.012, and 0.06. Calculate the limit of detection. (5marks)
 - (b) What are liquid-junction potentials? How do they arise and how can they be eliminated or minimized? (4marks)
 - (c) Ion selective electrode and reference electrode pair were placed in exactly 100ml of a food sample; a reading of 21.6mV was obtained. After the addition of exactly 10ml of a standard solution with a concentration of 100 μ g/ml, the electrode pair gave a reading of 43.7mV. The response slope of the indicator electrode was previously determined to be 57.8mV. What is the concentration of the food sample? (10marks)
 - (d) State two advantages and a major limitation of each of the following methods used in food analysis:
 - (i) Flame atomic absorption spectrometry
 - (ii) Electrothermal atomic absorption spectrometry (6marks)
2. (a) Why must we use a monochromator in absorption and emission spectroscopy in food analysis? (3marks)
 - (b) What type of energy source, monochromators and detectors are used in :
 - (i) Emission spectroscopy
 - (ii) Atomic absorption spectroscopy
 - (iii) X - Ray spectrometry (9marks)

- (c) In the determination of manganese at 403.3nm, solution X, containing an aliquot of the unknown solution gave a meter reading of 45. Solution Y, containing the same quantity of unknown solution plus 100ppm of added manganese; gave a meter reading of 83.5. Calculate the amount of manganese in solution X. (7marks)
- (d) A milk sample containing trace amounts of zinc is analyzed using an electrothermal atomic absorption spectrophotometer with a photomultiplier tube detector. A calibration sample containing 1.4ppm of zinc gives a signal of 124.5units. If the background signal is 8.2 units and the concentration equivalent of the background is 1.02ppm, calculate the concentration of zinc in a sample that gives a signal response of 94.5 units. (6marks).

3. (a) A cell was prepared by dipping a copper wire and a saturated calomel electrode into 0.10M CuSO_4 solution, obtained by digestion of a highly contaminated food sample. The copper wire was attached to the positive terminal of a potentiometer and the calomel electrode was attached to the negative terminal. $E^\circ \text{Cu} = 0.337\text{V}$
- (i) Write a half reaction for the copper electrode.
- (ii) Write the Nernst equation for the copper electrode.
- (iii) Calculate the cell voltage. (4marks)
- (b) (i) Explain the principle of direct current polarography indicating the region of the potential in which the dropping mercury electrode (DME) is used? (4marks)
- (ii) How can you remove oxygen from the polarographic cell and why? (3marks)
- (c) (i) What causes and how can you suppress the maxima in polarography?(3marks)
- (ii) An unknown amount of copper (II) ions in a food sample produces a faradic current of $12.3\mu\text{A}$ on a normal pulse voltammogram. After 0.100ml of $1.0 \times 10^{-3}\text{M Cu}^{2+}$ is added to the original volume of 5.00ml, the new current is $28.2\mu\text{A}$. Calculate the original amount of copper in the food sample. (6marks)
- (d) (i) Explain the difference, if any, between polarimetric and refractometric methods used in food analysis. (2marks)
- (ii) Calculate the percentage (w%) of glucose in solution if the tube is

15.0cm long, $t = 25^{\circ}\text{C}$ and $\alpha = 2.537^{\circ}$, $\rho = 1.0435$. Specific rotation of glucose is $[\alpha] = 52.5^{\circ}$. (3marks)

4. (a) With the help of a diagram, explain the principle of X-rays in food analysis. (3marks)
- (b) What is the short wavelength limit for a 60kV X-ray tube? What is the atomic number of the element for which just insufficient energy is available for excitation? Given: $I = 120.96$ units, $i = 500\text{mA}$, $k = 9.6 \times 10^{-7}$. (6marks)
- (c) Sodium benzoate, a salt of benzoic acid (a weak acid), is widely used as a food preservative. You wish to determine the ionization constant of benzoic acid and you choose to use conductometric method for your determination. You find that the equivalent conductance of a 0.002414M benzoic acid solution is found to be 32.22 at 25°C . Calculate the degree of dissociation of benzoic acid at this concentration, and calculate the ionization constant. Given that the Limiting Equivalent conductance of some ions in water at 25°C are: (8marks)

Cations	λ°	Anions	λ°
H^{+}	349.8	OH^{-}	198.6
Na^{+}	50.1	Cl^{-}	76.4
Ca^{2+}	59.5	Acetate	40.9
Mg^{2+}	53.1	Benzoate	32.4

- (d) Briefly explain what is meant by and the importance of quality control and quality assurance in food processing and manufacturing. (8marks)
5. (a) Describe how you would use an atomic absorption spectrometer to determine both copper and cobalt in a chosen food sample. Given that the detection limit for cobalt using the flame method is $7\mu\text{g/L}$ and $1\mu\text{g/L}$ using the carbon furnace. Outline an analytical method based on atomic absorption spectrophotometry for the determination of cobalt at a concentration of $0.05\mu\text{g/L}$ in an aqueous food sample. (14marks)
- (b) In a recent publication, the lead content of maize growing close to a defunct lead mine in Kabwe was calculated by the following method; 0.23g of a representative sample of the maize was heated under oxygen at 280°C for 20minutes, followed by a five minutes treatment at 450°C . After cooling, the sample tube was flushed with nitrogen the temperature raised to 1000°C and a stream of hydrogen passed over the sample.
- The resulting residue was dissolved in 40% nitric acid and made up to 10ml prior to aspiration into the flame of an atomic absorption

spectrophotometer equipped with a lead hollow cathode lamp. The mean of six readings gave 43.2ppb lead. Now answer the following questions.

- (i) Why measure lead in this kind of sample? (2marks)
 - (ii) What is the purpose of heating the sample? (2marks)
 - (iii) Why pass the stream of hydrogen over the sample? (2marks)
 - (iv) What is the concentration of lead in the maize sample in $\mu\text{g Pb/g}$? (5marks)
6. Write a detailed account of thermal analysis of foods indicating the different techniques used and their effects on foods. (25marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

2004 ACADEMIC YEAR SECOND SEMESTER FINAL

EXAMINATIONS

AGF 452 METHODS IN FOOD ANALYSIS II PRACTICAL

TIME ALLOWED: THREE HOURS

INSTRUCTIONS

Answer **all** the questions. Marks are shown in [] brackets.

