



CARIBBEAN EXAMINATIONS COUNCIL

CAPE®

Agricultural Science

**SYLLABUS
SPECIMEN PAPER
MARK SCHEME
SUBJECT REPORTS**

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Agricultural Science

Agricultural Science is a broad multidisciplinary field that encompasses aspects of exact, natural, economic and social sciences that are used in the practice and understanding of agriculture and the environment.

The CAPE Agricultural Science syllabus was developed in response to the fact that agriculture and food are prime industries in the region and are key components in the development of policies that drive economic growth, utilise natural resources and sustain the environment. It is very important that the agricultural industry in the Caribbean has persons who are equipped with the knowledge, skills and competencies to undertake and sustain the development of the agricultural sector leading to the goal of wealth creation through increased food production; and food security and safety. Additionally, there is increasing recognition of the role that agriculture plays in improving nutrition and health.

Persons who complete this course will be better positioned not only to be farmers, but to make evidence-based and informed judgments and decisions on implementing best practices to enhance the sector over time and on preserving the environment.

The subject is organised in two (2) Units.

UNIT 1: Fundamentals of Agriculture and Crop Production

- Module 1 The Science and Business of Agriculture
- Module 2 Horticulture and Management
- Module 3 Postharvest Technology and Innovation

UNIT 2: Animal Production and the Environment

- Module 1 Agriculture and the Environment
- Module 2 Animal Production and Management
- Module 3 Livestock Products and Innovation



CARIBBEAN EXAMINATIONS COUNCIL

**Caribbean Advanced Proficiency Examination®
CAPE®**

AGRICULTURAL SCIENCE SYLLABUS

Effective for examinations from May-June 2015



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Please check the website www.cxc.org for updates on CXC's syllabuses.





Introduction

The Caribbean Advanced Proficiency Examination (CAPE) is designed to provide certification of the academic, vocational and technical achievement of students in the Caribbean who, having completed a minimum of five years of secondary education, wish to further their studies. The examinations address the skills and knowledge acquired by students under a flexible and articulated system where subjects are organised in 1-Unit or 2-Unit courses with each Unit containing three Modules. Subjects examined under CAPE may be studied concurrently or singly.

The Caribbean Examinations Council offers three types of certification. The first is the award of a certificate showing each CAPE Unit completed. The second is the CAPE Diploma, awarded to candidates who have satisfactorily completed at least six Units, including Caribbean Studies. The third is the CXC Associate Degree, awarded for the satisfactory completion of a prescribed cluster of seven CAPE Units including Caribbean Studies and Communication Studies. For the CAPE Diploma and the CXC Associate Degree, candidates must complete the cluster of required Units within a maximum period of five years.

Recognised educational institutions presenting candidates for the CXC Associate Degree in one of the nine categories must, on registering these candidates at the start of the qualifying year, have them confirm, in the required form, the Associate Degree they wish to be awarded. Candidates will not be awarded any possible alternatives for which they did not apply.

Agricultural Science Syllabus

◆ RATIONALE

Agricultural Science is a broad multidisciplinary field that encompasses aspects of exact, natural, economic and social sciences that are used in the practice and understanding of agriculture and the environment. Agriculture is the set of activities that transform the environment for the production of animals and plants for food and other human usage. In addition, to protecting the environment, agriculture provides jobs especially for rural people and contributes to the viability of the area, creates a more stable food supply, and provides other desired environmental and rural outputs.

The CAPE Agricultural Science Syllabus was developed in response to the fact that agriculture and food are prime industries in the region and are key components in the development of policies that drive economic growth, utilise natural resources and sustain the environment. It is very important that the agricultural industry in the Caribbean has persons who are equipped with the knowledge, skills and competencies to undertake and sustain the development of the agricultural sector leading to the goal of wealth creation through increased food production; and food security and safety. Additionally, there is increasing recognition of the role that agriculture plays in improving nutrition and health.

Based on the attributes of the Ideal Caribbean Person as articulated by CARICOM, this course of study in CAPE Agricultural Science can contribute to the development of a Caribbean person who demonstrates multiple literacies, independent and critical thinking, questions the practices of past and present and brings this to bear on the innovative application of science and technology to problem solving; and values and displays the creative imagination in its various manifestations and nurtures its development in economic and entrepreneurial spheres in all other areas of life. With reference to the UNESCO Pillars of Learning, this course of study will also contribute to a person who will learn to know, learn to do, learn to live together, learn to be and learn to transform themselves and society. Hence, persons will be better positioned not only to be farmers, but to make evidence-based and informed judgments and decisions on implementing best practices to enhance the sector over time and on preserving the environment. The syllabus is designed to provide the knowledge, skills and competencies that are required for further studies, as well as for the world of work.

◆ AIMS

This syllabus aims to:

1. develop knowledge and understanding of the importance of agriculture as it relates to food and the environment and the multifunctionality of territories of the Caribbean region;
2. provide knowledge of the dynamic nature of the value-added chain in agricultural production (from production to consumption), post-production and marketing in a complex national, regional and international market;



3. develop an appreciation of the importance of agriculture in alleviating hunger and poverty, ensuring food security and safety, and improving nutrition and health;
4. develop an appreciation of the importance of agriculture in providing multiple pathways to employment and further education;
5. increase an awareness of the relationship between agriculture and the environment and the importance of preserving the environment;
6. utilise modern technology to improve agricultural production and encourage innovation and food security within nations and regionally;
7. use the scientific method to solve problems and make informed judgements;
8. integrate information, communication and technological (ICT) tools and skills.

◆ SKILLS AND ABILITIES TO BE ASSESSED

The skills students are expected to have developed on completion of this syllabus have been grouped under two headings:

- (a) Knowledge and Comprehension;
- (b) Application.

Knowledge and Comprehension (KC)

Knowledge:	The ability to identify, remember and grasp the meaning of basic facts, concepts and principles.
Comprehension:	The ability to select appropriate ideas, match, compare and cite examples and principles in familiar situations.

Application (A)

Application:	The ability to use facts, concepts, principles and procedures in unfamiliar situations. The ability to analyse and interpret unfamiliar situations, and make reasoned judgements and recommendations.
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◆ PREREQUISITES OF THE SYLLABUS

Any person with a good grasp of the contents of the Caribbean Secondary Education Certificate (CSEC) Agricultural Science or Integrated Science or Biology syllabuses or equivalent, should be able to pursue the course of study defined by the syllabus. However, successful participation in the course of study will also depend on the possession of good verbal and written communication skills.

◆ STRUCTURE OF THE SYLLABUS

The subject is organised in two (2) Units. A Unit comprises three (3) Modules each requiring fifty (50) hours. The total time for each Unit, is therefore, expected to be one hundred and fifty (150) hours. Each Unit can independently offer students a comprehensive programme of study with appropriate balance between depth and coverage to provide a basis for further study in this field.

UNIT 1: Fundamentals of Agriculture and Crop Production

Module 1	-	The Science and Business of Agriculture
Module 2	-	Horticulture and Management
Module 3	-	Postharvest Technology and Innovation

UNIT 2: Animal Production and the Environment

Module 1	-	Agriculture and the Environment
Module 2	-	Animal Production and Management
Module 3	-	Livestock Products and Innovation

In this syllabus, the specific objectives which are denoted by an asterisk (*) are particularly suitable for practical exercises. However, practical work should not necessarily be limited to these objectives.

◆ APPROACHES TO TEACHING THE SYLLABUS

The specific objectives indicate the scope of the content and the activities of the School-Based Assessment (SBA) that should be covered.

The role of the teacher is to facilitate students' learning accurate and unbiased information that will indirectly contribute to a more scientifically literate citizen, that is, capable of making educated decisions regarding the world we live in.

For Units 1 and 2, the cultivation of the crops, and the rearing of the animals must start in October to allow for achieving all the specific objectives contained in Modules 1, 2 and 3 of each unit.

◆ UNIT 1: FUNDAMENTALS OF AGRICULTURE AND CROP PRODUCTION

MODULE 1: THE SCIENCE AND BUSINESS OF AGRICULTURE

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand the principles governing Agriculture and its role locally and regionally;
2. know the Biology of plants and animals;
3. understand the different biogeochemical cycles and their effect on agriculture;
4. understand how the charges of elements relate to the absorption of nutrients in plants and animals;
5. understand the processes involved in Agribusiness management;
6. appreciate the importance of technology to the development of agriculture in the region;
7. develop analytical and practical skills.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. differentiate among the different branches of agriculture; | Agricultural Economics.
Agricultural Engineering.
Agronomy.
Animal Science.
Harvesting (fisheries).
Horticulture. |
| <ol style="list-style-type: none"> 2. explain the production systems associated with agriculture; | Extensive.
Intensive.
Semi-Intensive.
Integrated. |
| <ol style="list-style-type: none"> 3. discuss the evolution of agriculture in the region; | Techniques - crops, livestock, fisheries:

(a) traditional;
(b) non-traditional;
(c) modern. |

UNIT 1

MODULE 1: THE SCIENCE AND BUSINESS OF AGRICULTURE (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | | |
|-----|---|--|
| 4. | explain the different transport mechanisms across the cell membrane;* | Passive transport.
Simple diffusion.
Facilitated diffusion.
Active transport (sodium/potassium pump).

(Simple demonstrations). |
| 5. | describe the endocrine systems in farm animals; | Location and functions of the endocrine glands- including the exocrine gland. Hormones and their functions. |
| 6. | discuss the anatomy and physiology of male and female reproductive systems in farm animals; | Chicken rabbits, pigs, fish and small animals. |
| 7. | describe the process of digestion in ruminant and non-ruminant animals; | Ruminant animals - sheep and goats.

Non-ruminant animals- chicken and rabbits (Hindgut fermenters). |
| 8. | explain the role of plant processes in crop production;* | Photosynthesis – light and dark reactions.
Respiration – Krebs and Calvin Cycle.
Transpiration (pull and stream).
Photoperiodism.
Translocation.
Phototropism.

(Simple demonstrations) |
| 9. | explain the importance of biogeochemical cycles to agricultural production; | Carbon cycle.
Nitrogen cycle.
Phosphorus cycle.
Water cycle. |
| 10. | explain the significance of cation exchange capacity in nutrient uptake; | Level of acidity and alkalinity in soils.

Cations and anions effect on soil fertility. |

UNIT 1

MODULE 1: THE SCIENCE AND BUSINESS OF AGRICULTURE (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

11. explain the concepts involved in agribusiness;

Management performance.
Scope of management decisions.

Steps in decision making:

- (a) supply and demand;
- (b) diminishing returns;
- (c) depreciation;
- (d) comparative advantage;
- (e) resource substitutions.

Use of capital and credit.

12. explain the importance of agricultural trade to the region.

Definition of trade.
Impact of trade liberalisation.
Impact of food safety and security.
Impact of exploitation of natural resources on domestic food supply.

International Trade Agreements:

- (a) World Trade Organization (WTO);
- (b) North American Free Trade Agreement (NAFTA);
- (c) Caribbean Common Market (CARICOM);
- (d) Africa Caribbean Pacific Countries (ACP);
- (e) Union of South American Nations (UNASUR).

UNIT 1

MODULE 1: THE SCIENCE AND BUSINESS OF AGRICULTURE (cont'd)

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives in this Module, teachers are advised to engage students in the following teaching and learning activities.

1. Use videos to explain sodium/potassium pump.
2. Conduct research in groups on the evolution of Agriculture in the region.
3. Use computer aided technology, for example, YouTube and other social network, to conduct brain-storming sessions.
4. Visit an abattoir or research station to assist in identifying parts of the digestive and reproductive systems of non-ruminant and ruminant animals.
5. Use local materials to construct models to demonstrate the processes involved in the biogeochemical cycles.
6. Engage students in debates.
7. Supervise Agriculture Experience (SAE), –Incorporate real life experiences in an agribusiness setting by interacting with a farmer or a farming enterprise.

RESOURCES

Burton, L. DeVere	<i>Agriscience, Fundamentals and Application</i> , New York: Delmar, Cengage Learning, 2010.
Frandsen	<i>Anatomy and Physiology of Farm Animals</i> , New Jersey: Wiley Blackwell, 2009.
Ganpat, W. and Isaac, W.	<i>Sustainable Food Production Practices in the Caribbean</i> , Kingston: Ian Randle Publishers, 2012.

eBooks

Website: www.cta.int

AD02 -Soil Fertility Management
AD26 -Marketing For Small Scale Producers
AS6 -When We Take Care of the Land. pdf
CTA -Good Agriculture Policy



UNIT 1

MODULE 2: HORTICULTURE AND MANAGEMENT

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand the principles of horticulture;
2. appreciate the concept of integrated crop management;
3. develop practical and analytical skills.

SPECIFIC OBJECTIVES

Students should be able to:

1. discuss the methods and importance of non-conventional crop farming systems in the region;
2. discuss the management of turf grass;
3. practise sustainable landscaping;
4. discuss the production of ornamental plants;

EXPLANATORY NOTES

Tissue Culture.
Hydroponics.
Roof-top farming.
Indoor farming.
Organic farming.

Relate to the sporting disciplines:

- (a) cricket;
- (b) golf;
- (c) tennis;
- (d) football (soccer).

Lawn management

To include:

Soil management:

- (a) biofiltering of waste;
- (b) irrigation;
- (c) run-off.

Integrated Crop Management (ICM).
Wildlife habitats.
Shade /wind break.
Recycling.
Re-newable energy/solar lighting.

Anthurium.
Ginger lily.
Orchid.
Rose.
Houseplants.



UNIT 1

MODULE 2: HORTICULTURE AND MANAGEMENT (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | | |
|----|---|--|
| 5. | propagate orchard crops;* | Budding.
Grafting.
Layering. |
| 6. | discuss the production of traditional crops; | Banana.
Citrus.
Sugar cane.

Include innovative uses |
| 7. | cultivate a fruit, root and leaf crop;* | Crops:

(a) tomato;
(b) sweet pepper;
(c) lettuce.

Transplanting.
Direct planting. |
| 8. | explain appropriate harvesting techniques; | Maturity index.
Methods of harvesting.
Purposes of harvesting.
Time of day. |
| 9. | discuss the benefits of ornamental horticulture production. | Entrepreneurial opportunities.
Aesthetic value.
Social and economic benefits. |

UNIT 1

MODULE 2: HORTICULTURE AND MANAGEMENT (cont'd)

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives in this Module, teachers are advised to engage students in the following teaching and learning activities.

1. Cultivate three crops to investigate land preparation, disease control, pest control and weed control.
2. Visit commercial farms to examine the different irrigation systems and tillage implement and machinery.
3. Construct a simple irrigation system.
4. Use computer aided technology.
5. Supervise Agriculture Experience (SAE) – Incorporate real life experiences in exploratory agriculture by interacting with a farmer or a farming enterprise.

RESOURCES

- | | |
|--------------------------|--|
| Burton, L. DeVere | Agriscience, Fundamentals and Application, New York: Delmar, Cengage Learning, 2010. |
| Smith, B. | The Farming Handbook, The Netherlands: CTA Posthus 380, 2006 |
| Ganpat, W. and Isaac, W. | <i>Sustainable Food Production Practices in the Caribbean</i> , Kingston: Ian Randle Publishers, 2012. |

eBooks

Website: www.cta.int

AD09 - Vegetable Garden in the Tropics.pdf
AD17 - Cultivation of Tomato.pdf
AD18 - Protection of Stored Grains and pulses.pdf
AD19 - Propagating and Planting Trees.pdf
AD23 - Protected Cultivation.pdf
AD29 - Pesticides Compounds, Use and Hazards.pdf
AD30 - Non Chemical Crop Protection.pdf
AS1 - Nurseryman and His Trees.pdf
CTA 003 - Rainwater Harvesting.pdf
CTA - Good Agriculture Policy.pdf

<http://www.nap.edu> Pest Management in the Future National Academic of Sciences



UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY AND INNOVATION

GENERAL OBJECTIVES

On completion of this Module, students should:

1. demonstrate postharvesting techniques;
2. demonstrate the techniques involved in food processing;
3. acquire knowledge of marketing techniques;
4. understand the importance of food security, food safety and trade;
5. develop practical and analytical skills.

