



CARIBBEAN
EXAMINATIONS
COUNCIL

Caribbean Advanced
Proficiency Examination®

SYLLABUS

AGRICULTURAL SCIENCE

CXC A30/U2/21

Effective for examinations from May–June 2023



CAPE®

Correspondence related to the syllabus should be addressed to:

The Pro-Registrar
Caribbean Examinations Council
Caenwood Centre
37 Arnold Road, Kingston 5, Jamaica

Telephone Number: + 1 (876) 630-5200
Facsimile Number: + 1 (876) 967-4972
E-mail Address: cxcwzo@cx.org
Website: www.cxc.org

Copyright ©2021 by Caribbean Examinations Council
Prince Road, Pine Plantation Road, St Michael BB11091



Contents

INTRODUCTION.....	i
RATIONALE.....	1
AIMS.....	1
SKILLS AND ABILITIES TO BE ASSESSED	2
PREREQUISITES OF THE SYLLABUS.....	3
STRUCTURE OF THE SYLLABUS.....	3
APPROACHES TO TEACHING THE SYLLABUS	4
UNIT 1: FUNDAMENTALS OF AGRICULTURE AND CROP PRODUCTION.....	5
MODULE 1: THE SCIENCE AND BUSINESS OF AGRICULTURE	5
MODULE 2: HORTICULTURAL <i>PRACTICES</i>	13
MODULE 3: POSTHARVEST TECHNOLOGY	24
UNIT 2: ANIMAL PRODUCTION AND THE ENVIRONMENT.....	31
MODULE 1: AGRICULTURE AND THE ENVIRONMENT	31
MODULE 2: ANIMAL PRODUCTION AND MANAGEMENT	41
MODULE 3: LIVESTOCK PRODUCTS.....	52
OUTLINE OF ASSESSMENT	60
REGULATIONS FOR PRIVATE CANDIDATES	76
REGULATIONS FOR RESIT CANDIDATES	76
ASSESSMENT GRID	77
GLOSSARY OF EXAMINATION TERMS.....	78
SUGGESTED RESOURCES.....	81

NOTE TO TEACHERS AND LEARNERS

Please note that the syllabus has been revised and amendments are indicated by italics.

First issued in 2013

Revised 2021

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

For access to short courses, training opportunities and teacher orientation webinars and workshops go to our Learning Institute at <https://pli.cxc.org/>.



PLEASE NOTE

This icon is used throughout the syllabus to represent key features which teachers and learners may find useful.

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 at the **CAPE**® level. 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 *ten* **CAPE**® Units including Caribbean Studies, Communication Studies and Integrated Mathematics. Integrated Mathematics is not a requirement for the **CXC**® Associate Degree in Mathematics. The complete list of Associate Degrees may be found in the **CXC**® Associate Degree Handbook.

For the **CAPE**® Diploma and the **CXC**® Associate Degree, candidates must complete the cluster of required Units within a maximum period of five years. To be eligible for a **CXC**® Associate Degree, the educational institution presenting the candidates for the award, must select the Associate Degree of choice at the time of registration at the sitting (year) the candidates are expected to qualify for the award. Candidates will not be awarded an Associate Degree for which they were not registered.

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, contributes to the viability of the area, creates a *sustainable* food supply, and provides *opportunities* for desired environmental 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, *efficiently* 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 *in Science, Technology, Engineering and Mathematical (STEM) principles*. This will enable the undertaking and sustaining of the development of the agricultural sector leading to the goal of wealth creation through increased food production; food security and safety; and *marketing skills*. Additionally, there is increasing recognition of the *critical* 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. *Through the use of learner centred and authentic approaches to teaching, learning and assessment*, the syllabus is designed to provide the knowledge, skills and competencies that are required for further studies, *encourage entrepreneurship, strengthen the use of information, communication and technological (ICT) skills and for students to see Agriculture as a viable career path*.

◆ AIMS

This syllabus aims to:

1. develop an understanding of agriculture, its *importance in food production* and the environment, and the multifunctionality of *agriculture to the Caribbean region*;
2. *develop* knowledge of the dynamic nature of agriculture *from* production, post-production, marketing and utilisation in the national, regional and international community;

3. *promote an awareness of the importance of agriculture in alleviating hunger and poverty, and improving nutrition and health through food security and safety;*
4. *foster an understanding of the importance of agriculture in providing multiple pathways to employment and further education;*
5. *promote an understanding of the relationship between agriculture, climate change and the environment and the role of agriculture in preserving the environment;*
6. *utilise STEM principles to improve agricultural production within the region; and,*
7. *integrate information, communication and technological (ICT) tools and skills to make informed decisions.*

◆ 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; and,
- (b) Use of Knowledge.

Knowledge and Comprehension

Remember: The ability to identify, remember and grasp the meaning of basic facts, concepts and principles.

Understand: The ability to:

- select appropriate ideas, match, compare and cite examples of facts, concepts and principles in familiar situations; and,
- explain familiar phenomena in terms of theories, laws and principles.

Use of Knowledge

Apply The ability to:

- use facts, concepts, principles and procedures in unfamiliar situations;
- transform data accurately and appropriately;
- use common characteristics as a basis for classification; and,
- use formulae accurately for computations.

Analysis and Interpretation

The ability to:

- *identify and recognize the component parts of a whole and interpret the relationships between those parts;*
- *identify causal factors and show how they interact with each other;*
- *infer, predict and draw conclusions; and,*
- *make necessary and accurate calculations and recognize the limitations and assumptions of data.*

Evaluate

The ability to make reasoned judgements and recommendations based on the value of ideas and information and their implications.

Create

The ability to:

- *combine component parts to form a new meaningful whole; and,*
- *make predictions and solve problems.*

◆ 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 | - | Horticultural Practices |
| Module 3 | - | Postharvest Technology |

UNIT 2: Animal Production and the Environment

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

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 *or before* October *to allow sufficient time to satisfy the SBA requirements and achieve* all the specific objectives contained in 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;
2. *understand the application of biological concepts in relation to plant and animal production;*
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; *and,*
6. appreciate the importance of *agricultural trade* to the development of agriculture in the region.

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. <i>describe</i> the different branches of agriculture; | <p><i>The branches of Agriculture:</i></p> <ol style="list-style-type: none"> (a) Agricultural Economics; (b) Agricultural Engineering; (c) Agronomy; (d) Animal Science; (e) Apiculture; (f) Aquaculture; <i>and,</i> (g) Horticulture. <p><i>Include examples of components within each branch.</i></p> |
| <ol style="list-style-type: none"> 2. <i>describe</i> the farming systems associated with <i>crop and animal production</i>; | <ol style="list-style-type: none"> (a) <i>Definition and characteristics of the farming systems:</i> <ol style="list-style-type: none"> (i) extensive; (ii) semi-Intensive; (iii) intensive; (iv) integrated; <i>and,</i> (v) subsistence. (b) <i>Definition and characteristics of non-conventional farming systems (aquaponics, hydroponics, ecological farming).</i> |

UNIT 1

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- | | |
|---|---|
| 3. <i>evaluate the evolution of agriculture in the Caribbean;</i> | <ul style="list-style-type: none">(a) <i>Historical overview of agriculture in the Caribbean (pre-colonial, colonial and post-colonial).</i>(b) <i>Comparison of the contribution (advantages and disadvantages) of each era in (a) to:</i><ul style="list-style-type: none">(i) <i>crop production;</i>(ii) <i>animal production;</i>(iii) <i>economy;</i>(iv) <i>lifestyle; and,</i>(v) <i>modernisation (to include but not limited to greenhouse technology).</i>(c) <i>Modernisation of agriculture to include but not limited to sustainable energy, renewable energy, mechanisation, technology and research (genetics, chemicals – fertiliser use, pesticides).</i> |
| 4. <i>describe the endocrine systems in farm animals;</i> | <ul style="list-style-type: none">(a) <i>Farm animals to include: cattle, goats, sheep, chicken, rabbits, pigs.</i>(b) <i>Location and functions of the endocrine glands – including the exocrine gland. Hormones and their functions.</i>(c) <i>Identification of the hormones responsible for:</i><ul style="list-style-type: none">(i) <i>growth;</i>(ii) <i>digestion;</i>(iii) <i>reproduction; and,</i>(iv) <i>milk production.</i> |
| 5. <i>examine the role of the male and female reproductive systems in farm animal production;</i> | <ul style="list-style-type: none">(a) <i>Comparison of the anatomy and physiology of farm animals: cattle, goats, sheep, chicken, rabbits, pigs, fish.</i> |

UNIT 1

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (b) *The importance of reproduction to the production of meat, milk and eggs for example breeding methods (to include but not limited to upgrading, cross breeding).*
- (Use diagrams to illustrate the reproductive systems.)*
6. *analyse the importance of the process of digestion in farm animals production;*
- (a) *Comparison of the anatomy and physiology of the digestive system in farm animals:*
- (i) *ruminant animals – cattle, goats and sheep;*
- (ii) *non-ruminant animals – chicken and pigs; and,*
- (iii) *hindgut fermenters – rabbits.*
- (b) *Analysis of the process of digestion in farm animals.*
- (c) *The importance of digestion to the production of meat, milk and eggs.*
- (Use diagrams to illustrate the digestive systems.)*
7. *explain the importance of the plant processes in crop production;**
- (a) *Plant Processes:*
- (i) *photosynthesis – including the light and dark reactions;*
- (ii) *respiration – Krebs and Calvin Cycle;*
- Transpiration (pull and stream).*
- (iii) *translocation:*
- *passive transport (simple diffusion, facilitated diffusion, filtration, osmosis); and,*
 - *active transport (sodium/potassium pump).*

UNIT 1

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (b) *Explanation of Photoperiodism and Phototropism.*
 - (c) *The importance of plant processes to crop production:*
 - (i) *time of planting;*
 - (ii) *management of crops (irrigation, fertilising, pests and disease control, harvesting); and,*
 - (iii) *crop yield.**(Diagrams and Simple demonstrations)*
- 8. explain the importance of biogeochemical cycles to agricultural production;
 - (a) *Biogeochemical cycles:*
 - (i) *carbon cycle;*
 - (ii) *nitrogen cycle;*
 - (iii) *phosphorus cycle; and,*
 - (iv) *water cycle.*
 - (b) *Role and process to crop production:*
 - (i) *soil conditioning;*
 - (ii) *nutrient availability (abundance and lack) and motility;*
 - (iii) *cation exchange capacity (CEC); and,*
 - (iv) *crop yield.*
 - (c) *Role and process to animal production:*
 - (i) *availability of fodder; and,*
 - (ii) *nutritive value of fodder.*

UNIT 1

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- | | | |
|-----|---|--|
| 9. | explain the significance of cation exchange capacity to soil fertility; | <i>The effect of the Cation Exchange Capacity (CEC) on soil fertility:</i>

(a) <i>soil pH (level of acidity and alkalinity in soils); and,</i>

(b) <i>nutrient availability and uptake.</i> |
| 10. | <i>apply key business concepts in decision making;</i> | <i>(a) definition and application of concepts involved in agribusiness:</i>

(i) <i>supply and demand (interpretation of schedules, curves, equilibrium points);</i>

(ii) <i>diminishing returns (stages, simple calculations);</i>

(iii) <i>depreciation (methods, calculations using straight-line method, declining- balance methods and units of production);</i>

(iv) <i>opportunity costs (calculations);</i>

(v) <i>comparative advantage (analysis of graphs/ tables);</i>

(vi) <i>resource substitutions (options);</i>

(vii) <i>regional legislative framework;</i>

(viii) <i>use of capital and credit (suitability); and,</i>

(ix) <i>Break-even concept (calculation and interpretation).</i>

(b) <i>steps in decision making (management performance, scope of management decisions, performance appraisals).</i> |

UNIT 1

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

11. *design business plans for agricultural products; and,*

Components of the business plan:

- (a) *executive summary:*

- (i) *business description:*

- *mission statement;*
- *goals;*
- *description of product or service; and,*
- *regulatory structure.*

- (b) *marketing plan:*

- (i) *marketing analysis;*

- (ii) *marketing or promotional strategy; and,*

- (iii) *distribution strategy.*

- (c) *production plan:*

- (i) *production method:*

- *risk management (HACCP);*
- *environmental factors; and,*
- *financial plan (cost of production, pricing strategy).*

12. *assess the importance of agricultural trade to the region.*

- (a) *Definition of trade.*

- (b) *Agencies and trade agreements that govern regional and international trade:*

Agreements:

- (i) *World Trade Organization (WTO);*
- (ii) *North American Free Trade Agreement (NAFTA); and,*
- (iii) *Caricom Single Market and Economy (CSME).*

Agencies:

- (i) *Caribbean Common Market (CARICOM);*
- (ii) *Africa Caribbean Pacific Countries (ACP); and,*

UNIT 1

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (iii) Union of South American Nations (UNASUR).
- (c) Impact of *the following on domestic food supply*:
 - (i) *trade liberalisation*;
 - (ii) *food safety and security*; and,
 - (iii) *exploitation of natural resources*.