1. Describe how you would use an atomic absorption spectrophotometer to determine copper in a chosen food sample. Given that the detection limit for copper at 324.7nm using the flame method is $2\mu\text{g/L}$, outline an analytical method based on atomic absorption spectrophotometry for the determination of copper at a concentration of $0.5\mu\text{g/L}$ in an aqueous food sample. [10]
2. (a) A client has brought food sample labeled S 01 for lead determination at your facility. Study the sample carefully and design a protocol of how you are going to analyze the sample for the required analyte.[6]

(b) Using your designed protocol, analyze the sample as requested by your client.[20]

(c) Compare the calibration result of your method with the standard addition method result and comment.[4]

END OF PRACTICAL EXAMINATION

THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

2004 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGF 512: TECHNOLOGY OF MEAT AND FISH

INSTRUCTIONS:

1. TIME: THREE (3) HOURS
2. USE A DIFFERENT ANSWER BOOKLET FOR EACH SECTION

SECTION A : MEAT TECHNOLOGY

3. ANSWER ANY THREE (3) FROM SECTION A

SECTION B : FISH TECHNOLOGY

4. ANSWER QUESTION 1 AND ANY TWO QUESTIONS FROM 2 - 4. ALL QUESTIONS CARRY 10 MARKS EACH.
-

SECTION A : MEAT TECHNOLOGY

1. (a) Muscles are highly differentiated from one another. Explain. Show how some of these differences affect the colour, flavour and tenderness of meat. **(10 marks)**
(b) Define the following terms (i) Dark, Firm and Dry Meat (DFD), (ii) Pale, Soft and Exudative Meat (PSE), (iii) Porcine Stress Syndrome (PSS) **(10 marks)**
(c) Show by a schematic diagram the glycolytic pathway including all the enzymes, coenzymes and cofactors. Explain how lactic acid is produced. **(10 marks)**
2. (a) What are the characteristics of muscle fibre? **(10 marks)**
(b) What measures can be taken to prevent DFD and PSE? **(7 marks)**
© What is ultimate pH? What is the ultimate pH of typical mammalian muscles? **(4 marks)**
(d) What causes fresh meat to become discoloured? **(6 marks)**
(e) What does the carbohydrate component of meat consist of? What is the source of each of the substances? **(3 marks)**
3. (a) What is connective tissue, its functions and composition? **(15 marks)**
(b) What is (i) "thaw rigor", and (ii) cold shortening? **(5 marks)**
© Meat can be artificially tenderised. List the different methods used to tenderise meat. In brief notes describe one of the methods in detail. **(10 marks)**

4. (a) Cured meat can become discoloured. Explain. **(5 marks)**
(b) List the conditions employed in chilling that give fresh meat the longest shelf life.
How does chilling preserve meat? **(15 marks)**
© List the food poisoning or pathogenic organisms of concern in fresh meat and state how chilling affects them. **(8 marks)**
(d) What are the other reasons for chilling? **(2 mark)**
5. (a) List the micro-organisms used in the starter cultures of fermented sausages and the functions of any two. **(11 marks)**
(b) What are the reasons for processing meat? **(6 marks)**
© What are the effects of cooking on meat and meat products? **(4 marks)**
(d) What are the modes of heat transfer in cooking? **(3marks)**
(e) What is the purpose of smoking cured meats as well as fermented sausages? **(6 marks)**

PART B: FISH TECHNOLOGY

1. Explain briefly (maximum 5 lines)
(a) Kench curing
(b) Z value
(c) Gaping
(d) Plate or contact freezing
(e) Thermal arrest
2. Discuss the chemical composition of fish.
3. Explain the factors limiting the storage life of frozen fish.
4. Discuss the recommendations which highlight some of the important aspects to consider when using modified atmosphere packaging (MAP).

-----END OF EXAMS-----

UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS - DECEMBER 2004

AGF 542/MM 552

PROCESS DESIGN

TIME: THREE HOURS

ANSWER: FIVE QUESTIONS

All additional data that the student will require are attached. All questions carry equal marks

1. (a) Two major components of a typical process are the raw material storage and the product storage. Briefly, comment on these.

(b) A separator divides a process stream into three phases: a liquid organic stream, a liquid aqueous stream and a gaseous stream. Assume that the organic liquid is less dense than the aqueous liquid. The feed stream contains three components, all of which are present to some extent in the separated streams. The composition and flow rate of the feed stream are known. All the streams will be at the same temperature and pressure. The phase equilibria for the three phases are available. How many design variables need to be specified in order to calculate the output stream compositions and the flow rates?

- (c) A coal contains the following:

Carbon	75.60 w/w	Oxygen	10.00
Hydrogen	7.30	Moisture	0.60
Nitrogen	1.70	Ash	4.80

It is burned using the stoichiometric amount of air.

Per 100 kg of coal, calculate the volume of the products of combustion relative to one volume of air. Please note that the nitrogen, moisture and ash do not burn. Assume the ideal gas law applies.

Atomic masses: C, 12; H, 1; N, 14; O, 16.

2. (a) What does fouling in a heat exchanger mean? Comment on precipitation fouling and particulate fouling.

(b) A heat exchanger is required to cool continuously 20 kg/s of warm water from 360 K to 335 K by means of 25 kg/s of cold water, inlet temperature 300 K. Assume that the water velocities are such as to give an overall heat transfer coefficient of $2 \text{ kW}/(\text{m}^2)(\text{K})$.

Assuming that the heat capacity of water is 4.18 kJ/(kg)(K), calculate the total area required

- (i) in a parallel flow heat exchanger,
- (ii) in a counterflow heat exchanger
- (iii) in a 1-2 exchanger (one shell pass and two tube passes)

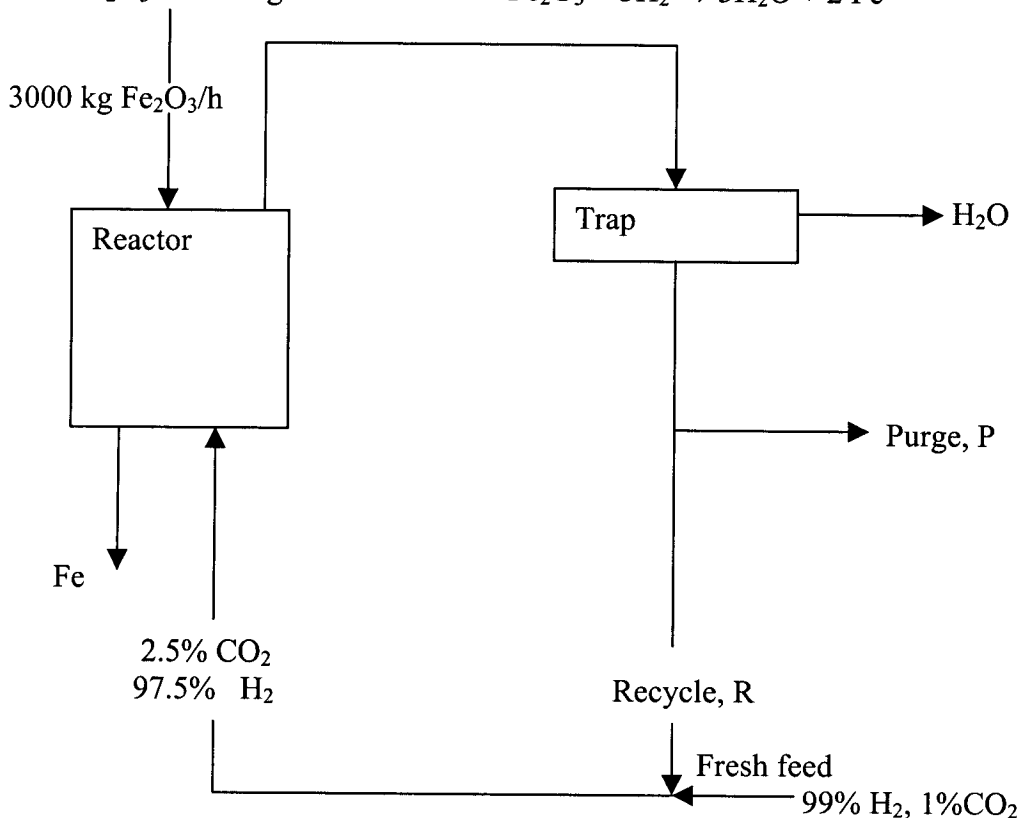
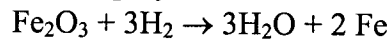
3. (a) Illustrate with sketches the temperature profiles for hot and cold fluids as a function of the distance along the flow path for (i) a parallel flow heat exchanger, (ii) a countercurrent flow heat exchanger, (iii) an evaporator.