SPECIFIC OBJECTIVES

Students should be able to:

1. describe the principles and techniques governing postharvest technology;

EXPLANATORY NOTES

Definition of postharvest.
Definition of postharvest technology.
Differentiate between processed and unprocessed products.
Unprocessed commodities techniques to include:

- (a) selection;
- (b) sorting/grading;
- (c) transportation;
- (d) packaging;
- (e) storage;
- (f) labelling.

2. describe processing procedures;

Canning.
Drying.
Freezing.
Pasteurisation.
Salting.
Smoking.

3. process one of the crops cultivated;*

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY AND INNOVATION (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

4. explain the procedures involved in the marketing of processed and unprocessed crop commodities;

including:

- (a) marketing;
- (b) marketing strategies;
- (c) pricing strategies;
- (d) wholesale and retail;
- (e) consumer preferences;
- (f) market behaviour;
- (g) advertising and promotion.

5. develop a business plan for the processed commodity;

Refer to Specific Objective 3

Consumer research.
Distribution.
Pricing.
Production plan.
Promotion.

(This should be carried out at the school level).

6. outline the principles involved in food safety and security in crop production;

Definition of food safety.

Hazard Analysis Critical Control Point (HACCP):

- (a) principles governing HACCP;
- (b) application of HACCP Principles.

Definition of food security.

Food and Agriculture (FAO) definition - All people at all times have both physical and economic access to the basic food they need.

The impact of food security on the region including bio security.

Ways of ensuring food security.

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY AND INNOVATION (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

7. evaluate the impact of technology on agriculture in the region.

Definition of Technology.

Technology related to:

- (a) Global Positioning Systems (GPS);
- (b) reproduction techniques;
- (c) Genetically Modification Organisms (GMO);
- (d) micro propagation.

Positive and negative impact of technology.

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives in this Module, teachers are advised to engage students in the following teaching and learning activities.

1. Organise competitions for best package design and promotion strategies.
2. Organise field trips to processing plants.
3. Use computer aided technology.
4. Supervise Agriculture Experience (SAE) – Incorporate real life experiences in entrepreneurship.

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY AND INNOVATION (cont'd)

RESOURCES

- Burton, L. DeVere *Agriscience, Fundamentals and Application*, New York: Delmar, Cengage Learning, 2010.
- Ganpat, W. and Isaac, W. *Sustainable Food Production Practices in the Caribbean*, Kingston: Ian Randle Publishers, 2012.

eBooks

Website: www.cta.int

- AD03 - Preservation of Fruits and Vegetables.pdf
- AD18 - Protection of stored Grains and Pulses.pdf
- AD31 - Storage of Tropical Agricultural Products.pdf
- Postharvest Management.pdf
- CTA 006 - Making Sweetpotato Chips.pdf
- CTA 008 - Preserving Green Leafy Vegetables Oblong .pdf
- CTA 011 - Making Banana Chips and Flour.pdf
- CTA 012 - Processing Tomatoes.pdf
- CTA 006 - Adding Value to Cereals Roots and Tubers .pdf
- CTA - Good Agriculture Policy
- CTA - Setting Up and Running a Small Food Processing Enterprise

◆ UNIT 2: ANIMAL PRODUCTION AND THE ENVIRONMENT

MODULE 1: AGRICULTURE AND THE ENVIRONMENT

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand the importance of the environment to stakeholders;
2. understand the effects of soil, water and air pollution on the environment;
3. appreciate the role of tourism, trade and society to agriculture;
4. be aware of the policies governing pollution;
5. acquire practical and analytical skills.

SPECIFIC OBJECTIVES

Students should be able to:

1. discuss the importance of the environment to stakeholders;
2. describe the major sources and impact of atmospheric pollution on the environment;
3. identify procedures used for maintaining and improving air quality;
4. describe the major sources and impact of soil and water pollution;

EXPLANATORY NOTES

Farmers.
Foresters.
Agro-tourists, for example, hikers, bikers, loggers.

Include climatic conditions and weather.

Importance of air quality.

Atmospheric effects:

- (a) greenhouse;
- (b) thinning of ozone layer;
- (c) global warming.

Composition of Natural soil.

Water quality.

Sources to include:

- (a) run-off;
- (b) agricultural chemical;
- (c) industry pollution;
- (d) domestic use;
- (e) oil spillage.



UNIT 2

MODULE 1: AGRICULTURE AND THE ENVIRONMENT (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

5. discuss the importance of international conventions and agreements in regards to pollution control;

Including:

- (a) United Nations Convention on climate change (UNFCCC) and Kyoto protocol;
- (b) Montreal Protocol;
- (c) International Convention for the prevention of Marine Pollution (MARPOL);
- (d) Cartagena Convention on law of the sea (UNCLOS).

6. determine the importance of forest to the environment;

Relationship between forests and other natural resources, for example:

- (a) watershed;
- (b) forest policies;
- (c) primary forest;
- (d) reforestation.

7. discuss the relationship between wildlife and the environment;

Population densities.

Assessing wildlife population.

Harvesting:

- (a) land;
- (b) aquatic.

Wildlife policies.

Wildlife trade:

- (a) land;
- (b) aquatic.

Conservation methods.

UNIT 2

MODULE 1: AGRICULTURE AND THE ENVIRONMENT (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

8. describe how the environment can be sustainably utilised for tourism and trade;

Threats to the environment including:

- (a) pollution of land, air and water;
- (b) creation of arid land;
- (c) flora and fauna.

Agro-tourism.

Eco-tourism.

Policies concerning tourism and agricultural trade (including wildlife and foresting).

9. discuss the role of society in shaping the agricultural agenda in the region.

Culture.

Religion.

Taboos.

Ethnicity.

Foods grown, processed and eaten.

Demographics.

Use of indigenous knowledge.

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives in this Module, teachers are advised to engage students in the following teaching and learning activities.

1. Visit watershed areas and meteorological station.
2. Identify forms of pollution in their communities and recommend laws for pollution control.
3. Use computer aided technology – YouTube and other social network clubs.
4. Visit the Global Learning and Observation to Benefit the Environment (GLOBE) website and participate in a group project.

<http://www.globe.gov/>
5. Organise debates on social issues, for example, religion, culture, environment, laws, and prices.
6. Discuss policies governing tourism and trade.
7. Supervise Agriculture Experience (SAE), – Incorporate real life experiences in an agribusiness setting by interacting with a farmer or a farming enterprise.



UNIT 2

MODULE 1: AGRICULTURE AND THE ENVIRONMENT (cont'd)

RESOURCES

Burton, L. DeVere *Agriscience, Fundamentals and Application*, New York: Delmar, Cengage Learning, 2010.

Ganpat, W. and Isaac, W. *Sustainable Food Production Practices in the Caribbean*, Kingston: Ian Randle Publishers, 2012.

eBooks

Website: www.cta.int

AD11 - Erosion Control in the Tropics.pdf

AD13 - Water Harvesting and Soil Moisture Retention.pdf

AD16 - Agroforestry.pdf

AS6 - When We Take Care of the Land.pdf

CTA - Good Agriculture Policy

UNIT 2

MODULE 2: ANIMAL PRODUCTION AND MANAGEMENT

GENERAL OBJECTIVES

On completion of this Module, students should:

1. appreciate the importance of animal production to agriculture in the region;
2. understand the management practices associated with farm animals;
3. develop practical and analytical skills.

SPECIFIC OBJECTIVES

Students should be able to:

1. explain the importance of animals to humans;
2. explain the importance of genetics and breeding associated with farm animals;
3. discuss reproductive management in farm animals;

EXPLANATORY NOTES

Aesthetics.
Companionship.
Food.
Sport.
Work.

Temperate and tropical breeds.

Type

A population of animals that breed true and there is no genetic history record or a herd book, for example, Trinidad and Tobago buffalypso.

Breed

A population of animals that breed true and their genetic history is recorded in a herd book, for example, Barbados Black Belly and Jamaica Hope.

Reproductive Management.
Selection of breeding stock.
Mating systems (random and controlled).
Pregnancy.
Gestation.
Parturition.
Lactation.
Weaning.
Reproductive system of chickens, rabbits, cattle, sheep or goats.

UNIT 2

MODULE 2: ANIMAL PRODUCTION AND MANAGEMENT (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

4. rear a batch of broiler birds and a pair of rabbits;*
5. investigate nutrition and feeding associated with farm animals;*
6. investigate the effect of different conditions on the growth of broiler birds;*
7. explain the features of housing associated with farm animals in the region;
8. discuss the major health concerns of farm animals in the region;

Farm animals include: chicken, rabbits, pigs, cattle, sheep/goats.

Include Feed Conversion Ratio (FCR):

Feed composition and quality
Use of feed additives and growth promoters.

Nutritional value of forages –grasses, legumes and fodder crops.

Including:

- (a) nutrition- Feed Conversion Ratio (FCR);
- (b) light;
- (c) stocking density;
- (d) temperature-wind stimulation.

(Refer to page 39-40).

Features to include:

- (a) orientation;
- (b) security;
- (c) sanitation;
- (d) roof design;
- (e) floor design;
- (f) delivery of water;
- (g) ventilation.

Internal and external parasites (including life cycles) and other major diseases.

UNIT 2

MODULE 2: ANIMAL PRODUCTION AND MANAGEMENT (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

9. explain the socio-economic factors associated with farm animal production.

EXPLANATORY NOTES

Farm animals to include:

- (a) chicken;
- (b) rabbits;
- (c) pigs;
- (d) cattle;
- (e) sheep;
- (f) goats.

Preventative measures:

Bio-security

- (a) isolation;
- (b) traffic control;
- (c) sanitation.

Culture.
Economics.
Geographic location.
Religion.

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives in this Module, teachers are advised to engage students in the following teaching and learning activities.

1. Rare chicken and rabbit to investigate nutrition, housing, reproduction and control of pests and diseases.
2. Visit farm, interview farmers and make recommendations on the new management system.
3. Visit abattoir to view reproductive systems.
4. Organise a field trip to a livestock farm.
5. Conduct experiment related to the Feed Conversion Ratio (FCR) and nutritional value of forages.
6. Use computer aided technology.
7. Supervise Agriculture Experience (SAE), –Incorporate real life experiences in exploratory agriculture by interacting with a farmer or farming enterprise.



UNIT 2

MODULE 2: ANIMAL PRODUCTION AND MANAGEMENT (cont'd)

RESOURCES

- Burton, L. DeVere *Agriscience, Fundamentals and Application*, New York: Delmar, Cengage Learning, 2010.
- Frandsen *Anatomy and Physiology of Farm Animals*, New Jersey: Wiley Blackwell, 2009.
- Smith, B. 2006 *The Farming Handbook*, The Netherlands: CTA Posthus 380, 2006.
- Ganpat, W. and Isaac, W. *Sustainable Food Production Practices in the Caribbean*, Kingston: Ian Randle Publishers, 2012.

eBooks

Website: www.cta.int

- AD01 - Pig Keeping in the Tropics.pdf
- AD04 - Small Scale Chicken Production.pdf
- AD07 - Goat Keeping in the Tropics.pdf
- AD14 - Dairy Cattle Husbandry.pdf
- AD20 - Backyard rabbit farming in the Tropics.pdf
- AD33 - Duck Keeping in the Tropics.pdf
- AD34 - Hatching Eggs By Hens Or In An Incubator.pdf
- Nutrient Requirements of Small Ruminants.pdf
- CTA 001- Rearing Dairy Goats Oblong.pdf
- CTA - Good Agriculture Policy

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS AND INNOVATIONS

GENERAL OBJECTIVES

On completion of this Module, students should:

1. demonstrate the techniques involved in processing livestock products;
2. understand the principles governing non-conventional farming methods;
3. develop skills in marketing livestock products;
4. appreciate the importance of agro-energy;
5. develop practical and analytical skills.

SPECIFIC OBJECTIVES

Students should be able to:

1. describe the techniques governing postharvest technology;
2. discuss the importance of emerging technologies and farming systems in agriculture;*

EXPLANATORY NOTES

Activities to include:

- (a) selection;
- (b) sorting/grading;
- (c) transportation;
- (d) packaging;
- (e) storage;
- (f) labelling;
- (g) carcass fabrication.

Definition of:

- (a) micro livestock;
- (b) neo-tropical animals;
- (c) aquaponics.

Set up a simple aquaponics system.

Practices involved in the management of aquaponics.

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS AND INNOVATIONS (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

3. explain the management practices involved in aquaculture;

Definition of aquaculture.

Management practices to include:

- (a) pond management;
- (b) nutrition system;
- (c) aeration;
- (d) water management;
- (e) pH control;
- (f) algae bloom management;
- (g) stocking density.

Integrated aquaculture system (rearing of ducks above fish pond and sheep around fish pond).

4. discuss the importance of technology in animal reproduction;

Advances in Reproductive Techniques.

- (a) sperm sexing;
- (b) oestrus synchronisation; (Artificial Insemination /Insemination or natural breeding);
- (c) embryo transfer.

Advantages in cloning:

- (a) recombinant DNA;
- (b) reproductive cloning;
- (c) therapeutic cloning;
- (d) genetical engineering (transgenetic animals).

Issues governing cloning and other reproductive techniques.

5. process carcasses of broiler birds;*

6. explain the procedures involved in the marketing of processed and unprocessed animal commodities;

Definition of marketing.

Marketing strategies.

Pricing strategies.

Wholesale/ retail.

Consumer preferences.

Market behaviour.

Advertising and promotion.



UNIT 2

MODULE 3: LIVESTOCK PRODUCTS AND INNOVATIONS (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

7. develop a marketing plan for the processed commodity;

Refer to Specific Objective 5.

Consumer research.
Production plan.
Pricing.
Promotion.
Distribution.

(This should be carried out at the school level).

8. outline the principles involved in food safety and security in animal production;

Definition of food safety.

Hazard Analysis Critical Control Point (HACCP).

- (a) principles governing HACCP.
- (b) application of HACCP Principles.

Definition of food security.
Food and Agriculture (FAO) definition - All people at all times have both physical and economic access to the basic food they need.

The impact of food security in the region.
Ways of ensuring food security (include bio security).

9. discuss methods used in harvesting agro-energy.

Definition of agro-energy.

Production of agro-energy:

- (a) organic matter – bio digester;
- (b) solar energy;
- (c) wind;
- (d) water.

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS AND INNOVATIONS (cont'd)

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives in this Module, teachers are advised to engage students in the following teaching and learning activities.

1. Conduct research on innovative practices in agriculture, aquaculture, aquaponics, tissue culture and genetically modified foods.
2. Conduct research to analyse the effectiveness of genetically modified foods.
3. Set up a small aquaponics system.
4. Visit Artificial Insemination (AI) facility.
5. Have a logo design competition for products.
6. Design a device that can be used to harvest agro-energy.
7. Invite guest lecturer to speak on marketing.
8. Visit a processing plant.
9. Supervise Agriculture Experience (SAE) – Incorporate real life experiences in entrepreneurship.

RESOURCES

- | | |
|--------------------------|--|
| Burton, L. DeVere | <i>Agriscience, Fundamentals and Application</i> , New York: Delmar, Cengage Learning, 2010. |
| Frandsen | <i>Anatomy and Physiology of Farm Animals</i> , New Jersey: Wiley Blackwell, 2009. |
| Ganpat, W. and Isaac, W. | <i>Sustainable Food Production Practices in the Caribbean</i> , Kingston: Ian Randle Publishers, 2012. |

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS AND INNOVATIONS (cont'd)

EBooks

Website: www.cta.int

AD12 - Preservation of Fish and meat Preservation of Fish and Meat.pdf
AD15 - Small Scale Freshwater Fish Farming.pdf
AD21 - On Farm Fish Culture.pdf
AD23 - Protected Cultivation.pdf
AD26 - Marketing For Small Scale Producers
AD36 - Preparation of dairy products.pdf
CTA009 - Make Money with Fish Farming A4.pdf
CTA013 - How to keep Bees and Process Honey.pdf
CTA - Agricultural and Fisheries Trade Issues for ACP count. pdf
CTA - Try the Rabbit.pdf
CTA - Good Agriculture Policy
CTA - Setting up and running a Small Meat or Fish Processing
Enterprise
CTA - Setting Up and Running Dairy Processing Business

◆ OUTLINE OF ASSESSMENT

Each Unit of the syllabus will be assessed separately and grades will be awarded independently for each Unit. The Assessment will comprise two components, external and internal.