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 *the different transport mechanisms across the cell membrane*.
2. Conduct research in groups on the evolution of Agriculture in the region *and present the findings*.
3. *Work individually or in groups to research the relevance of the international trade agreements. Students can present the findings to the class using PowerPoint presentations.*
4. Visit an abattoir or research station to *gather data that can assist students in the identification of the parts of the digestive and reproductive systems of non-ruminant and ruminant animals. This may also be done by having students watch video presentations.*
5. *Use diagrams or video presentations to assist students in identifying the locations of the various endocrine glands (including the exocrine glands).*
6. *Collaborate with Biology teachers to act as resource persons to assist students in understanding the plant processes in crop production.*
7. *Guide students in identifying and using local materials to construct models to demonstrate the processes involved in the biogeochemical cycles.*
8. Engage students in debates *on topics that focus on agricultural trade*.
9. *Guide students in completing a Supervised Agricultural Experience (SAE), – Incorporate real life experiences in an agribusiness setting by interacting with a farmer or a farming enterprise.*

UNIT 1

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

RESOURCES

- Burton, L. D. *Agriscience, Fundamentals and Application*. New York: Delmar, Cengage Learning, 2015.
- Failis, A.D. and Magee, C. *Anatomy and Physiology of Farm Animals*. New Jersey: Wiley Blackwell, 2018.
- Ganpat, W. and Isaac, W. *Sustainable Food Production Practices in the Caribbean 2*. Kingston: Ian Randle Publishers, 2015.

eBooks

- | | |
|--|---|
| AD26-Marketing For Small Scale Producers | http://journeytoforever.org/farm_library/AD26.pdf |
| AD02 - Soil Fertility Management | http://journeytoforever.org/farm_library/AD2.pdf |
| AS6-When We Take Care of the Land | https://rucore.org.za/wp-content/uploads/2011/11/AS6-When-we-take-care-of-the-land.pdf |
| CTA CTA-Good Agriculture Policy | www.cta.int |

Websites

- Soil Quality**
- www.fao.org
- www.soilquality.org.au
- <https://us01.z.antigena.com/l/6dS01cfV1qIjCoH1drbFFp3I7~lao7-YYlqJ2TWmJmxyvKLMW2b3~hJ~-x3LO5yF3TUyL2QTdpeZzluZO4dQxFB2luuBHvkE4cmasfUOcoXqFaodOdmqqw8kvn~vG1~qw0A8lxssSdwp246d21fcciKV>

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *understand the management practices involved in horticulture;*
2. *understand the principles of horticulture;*
3. *appreciate the concept of sustainable landscaping;*
4. *understand the impact of technology on crop production;*
5. *appreciate the role of agriculture in achieving food security; and,*
6. *develop skills needed to propagate plants.*

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

1. *describe the major branches of horticulture;*
 - (a) *Definition of horticulture.*
 - (b) *Branches of horticulture to include:*
 - (i) *floriculture;*
 - (ii) *pomology;*
 - (iii) *olericulture;*
 - (iv) *arboriculture; and,*
 - (v) *landscape horticulture.*
2. *demonstrate the management practices involved in horticulture;*

Management practices involved in horticulture (pomology {fruit crop} and olericulture {vegetables- root, leaf and legumes}):

 - (a) *Production system preparation:*
 - (i) *land preparation – land clearing, primary tillage, secondary tillage, drainage and bed formation; and,*
 - (ii) *Protected systems preparation (Hydroponics, Green House, Shade House).*
 - (b) *planting – sowing, transplanting, direct planting;*
 - (c) *cultural practices:*
 - (i) *moulding;*
 - (ii) *staking;*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

- (iii) *mulching;*
 - (iv) *pruning;*
 - (v) *irrigating; and,*
 - (vi) *fertilizer application.*
- (d) *pest and disease control:*
 - (i) *Pest (nematodes, insects and mites).*
 - (ii) *Causative agents (bacteria, fungi, microplasma like organisms).*
- (e) *weed control; and,*
- (f) *harvesting:*
 - (i) *pre-harvesting;*
 - (ii) *maturity indices;*
 - (iii) *time of harvest; and,*
 - (iv) *techniques.*
- 3. *examine the relevance of non-conventional crop farming systems in the Caribbean region;*
 - (a) *Non-conventional farming systems:*
 - (i) *hydroponics;*
 - (ii) *roof-top farming;*
 - (iii) *indoor/vertical farming (protected structures);*
 - (iv) *organic farming;*
 - (v) *urban and peri-urban farming; and,*
 - (vi) *container farming.*
 - (b) *Benefits and challenges of non-conventional farming systems.*
 - (c) *Suitability of the farming systems to the Caribbean.*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

4. *recommend appropriate practices for the establishment of lawn and turf;*

- (a) *Practices for the establishment of lawn and turf:*
- (i) *key characteristics of lawn and turf:*
- *disease resistant;*
 - *drought resistant;*
 - *ease of propagation; and,*
 - *suitability of soils.*
- (ii) *the characteristics of the varieties of grass, including but not limited to:*
- *Bermuda;*
 - *Savannah; and,*
 - *Zoysia/Manila.*
- (iii) *suitability of the variety of grass for:*
- *sports;*
 - *recreation; and,*
 - *aesthetic.*
- (iv) *methods of turf grass establishment:*
- *seeding;*
 - *plugging; and,*
 - *sprigging/sodding.*
- (b) *Lawn and turf grass management.*
- (i) *management practices:*
- *irrigating;*
 - *weed control;*
 - *fertilizer application; and,*
 - *cutting/mowing and rolling.*
- (ii) *Relate the management of turf grass to the sporting disciplines:*
- *cricket;*
 - *golf;*
 - *lawn tennis; and,*
 - *football (soccer).*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

5. *justify the utilisation of sustainable landscaping in the Caribbean;*
- (a) *Components of sustainable landscaping to include:*
- (i) *soil management:*
 - *biofiltering of waste (animals, waste water and biodigestion);*
 - *irrigation; and,*
 - *controlling run-off/harvesting water.*
 - (ii) *Integrated Crop Management (ICM);*
 - (iii) *agroforestry;*
 - (iv) *wildlife habitats;*
 - (v) *shade trees/wind breaks;*
 - (vi) *integrating livestock and crops;*
 - (vii) *recycling of plant material and solid waste; and,*
 - (viii) *renewable energy/solar lights.*
- (b) *Benefits and challenges of sustainable landscaping.*
- (Use of diagrams).*
6. *discuss the benefits of ornamental horticulture production;*
- (a) *Socio-economic benefits:*
- (i) *entrepreneurial opportunities;*
 - (ii) *aesthetic value;*
 - (iii) *health (medicinal value, health tourism, therapeutic value); and,*
 - (iv) *recreation (agro tourism).*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

7. *determine suitable conditions for the production of ornamental plants;*
- (b) *Environmental benefits:*
 - (i) *shading;*
 - (ii) *soil conservation;*
 - (iii) *water conservation;*
 - (iv) *wild-life habitat; and,*
 - (v) *air purification.*
 - (a) *Ornamental plants:*
 - (i) *Anthurium;*
 - (ii) *Ginger lily;*
 - (iii) *Orchid;*
 - (iv) *Rose, and,*
 - (v) *houseplants/Indoor plants (Sansevieria sp, Dieffenbachia sp, Aloe sp, Dypsis sp).*
 - (b) *Production practices (include innovative production practices):*
 - (i) *propagation (seeds, natural and artificial):*
 - *selection of planting materials;*
 - *growth medium;*
 - *protected structures; and,*
 - *growing conditions (light, temperature, water, humidity).*
 - (ii) *cultivation (soil type, land preparation, planting, spacing, shade);*
 - (iii) *cultural practices; and,*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

- (iv) *harvesting:*
- *pre-harvesting;*
 - *maturity indices;*
 - *time of harvest; and,*
 - *techniques.*
8. *execute artificial vegetative propagation of plants;**
- Procedures for the following propagation techniques:*
- (a) *budding (T-budding, inverted T);*
 - (b) *grafting (cleft, veneer);*
 - (c) *simple layering; and,*
 - (d) *air layering /circumposing.*
9. *discuss the production of traditional crops;*
- (a) *Banana.*
 - (b) *Citrus.*
 - (c) *Sugar cane.*
 - (d) *Nutmeg.*
 - (e) *Cocoa.*
 - (f) *Coffee.*
- Production practices (include innovative production practices):*
- (a) *propagation (seeds, natural and artificial):*
 - (i) *selection of planting materials;*
 - (ii) *growth medium;*
 - (iii) *protected structures; and,*
 - (iv) *growing conditions (light, temperature, water, humidity).*
 - (b) *cultivation (soil type, land preparation, planting, spacing, shade);*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (c) *cultural practices; and,*
 - (d) *harvesting:*
 - (i) *preharvesting;*
 - (ii) *maturity indices;*
 - (iii) *time of harvest; and,*
 - (iv) *techniques.*
10. *design suitable crop rotation systems,**
- (a) *Types of vegetables to include:*
 - (i) *fruit vegetables – sweet pepper, cucumber, melongene/eggplant, tomato, or ochro/okra;*
 - (ii) *root vegetables – carrot, radish, or beet;*
 - (iii) *legumes – string beans, yard long beans/ bora beans/ kidney beans; and,*
 - (iv) *leaf vegetables – pak choy/Chinese cabbage, spinach/ callaloo or lettuce.*
 - (b) *Production practices (include innovative production practices):*
 - (i) *propagation (seeds, natural and artificial):*
 - *selection of planting materials;*
 - *growth medium;*
 - *protected structures; and,*
 - *growing conditions (light, temperature, water, humidity).*
 - (ii) *cultivation (soil type, land preparation, planting, spacing, shade); and,*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (iii) *cultural practices;*
- *harvesting;*
 - *pre-harvesting;*
 - *maturity indices;*
 - *time of harvest; and,*
 - *techniques.*
11. *assess the application of agrotechnology for crop production in the Caribbean region.*
- (a) *Reproduction techniques (tissue culture, irradiation, micro propagation).*
- (b) *Genetically Modified Organisms (GMO).*
- (c) *Protected structures: Greenhouse, shade house, row covers, plastic mulch.*
- (d) *Water management (collection/ harvesting and drip irrigation):*
- (i) *water usage:*
- *recycling (waste water, desalination); and,*
 - *reusing (hydroponics, aquaponics).*
- (Include advantages and disadvantages of the different types of agrotechnology.)*
12. *examine the relevance of crop production to food security.*
- Food security:*
- (a) *definition of food security (FAO):*
- Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.*
- Pillars of food security:*
- *food availability;*
 - *food accessibility;*
 - *utilization; and,*
 - *stability.*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (b) *the impact of food security on the region including bio security. (Consider policies, regulations, surveillance and monitoring.)*
- (c) *the impact of food accessibility and availability.*
Ways of ensuring food security to include but not limited to:
 - (i) *education and training;*
 - (ii) *climate smart agriculture:*
 - *increase production;*
 - *appropriate technologies;*
 - *encourage home gardening; and,*
 - *diversification of crops.*

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. *Guide students to work together in utilizing the appropriate cultural practices to cultivate four vegetable crops (fruit, root, legume and leaf) in a crop rotation sequence. Encourage students to keep a record of all practical activities through the use of journals, pictures and/or videos.*
2. *Conduct field trips where students visit commercial farms or agricultural stations to examine the different crop production practices.*
3. *Conduct field trips or demonstration visits to golf courses where students can engage with live specimens of lawn grasses and turf. They can be guided in looking at their suitability for various activities, methods of establishment and management practices.*
4. *Invite resource persons (For example, dendrologist, agronomist, horticulturist) to address topics such as soil management in sustainable landscaping, ornamental production and aspects of traditional crop farming.*
5. *Incorporate the use of videos, interactive games, pictures, PowerPoint presentations to demonstrate propagation techniques.*
6. *Guide students to complete a Supervised Agricultural Experience (SAE) by incorporating real life experiences in exploratory agriculture by interacting with a farmer or a farming enterprise and presenting the findings.*

UNIT 1

MODULE 2: HORTICULTURAL PRACTICES (cont'd)

RESOURCES

7. *Encourage students to attend seminars, agricultural exhibitions and participate in workshops that will provide knowledge and experiences in aspects of crop production.*
8. *Conduct brainstorming sessions through a discussion on possible research projects on the topics within the Module.*

Burton, L. DeVere	Agriscience, Fundamentals and Application. New York: Delmar, Cengage Learning, 2015.
Smith, B.	The Farming Handbook. The Netherlands: CTA Posthus 380, 2006.
Ganpat, W. and Isaac, W.	<i>Sustainable Food Production Practices in the Caribbean 2</i> . Kingston: Ian Randle Publishers, 2015.

eBooks

AD09-Vegetable Garden in the Tropics	https://publications.cta.int/media/publications/downloads/1435_PDF.pdf
AD17-Cultivation of Tomato	https://core.ac.uk/download/pdf/132664169.pdf
AD18-Protection of Stored Grains and pulses	http://mail.journeytoforever.org/farm_library/AD18.pdf
AD19-Propagating and Planting Trees	http://journeytoforever.org/farm_library/AD19.pdf
AD23-Protected Cultivation	http://journeytoforever.org/farm_library/AD23.pdf
AD29-Pesticides Compounds, Use and Hazards	https://www.scribd.com/document/440591299/Agriculture-AD29-Pesticides-Compounds-Use-and-Hazards
AD30-Non Chemical Crop Protection	http://journeytoforever.org/farm_library/AD30.pdf
AS1-Nurseryman and His Trees	http://journeytoforever.org/farm_library/AS1.pdf
CTA003-Rainwater Harvesting	https://publications.cta.int/media/publications/downloads/1362_PDF.pdf
CTA-Good Agriculture Policy.pdf	https://www.cta.int/en

UNIT 1
MODULE 2: HORTICULTURAL PRACTICES (cont'd)

RESOURCES (cont'd)

Websites

Agrotechnology

<https://www.longdom.org/scholarly/agrotechnology-journals-articles-ppts-list-1823.html#:~:text=Agrotechnology%20focuses%20on%20technological%20processes,aesthetic%20and%20sound%20cultural%20values>

Pest Management in the Future National Academic of Sciences.