(b) In a shell and tube counterflow heat exchanger, water flows through a copper tube 20 mm I.D. (inside diameter) and 22 mm O.D. (outside diameter) while oil flows through the shell. Water enters at 25°C and comes out at 35°C while oil enters at 70°C and comes out at 64°C. The water and oil side film coefficients are 4650 and 1280 W/(m²)(°C) respectively. The thermal conductivity of the tube wall is 350 W/(m)(°C). The fouling factors on the water and oil sides may be taken as 2500 and 1000 W/(m²)(°C) respectively. If the length of the tube is 2.5 m, calculate the overall heat transfer coefficient and the heat transfer rate.

The overall heat transfer coefficient based on the outside tube area is:

$$U_o = \frac{1}{A_o \left[\frac{1}{A_o h_o} + \frac{1}{A_o h_{od}} + \frac{\ln(r_o / r_i)}{2\pi k_w L} + \frac{1}{A_i h_{id}} + \frac{1}{A_i h_i} \right]}$$

4. (a) Discuss the significance of degrees of freedom in process design.
 (b) The plant in the given flowsheet employs H₂ to reduce 3000 kg/h of Fe₂O₃ according to:



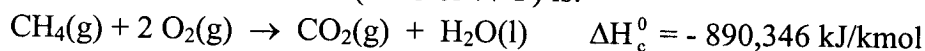
The hydrogen in the recycle is mixed with the H_2 in the fresh feed before entering the reactor. The purge stream, P, is bled off to prevent CO_2 buildup in excess of 2.5% at the inlet. The mass ratio of R to fresh feed gas is 4:1. Calculate the amount and composition of the purge stream. Give the composition in mole %.

Atomic weights: C, 12; O, 16; H, 1; Fe, 55.85.

5. (a) In the location of a plant, two important factors are transport facilities and availability of labour. Comment on these two factors.

(b) A gas stream of 100 kmol/h of CH_4 (methane) at 1 atm pressure and $100^\circ C$ ($212^\circ F$) is burned in a furnace using air at $40^\circ C$ ($105^\circ F$). The combustion is complete and 50% excess air is used. The product gases leave at $400^\circ C$ ($750^\circ F$). **Calculate the heat removed in the furnace.**

The combustion reaction at 298K ($25^\circ C$ or $77^\circ F$) is:



The latent heat of vaporisation of water at 298K ($25^\circ C$ or $77^\circ F$) = 44,045 kJ/kmol

For the gases, use the mean heat capacity data in the given figure. Remember 1 kcal = 4.187 kJ.

Note: In this problem, please do the calculations in MJ (1 MJ = 10^6 J).

6. (a) Discuss the discounted cash-flow-rate of return and pay back period measures of profitability.

(b) It is proposed to build a plant to produce a new product. The estimated investment required is 12.5 million pounds and the timing of the investment will be as follows:

Year 1: 1.0 million pounds (design costs)
 Year 2: 5.0 million pounds (construction costs)
 Year 3: 5.0 million pounds (construction costs)
 Year 4: 1.5 million pounds (working capital)

The plant will start up in year 4.

The forecast sales price, sales volume and raw materials costs are shown in the accompanying table:

End of year	1	2	3	4	5
Forecast sales, $10^3 t$	0	0	0	100	105
Forecast selling price, £/t	-	-	-	150	150
Raw material costs, £/t product	-	-	-	90	90

The fixed operating costs are estimated to be £0.4 million per year. The variable operating costs are estimated to be £10 per ton.

Calculate

- (i) the net cash flow in year 4 and year 5,
- (ii) the discounted cash flow in year 4 and in year 5,
- (iii) the cumulative net present worth (NPW) at the end of year 4 and also at the end of year 5.

7. (a) Briefly discuss why environmental considerations are important in plant design.

(b) An original loan of K20 million was made at 6 per cent per year simple interest for four years. At the end of this time, no interest had been paid and the loan was extended for 6 more years at a new compound interest rate of 8 per cent per year. What is the total amount owed at the end of the 10 years if no intermediate payments are made?

(c) Derive the formula for the present worth of an ordinary annuity with equal payments of R Kwacha at the end of each year.

A company is making total yearly payments of K50 million for 10 years. Determine the present worth of these payments at 20% interest. Calculate the compound amount accumulated over the 10 years.