EXTERNAL ASSESSMENT

(60 per cent)

Paper 01 The Paper will consist of forty-five (45) multiple-choice items, fifteen (15) items on each Module. Each question (1 mark) will be weighted by 2. The paper will contribute 30 per cent (90 marks) to the total score.

This paper will allow for a broader coverage of the syllabus. The questions will test knowledge, comprehension and application.

Paper 02 Section A of this paper will consist of three compulsory structured questions, one on each Module. Each question will be worth 15 marks.

Section B will consist of three essay questions, one on each Module. Each question will be worth 15 marks.

The paper will contribute 30 per cent (90 marks) to the total score.

This paper will require greater in-depth knowledge of the syllabus. The questions on Paper 02 will require application, analysis, synthesis and evaluation.

SCHOOL-BASED ASSESSMENT

(40 per cent)

Paper 03 (120 marks)

UNIT 1

Candidates will be required to produce a portfolio comprising reports of site visit and field practical activity, and a business plan. The portfolio must include photographs of all activities undertaken.

UNIT 2

Candidates will be required to produce a portfolio comprising a report on the processing of carcasses, a marketing plan and the report of an investigation (see page 32). The portfolio must include photographs of all activities undertaken.

SBA marks are not transferrable across Unit. The SBA for each unit is based on skills and competencies related specifically to the Modules of that Unit. However, candidates who repeat the same Unit in a subsequent sitting may reuse their SBA marks.

MODERATION OF THE SCHOOL-BASED ASSESSMENT

A sample of assignments will be requested by CXC for moderation purposes.

School-Based Assessment Record Sheets are available online via the CXC's website www.cxc.org.

All School-Based Assessment Record of marks must be submitted online using the SBA data capture module of the Online Registration System (ORS). A sample of assignments will be requested by CXC for moderation purposes. These assignments will be re-assessed by CXC Examiners who moderate the School-Based Assessment. Teachers' marks may be adjusted as a result of moderation. The Examiners' comments will be sent to schools. All samples must be delivered to the specified marking venues by the stipulated deadlines.

Copies of the students' assignment that are not submitted must be retained by the school until three months after publication by CXC of the examination results.

ASSESSMENT DETAILS

External Assessment by Written Papers (60 per cent of Total Assessment)

Paper 01 (1 hour 30 minutes – 30 per cent of Total Assessment)

1. Composition of the Paper

The paper comprises forty-five multiple-choice items, fifteen items based on each Module.

2. Syllabus Coverage

Knowledge of the entire syllabus is required.

The intention of this paper is to test candidates' knowledge across the breadth of the syllabus.

3. Question Type

Questions may be based on diagrams, data, graph, photographs or prose.

4. Mark Allocation

- (a) One mark will be assigned for each item.
- (b) The maximum mark available for this paper is forty-five and will be weighted to ninety.
- (c) This paper contributes 30 per cent towards the final assessment.
- (d) The marks will be awarded for Knowledge and Comprehension and Application of Knowledge.

5. Use of Calculators

Candidates will be allowed to use a non-programmable calculator in the examinations. Each candidate is responsible for providing his/her own calculator and to ensure that it functions throughout the examinations.

6. Use of Geometrical Instruments

Candidates are allowed to use geometrical instruments in the examinations. Each candidate is responsible for providing his or her own instruments.

Paper 02 (2 hours 30 minutes – 30 per cent of Total Assessment)

1. Composition of Paper

The paper is arranged into two sections. Section A will consist of three short answer questions, one on each Module. Section B will consist of three structured essay questions, one on each Module. All questions are compulsory.

2. Syllabus Coverage

- (a) Comprehensive knowledge of the entire syllabus is required.
- (b) Each question may focus on a single theme or develop a single theme or several unconnected themes.

3. Question Type

Questions are of a free-response form and may be based on diagrams, data, graph, photographs or prose.

4. Mark Allocation

- (a) Each question is worth 15 marks and the number allocated to each sub-question will appear on the examination paper.
- (b) The maximum mark for this paper is 90.
- (c) This paper contributes 30 per cent towards the final assessment.
- (d) The marks will be awarded for Knowledge and Comprehension and Application of Knowledge.

5. Use of Calculators

Candidates will be allowed to use a non-programmable calculator in the examinations. Each candidate is responsible for providing his/her own calculator and to ensure that it functions throughout the examinations.

6. Use of Geometrical Instruments

Candidates are allowed to use geometrical instruments in the examinations. Each candidate is responsible for providing his or her own instruments.

SCHOOL-BASED ASSESSMENT (SBA)

School-Based Assessment is an integral part of the students' assessment of the course of study covered by this syllabus. It is intended to assist the students in acquiring certain knowledge, skills and attitudes that are associated with the subject. The activities for the School-Based Assessment are linked to the syllabus and should form part of the learning activities to enable the students to achieve the objectives of the syllabus.

During the course of study for the subject, students obtain marks for the competence they develop and demonstrate in undertaking their School-Based Assessment assignments. These marks contribute to the final marks and grades that are awarded to the students for their performance in the examination.

The guidelines provided in this syllabus for selecting appropriate tasks are intended to assist teachers and students in selecting assignments that are valid for the purpose of School-Based Assessment. The guidelines provided for the assessment of these assignments are also intended to assist teachers in awarding marks that are reliable estimates of the achievements of students in the School-Based Assessment component of the course. In order to ensure that the scores awarded are in line with the CXC standards, the Council undertakes the moderation of a sample of the School-Based Assessments marked by each teacher.

School-Based Assessment provides an opportunity to individualise a part of the curriculum to meet the needs of the student. It facilitates feedback to the student at various stages of the experience. This helps to build the self-confidence of the students as they proceed with their studies. School-Based Assessment also facilitates the development of the critical skills and abilities emphasised by this CAPE subject and enhance the validity of the examination on which the students' performance is reported. School-Based Assessment, therefore, makes a significant and unique contribution to both the development of the relevant skills and the testing and rewarding of the student.

REQUIREMENTS OF THE SCHOOL-BASED ASSESSMENT

UNIT 1

Candidates will be required to produce a portfolio comprising reports of site visit and field practical activity, and a business plan. The portfolio must include photographs of all activities undertaken.

CRITERIA FOR ASSESSING THE PORTFOLIO

40 marks

A. Site Visit

(5 marks)

The following are guidelines for assessing the site visit.

- (a) The site visit is internally assessed by the teacher and externally moderated by CXC.
- (b) Each candidate will be required to report on at least one (1) site visit from a crop production farm.

The entry for each site visit should be recorded using the format below and the marks should be awarded accordingly.

Type of farm

Name of farm

Location of farm

Date of visit

Objectives

2 marks

Observations

2 marks

Comments/discussion

4 marks

Recommendations

2 marks

10 marks

(Scale down to 5 marks)

B. Field Practical Activity**(20 marks)**

Students will be required to cultivate **three** crops.

Fruit crop - tomato
Root crop - sweet potato
Leaf - lettuce

The students will write one (1) report from this activity and the marks should be awarded accordingly.

Name of crop

Family Name **1 mark**

Scientific Name **1 mark**

Common Name

Variety **1 mark**

Land Preparation **3 marks**

- Land clearing 1 mark
- Primary tillage 1 mark
- Secondary tillage 1 mark

Planting **2 marks**

- Spacing 1 mark
- Planting technique 1 mark

Other Cultural Activities **3 marks**

- Moulding
- Staking/Turning Vines
- Pruning
- Mulching
- Irrigation

(any three, 1 mark each)

Fertilizer Application **3 marks**

- Rate
- Type Of Fertilizer
- Methods Of Application
- Timing

(any three, 1 mark each)

Pest and Disease Control **3 marks**



- Rate
- Methods of application
- Timing
- Type of control

(any three, 1 mark each)

Harvesting

3 marks

- Maturing index
- Methods of harvesting
- Postharvest activities

1 mark

1 mark

1 mark

TOTAL

20 marks

(Scale down to 15 marks)

C. Business Plan

Business Description

4 marks

- Mission Statement
- Goals of Company
- Description of Product

2 marks

1 mark

1 mark

Market Analysis

2 marks

- Customer
- Market size and Trends

1 mark

1 mark

Marketing Plan

4 marks

- Marketing Strategies
- Sales Methods

2 marks

2 marks

Production Plan

8 marks

- Production Methods
- Environmental Factors
- Condition of facilities and Equipment
- Production Cost

2 marks

2 marks

2 marks

2 marks

Promotion	3 marks
<ul style="list-style-type: none"> • Advertising • Sampling 	2 marks 1 mark
Distribution	3 marks
<ul style="list-style-type: none"> • Cost of Product • Retail/wholesale 	2 marks 1 mark
Conclusion	4 marks
<ul style="list-style-type: none"> • Profit and Loss Statement • Recommendations 	2 marks 2 marks
Communication of Information	2 marks
Information communicated in a fairly logical manner with several grammatical errors	1 mark
Information communicated in a fairly logical manner with no grammatical errors	2 marks
TOTAL	30 marks
	(Scale down to 20 marks)

UNIT 2

Candidates will be required to produce a portfolio comprising a report on the processing of carcasses, a marketing plan and the report of an investigation. The portfolio must include photographs of all activities undertaken.

CRITERIA FOR ASSESSING THE PORTFOLIO**40 MARKS****A. Processing of Carcasses****(10 marks)****Sanitation****5 marks**

- Workstation
- Attire
- Waste disposal
- Proper use of tools

1 mark
1 mark
1 mark
2 marks

Slaughtering**3 marks**

- Method/procedure
- Materials/equipment

2 marks
1 mark

Dressing**2 marks**

- Complete defeathering and removal of entrails

2 marks

Procedures for processing**5 marks**

- Appropriate material/equipment preparation
- Adherence to guidelines
- Originality

2 mark
2 mark
1 mark

TOTAL**15 marks****(Scale down to 10 marks)****B. Marketing Plan****(10 marks)****Consumer Research****3 marks**

- Sampling
- Questionnaire

1 mark
2 marks

Production Plan**4 marks**

- Data Analysis
 - Quantity
 - Timing
- Production Cost

1 mark
1 mark
2 marks



Pricing	2 marks
<ul style="list-style-type: none"> Factors determining price 	2 marks
Promotion	2 marks
<ul style="list-style-type: none"> Method 	2 marks
Remarks	4 marks
<ul style="list-style-type: none"> Profit/loss 	1 mark
<ul style="list-style-type: none"> Conclusions 	2 marks
<ul style="list-style-type: none"> Recommendations 	1 mark
TOTAL	15 marks
	(Scale down to 10 marks)

C. Investigation (20 MARKS)

For examples of activities for the Investigation, see pages 39-42.

Criteria for assessing the Investigation

1. Problem Statement	1	1
2. Purpose of Project	1	1
3. Methods of Data Collection		2
<ul style="list-style-type: none"> Data collection design described. 	1	
<ul style="list-style-type: none"> Design clear, appropriate, carried out with few flaws. 	2	
4. Literature Review		2
<ul style="list-style-type: none"> Literature review appropriate. 	1	
<ul style="list-style-type: none"> Literature review appropriate and comprehensive. 	2	
5. Presentation of Data		2
<ul style="list-style-type: none"> Used photographs. 	1	2
<ul style="list-style-type: none"> Used photographs and tables. 	2	
6. Analysis of Data		4
<ul style="list-style-type: none"> Some analysis attempted. 	1	
<ul style="list-style-type: none"> Analysis adequately done. 	2	
<ul style="list-style-type: none"> Analysis used 2 or more approaches. 	3	
<ul style="list-style-type: none"> Analysis used a variety of approaches or exceeded requirements of the course. 	4	



7. Discussion of Findings	5
<ul style="list-style-type: none"> Some findings stated. Some findings stated and supported by data. Some findings stated, supported by data and their interpretability addressed. All findings stated, supported by data and their interpretability addressed. Reliability or validity, and usefulness of some findings addressed. 	1 2 3 4 5
8. Conclusion	2
<ul style="list-style-type: none"> Conclusion clear and based on finding(s). Conclusion clear, based on finding(s), valid and related to purpose(s) of project. 	1 2
9. Recommendations	2
<ul style="list-style-type: none"> Few recommendations based on findings. Recommendations fully derived from findings. 	1 2
10. Communication of Information	2
<ul style="list-style-type: none"> Information communicated in a fairly logical manner with several grammatical errors. Information communicated in a logical manner with no grammatical errors. 	1 2
11. Bibliography	2
<ul style="list-style-type: none"> Number of references is less than 4. Number of references is greater than 4, written using a consistent convention. 	1 2
Total	25 marks
(Scaled down to 20 marks)	

Examples of activities for the Investigation in Unit 2

1. Evaluation of two (2) broiler rations on Feed Conversion Ratio (FCR) - Nutrition.

Requirements: 100 day old chicks, 4 pens of equal sizes, 2 different growing rations

Method:

- (a) divide birds into four (4) groups (25 birds per pen);
- (b) weigh birds on arrival (day old chicks) and record weights;
- (c) thereafter weigh birds every week and record weights;
- (d) feed one grower ration to two (2) groups and the other grower ration to the other two (2) groups;

(All birds should receive the same starter ration)
- (e) weigh refusals every morning and record. Weigh feed every morning before offering to birds and record;
- (f) calculate weekly feed conversion ratio (FCR);

(FCR – feed consumed during a particular period divided by the weight gained during the same period);
- (g) calculate FCR for the entire production period;
- (h) explain any differences in FCR between the two (2) treatments.

2. Effect of light on the growth rate of broilers –Lighting

Requirements: 100 day old chicks, 4 pens of equal size

Method:

- (a) divide birds into four (4) groups (25 birds per pen);
- (b) weigh birds on arrival (day old birds) and record weights;
- (c) after brooding reduce the number of hours of light in two pens (example - leave the lights on in two (2) pens during the night. **IMPORTANT** – ensure that this light does not illuminate the other pens);
- (d) weigh bird weekly and record weights;
- (e) explain any differences in growth rates and final weights among the groups.

3. Effect of stocking density on broiler production (Housing)

Requirements: 100 day old chicks, 4 pens of equal sizes.

Method:

- (a) divide birds into four (4) groups and place each group into a pen;
Stocking Density: Pen 1 = 20 birds
Pen 2 = 20 birds
Pen 3 = 30 birds
Pen 4 = 30 birds
- (b) calculate stocking densities for each pen;
- (c) weigh birds on arrival (day old birds) and record weights;
- (d) thereafter weigh birds every week and record weights;
- (e) explain any differences in the final weights among the groups.

4. Effect of wind stimulation on broiler production -Temperature

Requirements: 100 day old chicks, 4 pens of equal size 4 fans

Method:

- (a) divide birds into four (4) groups (25 birds per pen);
- (b) place fans in two (2);
- (c) pens;
- (d) weigh birds on arrival (day old birds) and record weights;
- (e) beginning after brooding turns fans on during the day;
- (f) weigh birds on arrival (day old birds);
- (g) thereafter weigh bird weekly and record;
- (h) explain any differences in the final weights among the groups.

GENERAL GUIDELINES FOR TEACHERS

- 1. The specific objectives highlighted by an asterisk are suitable for School-Based Assessment, but the assignments need not assess only these objectives.
- 2. The reliability of the marks awarded is a significant factor in the School-Based Assessment, and has far reaching implications for the candidate's final grade. Teachers are asked to note the following:



- (a) the marks awarded must be carefully transferred to the CXC School-Based Assessment forms;
- (b) the teacher must allocate one-third of the total score for the School-Based Assessment to each Module. **Fractional marks should not be awarded.** In cases where the mark is not divisible by three, then the allocation is as follows:
 - (i) when the remainder is 1 mark, the mark is allocated to Module 3;
 - (ii) when the remainder is 2, then a mark is allocated to Module 3 and the other mark to Module 2;

For example, 35 marks are allocated as follows:

 - (iii) $35 / 3 = 11$ remainder 2 so 11 marks to Module 1 and 12 marks to each of Modules 2 and 3.
- (c) the standard of marking should be consistent.

3. Candidates who do not fulfil the requirements of the School-Based Assessment will be considered absent from the whole examination.

◆ REGULATIONS FOR PRIVATE CANDIDATES

Candidates who are registered privately will be required to sit Paper 01, Paper 02 and Paper 03. Detailed information on Papers 01, 02 and 03 is given on pages 28 to 31 of this syllabus.