<http://www.nap.edu>

<https://cxclearninginstitute.org/>

https://us01.z.antigena.com/l/6dS01cfV1qljIcOH1d_rbFFp3I7~lao7-YYIqJ2TWmJmxeyvKLMW2b3~hJ~-x3LO5yF3TUYL2QTdpeZzluZO4dQxFB2luuBHvkE4cmasfUOcoXqFaodOdmqqw8kvn~vG1~qw0A8IxssSdwp246d21fcciKV

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *understand* postharvesting techniques;
2. *understand* techniques involved in food processing;
3. acquire knowledge of marketing *strategies; and,*
4. *appreciate the need to ensure food safety in crops.*

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

1. *examine* principles governing postharvest *management;*
 - (a) *Definition of:*
 - (i) *postharvest; and,*
 - (ii) *postharvest management.*
 - (b) *Principles governing postharvest management:*
 - (i) *maintaining quality;*
 - (ii) *food safety; and,*
 - (iii) *reduction of loss.*
 - (c) *Components of postharvest management:*
 - (i) *storage (to include between harvest and storage):*
 - *appropriate containers;*
 - *access to energy;*
 - *temperature;*
 - *humidity;*
 - *air flow;*
 - *spacing; and,*
 - *condition.*

UNIT 1
MODULE 3: POSTHARVEST TECHNOLOGY (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

- | | |
|--|--|
| | <ul style="list-style-type: none"> (i) <i>handling; transportation;</i> (ii) <i>sanitation (to include containers, transportation, storage area);</i> (iii) <i>energy management and conservation:</i> <ul style="list-style-type: none"> – <i>alternate sources of energy including:</i> <ul style="list-style-type: none"> • <i>biofuels for transportation; and,</i> • <i>use of renewable energy.</i> – <i>energy efficient equipment such as air conditioners, refrigerators, smart fixtures and equipment; and,</i> – <i>energy conservation measures.</i> |
| | <p><i>(Crops to include fruit crops, root crops, leaf crops and legumes.)</i></p> |
| 2. <i>explain the relevance of postharvest technology;</i> | <ul style="list-style-type: none"> (a) <i>Overview of postharvest technology (definition and purpose).</i> (b) <i>Postharvest technology activities (to include environmentally friendly practices):</i> <ul style="list-style-type: none"> (i) <i>cleaning;</i> (ii) <i>sorting/grading;</i> (iii) <i>temperature management;</i> (iv) <i>storage;</i> (v) <i>packaging;</i> (vi) <i>labelling; and,</i> (vii) <i>transportation.</i> |

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

3. *discuss postharvest techniques used for ornamentals;*

4. *examine the processing methods for crops grown in the Caribbean;*

CONTENT

Techniques involved in:

- (a) *cutting;*
- (b) *transporting;*
- (c) *storing;*
- (d) *cleaning;*
- (e) *packaging;*
- (f) *labelling; and,*
- (g) *controlling temperature.*

(Ornamentals to include anthurium, ginger, lily, orchid, rose and indoor plants).

- (a) *Definition and explanation of the processes (to include environmentally-friendly and energy-saving methods):*

- (i) *bottling/canning;*
- (ii) *drying;*
- (iii) *chilling/freezing;*
- (iv) *preserving with salt/sugar; and,*
- (v) *fermentation.*

Give examples of crops best suited for each process.

- (b) *Factors to consider when selecting crops for processing:*

- (i) *texture;*
- (ii) *variety;*
- (iii) *moisture content; and,*
- (iv) *acidity.*

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

5. *recommend appropriate marketing strategies for crop commodities;*

CONTENT

- (c) *Factors to be considered to prevent spoilage and contamination during processing:*
Good manufacturing practices:
 - (i) *sanitation;*
 - (ii) *storage;*
 - (iii) *temperature;*
 - (iv) *product selection; and,*
 - (v) *consider the use of renewable energy source for electricity generation.*
- (a) *Definition of marketing.*
- (b) *Types of marketing strategies to include but not limited to (paid advertising, relationship marketing, internet marketing, word of mouth).*
- (c) *The use of market research to determine marketing strategies:*
 - (i) *Product*
 - *factors affecting the demand for crop commodities; and,*
 - *Types of product (market leader, market follower, market challenger).*
 - (ii) *price – pricing strategies, for example, competitive, skimming, penetration, cost-plus, and price bundling; and,*
 - (iii) *place (channels of distribution):*
 - *movement of the product to the customer:*
 - *indirect; and,*
 - *direct.*

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

6. *design a preventative food safety strategy for crops; and,*
- (iv) *promotion:*
 - *selling;*
 - *product sampling;*
 - *sales promotion; and,*
 - *advertising (social media, print, radio and television).*
 - (d) *Factors influencing the marketing of crop commodities:*
 - (i) *shelf life; and,*
 - (ii) *season.*
 - (a) *Food safety:*
 - (i) *definition of food safety (Food and Agriculture Organization - FAO):*

food safety is defined as the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.
 - (b) *Food safety strategy for Hazard Analysis Critical Control Point (HACCP):*
 - (i) *application of the seven principles governing HACCP (from farm to fork):*
 - *principles:*
 - *conduct a hazard analysis;*
 - *determine critical control points;*
 - *establish critical limits;*
 - *establish monitoring procedures;*

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- *establish corrective actions;*
- *establish verification procedures; and,*
- *establish record keeping and documentation procedures.*

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, *exhibitions and showcases in which students can undertake activities that require them to design promotional packages and strategies.*
2. Organise field trips to processing plants, *energy conservation plants and farms and have students share their observations and experiences in class discussions.*
3. *Have students conduct research on the marketing strategies used by agricultural businesses.*
4. *Incorporate the use of PowerPoint presentations and videos for students to observe processing procedures.*
5. *Guide students in a Supervised Agricultural Experience (SAE) in which they are required to incorporate real life experiences in entrepreneurship.*
6. *Process one of the crops cultivated using environmentally and energy saving methods for bottling/canning, drying, chilling/freezing or preserves with salt/sugar.*
7. *Invite energy management and conversation specialist to conduct presentations on the benefits of using energy efficiency and energy conservation methods.*

RESOURCES

- | | |
|--|---|
| Burton, L. D. | <i>Agriscience, Fundamentals and Application.</i> New York: Delmar, Cengage Learning, 2015. |
| Ganpat, W. and Isaac, W. | <i>Sustainable Food Production Practices in the Caribbean 2.</i> Kingston: Ian Randle Publishers, 2015. |
| Perrett-Pearson, M. and Ramharacksingh, R. | <i>Agricultural Science for CSEC Examinations.</i> Oxford: Macmillian Publishers, 2020. |

UNIT 1

MODULE 3: POSTHARVEST TECHNOLOGY (cont'd)

RESOURCES (cont'd)

eBooks

AD03-Preservation of Fruits and Vegetables	https://www.scribd.com/document/22415870/AD03-Preservation-of-Fruits-and-Veg-a-Tables
AD18-Protection of Stored Grains and Pulses	https://cgspace.cgiar.org/bitstream/handle/10568/73084/Pages%20from%20Agrodok-18-Protection-of-stored-grains-and-pulses.pdf?sequence=1
CTA6-Making Sweet Potato Chips and Flour	https://publications.cta.int/media/publications/downloads/1381_PDF.pdf
CTA11-Making Banana Chips and Flour	https://publications.cta.int/media/publications/downloads/1390_PDF.pdf
CTA12-Processing Tomatoes	https://cgspace.cgiar.org/bitstream/handle/10568/51808/012_Processing_Tomatoes_A4%20%281%29.pdf?sequence=1&isAllowed=y
CTA8-Preserving Green Leafy Vegetables and Fruits	http://www.agriculture.gov.vc/agriculture/images/stories/PDF_Documents/Preserving-Green-Leafy-Vegetables-and-Fruits.pdf
CTA-Adding Value to Cereals Roots and Tubers	https://cgspace.cgiar.org/bitstream/handle/10568/63592/921_Adding_value_to_cereals_roots_and_tubers_Developments.pdf?sequence=1

Websites

Post Harvest Handling: Processing, Storage, & Distribution	https://www.extension.iastate.edu/Documents/MCMS/GA_PSpoharvest.pdf
Food safety and quality	http://www.fao.org/food-safety/en/

◆ 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. *develop an awareness of the policies to reduce pollution on the environment;*
4. appreciate the role of tourism, trade and *socio-cultural practices* to agriculture; *and,*
5. *acquire analytical skills to enhance discourse about agriculture and the environment.*

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. <i>justify the importance of environmental protection to key agricultural stakeholders;</i> | <ol style="list-style-type: none"> (a) <i>Benefits of environmental protection to include but not limited to:</i> <ol style="list-style-type: none"> (i) <i>source of income;</i> (ii) <i>increased levels of productivity;</i> (iii) <i>food security;</i> (iv) <i>recreational activity;</i> (v) <i>maintaining biodiversity; and,</i> (vi) <i>health benefits.</i> (b) <i>The consequences of not protecting the environment to key agricultural stakeholders to include but not limited to:</i> <ol style="list-style-type: none"> (i) <i>loss of revenue/ income;</i> (ii) <i>diminished quality of goods;</i> (iii) <i>loss or damage of property; and,</i> (iv) <i>resource depletion and reduced access.</i> |
|--|--|

UNIT 2

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

SPECIFIC OBJECTIVES

Students should be able to:

2. *assess the impact of atmospheric pollution on the environment;*

CONTENT

- (c) *Examination of the perspective of the environment to key agricultural stakeholders:*
 - (i) *Policy makers.*
 - (ii) *Farmers.*
 - (iii) *Foresters.*
 - (iv) *Fishermen.*
 - (v) *Agro-tourists, for example, hikers, bikers, loggers.*
- (a) *Overview of composition of air.*
- (b) *Main causes of air pollution:*
 - (i) *human activities (burning of fossil fuels, agricultural activities); and,*
 - (ii) *natural disasters.*
- (c) *Importance of air quality.*
- (d) *Major Sources of air pollution – for example, carbon monoxide, Chlorofluorocarbon, asbestos, pesticides, volatile organic compounds.*
- (e) *Effects of air pollution*
 - (i) *atmospheric effects:*
 - *enhanced greenhouse effect and global warming;*
 - *thinning of ozone layer; and,*
 - *acid rain.*
 - (ii) *health effects:*
 - *respiratory disorders*
 - *increased vulnerability to stress and diseases; and,*
 - *lower reproductive rate.*

UNIT 2

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

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

- (iii) *land and water effects:*
- *disruption of habitat and loss of biodiversity;*
 - *contaminated water sources;*
 - *droughts/ flooding; and,*
 - *soil degradation.*
3. *discuss measures used for maintaining and improving air quality;*
- Measures used to maintain and improve air quality:*
- (a) *reducing the use of aerosols;*
 - (b) *reducing the use of fossil fuel;*
 - (c) *providing adequate ventilation of animal pens and storage facilities;*
 - (d) *reducing indiscriminate burning;*
 - (e) *servicing vehicles/machinery regularly;*
 - (f) *encouraging the use of electric/hybrid vehicles;*
 - (g) *reducing of harmful pesticides;*
 - (h) *encouraging organic farming (make mention of vertical farming);*
 - (i) *planting more trees; and,*
 - (j) *encouraging the use of renewable energy, energy efficiency and energy conservation.*
4. *assess the impact of soil and water pollution on the environment;*
- (a) *Overview of soil:*
 - (i) *composition of soil; and,*
 - (ii) *importance of soil.*
 - (b) *Overview of water:*
 - (i) *composition of water; and,*
 - (ii) *importance of water.*