THIS IS THE END OF THE EXAMINATION IN AGF 542/MM 552

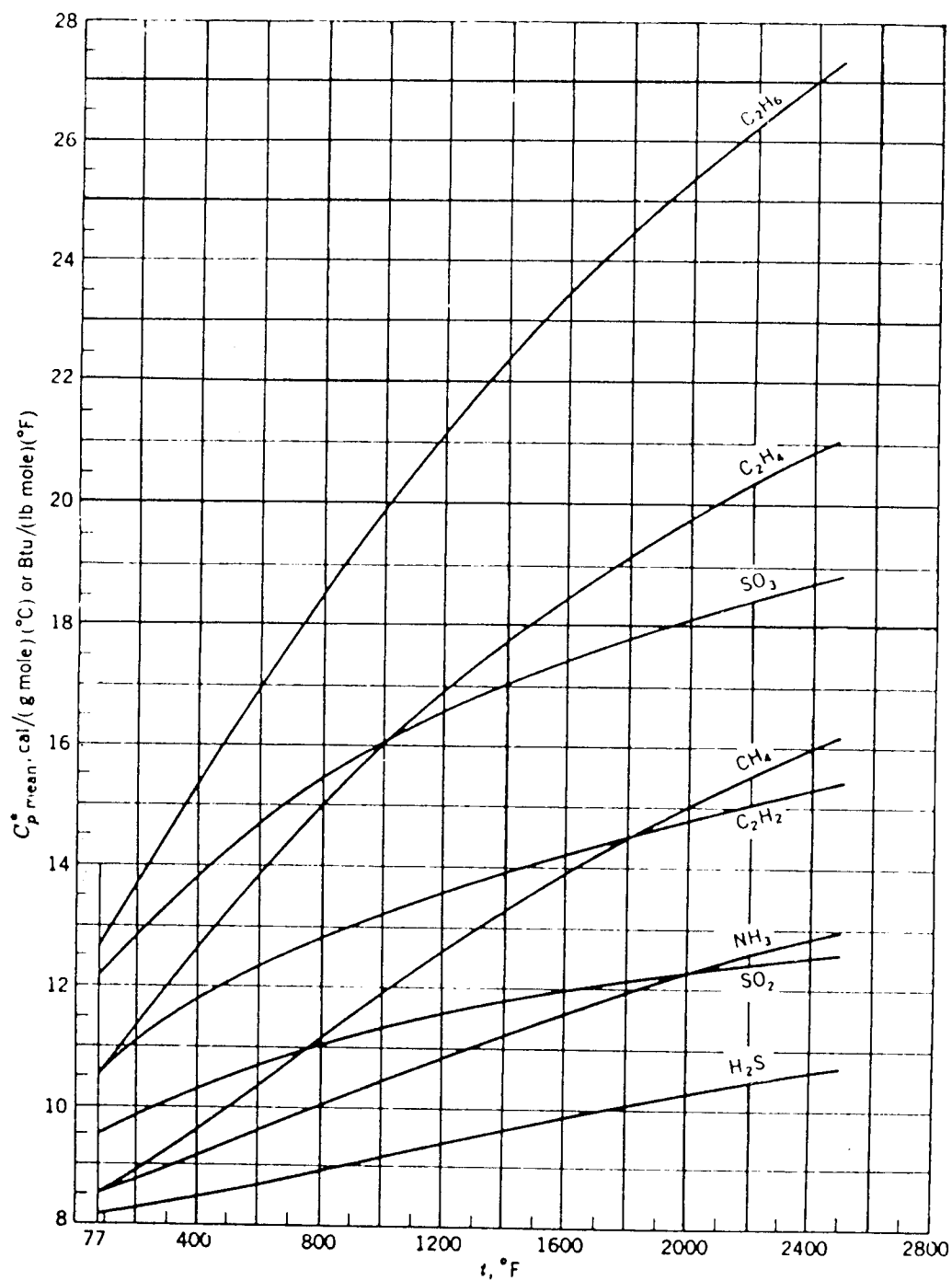


Figure 10-1 Mean molar heat capacities of gases in the ideal state. Base temperature, 77 F. Based mainly on data from D. D. Wagman (ed.), Selected Values of Chemical Thermodynamic Properties, Natl. Bur. Stand. Circ. 500, 1952. From J. M. Smith and H. C. Van Ness, Introduction to Chemical Engineering Thermodynamics, Second Edition, Copyright 1959 McGraw-Hill Book Co. Reprinted by permission.