◆ REGULATIONS FOR RESIT CANDIDATES

Resit candidates must complete Papers 01 and 02 of the examination for the year for which they re-register. A candidate who rewrites the examination within two years may reuse the moderated School-Based Assessment score earned in the previous sitting within the preceding two years.

Candidates are no longer required to earn a moderated score that is at least 50 per cent of the maximum possible score; any moderated score may be reused.

Candidates reusing SBA scores in this way must register as 'Resit candidates' and provide the previous candidate number. (In order to assist candidates in making decisions about whether or not to reuse a moderated SBA score, the Council will continue to indicate on the pre-slip if a candidate's moderated SBA score is less than 50 per cent).

Resit candidates must be registered through a school, a recognised educational institution, or the Local Registrar's Office.

◆ ASSESSMENT GRID

The Assessment Grid for the Unit showing marks assigned to papers and to Modules, and percentage contributions of each paper to the total scores.

Papers	Module 1	Module 2	Module 3	Total	(%)
EXTERNAL ASSESSMENT					
Paper 01 (90 minutes) Multiple-choice questions	30 (15 items)	30 (15 items)	30 (15 items)	90 (45 items)	(30)
Paper 02 (2 hours 30 minutes) Section A – Structured questions Section B – Essay questions	15 15	15 15	15 15	45 45	(30)
SCHOOL-BASED ASSESSMENT					
Paper 03 SBA (CVQ Level 2)	40	40	40	120	(40)
Total	100	100	100	300	(100)

◆ GLOSSARY

<u>WORD</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
Analyse	Examine in detail.	
Annotate	Add a brief note to a label.	Simple phrase or a few words only.
Apply	Use knowledge/principles to solve problems.	Make inferences/conclusions.
Assess	Present reasons for the importance of particular structures, relationships or processes.	Compare the advantages and disadvantages or the merits and demerits of a particular structure, relationship or process.
Calculate	Arrive at the solution to a numerical problem.	Steps should be shown; units must be included.
Classify	Divide into groups according to observable characteristics.	
Comment	State opinion or view with supporting reasons.	
Compare	State similarities and differences.	An explanation of the significance of each similarity and difference stated may be required for comparisons which are other than structural.
Construct	Use a specific format to make and/or draw a graph, histogram, pie chart or other representation using data or material provided or drawn from practical investigations, build (for example, a model), draw scale diagram.	Such representations should normally bear a title, appropriate headings and legend.
Deduce	Make a logical connection between two or more pieces of information; use data to arrive at a conclusion.	
Define	State concisely the meaning of a word or term.	This should include the defining equation/formula where relevant.
Demonstrate	Show; direct attention to.	
Derive	To deduce, determine or extract from data by a set of logical steps some relationship, formula or result.	This relationship etc. may be general or specific.
Describe	Provide detailed factual information of the appearance or arrangement of a specific structure or a sequence of a specific process.	Description may be in words, drawings or diagrams or any appropriate combination. Drawings or diagrams should be annotated to



<u>WORD</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
		show appropriate detail where necessary.
Determine	Find the value of a physical quantity.	
Design	Plan and present with appropriate practical detail.	Where hypotheses are stated or when tests are to be conducted, possible outcomes should be clearly stated and/or the way in which data will be analysed and presented.
Develop	Expand or elaborate an idea or argument with supporting reasons.	
Diagram	Simplified representation showing the relationship between components.	
Differentiate/ distinguish (between/ among)	State or explain briefly those differences between or among items which can be used to define the items or place them into separate categories.	
Discuss	Present reasoned argument; consider points both for and against; explain the relative merits of a case.	
Draw	Make a line representation from specimens or apparatus which shows an accurate relation between the parts.	In the case of drawings from specimens, the magnification must always be stated.
Estimate	Make an approximate quantitative judgement.	
Evaluate	Weigh evidence and make judgements based on given criteria.	The use of logical supporting reasons for a particular point of view is more important than the view held; usually both sides of an argument should be considered.
Explain	Give reasons based on recall; account for.	
Find	Locate a feature or obtain as from a graph.	
Formulate	Devise a hypothesis.	
Identify	Name or point out specific components or features.	
Illustrate	Show clearly by using appropriate examples or diagrams, sketches.	

<u>WORD</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
Interpret	Explain the meaning of.	
Justify	Explain the correctness of.	
Investigate	Use simple systematic procedures to observe, record data and draw logical conclusions.	
Label	Add names to identify structures or parts indicated by pointers.	
List	Itemize without detail.	
Measure	Take accurate quantitative readings using appropriate instruments.	
Name	Give only the name of.	No additional information is required.
Note	Write down observations.	
Observe	Pay attention to details which characterize a specimen, reaction or change taking place; to examine and note scientifically.	Observations may involve all the senses and/or extensions of them but would normally exclude the sense of taste.
Outline	Give basic steps only.	
Plan	Prepare to conduct an investigation.	
Predict	Use information provided to arrive at a likely conclusion or suggest a possible outcome.	
Record	Write an accurate description of the full range of observations made during a given procedure.	This includes the values for any variable being investigated; where appropriate, recorded data may be depicted in graphs, histograms or tables.
Relate	Show connections between; explain how one set of facts or data depend on others or are determined by them.	
Sketch	Make a simple freehand diagram showing relevant proportions and any important details.	
State	Provide factual information in concise terms outlining explanations.	
Suggest	Offer an explanation deduced from information provided or previous knowledge. (... a hypothesis;	No correct or incorrect solution is presumed but suggestions must be



<u>WORD</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
	provide a generalization which offers a likely explanation for a set of data or observations.)	acceptable within the limits of scientific knowledge.
Test	to find out, following set procedures	

◆ SUGGESTED RESOURCES

All schools presenting candidates for this subject **should provide the minimum facilities relevant to the areas to be covered.** However, where schools are having difficulties in providing these facilities the practical requirements of the syllabus can be met through any or a combination of the following alternatives:

- (a) summer attachment programmes under guidance and supervision;
- (b) sharing practical instructional facilities;
- (c) visits to Agricultural stations;
- (d) visits to private commercial farms;
- (e) sharing facilities with other schools.

Failure to provide these facilities may adversely affect students' performance. **It is recommended that participating schools provide the following facilities for each group of thirty students:**

The Field

- | | | | |
|----|---------------------------|---|---|
| 1. | Land Space | - | 1 bed 9' x 3' (approximately three square metres per student). |
| | | - | Nursery, grow box unit for vegetables, spices and herbs. |
| | | - | Grass plots – 2 pasture grasses, 2 soiling grasses, 1 legume. |
| 2. | Livestock | - | (a) poultry: broilers -100 once per term; |
| | | | (b) EITHER sheep: 1 male and 3 females. |
| 3. | Security | - | fencing |
| 4. | Field Tools and Equipment | - | access to: |
| | | - | wheelbarrow; |
| | | - | watering hose; |
| | | - | watering cans; |
| | | - | miscellaneous propagating tools, for example, pruning shears, secateurs, pruning saw, budding knife, tapes; |
| | | - | other agricultural tools - spade, hoe, rake, fork, cutlass; |
| | | - | scale; |
| | | - | soil auger or substitute, for example, flat spade and knife or cutlass; |
| | | - | rain gauge; |
| | | - | wet and dry bulb thermometers, weather vane, anemometer. |
| 5. | Safety | - | first aid kit |

Other Facilities

1. Maintenance
 - 1 farm attendant
2. Field Tools, Materials and Equipment
 - access to: spraying equipment, for example, mist blowers
 - knapsack sprayers with shield.

Chemicals

 - (a) Insecticides and fungicides;
 - (b) Herbicides/weedcide
 - (c) Fertilizer
 - miscellaneous veterinary equipment, for example, syringes, ear markers, clinical thermometers.
3. Laboratory Equipment
 - access to science laboratory:
 - simple balances;
 - microscopes;
 - hand lenses (one per student);
 - glassware including crucibles;
 - chemicals;
 - lamps;
 - 1 potometer;
 - 1 desiccator;
 - 1 set of sieves;
 - measuring instruments - tapes, rulers, pH meter.
4. Visual Aids
 - access to:
 - multimedia projector;
 - computer.

Western Zone Office
14 March 2013



TEST CODE **02102010**

SPEC 2013/02102010

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

CARRIBEAN ADVANCED PROFICIENCY EXAMINATION®

AGRICULTURAL SCIENCE

SPECIMEN PAPER

Unit 1 – Paper 01

1 hour 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 45 items. You will have 1 hour and 30 minutes to answer them.
2. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
3. Look at the sample item below.

Sample Item

Open-leaf lettuce which were planted on 16 May should be harvested

- (A) 30 May
- (B) 6 June
- (C) 13 June
- (D) 20 June

Sample Answer



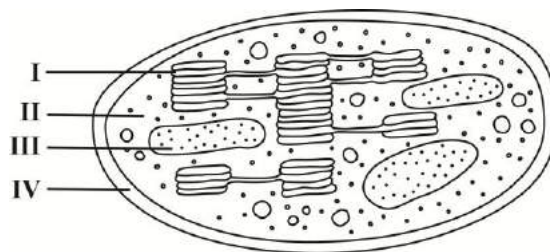
The best answer to this item is “20 June” so answer space (D) has been shaded.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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1. Which of the following statements is true about semi-intensive farming?
- (A) It involves large numbers of animals reared on a large area of land.
 - (B) The animals do not graze but are kept under permanent shelter.
 - (C) Large numbers of animals are reared on a small area of land.
 - (D) The animals are kept indoors at night but are allowed to graze in the field during the day.
2. Which of the following groups of crops is considered non-traditional?
- (A) Citrus, pineapple, sweet potato
 - (B) Nutmeg, coffee, pepper
 - (C) Arrowroot, cocoa, yam
 - (D) Cassava, mango, cotton
3. Active transport of some ions is achieved through the sodium-potassium pump in cell membranes.
- Which of the following is true about the sodium-potassium pump?
- (A) It actively moves sodium ions into the cell.
 - (B) It actively moves potassium ions from inside to outside the cell.
 - (C) The energy that it requires is provided by ATP from respiration.
 - (D) The resulting positive potential difference inside the cell restricts the entry of chloride ions.
4. Which of the following is NOT true about a carrier protein?
- (A) Can become saturated with ions
 - (B) Spans the membrane from one side to the other
 - (C) Changes shape to facilitate the transfer of ions
 - (D) Has a fixed shape and opens to allow the passage of ions
5. The digestion of the microbes found in the rumen of cattle produces
- (A) volatile fatty acids
 - (B) essential amino acids
 - (C) B-complex vitamins
 - (D) carbon dioxide and methane

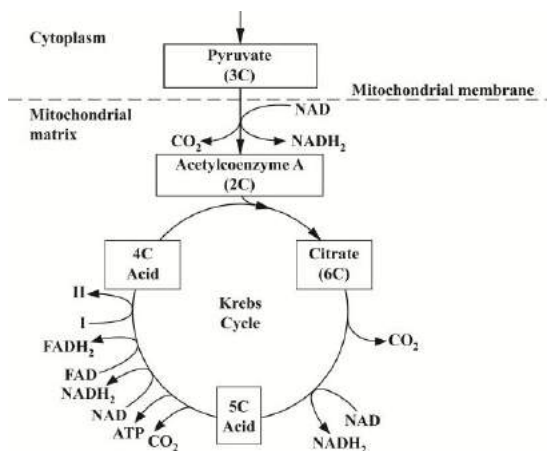
Items 6–7 refer to the following diagram of a chloroplast.



6. The light-independent reaction of photosynthesis occurs in
- (A) I
 - (B) II
 - (C) III
 - (D) IV
7. The structure labelled I is the
- (A) stroma
 - (B) thylakoid
 - (C) starch grain
 - (D) chloroplast envelope

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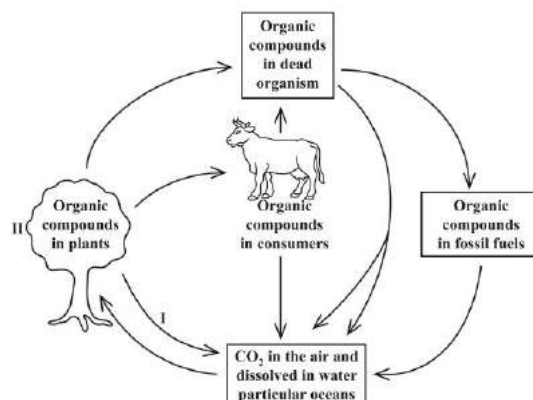
Item 8 refers to the following diagram of the Krebs cycle.



8. Which of the following states the process labelled by the arrow I → II in the diagram above?

- (A) NAD is reduced to NADH₂
- (B) NAD is oxidized to NADH₂
- (C) FAD is reduced to FADH₂
- (D) FAD is oxidized to FADH₂

Items 9-10 refer to the following diagram which shows the carbon cycle.



9. The process labelled I in the diagram above is

- (A) transportation
- (B) respiration
- (C) decomposition
- (D) photosynthesis

10. Which of the following is the MOST likely effect of deforestation at II in the diagram above?

- (A) Reduced CO₂ levels in the air and water, thus enhancing the greenhouse effect
- (B) Decreased levels of organic compounds in dead organisms, thus decreasing CO₂ levels
- (C) Increased levels of atmospheric CO₂ which trap long-wave radiation, thus increasing temperature
- (D) Increased surface temperature because more short-wave radiation reaches the earth

11. Acidic soils have a high concentration of

- I. H^+
- II. Mg^{2+}
- III. Al^{3+}
- IV. Ca^{2+}

- (A) I only
- (B) II only
- (C) I and IV only
- (D) II and III only

12. Firms A and B both produce two main products: ice cream and jam. Firm A is located in an area where there is a high level of milk production and pasture is abundant. Firm B is located in an area where a variety of fruits are grown.

Which of the following statements are MOST likely true?

- I. Firm B should give up jam production and focus on ice cream alone.
- II. Firm B spends a lot of money to produce ice cream, whereas Firm A spends a lot less to produce the same product.
- III. Firm A has a comparative advantage with ice cream production.

- (A) I and II only
- (B) I and III only
- (C) II and III only
- (D) I, II and III

13. Farmer Sheila owns 100 hectares of farm land. She has the option of farming the land or renting it to a neighbor at a rate of \$150.00 per hectare.

What is the opportunity cost for farming the land and not renting it to her neighbour?

- (A) \$15.00
- (B) \$150.00
- (C) \$1 500.00
- (D) \$15 000.00

14. In calculating depreciation, which of the following is the depreciation rate in the declining-balance method in relation to the straight-line method?

- (A) Half
- (B) Same
- (C) One and a half times
- (D) Twice

15. The forces causing world food prices to remain volatile are MOST likely

- I. oil prices
- II. climate change
- III. ethanol production from corn
- III. increased demand from developing countries such as China and India

- (A) I and II only
- (B) II and III only
- (C) I, II and IV only
- (D) I, II, III and IV

16. Which of the following methods of farming contributes the MOST to a reduction in temperatures?

(A) Hydroponics
(B) Rooftop farming
(C) Indoor farming
(D) Organic farming

17. The ideal soil for a turf grass cricket pitch should consist of

(A) 20–26% clay
(B) 27–33 % clay
(C) 34–40 % clay
(D) 41–46 % clay

18. The turf grass on the greens of a golf course should be maintained at a height of (in mm)

(A) 3–6
(B) 7–10
(C) 11–13
(D) 14–17

19. Which of the following are part of ICM?

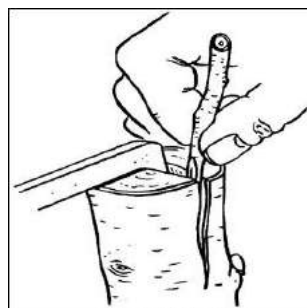
I. Pesticide usage
II. Soil management
III. Turf grass selection

(A) I and II only
(B) I and III only
(C) II and III only
(D) III and IV only

20. A farmer owns four hectares of partly hilly and partly flat land. He decides to plant cucumber on the hilly land. An advantage of cultivating cucumber on the hilly land is that it

(A) adds nitrogen to the soil
(B) increases the water-holding capacity of the soil
(C) has deep roots which prevent the soil from moving
(D) provides a crop cover, thus reducing erosion

Item 21 refers to the following diagram.