UNIT 2

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

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

- (c) *Discussion of the major sources of soil and water pollution:*
 - (i) *contaminated water run-off;*
 - (ii) *agricultural chemicals;*
 - (iii) *industrial pollutants;*
 - (iv) *indiscriminate disposal of waste; and,*
 - (v) *oil spillage.*
- (d) *Effects of soil and water pollution on crops, livestock and aquatic life:*
 - (i) *health effects:*
 - *reduced life processes (growth, reproduction);*
 - *increased mortality; and,*
 - *stress.*
 - (ii) *food security:*
 - *yield/quality;*
 - *availability;*
 - *accessibility;*
 - *utilization; and,*
 - *stability (stable food supply).*
 - (iii) *land and water:*
 - *disruption of habitat and loss of biodiversity;*
 - *soil degradation; and,*
 - *reduced soil fertility.*

UNIT 2

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

5. *examine measures used for maintaining and improving soil and water quality;*

Measures used to maintain and improve soil and water quality to include but not limited to:

(a) *improving soil quality:*

(i) *soil conservation:*

- *intercropping/strip cropping;*
- *terracing;*
- *minimum tillage; and,*
- *managing grazing.*

(ii) *soil amendment:*

- *lime (calcium carbonate);*
- *gypsum; and,*
- *decomposed organic matter/ compost/ vermicompost.*

(b) *improving water quality:*

- (i) *limiting the use of chemicals;*
- (ii) *safe use of chemicals;*
- (iii) *proper disposal of waste;*
- (iv) *bio-filtering of waste water (use of suitable plants);*
- (v) *natural filtration systems (cover crop/ mulching);*
- (vi) *artificial filtration systems (desalination); and,*
- (vii) *soil conservation.*

6. *discuss the importance of international conventions and agreements regarding pollution control;*

Discussion on the purpose, aim and importance of:

- (a) *United Nations Convention on climate change (UNFCCC);*

UNIT 2

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- | | | |
|----|--|---|
| 7. | <i>assess the importance of forests to the environment;</i> | <ul style="list-style-type: none">(b) International Convention for the prevention of Marine Pollution (MARPOL);(c) Cartagena Convention on law of the sea (UNCLOS);(d) <i>Paris Agreement</i>;(e) Montreal Protocol; <i>and</i>,(f) <i>Kyoto Protocol</i>. |
| 8. | <i>evaluate the relationship between neo-tropical animals and the environment;</i> | <ul style="list-style-type: none">(a) Relationship between forests and other natural resources:<ul style="list-style-type: none">(i) <i>regulating the ecosystem</i>;(ii) <i>protecting bio-diversity</i>;(iii) <i>watershed protection</i>;(iv) <i>absorbing harmful greenhouse gases</i>; <i>and</i>,(v) <i>providing habitats for indigenous flora and fauna</i>.(b) <i>Forest Policies</i>.(c) <i>Primary forest</i>.(d) <i>Reforestation (to include secondary forest)</i>.(a) <i>Definition of neo-tropical animals</i>.(b) <i>Assessing the impact of the environment on population densities of neo-tropical animals (wildlife) population</i>:<ul style="list-style-type: none">(i) <i>forestry (afforestation and deforestation)</i>;(ii) <i>infrastructural development</i>; <i>and</i>,(iii) <i>natural disasters</i>. |

UNIT 2

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

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

9. assess how the environment can be sustainably utilised for tourism and trade;
10. examine alternative sources of energy used in agriculture; and,
- (c) *Neo-tropical animal (land and aquatic) policies:*
 - (i) *harvesting;*
 - (ii) *trade; and,*
 - (iii) *conservation.*
 - (a) *Main goals of sustainable agriculture.*
 - (b) *Sustainable use of the environment for:*
 - (i) *tourism (agri/agro-tourism and eco-tourism); and,*
 - (ii) *trade.*
 - (c) *Policies concerning tourism and agricultural trade.*
 - (a) *Alternative sources of energy used in agriculture:*
 - (i) *biomass energy:*
 - *definition;*
 - *production of biomass energy (use of organic matter – bio digester); and,*
 - *production of ethanol.*
 - (ii) *solar energy (use of solar panels);*
 - (iii) *wind energy (use of wind turbines); and,*
 - (iv) *hydropower energy (use of hydroelectric power plants).*
 - (b) *Areas of utilisation in agriculture:*
 - (i) *lighting;*

UNIT 2

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (ii) *heating; and,*
 - (iii) *machinery operation (feeding and watering).*
- (c) *Benefits of using alternative sources of energy:*
 - (i) *clean source of energy;*
 - (ii) *reduction in air pollution;*
 - (iii) *reduction in cost over time;*
 - (iv) *reduction of solid waste; and,*
 - (v) *reduction on dependence of fossil fuel.*
- 11. *discuss the influence of socio-cultural practices in shaping sustainable agriculture in the region.*
 - Socio-cultural practices to include:*
 - (a) *religion;*
 - (b) *taboos;*
 - (c) *ethnicity;*
 - (d) *crops cultivated;*
 - (e) *livestock reared;*
 - (f) *demographics; and,*
 - (g) *heritage (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. *Conduct research on the importance of environmental protection to key agricultural stakeholders. Students can be placed in groups where they will use their findings to support the position taken.*
2. *Engage students in a class discussion on the impact of atmospheric pollution on the environment. Students can be encouraged to recommend appropriate and sustainable solutions.*

UNIT 2

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

Suggested Teaching and Learning Activities

3. *Students can visit or view video presentations on watershed areas and meteorological stations to learn about their role in the environment.*
4. *Engage students in an activity that requires them to identify forms of pollution in their communities and make recommendations for pollution control.*
5. *Use computer aided technology – YouTube and other social media network to view video presentations on pollution and its effect on the environment.*
6. *Visit the Global Learning and Observation to Benefit the Environment (GLOBE) website and participate in a group project. <https://www.globe.gov/>*
7. *Students can participate in a group activity in which they will create infographics on neo-tropical animals and the environment. These can be displayed in class or on the school notice board.*
8. *Conduct guided class discussions on areas such as policies governing tourism and trade, and social issues and how they shape sustainable agriculture in the region.*
9. *Guide students in a Supervised Agricultural Experience (SAE) that incorporates real life experiences in the utilization of alternative sources of energy at home/school.*

RESOURCES

- Burton, L. D. *Agriscience, Fundamentals and Application*. New York: Delmar, Cengage Learning, 2015.
- Ganpat, W. and Isaac, W. *Sustainable Food Production Practices in the Caribbean 2*. Kingston: Ian Randle Publishers, 2015.

eBooks

- | | |
|---|---|
| AD11 -Erosion Control in the Tropics.pdf | https://www.agromisa.org/wp-content/uploads/Agrodok-11-Erosion-control-in-the-tropics.pdf |
| AD13-Water Harvesting and Soil Moisture Retention.pdf | https://www.agromisa.org/wp-content/uploads/Agrodok-13-Water-harvesting-and-soil-moisture-retention.pdf |
| AD16-groforestry.pdf | http://www.agromisa.org/wp-content/uploads/Agrodok-16-Agroforestry_sample.pdf |

UNIT 2

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

AS6-When We Take Care of the Land.pdf <https://rucore.org.za/wp-content/uploads/2011/11/AS6-When-we-take-care-of-the-land.pdf>

CTA-Good Agriculture Policy www.cta.int

Websites

<https://cxclearninginstitute.org/>

www.who.int

Pollution, University of Minnesota Extension <https://extension.umn.edu/>

Sources of Soil Pollution www.fao.org

Sustainable Tourism <https://tourismnotes.com/>

UNIT 2

MODULE 2: ANIMAL PRODUCTION AND MANAGEMENT

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *appreciate the role of animals;*
2. *appreciate the importance of animal production to agriculture in the region;*
3. *understand the role of genetics in farm animals;*
4. *understand the management practices associated with farm animals;*
5. *understand the impact of technology on animal reproduction; and,*
6. *appreciate the importance of food security to animal production.*

SPECIFIC OBJECTIVES

Students should be able to:

1. *discuss the interactions between humans and animals;*

CONTENT

Interactions to include how humans and animals are of benefit to each other:

- (a) *Social:*
 - (i) *aesthetics;*
 - (ii) *companionship; and,*
 - (iii) *leisure activities.*
- (b) *Economic:*
 - (i) *food;*
 - (ii) *sport activities;*
 - (iii) *work/transport;*
 - (iv) *experimental/research purposes;*
 - (v) *employment;*
 - (vi) *trade (products and by-products); and,*
 - (vii) *income and revenue.*
- (c) *Overview of the role of humans in animal protection.*

UNIT 2

MODULE 2: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

2. discuss *the importance of micro livestock*;
3. explain *how social and economic factors impact farm animal production*;
4. explain *the ways in which breeding can be used to improve animal production*;

CONTENT

- (i) *Definition of micro livestock.*
- (ii) *Economic value of micro livestock.*
- (a) *Social and economic factors:*
 - (i) *education;*
 - (ii) *income/wealth;*
 - (iii) *employment;*
 - (iv) *culture;*
 - (v) *location;*
 - (vi) *demographic; and,*
 - (vii) *religion.*
- (b) *The impact of the social and economic factors on areas of farm animal production to be considered include:*
 - (i) *genetics and breeding;*
 - (ii) *nutrition and feeding;*
 - (iii) *housing and the environment;*
 - (iv) *health and diseases;*
 - (v) *socio-economic (location of the animal, waste management, security, animal aggression); and,*
 - (vi) *marketing.*
- (a) *Overview of breeding*
 - (i) *type versus breed; and,*
 - (ii) *temperate and tropical breeds.*

UNIT 2

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

SPECIFIC OBJECTIVES

Students should be able to:

5. *recommend suitable reproductive management practices used with farm animals;*

CONTENT

- (b) *The importance of genetic inheritance:*
- (i) *improved appearance;*
 - (ii) *environmental adaptation;*
 - (iii) *production:*
 - *fertility;*
 - *yields; and,*
 - *growth rate.*
 - (iv) *pests and disease resilience.*

Type

In genetics, a type is 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 criteria:

- (a) *selection of breeding stock:*
- (i) *age and weight;*
 - (ii) *breed;*
 - (iii) *lineage;*
 - (iv) *pedigree records; and,*
 - (v) *body conformation.*
- (b) *mating systems (random, selective and controlled – artificial insemination);*

UNIT 2

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

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

- (c) *pregnancy/gestation:*
 - (i) *nutrition;*
 - (ii) *housing/environmental condition;*
 - (iii) *sanitation; and,*
 - (iv) *health and safety.*
- (d) *parturition:*
 - (i) *suitable conditions;*
 - (ii) *nest boxes/farrowing crates/ bedding; and,*
 - (iii) *protection of young.*
- (e) *lactation:*
 - (i) *nutrition; and,*
 - (ii) *sanitation.*
- (f) *weaning:*
 - (i) *age at weaning; and,*
 - (ii) *nutrition (young and mother).*

Farm animals to include: sheep, goats, pigs, chickens, rabbits, cattle.