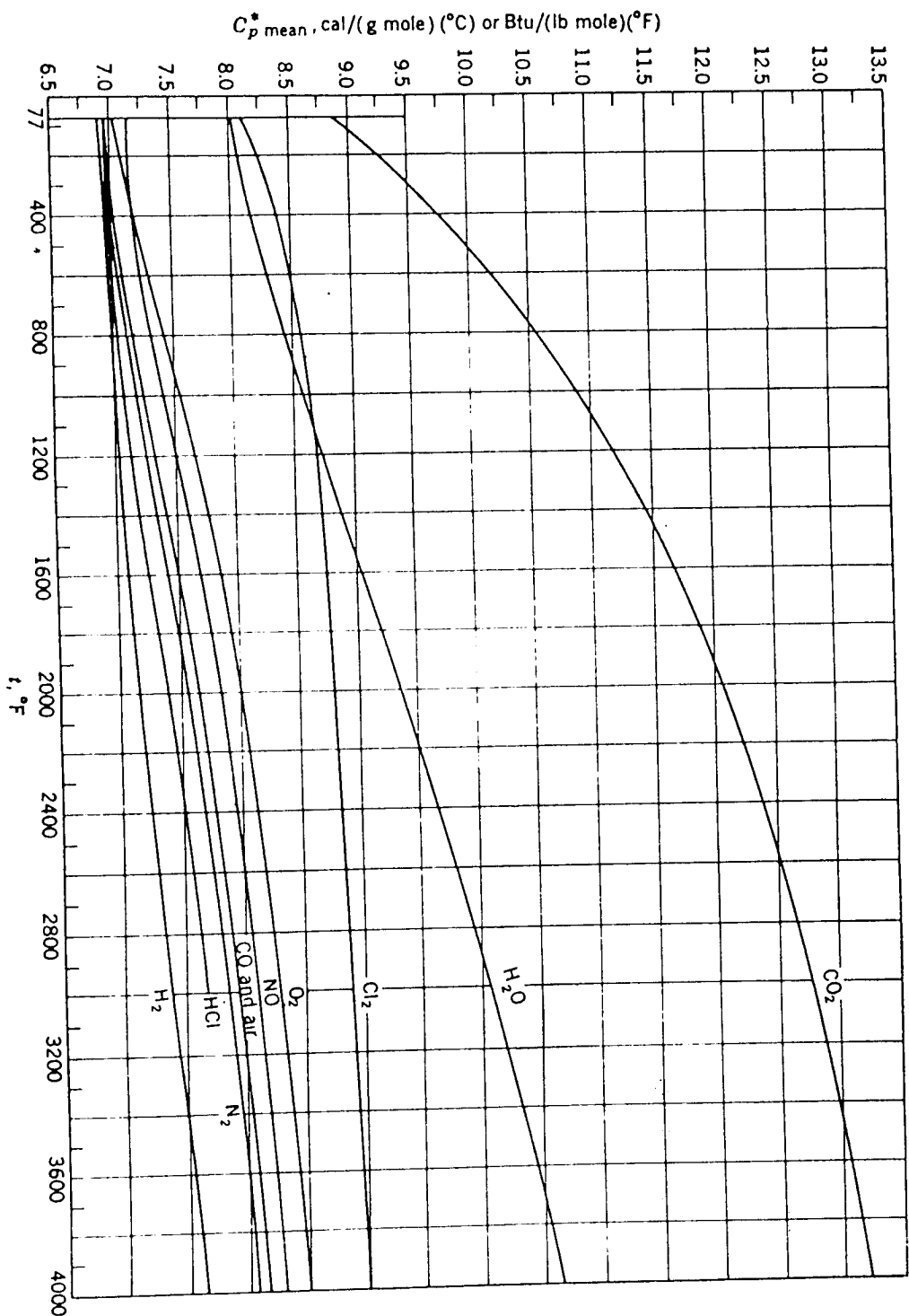
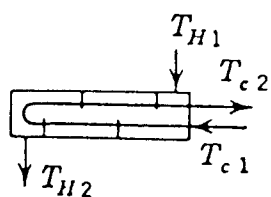
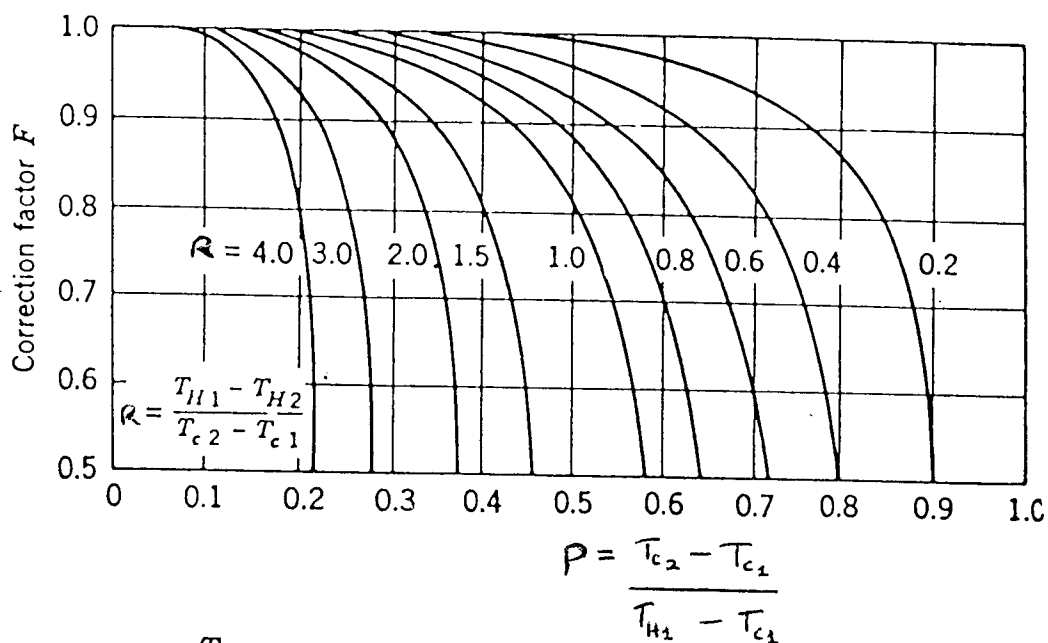
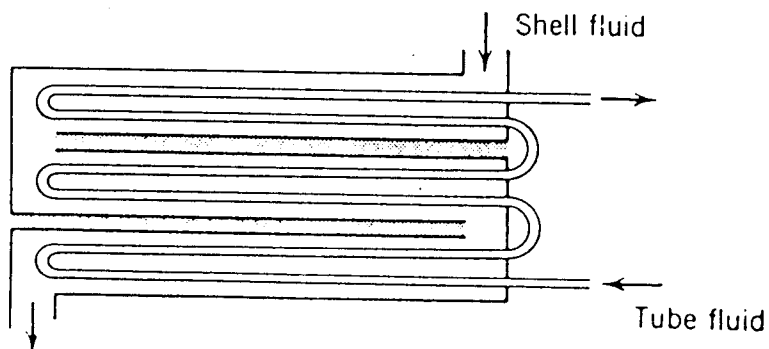
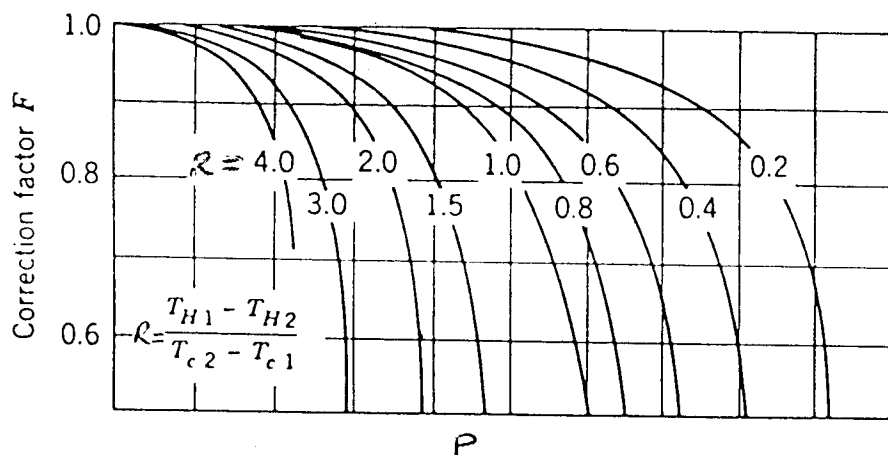


Figure 10-2 Mean molar heat capacities of gases in the ideal-gas state. Base temperature: 77°F . Based mainly on data from D. D. Wagman (ed.), Selected Values of Chemical Thermodynamic Properties, Natl. Bur. Stand. Circ. 500, 1952. From J. M. Smith and H. C. Van Ness, Introduction to Chemical Engineering Thermodynamics, Second Edition. Copyright 1959 McGraw-Hill Book Co. Reprinted by permission.



Correction Factor Plot for Exchanger with One Shell Pass and Two, Four, or any Multiple of Tube Passes

(a)



(b)

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

UNIVERSITY SECOND SEMESTER EXAMINATIONS-DECEMBER 2004

AGS 322: SOIL PHYSICS

Time: Three (3) Hours
Instruction: Answer all Questions

Marks: 85

-
1. Briefly define each of the following terms: [10 marks]
- a) Thermal conductivity
 - b) pF scale
 - c) cohesive forces
 - d) Sorptivity
 - e) Fick's law
2. Mass flow of air in the soil results from pressure differences between soil air and the external atmosphere. What phenomena are responsible for the pressure differences? [14 marks]
3. Water flow in a soil media can be described by the following equation in its partial differential form : [20marks]

$$\frac{\partial \theta}{\partial t} = K_x \cdot \frac{\partial^2 H}{\partial x^2} + K_y \cdot \frac{\partial^2 H}{\partial y^2} + K_z \cdot \frac{\partial^2 H}{\partial z^2}$$