21. The type of plant propagation shown in the diagram is

(A) veneer
(B) inverted „T“
(C) side grafting
(D) cleft grafting

Item 22 refers to the following picture of tomato leaves.



22. The pests attacking the leaves are MOST likely

(A) aphids
(B) mealy bugs
(C) leaf miners
(D) tunnel worms

23. Which of the following should be used for the reproductive stage in sweet pepper?

(A) Urea
(B) Blaucon
(C) 13:13:21
(D) Triple superphosphate

24. Open-leaf lettuce which were planted on 16 May should be harvested

(A) 30 May
(B) 6 June
(C) 13 June
(D) 20 June

Item 25 refers to the following information.

Denise carries out a germination test on two sets of seeds. The results are shown in the following table.

Seeds	Germination %
X	85
Y	65

25. Denise then plants 260 of EACH set of seeds. Which of the following shows approximately how many seeds would grow?

	X	Y
(A)	85	65
(B)	175	195
(C)	221	169
(D)	260	260

Item 26 refers to the following diagram.



26. The type of irrigation system shown in the diagram above is

(A) drip
(B) mist
(C) furrow
(D) overhead

27. Farmer Phillip has a severe infestation of weeds on his tomato plot. As part of his integrated crop management programme, which of the following methods would be LEAST appropriate for weed control?
- I. Biological
 - II. Manual
 - III. Chemicals with low toxicity
- (A) I only
(B) II only
(C) I and II only
(D) II and III only
28. Farmer Indar is about to harvest a crop of cassava. Which of the following maturity indices would NOT be useful?
- I. Shape of the tuber
 - II. Size of the tuber
 - III. Colour of tuber
 - IV. Yellowing of the cassava leaves
- (A) I only
(B) I and III only
(C) I, II and III only
(D) I, II III and IV
29. Which of the following is the BEST reason for a farmer to plant roses undercover?
- (A) Low cost.
(B) Aesthetic value.
(C) No soil is required.
(D) It is profitable.
30. Which of the following is NOT a benefit of growing orchids?
- (A) Aesthetic value.
(B) It is costly but profitable.
(C) Too many varieties are available.
(D) A wide variety of fertilizers is required.
31. Which of the following are true about postharvest technology?
- I. It is the application of techniques to delay the process of senescence.
 - II. It uses maturity indices to determine the maturity of the commodity.
 - III. It maintains a high quality in the harvested product.
- (A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III
32. Which of the following is NOT a processed product?
- (A) Jam
(B) Milk
(C) Cheese
(D) Butter
33. Which of the following techniques is or are used with unprocessed commodities?
- I. Selection
 - II. Processing
 - III. Packaging
- (A) I only
(B) II only
(C) I and II only
(D) II and III only
34. Which of the following is the oldest method of food preservation?
- (A) Drying
(B) Salting
(C) Smoking
(D) Freezing

GO ON TO THE NEXT PAGE

35. Which of the following are NOT true about the technique of smoking?
- I. Preserves and flavours the food
 - II. Dries the food without cooking
 - III. Can be used to preserve both meat and vegetables
- (A) I and II only
(B) I and IV only
(C) II and III only
(D) III and IV only
36. Which if the following are NOT true about canning?
- I. It produces a concentrated form of food.
 - II. It destroys microorganisms.
 - III. It reduces levels of some nutrients, especially vitamin C.
 - IV. It inactivates autolytic enzymes.
- (A) I and II only
(B) I and IV only
(C) II and III only
(D) III and IV only
37. Which of the following refers to marketing?
- (A) Educating consumers about the product
(B) The movement of the product to the consumer
(C) The systematic and objective collection, analysis and evaluation of information related to markets
(D) The process responsible for identifying, anticipating and satisfying the requirements of customer profitability
38. Alicia wants to market exotic beverages which are unavailable locally. Which of the following marketing strategies should she use?
- (A) Market leader
(B) Market follower
(C) Market challenger
(D) Internet marking
39. Peter produced a few bottles of pepper sauce for sale. Which of the following pricing strategies would maximize profit?
- (A) Limit pricing
(B) Skimming
(C) Cost plus pricing
(D) Loss leader
40. Which of the following is NOT true about a marketing plan?
- (A) It is a business plan.
(B) It describes the business.
(C) It describes the customer.
(D) It identifies the competitors.
41. Bevon recently completed an agroprocessing project at school. He submitted his business plan with the following headings.
- I. Introduction
 - II. Distribution
 - III. Consumer survey
 - IV. Promotion
 - V. Production plan
 - VI. Conclusion
 - VII. Recommendation
- Which of the following is the correct sequence for his business plan, assuming that I, VI and VII are correct?
- (A) II, III, IV, V
(B) III, IV, V, II
(C) III, V, IV, II
(D) V, IV, III, II

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42. Sita recently harvested sweet peppers. To boost sales, she visited her neighbours and educated them about the health benefits of sweet peppers. In her stall, she also displayed a large sign with the price of her commodity. In a business plan, her actions can be regarded as
- (A) distribution
 - (B) pricing strategy
 - (C) promotion
 - (D) consumer survey
43. Which of the following statements defines food security?
- (A) Involves quality control and the testing of food.
 - (B) Methods used to produce food that is safe and healthy.
 - (C) All people at all times have both physical and economic access to the basic food they need.
 - (D) It focuses on the physical, chemical and biological hazards of food handling and their control.
44. Norma is a safety officer at a biscuit factory. Recently she observed that the biscuit packages were not completely sealed. Which of the following does NOT form part of her duties in ensuring the safe handling of the packages?
- (A) Identifying critical points
 - (B) Conducting a hazard analysis
 - (C) Repairing the packaging machine
 - (D) Establishing record-keeping procedures
45. The Minister of Agriculture has observed that people are healthy, maintain a high standard of living and the population is increasing rapidly. This has led to limited food supply. Which of the following recommendations would MOST likely maintain food security in the country?
- (A) Enhance the water supply
 - (B) Provide a better standard of living
 - (C) Increase access to health-care facilities
 - (D) Provide measures to regulate population growth

END OF TEST

SPEC 2013/02102020



TEST CODE **02102020**

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

AGRICULTURAL SCIENCE

SPECIMEN PAPER

Unit 1 – Paper 02

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions in two sections. Answer ALL questions.
2. For Section A, write your answers in the spaces provided in this booklet.
3. For Section B, write your answers in the spaces provided at the end of each question in this booklet.
4. You may use a silent non-programmable calculator.

SECTION A

Answer ALL questions in this section.

Write your answers in the spaces provided in this booklet.

1. (a) (i) Write the chemical formula for photosynthesis.

[2 marks]

Figure 1 shows the effect of light intensity on rate of photosynthesis.

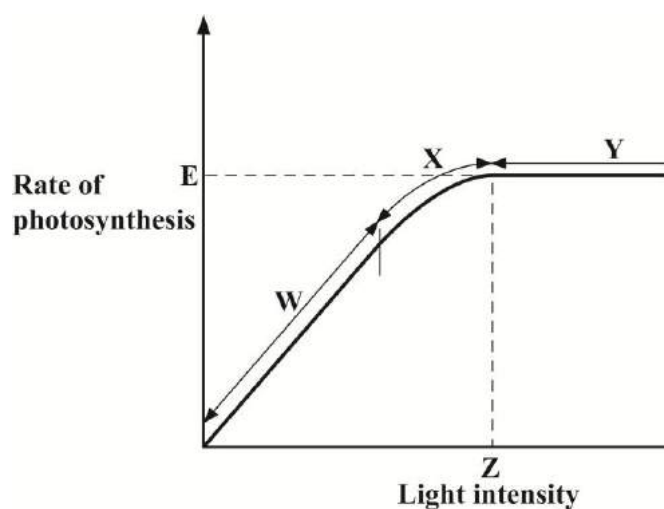


Figure 1. Effect of light intensity on rate of photosynthesis

- (ii) Describe the relationship between light intensity and photosynthetic rate as shown in Figure 1.

[3 marks]

GO ON TO THE NEXT PAGE

(iii) Explain the relationship between light intensity and crop production.

[2 marks]

(iv) Explain why C_4 plants in tropical conditions are more efficient at photosynthesis than C_3 plants.

[2 marks]

(v) Give TWO examples of C_4 plants.

[2 marks]

(b) (i) Define the term 'photoperiodism'.

[1 mark]

(ii) Suggest how phytochromes function in short-day plants.

[3 marks]

Total 15 marks

GO ON TO THE NEXT PAGE

2. (a) (i) Explain what is meant by 'dormancy' in seeds.

[2 marks]

(ii) State the function of dormancy in seeds.

[1 mark]

(iii) Name TWO environmental stimuli that may trigger a seed to germinate.

[2 marks]

(b) Figure 2 shows two types of germination, epigeal and hypogeal.



A: _____

B: _____

Figure 2. Types of germination

(i) Identify the types of germination shown in Figure 2. Write your answers in the relevant spaces in Figure 2. [1 mark]

- (ii) Explain how the germinating seed obtains energy before it starts to photosynthesise.

[2 marks]

- (c) (i) Briefly explain what is meant by Integrated Crop Management (ICM).

[2 marks]

- (ii) Table 1 shows some aims of ICM. Complete Table 1 by writing an example of an activity that, if undertaken, will lead to an achievement of the aim.

TABLE 1: AIMS OF INTEGRATED CROP MANAGEMENT

Aim	Example of Activity
Improvement of soil fertility	
Low-cost maintenance of soil structure	
Prevention of the build-up of pests, diseases and weeds	
Sustainable plant protection	
Prevention of damage to the environment	

[5 marks]

Total 15 marks

3. (a) (i) Define the term 'food spoilage'.

[1 mark]

GO ON TO THE NEXT PAGE

- (ii) Physical spoilage is one of the various types of spoilage that occur in produce. Identify TWO ways in which physical spoilage may occur.

[2 marks]

- (iii) Preservation techniques stop physiological activity in fruits and vegetables. Identify TWO other processes that are stopped.

[2 marks]

- (iv) After harvesting and cleaning, fruits and vegetables are sorted in preparation for processing. Explain the reason for the practice of sorting.

[2 marks]

- (b) (i) Define the term ‘food pasteurisation’

[2 marks]

- (ii) State TWO effects of pasteurisation of fruits and vegetables.

[2 marks]

- (iii) Explain how pasteurized fruits and vegetables could be preserved for even longer periods, after pasteurization.

[2 marks]

- (iv) During a laboratory class to demonstrate a processing procedure, your teacher immersed some fruits for some time in a jar containing a strong sugar solution (40 - 60%). Explain how this process controls the growth of microorganisms. Include the name of the process that is taking place.

[2 marks]

Total 15 marks

SECTION B

Answer ALL questions in this section.

Write your answers in the spaces provided at the end of each question.

4. (a) Table 1 shows the yield of rice in response to nitrogen fertilizer. The cost of nitrogen fertilizer is \$50.00 per 100 kg.

TABLE 1: RESPONSE OF RICE TO NITROGEN FERTILISER

Amount of Nitrogen Applied (kg)	Rice Yield (kg)	Yield Increase (kg)	Revenue (\$)
0	50	-	100
100	100	50	200
200	175	75	350
300	225	50	450
400	250	25	500
500	240	-10	480

- (i) Define the term ‘diminishing returns’. [2 marks]
- (ii) Describe the effect of addition of nitrogen fertilizer on yield of rice, and on revenue earned as shown in Table 1. Recommend the maximum amount of nitrogen fertilizer that a farmer should apply to the crop. [3 marks]
- (b) (i) Compare the relationship between demand and price for agricultural commodities under conditions of abundant and limited supply. Include in your answer a definition of the term ‘demand’. [7 marks]

GO ON TO THE NEXT PAGE

- (ii) Advise a farmer about a suitable production strategy to minimise loss of income when demand for rice is low. Explain the implications for nitrogen fertilizer use.

[3 marks]

Total 15 marks

Write your answer to Question 4 here.

[illegible]

[illegible]

- Total 15 marks**

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]

- Total 15 marks**

[illegible]

[illegible]



TEST CODE **02202010**

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CARRIBEAN ADVANCED PROFICIENCY EXAMINATION®

AGRICULTURAL SCIENCE

SPECIMEN PAPER

Unit 2 – Paper 01

1 hour 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 45 items. You will have 1 hour and 30 minutes to answer them.
2. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
3. Look at the sample item below.

Sample Item

Which of the following is NOT a threat to the environment by tourism?

- (A) Income
- (B) Pollution of land
- (C) Creation of arid lands
- (D) Disappearance of flora and fauna

Sample Answer



The best answer to this item is “Income,” so answer space (A) has been shaded.

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1. Which of the following is NOT an example of an agrotourist?
 - (A) Hiker
 - (B) Biker
 - (C) Farmer
 - (D) Logger

2. Which of the following gases is emitted in huge quantities by cattle in large intensive livestock units?
 - (A) Methane
 - (B) Nitrous oxide
 - (C) Sulphur dioxide
 - (D) Carbon monoxide

3. Of the nitrous oxide emissions from agricultural land, approximately what percentage comes from the dung and urine of grazing cattle?
 - (A) 5–10
 - (B) 20–40
 - (C) 45–50
 - (D) 55–60

4. Which of the following gases is NOT one of the main gases converted to a less toxic form by a catalytic converter in a gasoline motor vehicle?
 - (A) Carbon dioxide
 - (B) Carbon monoxide
 - (C) Oxides of nitrogen
 - (D) Unburnt hydrocarbons

5. Which of the following can assist in reducing pesticide runoff?
 - I. Calibrate the spray can
 - II. Follow pesticide label instructions
 - III. Only apply pesticides in cool, dry conditions
 - IV. Dispose of excess pesticides in drains
 - (A) I and II only
 - (B) II and III only
 - (C) I, II and III only
 - (D) II, III and IV only

6. A farmer fertilizes his tomato crop by top dressing. Ten minutes later there is a torrential shower where most of the fertilizer is washed into the drains. This MOST likely results in
 - I. eutrophication
 - II. algal bloom
 - III. salinity of water courses
 - (A) I and II only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II and III

7. The Parties of the United Nations Framework Convention on Climate Change (UNFCCC) agree that the critical response to climate change is the need to
 - (A) stop deforestation
 - (B) adapt to changing climate conditions
 - (C) find alternative sources of energy
 - (D) reduce greenhouse gas emissions

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8. Over the past decade, quarrying and logging have left several hills in the Caribbean bare. This has resulted in landslips and flooding of low-lying villages in these communities. How can this problem be minimized in the medium and long term?
- (A) Diversion ditches
 - (B) Settling ponds
 - (C) Gabion weirs
 - (D) Reafforestation
9. Which of the following strategies would MOST likely reduce the impact of habitat loss?
- I. Enforced forest policy
 - II. Establish forest reserves
 - III. Reafforestation
 - IV. Wildlife reintroduction
- (A) I only
 - (B) II and III
 - (C) I, II and III
 - (D) I, II and IV
10. Over the past ten years the annual harvest of animals by 5 000 hunters have fallen from 20 000 individuals to 10 000 individuals. These hunters rely on this resource to care for and maintain their families. Which of the following strategies allow for the sustainable use of this resource?
- (A) Strict bag limits
 - (B) The hunter's discretion
 - (C) A total ban on hunting
 - (D) A three-year moratorium on hunting
11. Which treaty governs the international trade of wildlife?
- (A) Kyoto Protocol
 - (B) MARPOL
 - (C) UNCLOS
 - (D) CITES
12. Which of the following is NOT a threat to the environment by tourism?
- (A) Income
 - (B) Pollution of land
 - (C) Creation of arid lands
 - (D) Disappearance of flora and fauna
13. Which of the following factors impact on the trade of locally produced foods to the tourism sector?
- I. Consistency
 - II. Quality of supply
 - III. Marketing and communication
- (A) I and II only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II and III
14. When establishing a livestock farm in any community, which role of society would have the GREATEST impact on the farm operations?
- (A) Culture
 - (B) Religion
 - (C) Taboo
 - (D) Demographics

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15. Farmer John wants to establish a broiler farm in a rural community that experiences flooding. Which of the following should inform his decision-making?