6. *examine 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; and,*

UNIT 2

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

SPECIFIC OBJECTIVES

Students should be able to:

7. *examine suitable nutrition management practices associated with farm animals; **

CONTENT

- (d) *cloning:*
 - (i) *types of cloning;*
 - *recombinant DNA;*
 - *reproductive cloning;*
 - *therapeutic cloning;*
 - and,
 - *genetical engineering (transgenic animals).*
 - (ii) *advantages and disadvantages in cloning; and,*
 - (iii) *issues governing cloning and other reproductive techniques.*
- (a) *Selection of the type of feed:*
 - (i) *age and stage of growth of the farm animal;*
 - (ii) *nutrient content of the feed; and,*
 - (iii) *purpose of rearing the animal.*
- (b) *Utilisation of Feed Conversion Ratio (FCR):*
 - (i) *definition of FCR;*
 - (ii) *FCR calculation; and,*
 - (iii) *FCR interpretation.*
- (c) *Utilisation of feed additives and growth promoters to enhance production.*
- (d) *Nutritive value versus feeding value:*
 - (i) *forages – grasses, legumes, fodder crops, hay and silage; and,*
 - (ii) *concentrates.*

UNIT 2

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

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

- (e) *Nutritive value versus feeding value:*
- (i) forages – grasses, legumes, fodder crops, hay and silage; and,
 - (ii) concentrates.
- (f) *Management of Grazing System in satisfying nutritional requirements*
- (i) continuous grazing;
 - (ii) rotational grazing; and,
 - (iii) zero grazing.
- Farm animals include: chicken, rabbits, pigs, cattle, sheep, goat.*
8. *examine the effect of different conditions on the growth of broiler birds;**
- Conditions affecting growth of broiler birds:*
- (a) nutrition – type of feed, Feed Conversion Ratio (FCR);
 - (b) light (presence and absence);
 - (c) stocking density;
 - (d) temperature; and,
 - (e) ventilation.
- (Refer to pages 74-75).
9. *design suitable housing for farm animals in the region;*
- Features of suitable farm housing to include:*
- (a) security from (predators, praedial larceny);
 - (b) brooding/parturition structures;
 - (c) Adequate feeding and watering structures (feeding troughs);
 - (d) ventilation/temperature control (roof, floor and wall design, west to east orientation);
 - (e) biosecurity (foot baths, hand sanitizers, sanitation);

UNIT 2

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (f) light including the use of solar photovoltaic to provide electricity and energy efficient lighting;
 - (g) stocking density;
 - (h) transportation; and,
 - (i) loading areas.
10. *examine* the major health concerns of farm animals in the region;
- (a) *Characteristics of a healthy animal:*
 - (i) *appearance;*
 - (ii) *appetite;*
 - (iii) *body odour;*
 - (iv) *body temperature; and,*
 - (v) *steady gait.*
 - (b) Internal and external parasites (including life cycles *and the impact on health*):
 - (i) *internal parasites: round worms, liver fluke, tape worms; and,*
 - (ii) *external parasites: ticks, mites, flees, lice.*
 - (c) *Causative agents and symptoms of major diseases: mastitis, coccidiosis, footrot, anthrax, snuffles, chronic respiratory disease (CRD), scouring and zoonoses.*
 - (d) Preventative measures (Bio-security):
 - (i) isolation;
 - (ii) traffic control; and,
 - (iii) sanitation.

UNIT 2

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (f) *Treatment and control of the major diseases:*
- (i) *medication;*
 - (ii) *vaccination;*
 - (iii) *quarantine; and,*
 - (iv) *culling.*
- Farm animals include: chicken, rabbits, pigs, cattle, sheep/goats.*
11. *examine the relevance of food security to animal production; and,*
- Food security:*
- (a) *definition of food security (FAO):*
- food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for and active and healthy life.*
- Pillars of food security:*
- *food availability;*
 - *food access;*
 - *utilization; and,*
 - *stability.*
- (b) *the impact of food security on the region including bio security. (Consider policies, regulations, surveillance and monitoring.)*
- (c) *the impact of food accessibility and availability.*
- (d) *the impact of food accessibility and availability.*
- (e) *ways of ensuring food security to include but not limited to:*
- (i) *education and training;*
 - (ii) *climate smart agriculture:*
 - *increase production; and,*
 - *appropriate technologies.*
 - (iii) *increase neo-tropical animals.*

UNIT 2

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

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- | | |
|--|--|
| 12. <i>explain the management practices involved in aquaculture.</i> | <ul style="list-style-type: none">(a) <i>Definition of aquaculture.</i>(b) <i>Management practices to include:</i><ul style="list-style-type: none">(i) <i>pond management;</i>(ii) <i>nutrition system;</i>(iii) <i>aeration;</i>(iv) <i>water management;</i>(v) <i>pH control;</i>(vi) <i>algae bloom management; and,</i>(vii) <i>stocking density.</i> <p style="margin-left: 40px;"><i>Integrated aquaculture system
(rearing of ducks above fish pond and sheep around and above fish pond).</i></p> |
|--|--|

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. *Rear chicken and rabbit to investigate nutrition, housing, reproduction and control of pests and diseases.*
2. *Conduct experiment related to the Feed Conservation Ratio (FCR) and feeding value of forages.*
3. *Conduct a site visit to an Artificial Insemination (AI) facility to observe the different stages of AI. Students should record their observations. This could be further explored in a class discussion.*
4. *Incorporate the use of computer aided technology to enhance the learning experience through video presentations on the reproductive systems and organs.*
5. *Guide students in completing a Supervised Agriculture Experience (SAE), in which they will incorporate real life experiences in exploratory agriculture by interacting with a farmer or farming enterprise to gather data on their management practices. They will present their findings to the class.*

UNIT 2

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

RESOURCES

Burton, L. D.	<i>Agriscience, Fundamentals and Application</i> . New York: Delmar, Cengage Learning, 2015.
Failis, A.D. and Magee, C	<i>Anatomy and Physiology of Farm Animals</i> . New Jersey: Wiley Blackwell, 2018.
Ganpat, W. and Isaac, W.	<i>Sustainable Food Production Practices in the Caribbean 2</i> . Kingston: Ian Randle Publishers, 2015.
Ramharacksingh, R.	<i>Agricultural Science for CSEC Examinations</i> . Oxford: Macmillian Publishers, 2011.
Smith, B.	<i>The Farming Handbook</i> . The Netherlands: CTA Posthus 380, 2006.

eBooks

AD01 - Pig farming in the Tropics.pdf	https://publications.cta.int/media/publications/downloads/1645_PDF.pdf
AD04 - Small Scale Chicken Production.pdf	https://cqspace.cgiar.org/bitstream/handle/10568/52972/AD4.pdf?sequence=1&isAllowed=y
AD07 - Goat Keeping in the Tropics.pdf	https://utt.edu.tt/uploads/library/ebooks/AD07-Goat-Keeping-in-the-Tropics.pdf
AD14 - Dairy Cattle Husbandry.pdf	http://journeytoforever.org/farm_library/AD14.pdf
AD20 - Backyard rabbit farming in the Tropics.pdf	http://journeytoforever.org/farm_library/AD20.pdf
AD33 - Duck Keeping in the Tropics.pdf	http://www.fao.org/3/ca4022en/ca4022en.pdf?tag=make_money0821-20

UNIT 2

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

eBooks

AD34 - Hatching Eggs By Hens Or In An Incubator.pdf

http://journeytoforever.org/farm_library/AD34.pdf

CTA 001- Rearing Dairy Goats Oblong.pdf

http://publications.cta.int/media/publications/downloads/1360_PDF.pdf

CTA - Good Agriculture Policy

www.cta.int

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS

GENERAL OBJECTIVES

On completion of this Module, students should:

1. *understand slaughtering and post slaughtering procedures;*
2. *demonstrate an understanding of the techniques involved in processing animal products;*
3. *understand the importance of food security and food safety in processing animal products; and,*
4. *develop skills in marketing livestock products;*

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

1. *examine the established procedures for slaughtering of farm animals;*

(a) *Procedures included in the following activities:*

(i) *ante-mortem inspection:*

- *conditions score (signs of a healthy animal, readiness for slaughter - purpose);*
- *pre-slaughtering activities (transport, time of day); and,*
- *sanitation and safety practices.*

(ii) *slaughtering:*

- *method:*
 - *restraint devices;*
 - *stunning (manual and mechanical/electrical); and,*
 - *killing and bleeding.*
- *sanitation.*

Mention religious or ritual practices.

Farm animals to include sheep, goats, pigs, chicken, rabbits, cattle.

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

2. *examine the established procedures for post slaughter handling of farm animals;*

CONTENT

- (b) *The use of technology in slaughtering activities (stunning).*

- (a) *Procedures included in the following activities:*

- (i) *post slaughter handling:*

- *removal of feathers/hair/skin;*
- *evisceration (removal of entrails); and,*
- *removal of feet/neck/hooves.*

- (ii) *postmortem inspection by qualified personnel:*

- *carcass and organs;*
- *meat; and,*
- *blood.*

- (iii) *conditioning and aging to improve quality (draining, chilling, freezing).*

- (iv) *carcass Fabrication:*

- *meat cuts; and,*
- *organ and other products for example liver, heart, lungs, feet, intestines.*

- (v) *use of offal, blood and skin/hide/hairs.*

- (b) *The use of technology in post slaughtering activities. For example, chilling, and vacuum packaging.*

Farm animals to include sheep, goats, pigs, chicken, rabbits, cattle.

UNIT 2
MODULE 3: LIVESTOCK PRODUCTS (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

3. *examine the processing methods used to prepare animal products;*

- (a) *Overview of processing:*
 - (i) *definition; and,*
 - (ii) *benefits.*
- (b) *Explanation of the processes (to include environmentally friendly and energy saving methods):*
 - (i) *meat, fish and poultry:*
 - *curing;*
 - *cooking;*
 - *chilling;*
 - *freezing;*
 - *fermentation;*
 - *salting;*
 - *pickling;*
 - *smoking; and,*
 - *canning.*
 - (ii) *non meat (yoghurt, cheese, butter):*
 - *pasteurisation;*
 - *churning;*
 - *fermentation; and,*
 - *canning/bottling/vacuum packaging.*
- (c) *Factors to consider when selecting animal products for processing:*
 - (i) *quality (age, colour, marbling, texture, smell); and,*
 - (ii) *purpose:*
 - *meat (canned meat, salted meat, pickled meat); and,*
 - *non meat (yoghurt, cheese, butter).*

UNIT 2
MODULE 3: LIVESTOCK PRODUCTS (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- (d) *Good manufacturing practices to be considered to prevent spoilage and contamination during processing:*
- (i) *sanitation;*
 - (ii) *storage;*
 - (iii) *temperature;*
 - (iv) *product selection; and,*
 - (v) *consider the use of renewable energy resource for electricity generation.*
- Farm animals to include chicken, rabbits, pigs, cattle, sheep/goats.*
4. *design a food safety strategy for animal products;*
- (a) *Food safety:*
- (i) *definition of food safety (FAO):*
food safety is defined as the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use; and,
 - (ii) *the impact of potential food hazards from animal products to humans (bacterial spoilage, contamination, allergens).*
- (b) *Food safety strategy for Hazard Analysis Critical Control Point (HACCP):*
- (i) *application of the seven principles governing HACCP (from farm to fork) to animal products (slaughtering, processing, packaging, storage, retail):*
 - *principles:*
 - *conduct a hazard analysis;*
 - *determine critical control points;*

UNIT 2
MODULE 3: LIVESTOCK PRODUCTS (cont'd)

SPECIFIC OBJECTIVES

CONTENT

Students should be able to:

- *establish critical limits;*
 - *establish monitoring procedures;*
 - *establish corrective actions;*
 - *establish verification procedures; and,*
 - *establish record keeping and documentation procedures.*

- 5. *evaluate the impact of processed animal products on food security in animal production;*
 - Ways in which processing of animal products ensures food security to include but not limited to:*
 - (a) *efficient utilisation of animal products and by-products (include benefits to small entrepreneurs);*
 - (b) *increase utilisation of products from local animals;*
 - (c) *extension of shelf life;*
 - (d) *greater affordability; and,*
 - (e) *greater availability.*

- 6. *develop marketing plans for animal commodities;*
 - (a) *Overview:*
 - (i) *definition of marketing;*
 - (ii) *types of market:*
 - *perfect competition;*
 - *imperfect competition;*
 - *oligopoly; and,*
 - *monopoly.*

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

CONTENT

- (iii) *components of market research:*
 - *target market;*
 - *market size; and,*
 - *competition.*
- (iv) *Types of marketing strategies to include but not limited to paid advertising, relationship marketing, internet marketing, word of mouth).*
- (b) *The use of market research to determine:*
 - (i) *product:*
 - *factors affecting the demand for livestock products; and,*
 - *types of product (market leader, market follower, market challenger).*
 - (ii) *price:*
 - *pricing strategies, for example, competitive, skimming, penetration, cost-plus, and price bundling;*
 - (iii) *place (channels of distribution) – movement of the product to the customer:*
 - *indirect; and,*
 - *direct.*
 - (iv) *promotion:*
 - *selling;*
 - *product sampling;*
 - *sales promotion; and,*
 - *advertising (social media, print, radio and television).*

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS (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. *Invite a public health inspector to demonstrate an ante-mortem inspection on broiler. Students can be given guided questions that will be used to direct a class discussion after observing the demonstration.*
2. *Conduct research to analyse the effectiveness of genetically modified foods. This can be done as group work where students are required to share their findings.*
3. *Students can participate in a group activity where they will design a logo for a product.*
4. *Students can be asked to do research the relevance of HACCP principles. They can then be guided in discussing their findings.*
5. *Invite a guest lecturer to speak on marketing and its application in agriculture and the marketing of livestock products.*
6. *Organise a field trip to a processing plant to observe the procedures involved in slaughtering and fabricating slaughtered animals.*
7. *Incorporate the use of hands-on activities which require students to process carcasses of broiler birds.*