- a) Explain the different components in the equation above
 - b) Derive from the above equation, an equation describing:
 - i) Saturated flow under anisotropic conditions
 - ii) Unsaturated flow under isotropic conditions
 - iii) Horizontal flow under unsaturated conditions
 - iv) Laplace equation
4. Briefly discuss the main principles of the each of the following soil water measurement methods: (16 marks)
- a) Neutron scattering method
 - b) Time Domain Reflectometry method (TDR)
5. During evaporation experiment from a bare soil surface carried out at Msekera Regional Research Station the following data was obtained from a set tensiometers installed at different soil depths. The mercury reservoir was installed at 25 cm above the soil surface. [25 marks]

Table 1: Tensiometer measurements during two dates in March 2002

Depth (cm)	Tensiometer Readings (cm)	
	March 23, 2002	March 30, 2002
15	36.4	52.7
30	12.0	15.5
60	9.8	12.2
90	11.9	12.6
120	13.5	15.3

The water characteristic curve and hydraulic conductivity functions are given by:

$$\theta = \theta_r + (\theta_s - \theta_r) \cdot \left[1 + (\alpha \cdot |h|)^n \right]^{-m}$$

$$K_{(\theta)} = K_s \cdot \left(\frac{\theta - \theta_r}{\theta_s - \theta_r} \right)^{0.5} \cdot \left[1 - \left(1 - \left(\frac{\theta - \theta_r}{\theta_s - \theta_r} \right)^{\frac{1}{m}} \right)^m \right]^2$$

where $\theta_s = 0.367 \text{ cm}^3 \text{ cm}^{-3}$, $\theta_r = 0.057 \text{ cm}^3 \text{ cm}^{-3}$, $\alpha = 0.04 \text{ cm}^{-1}$, $n = 5.05$, $m = 0.802$ and $K_s = 40 \text{ mm day}^{-1}$

- Determine the depth (cm) for the average plane of zero flux during this period
- Determine the amount of soil water storage (mm) from the soil surface to a depth of 50cm in the profile for each date
- Determine the water loss (mm and mm day⁻¹) through evaporation that occurred at the soil surface during the measured period
- Determine the drainage (mm and mm day⁻¹) that occurred at 75cm soil depth during the measured period
- What three measures or practices would you recommend to a farmer in order to reduce water loss through the soil surface

End of Exam

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
SECOND SEMESTER EXAMINATIONS DECEMBER 2004

AGS 331: SOIL SURVEY TECHNIQUES

INSTRUCTION: Answer all questions

TIME: 3 hours

1. What is the importance of correlation and quality control in soil survey?
(10 Marks)

2. Explain the following terms: (10 Marks)
 - a) Simple mapping unit
 - b) Soil variability
 - c) Compound mapping unit

3. List common field equipment used in soil survey and indicate their uses. What are the main differences between using a cyclometer and a surveyors tape in measuring distances.
(10 Marks)

4. What is the first decision to be made when planning a soil survey? Why is this important (6 Marks)

5. Explain how the process of mapping is done. Mention the various aspects of the land that are mapped during this phase (14 Marks)

6. a) An investor wishes to buy a piece of land for farming in Kalomo. Explain why this investor would need a soil survey. (5 marks)

b) List and explain two non-agricultural applications of soil survey information. (5 marks)

7. a) Explain the importance of scale, remote sensing, and ground truthing in each of the following soil survey levels:

- i. Exploratory
- ii. Semi-detailed
- iii. Very detailed

b) How has each one of the survey levels in Question ~~7~~^a above been used in Zambia? (4 marks)

8. a) Describe the main characteristics of general and special purpose soil surveys. (6 marks)

b) What are the main advantages and disadvantages of each of the above soil survey approaches? (4 marks)

9. How are airphotos used in soil surveying? (10 marks)

END OF EXAM

MERRY XMAS & HAPPY NEW YEAR!!!

THE UNIVERSITY OF ZAMBIA
SECOND SEMESTER EXAMINATIONS
DECEMBER 17, 2004
AGS422
SOIL MICROBIOLOGY

TIME: 3 HOURS

INSTRUCTIONS: Answer all Questions

Marks: 100

1. Define the following terms: (8 marks)
 - a. Soil Microbiology
 - b. Denitrification
 - c. Xenobiotic compounds
 - d. Carbon assimilation efficiency
 - e. Stationary phase of the microbial growth curve
 - f. Anabolism
 - g. Carbon assimilation efficiency
 - h. Holozoic nutrition

2. Indicate whether the following statements are true or false: (7 marks)
 - a. Fungi are generally more efficient in assimilating organic carbon than bacteria.
 - b. Mycorrhizae are a symbiotic association between plant roots and Rhizobia
 - c. The formation of cysts is one mechanism that enables protozoa to survive periods of unfavorable environmental conditions
 - d. An organism 15 μm long will appear to be 0.45 cm long when viewed through a microscope with an objective lens with a magnification of 30 x and an ocular with a magnification of 10 x.
 - e. A soil containing 5 % organic matter and a total nitrogen content of 0.08 % has a C: N ratio greater than 30: 1.
 - f. A positive effector reduces the activity of allosteric enzymes
 - g. Some fungi are photolithotrophic
 - k. Soil Microbiology is fun

3. Answer the following questions, briefly and concisely
 - a. What functions do cysts serve for protozoa and what causes encystation to occur (5 marks)
 - b. List the origin of enzymes found in the soil (5 marks)
 - c. Describe how you would distinguish gram positive bacteria from gram-negative bacteria (5 marks)

- 4 The Chitemene or slash and burn system of farming is practiced in Northern regions of Zambia with highly leached acidic soils. Tree branches and shrubs are cut, heaped and let to dry early in the dry season. Just before the onset of the rainy season, the dried branches and shrubs are burnt. Ash from the burnt plant materials is spread in the area to be cultivated and then dug into the soil. The ash supplies some nutrients to the soil and neutralizes the acidity of the soil.

Describe how applying ash to the soil affects microbial activity and in turn the fertility of the soils in Chitemene fields in the first season of cultivation. (10 marks)