(A) Taboos
(B) Religion
(C) Demographics
(D) Indigenous knowledge

Item 16 refers to the information in the following table.

Trait	Estimated Heritability (%)		
	Cattle	Sheep	Pig
Number of young weaned	10–15	10–15	10–15
Weight of young at weaning	15–30	15–20	15–20
Postweaning rate of gain	50–55	50–60	25–30
Postweaning gain efficiency	40–57	20–30	30–35

16. Which is the MOST heritable trait for the three classes of animals?

(A) Number of young weaned
(B) Weight of young at weaning
(C) Postweaning rate of gain
(D) Postweaning gain efficiency

17. Which of the following criteria is NOT utilized in selecting breeding stocks of rabbits?

(A) Pedigree
(B) Performance
(C) Coat colour
(D) Conformation

18. Which of the following is true about kindling in rabbits?

(A) The kits are born without fur.
(B) The eyes of the kits open after two days.
(C) The kits may not suckle for the first 24 hours.
(D) The doe plucks fur from her abdomen to cover the kits.

19. The Feed Conversion Ratio (F.C.R) of 100 broilers is 3. What is the total amount of broiler feed that is fed to acquire a 2 kg weight gain per broiler?

(A) 6 kg
(B) 200 kg
(C) 300 kg
(D) 600 kg

20. A farmer discovered that 200 broilers consumed 600 kg of feed over a two-week period and they gained an average of 2 kg each. What is the F.C.R. over the two weeks?

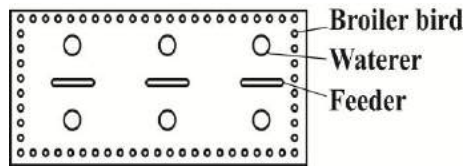
(A) 1.0
(B) 1.5
(C) 2.0
(D) 2.5

21. Farmer Khan discovers that at night his broiler birds are roosting. This batch of broilers has a lower than required body weight. How can this problem be rectified?

(A) Improve ventilation
(B) Reduce pen density
(C) Increase feed offered
(D) Introduce artificial lighting

GO ON TO THE NEXT PAGE

Item 22 refers to the following diagram showing the distribution of broilers in a pen.

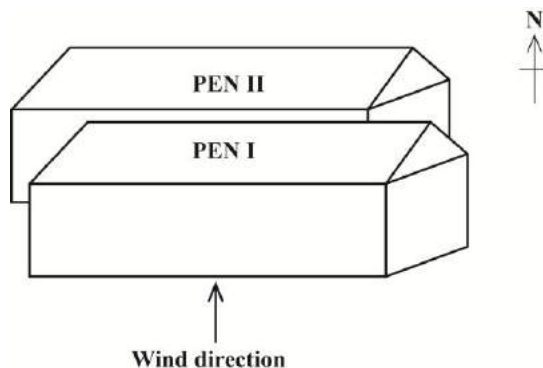


22. The BEST way to rectify this distribution of birds is by

- (A) culling the birds
- (B) installing fans
- (C) installing sprinklers
- (D) reducing the stock density in the pen

Item 23 refers to the following information:

A farmer plans to erect his farmhouse for rearing layers as shown in the diagram. The wind currently blows towards the north.



23. What is the design flaw in the diagram above?

- (A) Orientation
- (B) Roof design
- (C) Security
- (D) Ventilation

24. Farmer John believes his cows are infested with roundworms. Which of the following actions would you recommend to farmer John?

- I. Fecal floatation
- II. Identify species
- III. Treat with anthelmintics
- IV. Quarantine animals

- (A) I and III only
- (B) II and IV only
- (C) I, II and III only
- (D) I, II and IV only

25. Several animals on a sheep farm were afflicted with hoofrot. What measures should the farmer take in order to prevent the spread of this condition?

- I. Ensure pens are dry
- II. Trim hooves
- III. Dip hooves after trimming in copper sulphate solution
- IV. Wash pens daily

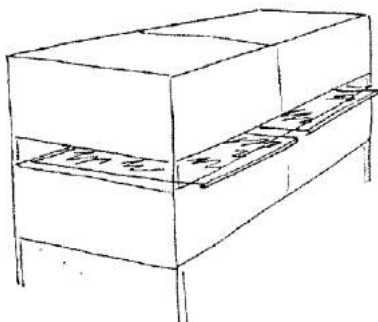
- (A) I and II only
- (B) II and III only
- (C) III and IV only
- (D) I, II and III only

26. A sample of livestock feed was treated with sodium hydroxide and a few drops of copper sulphate. The colour changed from blue to violet. What nutrient in this sample is being tested?

- (A) Carbohydrates
- (B) Fats
- (C) Protein
- (D) Starch

GO ON TO THE NEXT PAGE

Item 27 refers to the following diagram of a hutch



27. One disadvantage of this hutch is that it

- (A) prevents air from circulating
- (B) needs a roof
- (C) takes up too much space
- (D) must be cleaned every day

28. Which of the following is a symptom of Gumboro disease in poultry?

- (A) Lesions in poultry
- (B) Green faeces
- (C) Watery diarrhoea
- (D) Nervous tremors

29. Which socioeconomic factor impacts the livestock industry MOST in the Caribbean region?

- (A) Culture
- (B) Religion
- (C) Economics
- (D) Geographic location

30. The rearing of pigs and the consumption of pork are frowned upon by numerous sections of the Caribbean Community. To which of the following socio-economic factors can this be attributed?

- (A) Culture
- (B) Religion
- (C) Economics
- (D) Geographic location

31. Which technique in postharvest technology accomplishes the following?

- I. Protects the product
- II. Makes the product appealing
- III. Standardizes quantities
- IV. Makes handling easier

- (A) Storage
- (B) Selection
- (C) Packaging
- (D) Processing

32. Which of the following are advantages of microlivestock?

- I. They enhance yields in agro forests.
- II. They command higher prices in niche markets.
- III. They are productive in highly degraded areas.

- (A) I and II only
- (B) I and III only
- (C) II and III only
- (D) I, II and III

33. Neotropical animals are NOT native to

- (A) Mexico
- (B) Canada
- (C) Australia
- (D) the Caribbean

34. Which of the following is NOT considered a pond management operation during the production cycle in aquaculture?

- (A) Record keeping
- (B) Fertilizing the pond
- (C) Scraping the pond floor
- (D) Maintaining a constant water level

GO ON TO THE NEXT PAGE

35. The recommended feeding rate for fish as a percentage of body weight is
- (A) 2%
 - (B) 3%
 - (C) 4%
 - (D) 5%
36. A farmer wishes to have all calves born during the month of July in order to make use of the favourable conditions at the start of the rainy season.
- Which of the following methods would MOST likely give the farmer this result?
- (A) Super ovulation
 - (B) Embryo transfer
 - (C) Artificial insemination
 - (D) Oestrus synchronisation
37. Farmer Gary wishes to have only female calves born at his farm. What method would make this possible?
- (A) Sperm sexing
 - (B) Natural service
 - (C) Super ovulation
 - (D) Artificial insemination
38. The management practice responsible for identifying, anticipating and satisfying the requirements of customers is called
- (A) production
 - (B) marketing
 - (C) consumption
 - (D) management
39. A farmer has the LEAST control over
- (A) marketing strategy
 - (B) pricing strategy
 - (C) market behaviour
 - (D) advertising and promotion
40. Farmer Kerry has surplus lambs on his farm and sales are not moving as quickly as he expects. Which area of his marketing plan should he address?
- (A) Pricing
 - (B) Promotion
 - (C) Distribution
 - (D) Consumer research
41. A farmer decides to rear a batch of turkeys for sale in the month of July. He soon discovers that sales are low for whole turkeys. Which aspect of his marketing plan is flawed?
- (A) Pricing
 - (B) Promotion
 - (C) Distribution
 - (D) Consumer research
42. A systematic preventative control to food safety, focusing on the physical, chemical and biological hazards of food handling and their control is called
- (A) Food Security
 - (B) Good Agricultural Practices
 - (C) Good Manufacturing Practices
 - (D) Hazard Analysis Critical Control Point
43. Which of the following is NOT a benefit of HACCP?
- (A) Self-control food safety
 - (B) Increased value of the product
 - (C) Reduced incidence of food-borne diseases
 - (D) Identification of potential problems beforehand

GO ON TO THE NEXT PAGE

44. Which of the following is NOT a source of agroenergy?

- (A) Lumber
- (B) Animal fat
- (C) Fossil fuel
- (D) Crop residues

45. Commercial production of ethanol comes from

- (A) algae
- (B) rapeseed
- (C) soybean
- (D) sugar cane

END OF TEST

SPEC 2013/02202020



TEST CODE **02202020**

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CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

AGRICULTURAL SCIENCE

SPECIMEN PAPER

Unit 2 – Paper 02

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions in two sections. Answer ALL questions.
2. For Section A, write your answers in the spaces provided in this booklet.
3. For Section B, write your answers in the spaces provided at the end of each question in this booklet.
4. The use of silent non-programmable calculators is allowed.

SECTION A

Answer ALL questions in this section.

Write your answers in the spaces provided in this booklet.

1. (a) Outline TWO ways by which agricultural activities contribute to groundwater pollution.

[2 marks]

- (b) (i) Explain what is meant by 'Air Pollution Index' (API).

[2 marks]

- (ii) Identify the API that is considered acceptable and state the effect of a higher than acceptable API.

[2 marks]

- (c) (i) Define 'population density' as it pertains to wildlife.

[2 marks]

- (ii) Name TWO methods of assessing a wildlife population.

[2 marks]

(iii) Explain why wildlife policies are necessary in the Caribbean.

[3 marks]

(d) Explain the relationship between forests and watershed areas.

[2 marks]

Total 15 marks

2. (a) (i) Define the term ‘breed’ as it applies to livestock.

[2 marks]

(ii) Name TWO breeds of livestock developed in the Caribbean.

[1 mark]

- (b) Distinguish between 'random mating' and 'controlled mating'. Include a definition of EACH term in your answer.

[4 marks]

- (c) (i) Name TWO forages found in the Caribbean that are fed to rabbits.

[1 mark]

- (ii) Describe an appropriate feeding regime for a doe that is three weeks pregnant.

[3 marks]

- (d) Figure 1 shows the performance of cattle on two different forages, from March 2011 to August 2012.

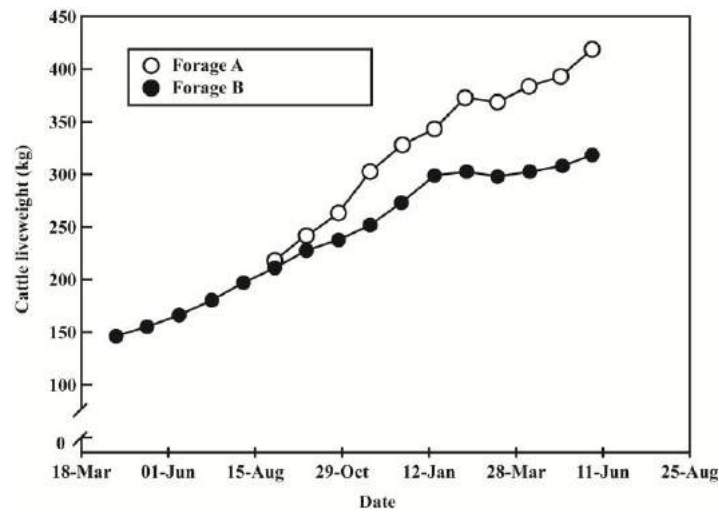


Figure 1. Performance of cattle on two different forages

- (i) Describe the shape of the graphs.

[2 marks]

- (ii) Suggest a reason for the performance of the cattle on Feed A during October to June.

[2 marks]

Total 15 marks

3. (a) A farmer washes the waste from his dairy pens into a fish pond located nearby. There are 500 tilapia and 500 cascadura in the pond, and it is not aerated. One morning the farmer notices a red colour on the surface of the pond. Also, 350 tilapia and 120 cascadura have died.

(i) Name the organism responsible for the red colour in the pond.

[1 mark]

(ii) With reference to the organism named in (a) (i), explain why the fish died in the pond.

[3 marks]

(iii) Suggest why more cascadura may have survived than tilapia.

[2 marks]

(iv) State TWO activities that the farmer can undertake to prevent the fish from dying.

[2 marks]

(b) (i) Define the term 'food security'.

[1 mark]

(ii) Outline how HACCP principles are applied to dairy farming.

[3 marks]

(c) Describe how energy is obtained from a biodigester.

[3 marks]
Total 15 marks

SECTION B

Answer ALL questions in this section.

Write your answers in the spaces provided at the end of each question.

4. Discuss the linkages between agriculture and tourism in the Caribbean. Include in your essay, the negative and positive impact of tourism on agriculture. **[15 marks]**

Write your answer to Question 4 here.

[illegible]

[illegible]

[illegible]

- Total 15 marks**

[illegible]

[illegible]

Unit 1 Paper 01

Item	Specific Objective	Key	Item	Specific Objective	Key
1	1.1.2	D	26	1.2.7	D
2	1.1.3	A	27	1.2.7	B
3	1.1.4	C	28	1.2.8	A
4	1.1.4	D	29	1.2.9	D
5	1.1.7	B	30	1.2.9	D
6	1.1.8	B	31	1.3.1	B
7	1.1.8	B	32	1.3.1	B
8	1.1.8	A	33	1.3.1	C
9	1.1.9	B	34	1.3.2	A
10	1.1.9	C	35	1.3.2	A
11	1.1.10	C	36	1.3.2	B
12	1.1.11	D	37	1.3.4	B
13	1.1.11	C	38	1.3.4	A
14	1.1.11	D	39	1.3.4	D
15	1.1.12	D	40	1.3.5	A
16	1.2.1	B	41	1.3.5	C
17	1.2.2	B	42	1.3.5	A
18	1.2.2	A	43	1.3.6	C
19	1.2.3	D	44	1.3.6	C
20	1.2.3	C	45	1.3.6	D
21	1.2.5	D			
22	1.2.7	C			
23	1.2.7	C			
24	1.2.7	D			
25	1.2.7	C			

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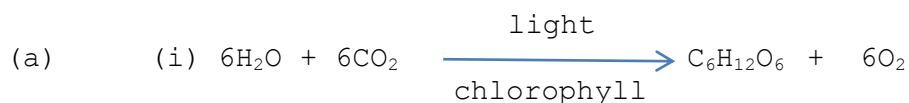
AGRICULTURAL SCIENCE

UNIT 1 - PAPER 02

MARK SCHEME

2013

Agricultural Science
Unit 1 – Paper 02
Mark Scheme

Question 1**2 marks****1 error = 1 mark****2 marks**(ii) Light intensity and rate of photosynthesis

- At low light intensities, rate of photosynthesis increases linearly with increasing light intensities (W)
- Rate gradually slows down, as other factors become limiting (X)
- No further rate increase at optimum light intensity (Y)

1 mark for each point**3 marks**(iii) Light intensity and crop production

- Optimum photosynthesis, hence optimum light intensity, leads to optimum crop production
- Some plants are able to adapt to various levels of light intensity; knowledge of the light intensity required is essential for crop production, especially for crops grown under cover, or for indoor plants.

1 mark for each point**2 marks**(iv) C₄ plants and photosynthesis

- The maximum rate of CO₂ fixation is greater in C₄ plants, therefore the higher light intensities and temperatures of the tropics are more efficiently exploited during photosynthesis.
- C₄ plants lose less water – about half the water that C₃ plants lose for each molecule of CO₂ fixed. Therefore, C₄ plants are more adapted to tropical conditions and are more efficient at photosynthesis.