RESOURCES

- | | |
|---------------------------|---|
| Burton, L. D. | <i>Agriscience, Fundamentals and Application.</i> New York: Delmar, Cengage Learning, 2015. |
| Faills, A.D. and Magee, C | <i>Anatomy and Physiology of Farm Animals.</i> New Jersey: Wiley Blackwell, 2018. |
| Ganpat, W. and Isaac, W. | <i>Sustainable Food Production Practices in the Caribbean 2.</i> Kingston: Ian Randle Publishers, 2015. |

UNIT 2

MODULE 3: LIVESTOCK PRODUCTS (cont'd)

ebooks

AD12 - Preservation of Fish and meat.pdf	http://journeytoforever.org/farm_library/AD12.pdf
AD15 - Small Scale Freshwater Fish Farming.pdf	https://awsassets.panda.org/downloads/39_small_scale_freshwater_fish_farming_2008_author_eira_carballo_assiah_van_eer_ton.pdf
AD21 - On Farm Fish Culture.pdf	http://journeytoforever.org/farm_library/AD21.pdf
AD23 - Protected Cultivation.pdf	http://journeytoforever.org/farm_library/AD23.pdf
AD26 - Marketing for Small Scale Producers	http://journeytoforever.org/farm_library/AD26.pdf
AD36 - Preparation of dairy products.pdf	http://journeytoforever.org/farm_library/AD36.pdf
CTA013 - How to keep Bees and Process Honey.pdf	http://www.fao.org/3/CA2542EN/ca2542en.pdf
Policy	www.cta.int
CTA - Setting up and running a Small Meat or Fish Processing Enterprise	https://publications.cta.int/en/publications/publication/1175/management-entrepreneurship/index.html
CTA - Setting Up and Running a small-scale dairy processing business	http://publications.cta.int/media/publications/downloads/1434_PDF.pdf

◆ OUTLINE OF ASSESSMENT

Each Unit of the syllabus will be assessed separately. *The scheme of assessment for each Unit will be the same. A candidate's performance on each Unit will be reported as an overall grade as well as a grade on each Module of the Unit.* Grades will be awarded independently for each Unit. The Assessment will comprise two components, external and internal (*School-Based Assessment*).

EXTERNAL ASSESSMENT

(60 %)

Paper 01 (1 hour 30 minutes)

The Paper will consist of forty-five (45) multiple-choice items, fifteen (15) items on each Module. Each *item* is worth 1 mark (weighted up to 2).



Paper 02 (2 hours 30 minutes)

The paper consists of three compulsory structured essay questions, one from each Module. Each question is worth 30 marks.

SCHOOL-BASED ASSESSMENT

(40 %)

Paper 03

UNIT 1

Candidates will be required to cultivate four types of crops and produce a portfolio.

UNIT 2

Candidates will be required to rear, slaughter and process broiler birds and produce a portfolio.

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

All School-Based Assessment Record of marks must be submitted online using the SBA data capture module of the Online Registration System (ORS) *by the stipulated deadline*. 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.

Copies of the students' assignment 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 *Use 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

This paper will consist of three questions, one from each module. Questions on this paper test the skills *Knowledge and Comprehension (KC)* and *Use of Knowledge (UK)*. Knowledge of the entire Unit is expected.

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 30 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. *Students are encouraged to work in groups (maximum 5 persons per group) to complete the School-Based Assessment.*

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.

The Caribbean Examinations Council seeks to ensure that the School-Based Assessment scores are valid and reliable estimates of accomplishment. The guidelines provided in this syllabus are intended to assist in doing so.

CRITERIA FOR THE SCHOOL-BASED ASSESSMENT (SBA) (Paper 030)

Unit 1

This paper is compulsory and consists of a portfolio. Candidates have the option to work in small groups (maximum of 5 members in a group) to complete their SBA's

1. **The aims of the portfolio are to:**

- (a) enable candidates to experience real-world application of agricultural concepts;
- (b) enable candidates to evaluate the application of sustainable energy in agricultural systems;
- (c) develop candidates' abilities in managing crop production systems;
- (d) develop candidates' abilities to apply business concepts in agriculture;
- (e) encourage candidates to initiate and sustain a statistical investigation;
- (f) develop candidates' ability to work collaboratively; and,
- (g) provide opportunities for all candidates to show, with confidence, that they have mastered the syllabus.

2. **Requirements**

- (a) The portfolio is a combination of **written and practical work** based on candidate's site visit and experiences with crop production.
- (b) Each portfolio should include:
 - (i) a site visit report;
 - (ii) a report on crop production;
 - (iii) mark sheet for practical activity (must include teacher's score and candidates' reflections); and,
 - (iv) a business plan.

3. **Integration of Portfolio into the Course**

- (a) The activities related to portfolio work should be integrated into the course so as to enable candidates to learn and practise the skills of undertaking a successful portfolio.
- (b) Time should be allocated in class for general discussion of portfolio work.
- (c) Class time should also be allocated for discussion between teacher and student, and student and student.

4. **Management of Portfolio**

(a) **Planning**

An early start to planning portfolio work is highly recommended and the schedule of the dates for submission should be developed by teachers and candidates.

(b) **Guidance**

Each candidate should know the requirements of the portfolio and its assessment process.

Although candidates may consult with resource persons besides the teacher the candidates' submission should be their own work.

Candidates are not expected to work on their own. The teacher is expected to give appropriate guidance at all stages of portfolio work, for example, chapters to read, alternative procedures to follow and other sources of information.

(c) **Authenticity**

Teachers are required to ensure that all portfolios are the candidates' work.

The recommended procedures are to:

- (i) *engage candidates in discussion;*
- (ii) *ask candidates to describe procedures used and summarise findings either orally or written; and,*
- (iii) *ask candidates to explain specific aspects of the analysis.*

REQUIREMENTS OF THE SCHOOL-BASED ASSESSMENT

UNIT 1

Candidates will be required to *cultivate four crops and produce a portfolio comprising reports of site visit and field practical activity, a reflection on crop production and a business plan*. The portfolio must include photographs of all activities undertaken.



The portfolio will be marked out of a total of 120 marks. Marks for the portfolio will be allocated across Modules in the ratio 1:1:1. The marks earned by a student are assigned to each Module. For example, if a student earns 110 out of 120 for his School-Based Assessment, 110 marks will be assigned to Module 1, 110 marks to Module 2 and 110 marks to Module 3. The total score will be 110+110+110= 320 out of 360.

CRITERIA FOR ASSESSING THE PORTFOLIO

Section A - Site Visit Report

Candidates will be required to conduct a site visit to a crop production farm (preferably an established farm) and prepare a report on the site visit.

(i) Farming System **2 marks**

- description of the type of farming system observed is provided **(1 mark)**.
- photo evidence from the site visit to support the type of system is provided **(1 mark)**.

(ii) Crop Production Practices. **4 marks**

- description of TWO practices that the farm utilizes. **(1 mark each)**
- description of the benefits of these practices to the farm. **(1 mark each)**

NO mark is awarded for stating the practice

(iii) Challenges with Crop Production. **4 marks**

- outline of TWO challenges faced by the farm **(1 mark each)**.
- description of how EACH challenge is/could be resolved **(1 mark each)**.

(iv) Observation of how TWO marketing strategies are and/or could be used by the farmer. **4 marks**

- description of how the farmer **uses/could** use EACH marketing strategy. **(1 mark)**
- description of how EACH strategy could assist/assists with improved sales. **(1 mark)**

NO mark is awarded for stating the strategy

(v) Impact of TWO ways sustainable energy is and/or could be used on agricultural practice **6 marks**

- description of TWO ways sustainable energy is and/or could be used on the farm **(1 mark each)**
- outline of ONE benefit of **each** of the ways sustainable energy is and/or could be used **(1 mark each)**
- outline of ONE challenge/limitation with **each** of the ways sustainable energy is and/or could be used **(1 mark each)**.

TOTAL 20 marks

Section B – Field Practical Activity

Cultivate **FOUR crops** – one fruit crop, one root crop, one leaf crop and one legume. Candidates will be evaluated as follows

Report on Crop Cultivation (10 marks for each crop cultivated; 40 marks)

Each report will be marked as follows:

Provide ONE justification for how the following activities were executed for each crop cultivated. The justification **must** describe what was done and provide a reason for how the activity was undertaken. **NO mark will be awarded for describing only or giving a reason only.**

40 marks

- (i) Production System Preparation (Land/hydroponics) **(1 mark)**
- (ii) Planting **(1 mark)**
- (iii) Cultural Practices **(6 marks)**
 - Fertilizer Application
 - Type of fertilizer **(1 mark)**
 - Methods of application **(1 mark)**
 - Timing of fertilizer application **(1 mark)**
 - Any other THREE cultural practices undertaken **(1 mark each)**
- (iv) Pest and/or Disease Management **(1 mark)**
- (v) Method of Harvesting **(1 mark)**

Minus 50 percent from the candidate's earned total marks if photographs are not provided to show **at least 3** of the activities undertaken (i-v) for **EACH** crop.

Section C – Practical Activity

Award marks as follows for each activity

advanced skills demonstrated in the performance of the activities **(5-6 marks)**

essential skills are demonstrated but some areas require improvement **(3-4 marks)**

skills are performed with a low level of ability **(1-2 marks)**

30 marks

- (i) Production System Preparation **(6 marks)**
- (ii) Planting **(6 marks)**
- (iii) Cultural Practices **(6 marks)**
- (iv) Harvesting **(6 marks)**

Teacher MUST include the candidate's earned total marks for the practical activities on the page with the candidate's reflection as this grade will NOT change during moderation

- (i) Candidate's Reflection on Practical Activities
 - **Challenges (4 marks)**
 - description of TWO challenges encountered **(1 mark each)**
 - description of how the TWO challenges were resolved **(1 mark each)**
 - **Recommendations (2 marks)**
 - TWO recommendations for successful crop production **(1 mark each)**

TOTAL 70 marks

Section D – Business Plan

Create a business plan for a **processed product** which can be created from ONE of the crops that were cultivated.

BUSINESS DESCRIPTION

5

- (i) Mission Statement **(3 marks)**
 - Award **1 mark** for outlining the value of the product.
 - Award **1 mark** for including the target audience.
 - Award **1 mark** for a mission statement that is clear, short, and specific.
- (ii) Goal of Company **(1 mark)**
 - At least one goal linked to the mission statement.
- (iii) Description of Product **(1 mark)**
 - State the benefit of the product to the target market.

MARKETING PLAN

6

- (i) Market Analysis **(2 marks)**
 - At least TWO details about the target market are described **(1 mark each)**
- (ii) Marketing/Promotional Strategies **(2 marks)**
 - At least ONE strategy relevant to the target market is described and justified. **(1 mark for describing a relevant strategy and 1 mark for a suitable justification)**
- (iii) Sales Strategy **(1 mark)**
 - A suitable justification is provided for a named sale strategy.
- (iv) Distribution Strategy **(1 mark)**
 - Justification is provided for a named distribution strategy.

PRODUCTION PLAN

19

- (i) Production Methods **(4 marks)**
 - At least ONE production method is described **(1 mark)**
 - At least TWO factors which influenced the selected processing methods are outlined **(1 mark each)**
 - Environmental Factors - at least ONE relevant environmental factor to be considered is described **(1 mark)**
- (ii) HACCP plan **(8 marks)**

The plan identifies the following for TWO named hazards during processing:

 - a critical control point for the hazard during processing **(1 mark each)**
 - a suitable strategy for monitoring the hazard identified **(1 mark each)**

- a corrective action relevant to the hazard identified **(1 mark each)**
- a critical control limit associated with the corrective action identified **(1 mark each)**

(iii) Financial Plan (7 marks)

Production Costs (3 marks)

- a list of each item required for production and their cost **(1 mark for the list of items and 1 mark for the cost)**
- The overall production cost is accurate **(1 mark)**

Pricing of Product (4 marks)

- A suitable justification is provided for a named pricing strategy **(1 mark)**
- Calculation of the break-even cost is shown **(2 marks – 1 mark for correct working and 1 mark for the value calculated)**
- The final cost of the product is stated and **must** consider break even cost **(1 mark)**

TOTAL 30 marks

CRITERIA FOR THE SCHOOL-BASED ASSESSMENT (SBA) (Paper 030)

UNIT 2

This paper is compulsory and consists of a portfolio. Candidates have the option to work in small groups (maximum of 5 members in a group) to complete their SBA's

1. The aims of the portfolio are to:

- (a) develop candidates' abilities in managing animal production systems;
- (b) develop candidates' abilities to manage the process of animal slaughtering;
- (c) enable candidates to explore environmental issues in animal production;
- (d) develop candidates' abilities to design marketing plan for animal products;
- (e) develop candidates' abilities to investigate animal production activities;
- (f) develop candidates' ability to work collaboratively; and,
- (g) provide opportunities for all candidates to show, with confidence, that they have mastered the syllabus.