- 5 Nitrogen is usually the most limiting nutrient to plant growth in soils. Discuss the various processes by which nitrogen enters and leaves cultivated soils and describe the role that soil microorganisms play in these various processes. (10 marks)
- 6 According to the Kyoto Protocol, Developing Countries that engage in activities that reduce greenhouse gases in the atmosphere can earn points or money for participating in such activities. If you, are a manager of a large scale crop production farm, what crop production and soil management practices would you adopt on your farm to earn points for increasing the amount of carbon sequestration. Mention how each of the management practices you would adopt would enhance carbon sequestration. (7.5 marks)
- 7 A sales lady from a company selling a new product called EM (Effective Microorganisms), composed of fungi, bacteria and Actinomycetes claims that applying their product to any soil in Zambia will double the yield of maize on that soil. Would you agree or disagree with this sales lady? Why would you agree or disagree with her? (7.5 marks)
- 8 A soil with 1.0 % organic matter, a bulk density of 1.45 g.cm^{-3} , total nitrogen content of 0.08 %, has a cultivated layer 24 cm deep. Answer the following questions related to this soil:
- If the average rate of microbial respiration is $4.8 \text{ mg CO}_2/\text{kg soil per day}$. What will be the organic carbon matter content of this soil after 3 years, assuming there is no addition of organic matter to the soil and that the respiration rate does not change during the 3 year period (10 marks)?
 - If the above microbial respiration rate is due to soil microbes with a C/N ratio of 12: 1 and a carbon assimilation efficiency of $2/3$ or 66.7 %:
 - Calculate the amount of carbon that will be assimilated into microbial biomass in 6 months in 1 hectare of this soil (7.5 marks)
 - Calculate the amount of nitrogen that will be assimilated by microbes in one month per hectare of this soil. (7.5 marks).
 - If a farmer applies 15 metric tonnes of organic matter per hectare per year to the above soil, how many years will it take to increase the organic matter content of the soil to 3 %, if the rate soil respiration is $4.8 \text{ mg CO}_2/\text{kg soil/day}$? (10 marks)

Note: 1 year = 365 days

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SECOND SEMESTER EXAMINATIONS
DECEMBER 2004

AGS 452: PRINCIPLES OF LAND HUSBANDRY

TIME: 3 HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1. a) Discuss the three (3) strategies for better land husbandry and give examples of situations where these strategies may work better (9 Marks)

b) How are the strategies for better land husbandry interrelated? (3 Marks)

2. Explain why it may be important to consider even the non farming activities when the focus of the programme you are involved in is land husbandry. Give reasons (8 Marks)

3. Define the following terms and explain how each of these contributes to good land husbandry:

- a) Water conservation
- b) Minimum tillage
- c) Composting
- d) Green manuring
- e) Agroforestry

} (30 Marks)

4. Soil erosion is best described by the universal soil loss equation (USLE) which is given by the formula:

$$A = RKLSCP$$

Each of the components represents a factor which contributes to the final erosion

a) Explain what each component is and describe the factors importance in the process and how these factors impact on the final erosion (10 Marks)

b) For each component, which are the conditions that are undesirable and which are desirable with respect to land husbandry (5 Marks)

c) Describe how one would mitigate against the negative effects of each of these factors where the land is used for crop production (5 Marks)

5. Tillage or lack thereof is one means of influencing erosion or its control. Describe at least four (4) tillage related mitigating techniques which can help control or reduce erosion (Describe actual techniques of tillage). How is erosion controlled by these techniques (20 Marks)

6. With reference to wind erosion, define and explain the following:

- a) The point of zero velocity also called the Y intercept
- b) The drag force or shear exerted by the wind on the surface
- c) WEG
- d) Wind capacity to transport soil particles
- e) Mulches

(10 Marks)

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS
DECEMBER 2004

AGS 522: SOIL AND PLANT ANALYSIS

TIME: 3 HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS

Marks: 100

1. Given the following foliar analysis data, discuss the nutrient concentration levels for crops generally and suggest the symptoms that may appear on a soya plant. [10]

N	-	1.2 %
P	-	0.5 %
K	-	3.5 %
Ca	-	0.1 %
Mg	-	0.4 %

Zn	-	25 mg kg ⁻¹
Mn	-	200 mg kg ⁻¹
Fe	-	80 mg kg ⁻¹
B	-	5 mg kg ⁻¹

2. You have been asked to prepare a land use plan for a farm, how would you go about a soil fertility survey? Discuss the various parameters that you would consider and all the activities you would carry out up to submitting the samples to the laboratory. [10]
3. Select the best answer: [10]
- (i) - Most of the analyses done in an agricultural soil testing laboratory are measurements of the physical properties of the soil.
- (a) True
(b) False
- (ii) - The portion of a soil nutrient present in the soil solution is appropriately referred to as:
- (a) capacity factor
(b) intensity factor
(c) reserve factor
(d) latent factor
- (iii) - Soil tests generally extract only a portion of the total amount of a given nutrient.
- (a) True
(b) False

(iv) - Soil test correlation

- (a) Seeks to find the amount of fertilizer required at various soil test levels
- (b) Must always be done in the field
- (c) Examines how the amount of nutrient extracted is related to crop nutrient uptake or growth
- (d) a and b

(v) - Rating a soil test as low, medium or high is best described as:

- (a) calibration
- (b) interpretation
- (c) correlation
- (d) extraction

(vi) - Which of the following tools will likely lead to the most contamination of subsoil samples when taking deep samples?

- (a) Oakfield probe
- (b) Screw auger
- (c) Bucket auger

(vii) - A deficiency of the following micronutrient is least likely to occur on an alkaline soil

- (a) B
- (b) Mo
- (c) Zn
- (d) Mn
- (e) Fe

(viii) - We are concerned about very acid soils because they may contain harmful concentrations of

- (a) Mn
- (b) Al
- (c) Mg
- (d) a and b
- (e) a, b and c

(ix) - Which is more reliable as an index for interpretation/recommendation for S?

- (a) soil test
- (b) plant tissue analyses

(x)- Which of the following can more likely cause 'temporary P-deficiency'?

- (a) Low soil temperature
- (b) Soil pH 6.5
- (c) Close planting
- (d) Fertilizer source

4. A soil analysis gives 8 me of Ca 100g^{-1} soil. What is the weight of Ca in kg ha^{-1} ? (BD = 1.3 g cm^{-3} , furrow slice = 20 cm) [10]

5. Although K, Ca and Mg are extracted simultaneously in the same solution, they cannot be determined simultaneously on the AAS. What must be done? [5]

6. Given the following soil test results, indicate your interpretations and where you would recommend fertilizer application for soil fertility balance [20]

Element	Test Level	Interpretation	Recommendation (Y or N)
$\text{pH}_{\text{CaCl}_2}$	5.5		
EC	0.2 mS cm^{-1}		
N	0.5 g kg^{-1}		
P	7 mg kg^{-1}		
K	75 mg kg^{-1}		
Mg	80 mg kg^{-1}		
Ca	250 mg kg^{-1}		
S	4 mg kg^{-1}		
Zn	0.2 mg kg^{-1}		
B	0.1 mg kg^{-1}		

7. What is the composition of the Bray-1 P extractant? [5]

8. Given concentrated H_2SO_4 (36 N), how would you prepare a 5N stock solution and then a 0.125 N working solution. [10]

9. In an analysis that you would use colorimetry or turbidimetry, what are some of the potential sources of interference, ranging from extraction to color/turbidity development? What would you do to eliminate these? [10]

10. Discuss soil analysis for the essential micronutrients. How would you go about them and what are the critical levels? [10]