2 marks for any point fully explained**2 marks**

Agricultural Science
Unit 1 - Paper 02
Mark Scheme

Question 1 continued

(v) Example of C₄ plants

- Sugarcane
- Corn (maize)
- Sorghum
- Millet

**For any two examples 1 mark each
2 marks**

(b) (i) Photoperiodism is a plant's response to day length
by flowering **1 mark**

(ii) Phytochrome

- A blue-green pigment that exists in two interconvertible forms, P_R which absorbs red light, and P_{FR} which absorbs far red light.
- Normal light contains more red light so during daylight there is more P_{FR} (P_R quickly converting to P_{FR})
- During the night P_{FR} is slowly converted back to P_R, short-day plants require long nights for flowering to be initiated
- If interrupted by red light, flowering is not initiated, so P_{FR} seems to inhibit flowering

**Any 3 = 3 marks
3 marks**

Total 15 marks

Agricultural Science
Unit 1 - Paper 02
Mark Scheme

Question 2

(a) (i) Dormancy

- The embryo in the seed survives by becoming dehydrated.
- Respiration and metabolic rates drop to low levels

1 mark each
2 marks

(ii) Function of dormancy

To allow the seeds to germinate when conditions are most suitable

1 mark

(iii) Environmental stimuli

- Bursting of the testa when wet by rainfall
- Exposure to light as the fruit rots
- Changes to the testa as it passes through the digestive tract of an animal

Any 2 = 2 marks
2 marks

(b) (i) A - hypogeal
B - epigeal

1 mark for both correct
1 mark

(ii) As the seed takes in water, the enzymes begin to function; the endosperm (food store) provides the substrate for respiration which provides the energy.

Well explained = 2 marks
(incomplete = 1 mark)

2 marks

(c) (i) ICM

- A system of crop production which conserves and enhances natural resources
- While producing food on an economically viable and sustainable foundation
- It is based on the understanding of the interactions between biology, environment and land management systems.

Any 2 = 2 marks
2 marks

Agricultural Science
Unit 1 – Paper 02
Mark Scheme

Question 2 continued

(c) (ii)

Aim	Example of Activity
Improvement of soil fertility	Use of nitrogen-fixing plants; Green manures; Agro-forestry techniques
Low-cost maintenance of soil structure	Minimum tillage; Soil conservation techniques
Prevention of the build-up of pests, diseases and weeds	Crop rotation
Sustainable plant protection	Biological methods; Integrated pest management
Prevention of damage to the environment	Organic farming; Minimum use of non-renewable fuel; Minimum use of chemical inputs

1 mark for any one activity related to aim
5 marks

Total 15 marks

Question 3

(a) (i) Food spoilage – any change in food that causes it to become inedible. **1 mark**

(ii) Through insects, rodents, improper handling, packing and or transportation, poor quality produce

1 mark each for any two points
2 marks

(iii) Autolysis
Microorganism growth
Enzyme changes

Any 2 points
2 marks

Agricultural Science
Unit 1 – Paper 02
Mark Scheme

Question 3 continued

(iv) Sorting

To achieve uniformly sized products and to remove bad ones.

1 mark for each underlined point

2 marks

- (b) (i) Pasteurization is a mild heat treatment at temperatures up to 100°C, which destroys some microorganisms.

Complete answer = 2 marks

Incomplete = 1 mark

2 marks

(ii) Effects of pasteurization

- A slight decrease in taste
- A slight decrease in nutritional value
- The enzymes are inactivated
- Bacteria are killed, but not all

Any 2 = 2 marks

2 marks

- (iii) To prevent the surviving spore-producing microorganisms from multiplying after pasteurisation and thus last longer

(1 mark)

- Store at temperatures below 15°C
- Sugar can be added
- Salting or place it in brine

Any 1 bulleted point = 1 mark

2 marks

(iv) Concentrated sugar solution

- The concentration of water molecules is greater inside the fruits than in the sugar solution, so water molecules leave the fruits and enter the sugar solution (osmosis)
- Reduced moisture in the fruits – reduced microorganisms

Complete explanation = 2 marks

Incomplete = 1 mark

2 marks

Total 15 marks

Agricultural Science
Unit 1 – Paper 02
Mark Scheme

Question 4

- (a) (i) Diminishing returns
Reduction in additional output for every additional unit of input **2 marks**

- (ii) For every additional increment of nitrogen fertilizer, the additional increase in yield declines after 200 kg. The maximum amount of fertilizer the farmer should apply should be the level at which the cost of additional fertilizer equals and is not more than the increase in returns from increased yield.

1 mark each underlined point = 3 marks
3 marks

- (b) (i) Demand is the quantity of an item that customers are willing to buy at a given price. Therefore, demand is driven by desire to acquire the item and the ability to purchase it. **2 marks**

Availability also influences the price and the quantity that the customer is willing to buy at a given price depending on the elasticity of demand of the item.

1 mark

Therefore, under conditions of abundant supply, customers will be willing to buy more at a lower unit price, depending on elasticity of demand. **2 marks**

Under conditions of limited supplies, prices will increase and they will buy less depending on the elasticity of demand for the product. **2 marks**

7 marks

- (ii) Suitable production strategies should aim to cut cost. These include either reducing area under rice production or reducing inputs that would increase yield.

Complete answer = 2 marks
Incomplete = 1 mark

Both strategies should lead to lower N₂ fertilizer application to reduce cost of production. **1 mark**

3 marks

Total 15 marks

Agricultural Science
Unit 1 – Paper 02
Mark Scheme

Question 5

(a)

Bloom Quality	Forest tree cover – variable light and less variable RH	Shade house – uniform light and RH
Bloom size	Variable size due to light	More uniform size due to uniform light
Colour or gloss	Variable colour / gloss due to light	Richer and more uniform colour due to even shade/ uniform and brighter gloss due to shade
Freedom from damage	Damage from falling leaves and twigs	Less physical damage
Stem straightness, length	Good stem length; variable straightness due to uneven light	Good stem length / straight stems

4 marks for each growing condition

1 mark for any of four quality characteristic with reference to effect of environmental factor

8 marks(b) (i) Bacterial wilt

- Wilted falling leaves
- Reduced leaf production
- Reduce bloom production
- Poor quality blooms

Any 2 = 2 marks**2 marks**(ii) Bed preparation

- Raised beds
- Drains at sides of beds
- Any other measure to increase drainage e.g. grading, tillage

Harvesting practice

- Sanitation of knives
- Changing knives between plants
- Harvesting from plants in uninfected part of the farm first
- Sanitation of clothing especially boots and gloves in moving from one part of the farm to another to harvest

Any 5 points = 5 marks**5 marks****Total 15 marks**

Agricultural Science
Unit 1 - Paper 02
Mark Scheme

Question 6

(a) Food security

Key elements come from World Food Summit definition: "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life"

Environmental factors - hurricane, flood, drought, volcanic eruption - all affect food availability in sufficient quantities and some may also affect food safety, or even physical access to the food.

Social factors - education (can affect handling of food and food safety, food preparation and nutrition), family characteristics, for example, large household might affect adequacy of supply to individual persons e.g. children.

Economic factors - poverty at the level of the individual or household can affect financial access, also landlessness - inability to grow one's own food; at the level of the country high dependence on imported food can affect availability, access if prices are very high or if government is unable to subsidise staples

**1 marks for each factor well explained = 6 marks
6 marks**

(b) Food safety

Important to consumer health, nutritious quality of food, food sufficiency (unsafe food has to be discarded), expenditure on food (discarded food or food that will cause ill-health lead to unnecessary expenses)

2 marks

HACCP from the field to the market

Field - prevention of contamination at harvest by:

- Avoid harvesting wet leaves which are more susceptible to damage (damage creates entry points for bacteria)
- Use clean knives
- Avoid placing harvested lettuce on the ground

Agricultural Science
Unit 1 – Paper 02
Mark Scheme

Postharvest

- Remove from field in containers which will minimise physical damage
- Remove lower leaves that have dirt
- Use clean knives when removing parts during washing
- Keep in cool environment to prevent wilting leading to quality deterioration and growth of pathogens
- Place in plastic bags to avoid water loss instead of sprinkling with water

Market

- Transport in clean containers in a clean vehicle
- If not using plastic bags, sprinkle with water from clean source to maintain freshness
- Avoid placing lettuce on the ground or on unclean tables/stands
- Avoid handling money and unwrapped lettuce with same hands

**At least 2 points from each stage from the field to the market
and 1 point from any stage = 7 marks**

9 marks

Total 15 marks

Unit 2 Paper 01

Item	Specific Objective	Key	Item	Specific Objective	Key
1	2.1.1	C	26	2.2.5	D
2	2.1.2	A	27	2.2.8	B
3	2.1.2	B	28	2.2.8	C
4	2.1.3	A	29	2.2.10	B
5	2.1.4	C	30	2.2.10	B
6	2.1.4	C	31	2.3.1	C
7	2.1.5	D	32	2.3.2	D
8	2.1.6	D	33	2.3.2	C
9	2.1.6	C	34	2.3.3	C
10	2.1.7	A	35	2.3.3	B
11	2.1.7	D	36	2.3.4	D
12	2.1.8	A	37	2.3.4	A
13	2.1.8	D	38	2.3.6	B
14	2.1.9	D	39	2.3.6	C
15	2.1.9	D	40	2.3.7	B
16	2.2.2	B	41	2.3.7	D
17	2.2.3	C	42	2.3.8	D
18	2.2.3	B	43	2.3.8	B
19	2.2.4	D	44	2.3.9	C
20	2.2.4	B	45	2.3.9	D
21	2.2.5	D			
22	2.2.5	B			
23	2.2.6	A			
24	2.2.7	C			
25	2.2.7	D			

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UNIT 2 - PAPER 02

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2013

Agricultural Science
Unit 2 – Paper 02
Mark Scheme

Question 1

(a) Agricultural activities and groundwater pollution

- Agricultural pesticides, fertilizers, herbicides and animal waste are agricultural sources of groundwater pollution. The agricultural contamination sources are varied and numerous: such as spillage of fertilizers and pesticides during handling, runoff from the loading and washing of pesticide sprayers or other application equipment, using chemicals uphill from or within a few hundred feet of a well.
- Agricultural land that lacks sufficient drainage is considered by many farmers to be lost income land. So they may install drain tiles or drainage wells to make the land more productive. The drainage well then serves as a direct conduit to groundwater for agricultural wastes which are washed down with the runoff.
- Storage of agricultural chemicals near conduits to groundwater, such as open and abandoned wells, sink holes, or surface depressions where ponded water is likely to accumulate. Contamination may also occur when chemicals are stored in uncovered areas, unprotected from wind and rain, or are stored in locations where the groundwater flows from the direction of the chemical storage to the well.

Any two = 2 marks
2 marks

- (b) (i) An air pollution index (API) is a quantitative measure that describes ambient air quality. The index is obtained by combining figures for various air pollutants into a single measurement. API is a yardstick with a scale from 0 to 500.

Complete definition = 2 marks
Incomplete = 1 mark
2 marks

Agricultural Science
Unit 2 - Paper 02
Mark Scheme

Question 1 continued

(ii) API

- An API of 100 is considered acceptable.
- The higher the AQI value, the greater the level of air pollution and the greater the health concern.

2 Points = 2 marks
2 marks

- (c) (i) Population density as it relates to wildlife is the population/number of wild animals or wild animal species that inhabits a unit forest space.

Complete definition = 2 marks
Incomplete = 1 mark
2 marks

(ii) Methods of assessing wildlife population

- Satellite technology
- Air count
- Extraction/harvest rates
- Droppings assessment

Any 2 = 2 marks
2 marks

(iii) Need for wildlife policies

- The Caribbean is made up of mostly small islands. This presents a problem in that the boarders of forested areas are the boarders of dwelling communities. Such a situation allows hunters and poachers easy access to the forest and thus extraction rates may be high.
- Additionally there is a huge market for wildlife commodities and poachers in particular try to capitalize on this situation. These actions threaten wildlife population in the region and lead to the endangerment and/or extinction of many the Caribbean's wildlife species.

Agricultural Science
Unit 2 – Paper 02
Mark Scheme

Question 1 continued

- Therefore wildlife policies are necessary to arrest this growing trend. Most countries have limited resources to allocate to wildlife protection programs. Governments try to protect wildlife by introducing policies but with limited resources these policies are either not enforced or not fully enforced.

1 mark for each bullet point = 3 marks
3 marks

(d) Forest and watershed areas

- Forests capture rainfall and replenish and cleanse our water supply. The availability and quality of water in many regions of the world are more and more threatened by overuse, misuse and pollution, and it is increasingly recognized that both are strongly influenced by forests.
- Forested catchments supply a high proportion of the water for domestic, agricultural and industrial needs. Therefore, the relationship between forests and water is a critical issue that must be accorded high priority.

1 mark for each point = 2 marks
2 marks

Total 15 marks

Question 2

(a) (i) Definition of breed

A breed is a population of animals which are distinguishable from other populations with regard to visible traits (phenotypes) which are genetically determined. These traits must be measurable and described in a herd book for the registered animals.

Complete definition = 2 marks
Incomplete = 1 mark
2 marks

(ii) Breeds developed in the Caribbean

- Barbados Black Belly
- Jamaica Hope
- Jamaica Black
- Jamaica Red

Any 2 = 1 mark
1 mark

Agricultural Science
Unit 2 – Paper 02
Mark Scheme

Question 2 continued

(b) Definition

- Random mating is where all individuals in the group have an equal opportunity to mate with all other individuals in the group.
- Controlled mating is where large numbers of females are mated to one or more selected males/sires which should be of the same breed.

1 mark each = 2 marks
2 marks

In random mating no herd/flock improvement is expected except through natural selection where small herds/flocks are used and a high degree of inbreeding is expected. This mating system best suits extensive production systems.

Controlled mating offers the opportunity for herd/flock improvement and best suits intensive production systems.

2 marks for clear distinction
1 mark for partial distinction
2 marks

(c) (i) Forage for rabbits

Mulberry (*Morus* spp.), Leucaena (Wild tamarind, River tamarind), Rabbit meat, Water grass, Para grass, Tanner grass, Elephant grass, Malato, Kudzu

Any 2 = 1 mark
1 mark

(ii) Feeding regime

- Three-weeks pregnant doe should receive a higher plain of nutrition because of the foetal development within the doe which creates added demands for nutrients.
- At this stage the doe cannot ingest as much feed as a non-pregnant doe because of the developing fetuses which compete with the stomach for expansion room.

Any 1 = 1 mark

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Mark Scheme

Question 2 continued

A feed regime for this physiological state should include the following:

- Energy: at least 2500 to 2900 Kcal of DE/kg
- Protein: 14 – 16%
- Adequate amounts of vitamins and minerals
- At least 30% of the ration should consist of forages

Any 4 = 2 marks
3 marks

- (d) (i) The shape of the graph is sigmoid. Performances for both forages increase gradually and uniformly from 18 March to 15 August. Thereafter the preference for Forage A is higher than Forage B.

Complete description = 2 marks
Incomplete = 1 mark
2 marks

(ii) Performance during Oct. to June

- Forage A may be an improved grass while Forage B may not be
- Forage A could have responded better to fertilizer application in August and produced more protein
- Forage A could have responded better to irrigation beginning in 15 August 2011

Any 2 = 2 marks
2 marks

Total 15 marks

Agricultural Science
Unit 2 – Paper 02
Mark Scheme

Question 3

(a) (i) Algae **1 mark**

(ii) Death of the fish

- Nitrogen and phosphorus run-off from farm, plus N₂ from fish waste encourage growth of algae
- Algae die faster than new growth
- Dying algae consume oxygen
- Fish die from lack of oxygen

Any 3 = 3 marks
3 marks

(iii) Survival of cascadura

- Lower level feeder
- Hardier fish
- Indigenous spp.

Any 2 = 2 marks
2 marks

(iv) To prevent fish from dying

- Add air/oxygen
- At least 50% water cover at all times/control light entering pond
- Recycle water (add vegetables in an aquaponic system)
- Control pH
- Feed less/reduce feed

Any 2 = 2 marks
2 marks

(b) (i) Food security – people at all times have both physical and economic access to the basic food they need

1 mark

Agricultural Science
Unit 2 – Paper 02
Mark Scheme

Question 3 continued

(ii) HACCP principles are applied at stages in dairying where contamination is likely to happen i.e. "Critical Control Points". These are:

- When cows are being led to the dairy
- When cows are in the dairy before milking
- Preparation for milking – both the milker and the animal
- During milking
- Transferring milk from the milking parlour to the dairy
- When cows leave the parlour
- The parlour

At each step of the way care must be taken to ensure sanitary measures are being adopted. **1 mark**

Any 4 bullet points = 2 marks
3 marks

(c) Obtaining energy from a biodigester

- A biodigester uses bacteria to break down organic matter and capture methane released by the bacteria in a process called anaerobic fermentation. Anaerobic means the microorganisms digest the food in the absence of oxygen.
- The simple formula is $C_6H_{12}O_6 \rightarrow 3CO_2 + 3CH_4$
- There are four steps in the process – hydrolysis, acidogenesis/fermentation, acetogenesis and methanogenesis, and different bacteria operate at each step.