2. Requirements

- (a) The portfolio is a combination of written and practical work based on candidate's site experiences with animal production.

- (b) *Each portfolio should include:*
 - (i) *a report on practical activity (rearing and slaughtering of broiler birds);*
 - (ii) *mark sheet for practical activity (MUST include teacher's score and candidates' reflections);*
 - (iii) *a marketing plan; and,*
 - (iv) *a report of an investigation.*

3. *Integration of Portfolio into the Course*

- (a) *The activities related to portfolio work should be integrated into the course so as to enable candidates to learn and practise the skills of undertaking a successful portfolio.*
- (b) *Time should be allocated in class for general discussion of portfolio work.*
- (c) *Class time should also be allocated for discussion between teacher and student, and student and student.*

4. *Management of Portfolio*

(a) *Planning*

An early start to planning portfolio work is highly recommended and the schedule of the dates for submission should be developed by teachers and candidates.

(b) *Guidance*

Each candidate should know the requirements of the portfolio and its assessment process.

Although candidates may consult with resource persons besides the teacher the candidates' submission should be their own work.

Candidates are not expected to work on their own. The teacher is expected to give appropriate guidance at all stages of portfolio work, for example, chapters to read, alternative procedures to follow and other sources of information.

(c) *Authenticity*

Teachers are required to ensure that all portfolios are the candidates' work.

The recommended procedures are to:

- (i) *engage candidates in discussion;*
- (ii) *ask candidates to describe procedures used and summarise findings either orally or written; and,*
- (iii) *ask candidates to explain specific aspects of the analysis.*

REQUIREMENTS OF THE SCHOOL-BASED ASSESSMENT



Unit 2

Candidates will be required to *rear, slaughter and process a batch of broiler birds*, and produce a portfolio comprising a report on the *rearing of the birds*, *reflection on the slaughtering activity*, a marketing plan and the report of an investigation *carried out when rearing the birds*. The portfolio must include photographs of all activities undertaken.

The portfolio will be marked out of a total of 120 marks. Marks for the portfolio will be allocated across Modules in the ratio 1:1:1. The marks earned by a student are assigned to each Module. For example, if a student earns 110 out of 120 for his School-Based Assessment, 110 marks will be assigned to Module 1, 110 marks to Module 2 and 110 marks to Module 3. The total score will be 110+110+110= 330 out of 360.

CRITERIA FOR ASSESSING THE PORTFOLIO

Field Practical Activity (*from rearing to processing*)

Candidates will be required to rear a batch of broiler birds

Section A – Report on the Rearing of Broiler Birds

For each of the following areas listed below (i-iv), award **1 mark** for describing what was done and **1 mark** each for a suitable justification for each area. **NO mark** is awarded for only stating the concept. **Minus 50 percent from the candidate's earned total marks if photographs are not provided to show at least 9 of the activities undertaken (i-iv).**

- | | | |
|-------|--|-----------------|
| (i) | Preparation of Poultry Pen | 6 marks |
| | <ul style="list-style-type: none">- Sanitation (2 marks)- Security (2 marks)- Structure Maintenance (2 marks) | |
| (ii) | Brooding | 8 marks |
| | <ul style="list-style-type: none">- Selection of Litter (2 marks)- Nutrition equipment (2 marks)- Partitioning (2 marks)- Temperature Maintenance (2 marks) | |
| (iii) | Management Practices | 10 marks |
| | <ul style="list-style-type: none">- Nutrition Management<ul style="list-style-type: none">• Feeding (2 marks)• Watering (2 marks)• Supplements (2 marks)- Sanitation (2 marks)- Litter disposal (2 marks) | |
| (iv) | Preparation for Slaughter (2 marks) | 2 marks |

(v)	HACCP Plan for slaughtering, the plan identifies the following for TWO named hazards during processing:	8 marks
	- a critical control point for the hazard during processing (1 mark each) - a suitable strategy for monitoring the hazard identified (1 mark each) - a corrective action relevant to the hazard identified (1 mark each) - a critical control limit associated with the corrective action identified (1 mark)	
(vi)	Environmental Considerations	6 marks
	- Description of <i>THREE</i> environmental considerations during broiler processing post slaughter (1 mark each) - Suggest <i>ONE</i> benefits for <i>EACH</i> consideration suggested (1 mark each)	
	TOTAL	40 marks

Section B – Practical Activity

Award marks as follows for each activity

advanced skills demonstrated in the performance of the activities (5-6 marks)

essential skills are demonstrated but some areas require improvement (3-4 marks)

skills are performed with a low level of ability (1-2 marks)

(i)	Sanitation (Preparation for Slaughter) (6 marks)	
(ii)	Slaughtering (6 marks)	
(iii)	Dressing (6 marks)	
(iv)	Processing (6 marks)	24 marks

Teacher MUST include the candidate's earned total marks for the practical activities on the page with the candidate's reflection as this grade will NOT change during moderation

(i)	Reflection on Practical Activities	6 marks
	- <u>Challenges (4 marks)</u> • description of TWO challenges encountered (1 mark each) • description of how the TWO challenges were resolved (1 mark each) - <u>Recommendations (2 marks)</u> • TWO recommendations for successful slaughtering of broiler birds (1 mark each)	
	TOTAL	30 marks

Section C – Marketing Plan

Candidates will be required to prepare a marketing plan for an animal product

MARKETING ANALYSIS- Consumer Research

- | | | |
|-------|--|----------------|
| (i) | Sampling (2 marks) <ul style="list-style-type: none">- Comprehensive description of the sample (1 mark)- Relevant justification for the sample selected (1 mark) | 2 marks |
| (ii) | Questionnaire (2 marks) <ul style="list-style-type: none">- Questionnaire is designed to collect information on at least TWO elements of the marketing mix- product, place, price, promotion (1 mark)- Questionnaire is designed to collect information on quantity and timing (1 mark) | 2 marks |
| (iii) | Findings (6 marks) <ul style="list-style-type: none">- 3 marks for stating THREE findings from data analysis (1 mark each)- 3 marks for results presented (using charts and/or tables) to support each finding stated (1 mark each) | 6 marks |
| (iv) | Promotional Strategies (4 marks) <ul style="list-style-type: none">- At least TWO strategies relevant to the target market are described and justifications are linked to the results of market research (1 mark EACH for describing a relevant strategy and 1 mark for a suitable justification of EACH strategy). | 4 marks |
| (v) | Sales Strategy (2 marks) <ul style="list-style-type: none">- At least ONE strategy relevant to the target market is described and justified using the results of market research (1 mark for describing a relevant strategy and 1 mark for a suitable justification). | 2 marks |
| (vi) | Pricing Strategy (2 marks) <ul style="list-style-type: none">- At least ONE strategy relevant to the target market is described and justified using the results of market research (1 mark for describing a relevant strategy and 1 mark for a suitable justification) | 2 marks |
| (vii) | Distribution Strategy (2 marks) <ul style="list-style-type: none">- At least ONE strategy relevant to the target market is described and justified using the results of market research (1 mark for describing a relevant strategy and 1 mark for a suitable justification) | 2 marks |

TOTAL 20 marks

Section D – Report of an Investigation

For examples of activities for the Investigation, see pages 74-75.

- | | | |
|-------|---|----------------|
| (i) | Problem Statement <ul style="list-style-type: none">- The problem is clearly described (1 mark) | 1 mark |
| (ii) | Purpose of Investigation <ul style="list-style-type: none">- The purpose is clearly stated (1 mark)- The purpose is linked to the problem statement (1 mark)- The purpose gives clear direction for the investigation (1 mark) | 3 marks |
| (iii) | Methods of Data Collection <ul style="list-style-type: none">- Data collection design is clearly described. (1 mark)- Data collection is appropriate (1 mark)- Data collection method is adequately justified (1 mark) | 3 marks |
| (iv) | Literature Review <ul style="list-style-type: none">- Literature review is appropriate. (1 mark)- Literature review appropriate is comprehensive (cites at least 4 sources) (1 mark) | 2 marks |
| (v) | Presentation of Data <ul style="list-style-type: none">- Data presented are relevant to the purpose of the <i>investigation</i> (1 mark)- Data is presented in an appropriate form using tables, charts and graphs (1 mark) | 2 marks |
| (vi) | Analysis of Data
Summary of data (2 marks) <ul style="list-style-type: none">- All data presented are summarized accurately (2 marks)- There are inaccuracies in the data summarized (1 mark)
Link to data presented (2 marks) <ul style="list-style-type: none">- Analysis is related to the data presented (2 marks)- The link to the data presented is limited (1 mark) | 4 marks |
| (vii) | Discussion of Findings <ul style="list-style-type: none">- At least two findings related to the purpose of the data are presented (1 mark each)- Each finding is supported by data (1 mark each)- Reliability or validity, and usefulness of some findings is addressed (1 mark) | 5 marks |
| | Conclusions <ul style="list-style-type: none">- Clear conclusions based on finding(s) are presented (1 mark)- Conclusions is related to the purpose (s) of the <i>investigation</i> (1 mark) | 2 marks |
| | Recommendations <ul style="list-style-type: none">- At least TWO recommendations based on findings are presented (1 mark each) | 4 marks |

- Recommendations are related to the problem statement (**1 mark each**)

Communication of Information

2 marks

- Consistently used correct spelling and grammar (**1 mark**)
- Expression of ideas is clear unambiguous and in a logical manner (**1mark**)

Bibliography

2 marks

- At least 2 references written using a consistent convention (**1 mark**)
- At least 3-4 references written using a consistent convention (**2 marks**)

TOTAL 30 marks

*The activities listed below are to be used **ONLY** as a guide for the SBA task. Candidates are encouraged to modify the suggested activities or create their own other investigations based on the objectives in the syllabus.*

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:

- divide birds into four (4) groups (25 birds per pen);
- weigh birds on arrival (day old chicks) and record weights;
- thereafter weigh birds every week and record weights;
- 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)
- weigh refusals every morning and record. Weigh feed every morning before offering to birds and record;
- calculate weekly feed conversion ratio (FCR);

(FCR – feed consumed during a particular period divided by the weight gained during the same period);
- calculate FCR for the entire production period; and,
- 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; and,
- (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; and,
- (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; and,
- (h) explain any differences in the final weights among the groups.

GENERAL GUIDELINES FOR TEACHERS

1. 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 portfolio will be marked out of a total of 120 marks. Marks for the portfolio will be allocated across Modules in the ratio 1:1:1. The marks earned by a student are assigned to each Module. **Fractional marks should not be awarded.*** For example, if a student earns 110 out of 120 for his School-Based Assessment marks are allocated as follows:

110 marks will be assigned to Module 1, 110 marks to Module 2 and 110 marks to Module 3. The total score will be 110+110+110= 330.
 - (c) The standard of marking should be consistent.
2. 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

CAPE® candidates may reuse any moderated SBA score within a two-year period. 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 preliminary results if a candidate's moderated SBA score is less than 50 per cent in a particular Unit. Candidates reusing SBA scores should register as "Resit candidates" and must provide the previous candidate number when registering.



◆ 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 raw)	30 (15 raw)	30 (15 raw)	90 (45 raw)	(30)
Paper 02 (2 hours 30 minutes) Structured Essay Question	30	30	30	90	(30)
SCHOOL-BASED ASSESSMENT					
Paper 03 SBA (CVQ Level 2)	40 (120 raw)	40 (120 raw)	40 (120 raw)	120 (360 raw)	(40)
Total (Weighted)	100	100	100	300	(100)



◆ GLOSSARY OF EXAMINATION TERMS

<u>WORD</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
Analyse	Examine in detail.	<i>Break complex situations into separate parts and show how ideas are related.</i>
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	<i>Present</i> 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.
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 show appropriate detail where necessary.

<u>WORD</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
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.	
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. <i>Make a simple freehand diagram showing relevant proportions and any important details. Simplified representation showing the relationship between components.</i>	
Interpret	Explain the meaning of.	

<u>WORD</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
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.	
Name	Give only the name of.	No additional information is required.
Note	Pay attention to details; to examine and <i>write down</i> observations.	
Outline	Give basic <i>details</i> /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.	
State	Provide factual information in concise terms.	
Suggest/ <i>Recommend</i>	Offer an explanation deduced from information provided or previous knowledge. (... a hypothesis; provide a generalization which offers a likely explanation for a set of data or observations.)	suggestions must be 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; and,
- (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. | Poultry | - | broilers -100 once per term |
| 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; and, |
| | | - | 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/weedcides; and,
 - (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; and,
 - measuring instruments - tapes, rulers, pH meter.
4. Visual Aids
 - access to:
 - multimedia projector; and,
 - computer.