END

UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS – DECEMBER, 2004

AGS 542 – SOIL GENESIS AND CLASSIFICATION

INSTRUCTIONS: ANSWER ALL QUESTIONS. TIME: 3 HOURS

1.
 - a) A geological survey of the Lusitu area in the Zambezi Valley indicates extensive areas of the Karroo sediments dominated by the Madumambisa mudstones. If the soils in this area have developed in situ, explain what kind of soils you would expect to find in the Lusitu area. (5 marks)
 - b) A soil has developed from limestone but it is sandy and acidic. How would you explain this? (5 marks)
2. Using suitable illustrations where possible explain the following pedological terms:
 - a. accumulation catena
 - b. lessivage
 - c. cumulization
 - d. solution weathering
 - e. illuviation (10 marks)
3.
 - a) With suitable examples explain the main weaknesses in using Jenny's hypothesis that any soil is a function of five factors. (5 marks)
 - b) Explain the main assumption that must be made in using the concept of the catena as proposed by Geoffrey Milne. (5 marks)
4. Discuss the influence of vegetation and fauna in soil differentiation. (10 marks)
5. During a soil survey soils in one map unit have been classified as "Fine loamy, Kaolinitic, Isohyperthermic, Typic Kandiaquults."
 - a. Explain the main characteristics of this soil. (6 marks)
 - b. What would be the main potentials and limitations of this soil for crop production? (4 marks)
6. Explain the main structural differences between Soil Taxonomy and the World Reference Base for Soil Resources. (10 marks)
7. Soil Taxonomy mostly uses soil properties and not pedogenic properties as differentiating criteria. What advantages does this offer? (10 marks)

8. Why is it more useful to present soil information at the family than at any other levels in Soil Taxonomy? (10 marks)

END OF EXAM
MERRY XMAS & HAPPY NEW YEAR!!!

UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS
DECEMBER 2004

AGS 562: MANAGEMENT OF IRRIGATION AND DRAINAGE SYSTEMS

INSTRUCTIONS: ANSWER ALL QUESTIONS

TIME: 3 HOURS

Q1.

You are setting up a furrow irrigation system and have reached the step to determine furrow length. The following are the results which you have recorded:

The stream size is 3 cubic meters per hour

The steady state flow at 100m is 0.8 cubic meters per hour.

Determine the infiltration rate. (5 marks)

Given that the furrow width is 0.8 m wide and the furrow length is 150 m.

Determine the amount of water added to this furrow if it requires 45 minutes for the water to reach the 150m mark. (5 marks)

What will the moisture distribution be at the 0 m, upper end, the 75 m, middle point and the 150m, end point of the furrow.? (5 marks)

If water is allowed to flow for another 2 hours.

How much extra water will have been added and what would the distribution at the 0m, upper end, the 75 m, middle point and 150m bottom end, be now. (5 marks)

Q2.

When water in furrow and or border irrigation reaches the end of the furrow or strip its distribution is found to be inadequate at the bottom end. The practice is to allow water to continue flowing for an extra period of time to even out the distribution. To get better efficiency in distribution, the stream size or discharge is said to be cut back.

Explain the stream or discharge cut back concept. (5 marks)

What formula would you use to help you establish the correct cut back? Give the actual formula. Explain all the components of this formula. (10 marks)

Q3.

Irrigation scheduling and management involves developing an irrigation time table or schedule. Uncertainties in weather, climate and hardware however make this task very difficult.

As a result a timetable is developed which is acceptable rather than optimum. This time table should be hydraulically feasible and meets self imposed constraints and subjective priorities by a step by step process.

Name and describe this step by step process ensuring to highlight its essential features. (5 marks)

When a computer is used to aid in developing the time table, three in built options are considered or used when refining the time table to ensure that it actually will work;

Name each of the three options and describe how each attempts to solve the problem./s (15 marks)

The very final step in the whole process involves verifying that the new proposed time table or schedule will work and is compatible with the hardware and existing infrastructure.

Name this step and describe what it involves. (5 marks)

Q4.

Among the health hazards associated with irrigation are mosquito transmitted diseases.

- (a) Describe three of these diseases explaining the diseases and how they affect human beings. (5 marks)
- (b) What measures would you put in place to mitigate and control these diseases? (5 marks)

Among the pollutants which can be encountered when sewage effluent is used for irrigation is the entry of Nitrogenous Compounds in ground water.

Describe how this hazard may manifest itself, how it occurs, and its effect on human beings and how it can be controlled. (10 marks)

Q5.

Given the Figure 1.

Name the Figure and explain what the curves represent. What is the Figure used for? (5 marks)

Explain what the lines and curves labeled (i), (ii), (iii), (iv) represent and how each is derived. (5 marks)

There are a number of points in the figure;

What are the points identified by (a), (b), (c), (d), (B), (C) and what is their significance? (5 marks)

Explain the B-C and the B/C concepts? When is each most appropriate to use? (5 marks)

END OF EXAMINATION

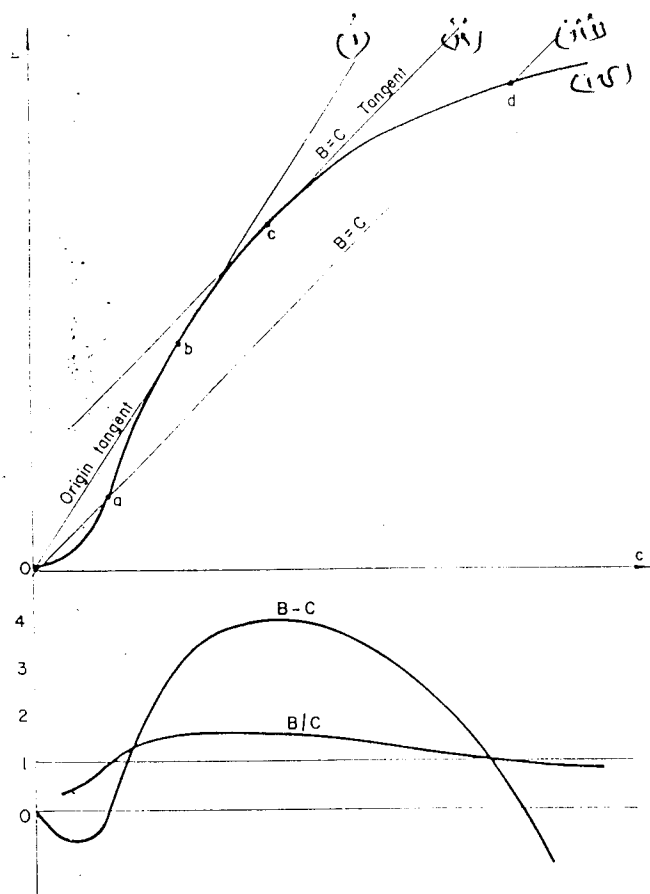


FIGURE 1. Typical benefit-cost curve.