1 mark for breakdown of organic matter by bacteria to form methane

1 mark for anaerobic process/formula
1 mark for the steps in the process

3 marks

Total 15 marks

Agricultural Science
Unit 2 - Paper 02
Mark Scheme

Question 4

Introduction

- Stating the linkages between agriculture and tourism
- Statement on negative and positive impacts

Negative impact (examples)

- Rising cost of energy, groundwater.
- New infrastructure means less land for agriculture
- Increased pollution (including solid waste)

Positive impact (examples)

- Linkages lead to ensuring the suitability of the region's tourism product, thus ensuring its preservation
- Conservation of wildlife and other natural resources such as rain forests
- Boost for agriculture - increased production to supply hotels; greater involvement of local communities
- Diversifying Caribbean economies - creative ways of producing food, using food and preserving food; catalyzing investment; stimulating entrepreneurship
- Prevents over-fishing i.e. marine populations preserved for snorkeling, etc

2 marks for introduction

5 marks for any 3 negative impacts discussed

5 marks for any 3 positive impacts discussed

3 marks for language:

- Sentences must be clear, complete, and meaningful
- Subjects and verbs must agree
- Consistency of tense
- Correct spelling and punctuation
- Logical and coherent arguments

(Superior = 3 marks; Competent = 2 marks; Incompetent = 1 mark)

Total 15 marks

Agricultural Science
Unit 2 – Paper 02
Mark Scheme

Question 5

(a) Disorder

- Name of disorder – inbreeding
- In flock mating any male has equal opportunity to mate with any female in the flock.
- The flock was closed (no new animals were introduced into the flock)
- From the time the first generation was sexually mature, family members would mate with each other (fathers would mate with their daughters, mother with their sons, and sister and brothers).
- After some time desirable traits may deteriorate.
- These undesirable traits include undesirable conformation for the particular breed (shape, colour, and size)
- And reduced performances (growth rate, milk production, and litter size).

1 mark for each point

7 marks

(b) Selection of breeding stock

- The purpose of selection of breeding stock is for the farmer to identify those animals which he/she would like
- To become parents of the future generations of the flock/herd
- Or for growing out for markets.
- When selecting pure bred animal the recognised trait of the breed must be considered, for example
- High milk production – give example
- Large litter size – give example
- Good mothering ability – give example
- Any other example

1 mark each

8 marks

Total 15 marks

Agricultural Science
Unit 2 – Paper 02
Mark Scheme

Question 6

(a) Production plan

- Choose a breed for desired characteristics (for example, number of litter per year, number per litter, conformation, weaning weight, FCR) **1 mark**

- Housing plan based on the following:
 - Number to be reared (1000)
 - Size of individual hutch
 - Inclusion of litter box
 - Construction material
 - Ease of cleaning
 - Security and protection from weather

Any 4 = 2 marks

- Maintenance regime
 - Feeding regime
 - Feed material/source
 - Health and disease
 - Weight check
 - Breeding regime

Any 3 = 3 marks

- Record-keeping plan for the following:
 - Feeding
 - Growth
 - Breeding
 - Diseases
 - Expenditure and income

Any 4 = 2 marks

- Marketing – preparation and sale **1 mark**

9 marks

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Unit 2 – Paper 02
Mark Scheme

Question 6 continued

(b) Sustainable agricultural production

- Definition of aquaponics
- Fish produce waste, which the plants use as nutrients, leaving a clean environment for the fish
Any point = 1 mark
- Definition of sustainable agriculture – the production of food, fibre, or other plant or animal products using farming techniques that protect the environment, public health, human communities and animal welfare **1 mark**
- Achieved by the following:
 - Water is circulated, used in production of tomato and rearing of fish; water kept clean by processes in tomato
 - Eliminates the need for solid waste disposal
 - Less land required
 - Tomato fertilized organically**1 mark for each point = 4 marks**

6 marks

Total 15 marks

CARIBBEAN EXAMINATIONS COUNCIL

**REPORT ON CANDIDATES' WORK IN THE
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®**

MAY/JUNE 2015

AGRICULTURAL SCIENCE

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GENERAL COMMENTS

This was the first sitting of the CAPE Agricultural Science examination and the scripts were scored by e-marking. While there were challenges, marking was completed in a timely manner.

The two units were examined. Unit 1 and Unit 2 each consisted of three papers. Paper 01 comprised 45 multiple-choice items and Paper 02 six compulsory questions, three of which were structured (Section A) and three which were essay questions (Section B). Each question was worth 15 marks. Paper 03 consisted of the School-Based Assessment (SBA).

Teachers should note the following:

- Pay careful attention to the teaching of the syllabus. The structured questions are longer and a single question attempts to integrate several areas of the syllabus.
- The questions in this paper assume that students would have benefited from the opportunities of learning provided by field trips.
- The last three questions are essay questions that require in-depth knowledge of topics in the syllabus.

DETAILED COMMENTS

UNIT 1

Paper 01 – Multiple Choice

The following areas proved challenging for some candidates:

- Carbon cycle
- Phosphorous cycle
- Entrepreneurial questions
- Plant diseases
- Spoilage in the canning of tomatoes

Paper 02 – Structured Essay

Question 1

Specific Objectives: 1.1.5 and 1.1.7

Candidates demonstrated a fair understanding of what are hormones and their functions in dairy cattle. The digestion in ruminants was also fairly understood as candidates had some knowledge of the major differences between non-ruminants and ruminants.

Specific Areas of Good Performance

- Definition of a hormone
- Major differences between digestion in non-ruminants and ruminants

Specific Areas of Poor Performance

- A few candidates gave very vague responses for the definition of a hormone. A good definition is *a chemical substance produced by the endocrine glands, carried in the bloodstream, to regulate activities in other parts of the body.*
- The artificial hormone which is also produced naturally by dairy cattle (*Bovine somatotropin, BST*)
- The molecule that is the major energy source for ruminants (cellulose).

Recommendations to Teachers

- More emphasis should be placed on the various hormones produced by dairy cattle.
- More revision is necessary.
- Teachers *must* spend more time on understanding the depth of knowledge that should be delivered to the students.

Question 2

Specific Objectives: 1.2.3 and 1.2.5

This question tested candidates' knowledge of plant propagation techniques and their application. Candidates were also expected to have some knowledge of landscaping. Candidate performance was fair.

Specific Areas of Good Performance

- Part (a) — Most candidates were able to correctly identify the appropriate propagation techniques for the various tree crops.
- Part (c) — Most candidates were able to identify the benefits of trees to a landscape.

Specific Areas of Poor Performance

- Part (b) — Some candidates showed confusion when comparing the propagation techniques for mango and croton.

Recommendations to Teachers

- Students must be allowed practical sessions to assist their understanding of this particular topic.

Question 3

Specific Objectives: 1.3.4 and 1.3.5

This question tested candidates' knowledge of marketing and consumer research. Candidate performance was average.

Specific Areas of Good Performance

- Part (a) (i) — consumer research
- Part (b) (i) — marketing plan

Specific Areas of Poor Performance

- Part (a) — Factors to consider when designing packaging. A good response could have included *protection, visibility, added value, utility, environmental consideration and cost*.
- The four Ps of marketing, namely *product characteristics, price, promotion and place*.

Question 4

Specific Objective: 1.1.2

This question tested candidates' knowledge of integrated farming, and performance was good.

Specific Area of Good Performance

- Part (b) — benefits of integrated farming systems.

Specific Area of Poor Performance

- Part (a) — How each unit in the integrated system contributes to the other units. An example of a good response is:

Crop unit — food for the family, residue for livestock feed, income

Livestock unit — protein for the family, excreta for the biodigester, manure for crops and fish pond

Biodigester — energy (methane) for the family, for example, cooking gas and electricity, manure for crops and fish pond

Fish pond — income for the family, irrigation for crops

Family unit — organic matter for compost, labour for other units

Recommendations to Teachers

- More emphasis should be placed on the role of the various units in the integrated farming system.
- Field trips to integrated farms may be undertaken to give students wider exposure to this area.

Question 5

Specific Objective: 1.2.3

This question tested candidates' knowledge of sustainable landscaping. Candidates did not seem to be familiar with this topic.

Specific Area of Good Performance

- Candidates demonstrated a fair working knowledge of Part (b) — site selection in designing for sustainable landscaping

Specific Areas of Poor Performance

- Candidates did not demonstrate a good working knowledge of Parts (a) and (c) — what is meant by sustainable landscaping and the social benefits of social landscaping.

Candidates were required to say that sustainable landscaping *is a stable and productive ecosystem that conserves the physical and biological processes occurring on that landscape. It encompasses a variety of practices that have been developed in response to environmental issues, and focuses on the management and design of residential, recreational and commercial landscapes.*

Some benefits are *beautification, therapeutic, diversity of plant and animal life, visual enjoyment, privacy, noise reduction, and recreational activities for families and communities.*

Question 6

Specific Objective: 1.3.7

This question tested candidates' knowledge of how GPS technology can be applied to benefit agriculture. It was not well done.

Specific Areas of Good Performance

- Some candidates were able to describe some ways in which GPS technology could be used in agriculture to improve production efficiency.

Specific Areas of Poor Performance

- Candidates did not demonstrate an understanding of the application of GPS in agriculture. Instead, they described the general uses of GPS technology as in aviation, communication etc.
- Most candidates were unable to list four ways in which GPS technology could be used to improve the efficiency of agriculture production

Candidates should have centred their essay around *the use of GPS in precision agriculture, applied to crop production (for mapping out geographical areas or crop zones, nutrient status, pest and disease infestation, accurate swathings of fields for pesticide application, and for machine efficiency), and to livestock production (animal position and behaviour, remote herding and feeding, and health management).*

Recommendations to Teachers

- Students should be encouraged to investigate the application of GPS technology in agriculture.
- Teachers need to familiarize themselves with GPS technology.
- All aspects of the syllabus should be covered thoroughly.

UNIT 2

Paper 01 – Multiple Choice

The following areas proved challenging for some candidates:

- Eutrophication
- Environmental questions, that is, the Montreal Protocol
- Poultry diseases
- Business and marketing

Paper 02 – Structured Essay

Question 1

Specific Objectives: 2.1.2, 2.1.3 and 2.1.5

This question tested candidates' knowledge of greenhouse gases and air quality. Candidate performance was poor.

Specific Area of Good Performance

- Interpreting the trends in the graph in Part (b) — candidates had a fair understanding of the trend in carbon dioxide concentration.

Specific Areas of Poor Performance

- Candidates gave vague responses for the definition of a greenhouse gas. A good response is *an atmospheric gas that absorbs and emits radiation within the thermal infrared range/any gaseous compound that absorbs infrared radiation, traps heat in the atmosphere and contributes to the greenhouse effect.*

- Most candidates could not outline how carbon dioxide and methane enter the atmosphere.

Carbon dioxide enters the atmosphere by combustion, respiration in living organisms, diffusion from the oceans, decomposition of dead organisms, volcanic eruptions, and chemical reactions, for example, in the manufacture of cement. Methane enters the atmosphere through the fossil fuel industry, livestock production, decay of organic matter, manure management, and through wetlands and swamps.

- Candidates did not respond correctly to Part (c) – the Kyoto Protocol.

The Kyoto Protocol was adopted on 11 December 1997 and amended on 21 December 2012. It seeks to commit countries to reduce greenhouse gas emissions. A heavier burden is placed on developed countries to reduce these emissions because of their 150 years of industrialization.

Recommendations to Teachers

- Teachers should seek to become thoroughly familiar with the syllabus.

Question 2

Specific Objectives: 2.2.5 and 2.2.8

This question tested candidates' knowledge and application of feed conversion ratio (FCR), and the effects of internal parasites on FCR. It was well done by some candidates.

Specific Areas of Good Performance

- Part (a) (i) — Most candidates were able to give a definition for FCR.
- Part (b) — Most candidates were able to express some knowledge of how the internal parasites affect FCR.

Specific Area of Poor Performance

- Part (a) (iii) — Some candidates could not calculate the FCR from the information given in the question.

Recommendations to Teachers

- More emphasis should be placed on calculating FCR.
- Students need to have a deeper understanding of the effects of internal parasites.
- Practical activities must form part of students' learning.

Question 3

Specific Objectives: 1.3.4 and 1.3.6

This question tested candidates' knowledge and their ability to apply knowledge of reproductive technology and marketing. Performance was fair.

Specific Areas of Good Performance

- Parts (b) (i) and (c) — Ethical issues about cloning animals and the promotion of therapeutic cloned chickens.

Specific Areas of Poor Performance

- Part (a) (i) — Most explanations of cloning were too vague. An acceptable response is *the production of an exact copy of an organism using a single cell*.
- Part (a) (ii) — Most candidates did not produce good annotations for the processes that occur during reproductive cloning.

Recommendations to Teachers

- Teachers should seek to become thoroughly familiar with the syllabus.

Question 4

Specific Objectives: 2.1.3 and 2.1.6

This question tested candidates' knowledge of air quality and reforestation. It was fairly well done by some candidates.

Specific Area of Good Performance

- Part (a) — Most candidates adequately defined air quality.

Specific Areas of Poor Performance

- Part (a) — Candidates could not relate air quality to photosynthesis. A good response would have been: *Photosynthesis produces biomass. Light, CO₂, and water are required for photosynthesis. Air quality is reduced by pollutants, so light and CO₂ concentrations are lowered, thus reducing photosynthesis.*
- Part (b) — Candidates could not explain how reforestation improves environmental conditions for crop production. Their responses should have included *Reforestation improves air quality (by reducing pollution), increases water availability, reduces flooding and soil erosion, improves soil fertility, provides shade for crops, and facilitates sustainable agricultural production through agroforestry.*

Recommendations to Teachers

- Teachers should seek to become thoroughly familiar with the syllabus.
- Teachers should ensure that they dedicate more time on understanding the depth of knowledge that should be delivered to the students.

Question 5

Specific Objective: 2.2.8

This question tested candidates' knowledge of poultry diseases and biosecurity. Performance was poor.

Specific Area of Good Performance

- Part (c) — Most candidates demonstrated a vague knowledge of biosecurity.

Specific Areas of Poor Performance

- Part (a) — Most candidates did not list all four contagious diseases affecting broilers as required by the question. Contagious diseases are *Newcastle*, *Bird flu*, *Fowl pox* and *Fowl cholera*.
- Part (b) — Most candidates could not describe three ways by which a flock of broilers could become infected with a contagious disease. Correct responses should have included *overcrowding*, *improper sanitation*, *keeping birds of the same age in close proximity*, *failure to remove dead or diseased birds*, *contaminated feed or water*, *having different bird species on the same farm*, and *spread of disease by other animals including humans*.

Recommendations to Teachers

- Teachers should seek to become thoroughly familiar with the syllabus.
- Teachers **MUST** spend more time on understanding the depth of knowledge that should be delivered to the students.

Question 6

Specific Objective 2.3.1

This question tested candidates' knowledge of grading and postharvest handling techniques. It was not well done.

Specific Areas of Good Performance

- Some candidates demonstrated some level of understanding over the three parts of the question.

Specific Areas of Poor Performance

- Candidates did not demonstrate the required content depth for this subject level.
- For Part (a), candidates were required to say that *grading is classifying the fish of the same type/size, using established guidelines*. This increases the value of the fish because it *conveys a sense of quality to the consumer, it reduces the efforts of the consumer to distinguish among different groups, and it increases the willingness of the consumer to pay more for better quality*.

- For Part (b), candidates were awarded marks if they said that the basis for grading fish prior to harvesting was *size*. This is important to profitability because *the size most desired by the market will attract higher prices, wastage of fish will be reduced, and fish will be grown to the desired size to reduce production costs*.
- For Part (c), candidates should have described any four of the following postharvest handling strategies: *Cleaning the fish, slicing/filleting, freezing, salting, smoking and packaging*.

Recommendations to Teachers

- Teachers should seek to become thoroughly familiar with the syllabus.
- Teachers from the business departments could assist here.
- Teachers should ensure that they dedicate more time to understanding the depth of knowledge that should be delivered to the students.