Western Zone Office
24 August 2022

CARIBBEAN EXAMINATIONS COUNCIL

Caribbean Advanced Proficiency Examination[®]
CAPE[®]



AGRICULTURAL SCIENCE

Specimen Papers and Mark Schemes/Keys

Specimen Papers, Mark Schemes and Keys:

Unit 1 Paper 01
Unit 1 Paper 02
Unit 2 Paper 01
Unit 2 Paper 02



TEST CODE **02102010**

SPECIMEN 2022

CARIBBEAN EXAMINATIONS COUNCIL
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®
AGRICULTURAL SCIENCE

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. In addition to this test booklet, you should have an answer sheet.
3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.
4. 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.
5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

Sample Item

Open-leaf lettuce planted on 16 May
should be harvested by

- (A) 30 May
(B) 06 June
(C) 13 June
(D) 20 June

Sample Answer



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

6. If you want to change your answer, erase it completely before you fill in your new choice.
7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.
8. You may do any rough work in this booklet.
9. Figures are not necessarily drawn to scale.
10. You may use a silent, non-programmable calculator to answer items.

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

1. Which of the following systems of farming utilizes very little land for crop production?
- (A) Intensive
 - (B) Extensive
 - (C) Subsistence
 - (D) Semi-intensive
2. Modernization of agriculture in the Caribbean
- I. utilizes research in order to gain technical knowledge
 - II. reduces manual work which leads to increased profits
 - III. makes use of sustainable energy and practices
- (A) I and II only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II and III
3. Which of the following statements is correct in relation to digestion in farm animals?
- (A) Rabbits chew the cud during the day.
 - (B) Rabbits complete digestion by coprophagy.
 - (C) Poultry digest grass by grinding it in the gizzard.
 - (D) The absorption of nutrients mainly takes place in the stomach of farm animals.
4. John wanted to plant tomatoes. He was advised that he needs to conduct soil tests to know the pH and the nutrient status of the soil in the area selected.
- With which branch of agriculture would this activity be associated?
- (A) Agronomy
 - (B) Horticulture
 - (C) Agricultural engineering
 - (D) Agricultural economics
5. Which of the following is the LARGEST endocrine gland in farm animals?
- (A) Thyroid
 - (B) Adrenal
 - (C) Pancreas
 - (D) Pituitary
6. The light-dependent reaction of photosynthesis occurs in the
- (A) stroma
 - (B) thylakoid
 - (C) leaf stoma
 - (D) leaf cuticle
7. A farmer constructed a poultry house at a cost of \$ 30 000 and it will depreciate annually by 7%.
- What is the cost of depreciation in the fourth year, if the straight-line method is used?
- (A) \$2 100
 - (B) \$4 200
 - (C) \$6 300
 - (D) \$8 400

GO ON TO THE NEXT PAGE

8. Which of the following hormones is responsible for milk let down?
- (A) Oxytocin
 - (B) Prolactin
 - (C) Oestrogen
 - (D) Progesterone
9. Some young farmers wanted to start producing juices. The farmers went to a lending agency and were denied a loan as they did not present an adequate business plan.
- Which of the following are MOST likely the challenges with the business plan presented?
- I. The product is inadequately described.
 - II. Poor marketing strategies to be employed.
 - III. Sources from which the money is borrowed are not listed.
- (A) I and II only
 - (B) II and III only
 - (C) I and III only
 - (D) I, II and III
10. The equilibrium price is the price at which demand and supply are equal. At this price the
- (A) cost of production will determine the demand
 - (B) same quantity will be supplied as is demanded
 - (C) quantity demanded for another commodity decreases
 - (D) quantity demanded for another commodity increases
11. The nitrogen cycle contribute to crop growth when
- I. waste materials decompose and provide nutrients
 - II. nitrites are converted to nitrates, to provide nutrients
 - III. the roots of legumes use fungi to produce nitrogen and provide nutrients
- (A) I and II only
 - (B) II and III only
 - (C) I and III only
 - (D) I, II and III
12. Which of the following is LEAST likely to improve soil fertility for a soil which has a low cation exchange capacity?
- (A) Add inorganic fertilizer to the soil.
 - (B) Incorporate organic manure into the soil.
 - (C) Carry out deep ploughing on the plot of land.
 - (D) Increase irrigation to the plot when growing crops.
13. Ruminants can digest cellulose by the action of millions of microbes in their rumen. How does the digestion of cellulose benefit the ruminants?
- (A) It synthesizes B complex vitamins.
 - (B) It synthesizes carbon dioxide and methane.
 - (C) It produces essential amino acids for growth.
 - (D) It provides volatile fatty acids to assist with movement.

GO ON TO THE NEXT PAGE

14. Which of the following allows free movement of labour and the expansion of trade with other states?

(A) World Trade Organization (WTO)
(B) African, Caribbean and Pacific Countries (ACP)
(C) CARICOM Single Market and Economy (CSME)
(D) North American Free Trade Agreement (NAFTA)

15. Phototropism is BEST defined as

(A) the movement of plants towards light
(B) the movement of plants towards water
(C) the movement of plants towards gravity
(D) the movement of plants towards fertilizer

Item 16 refers to the following information.

Farmer Ken grew 50 lettuce seedlings in his shade house and 50 lettuce seedlings in his open field. He noticed that the lettuce in the shade house produced heads with more leaves and that the leaves were larger than those grown in the open field.

16. He deduced that the reasons for these differences may be that

I. the lettuce grown in the shade house was less affected by pests and diseases
II. the shade house provided higher humidity for the lettuce than the open field
III. transpiration of the lettuce plants is greater in the shade house than in the open field
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

17. The branch of horticulture that deals with the production, storage, processing and marketing of vegetables is called

(A) viticulture
(B) floriculture
(C) olericulture
(D) arboriculture

18. A farmer observed that his bushy tomato plants were lying on the ground. Also, after harvesting many of the fruits were damaged. He was told by the extension officer that he needs to pay more attention to his cultural practices.

Which of the following cultural practices would BEST rectify this problem?

(A) Staking and pruning
(B) Moulding and pruning
(C) Staking and moulding
(D) Mulching and pruning

19. The management practice credited for increasing soil moisture, improving soil structure and encouraging the presence of soil microorganisms is called

(A) aerating
(B) moulding
(C) mulching
(D) irrigating

20. Which of the following is NOT true of organic farming?

(A) Organic foods are more nutritious than other foods.
(B) Organic farming aims to produce superior quality products using little or no chemicals.
(C) Organic farming seeks to inspire environmentally friendly cultivation and production.
(D) Organic farmers are required to have specific knowledge about localized growing systems.

GO ON TO THE NEXT PAGE

21. Which of the following is NOT a benefit of agroforestry?

- (A) A practical method of integrated land management.
- (B) The use of ecologically diverse output from the land.
- (C) The fast-growing species and hybrids result in quick economic returns.
- (D) A method of promoting sustainable and renewable forest management.

22. Which socioeconomic factor has the LEAST impact on the ornamental horticulture industry in the Caribbean?

- (A) Aesthetic
- (B) Recreational
- (C) Entrepreneurial
- (D) Medicinal health

23. A farmer observed that his crop yields have been declining over the last five years. The extension officer suggested that he implement more soil and water conservation measures on his farm.

These measures are likely to be beneficial because they aim to

- I. maintain and improve soil fertility
- II. control water runoff and prevent soil erosion
- III. utilize residual materials and increase microorganisms in the soil

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

Items 24 and 25 refer to the following image.



24. The activity shown in the image usually takes place when carrying out

- (A) budding
- (B) grafting
- (C) air layering
- (D) simple layering

25. A plant technician would remove the cambium layer to

- (A) ensure that the shoot does not die
- (B) remove diseased tissue from the plant stem
- (C) increase the time taken for the shoot to produce roots
- (D) prevent water and mineral salts from getting to the top of the stem

26. Which of the following ornamental plants are NOT produced from offshoots?

- (A) Roses
- (B) Orchids
- (C) Anthuriums
- (D) Ginger lilies

27. Which of the following is the vegetative organ that could be BEST used to cultivate new banana plants?
- (A) Bulb
 - (B) Corn
 - (C) Sucker
 - (D) Rhizome
28. Which of the following crop rotation sequences would be BEST for a vegetable farmer?
- (A) Leaf → fruit → root → legume
 - (B) Leaf → legume → root → fruit
 - (C) Leaf → root → legume → fruit
 - (D) Leaf → fruit → legume → root
29. Water usage is very important for farmers. Which of the following does NOT support economical water usage?
- (A) Recycling of water used for cleaning the milking station
 - (B) Drip irrigation for tomato plants in an open field
 - (C) Growing plants in a hydroponic system
 - (D) Sprinklers used to water a crop of yams
30. Which of the following sequences of activities is BEST suited for the preparation of land for the establishment of lawns?
- (A) Grading, ploughing, levelling, irrigating
 - (B) Ploughing, grading, levelling, irrigating
 - (C) Grading, levelling, ploughing, irrigating
 - (D) Ploughing, levelling, grading, irrigating
31. Storage is one of the components of postharvest management. Which of the following is important for the proper storage of crops?
- (A) Handling
 - (B) Humidity
 - (C) Sanitation
 - (D) Transportation
32. Postharvest losses are most likely to occur during the process of
- (A) storage
 - (B) labelling
 - (C) packaging
 - (D) transportation
33. Which of the following measures BEST ensures that crops do not become contaminated?
- (A) Wash produce using suitable detergent.
 - (B) Reuse containers that are in good condition.
 - (C) Place produce in a cool, dry area after harvesting.
 - (D) Remove damaged produce before placing in storage.
34. Which of the following methods helps to extend the shelf-life of crop commodities?
- (A) Packing of produce in refrigerated trucks
 - (B) Packing of produce on the floor of open trucks
 - (C) Packing of produce in boxes or sacks on open trucks
 - (D) Packing of produce in moulded crates on refrigerated trucks

GO ON TO THE NEXT PAGE

35. The drying of cassava is a suitable method of processing MOST likely because it

(A) destroys microorganisms
(B) removes the excess moisture
(C) makes the cassava more expensive
(D) improves the taste of the cassava

36. The agro-processing plant received an oversized container of vegetables from A-1 Farms for processing.

What damage to the vegetables would MOST likely occur?

(A) Punctures
(B) Heat damage
(C) Compression
(D) Chilling damage

37. A supermarket complained that the produce received from a farm was discoloured, squashed and decayed from physical damage. The damage MOST likely occurred during

(A) storage
(B) cleaning
(C) packaging
(D) transporting

38. Which of the following is NOT considered a part of the four P's of marketing?

(A) Place
(B) Price
(C) People
(D) Promotion

39. Which of the following microorganisms is the LEAST likely reason why cut flowers are kept cool?

(A) Slows down chemical damage to flowers.
(B) Prevents flowers from continuing to bloom.
(C) Prevents flowers from going past their best date.
(D) Consumers can enjoy the blooms for a longer time.

40. Which postharvest method is NOT appropriate for the following ornamental plants?

(A)	Roses	Place flower stems in clean water with a preservative.
(B)	Orchids	Flowers are placed in special tubes filled with water to support stem.
(C)	Anthuriums	Stored in a cool area and graded according to size, colour and injury.
(D)	Ginger lilies	Flowers are placed in buckets of clean water with basal ends upwards.

GO ON TO THE NEXT PAGE

41. Clarke's Factory provides a variety of pepper sauces to consumers locally and internationally. The company has a consistent supply of ingredients and needs to utilize the best processing method to stop the growth of microorganisms.

Which of the following methods should the business utilize?

- (A) Drying
- (B) Bottling
- (C) Pickling
- (D) Freezing

42. The market has various vendors selling a variety of fruits and vegetables. Sales are consistent but some vendors decided that in order to improve their sales they would place their original price next to the sale price.

Which of the following BEST describes the pricing strategy being adopted by some of the vendors?

- (A) Loss-leader pricing
- (B) Penetration pricing
- (C) Competitive pricing
- (D) Physiological pricing

43. Rawlins Lab intends to process fruit crops to create a variety of products. One of the HACCP principles indicates the importance of identifying possible hazards during the processing of products.

At which stage of the process is a chemical hazard MOST likely?

- (A) Cooking
- (B) Packaging
- (C) Cold storage
- (D) Receiving of raw goods

44. The abattoir has been having problems with its electricity and is concerned about the quality of its meats. It decides to discard all meat on hand.

Which of the following principles describes the action taken by the abattoir?

- (A) Establish critical limits
- (B) Establish corrective actions
- (C) Identify Critical Control Point's
- (D) Monitor Critical Control Point's

45. A market challenger is MOST likely to be come a market leader by

- (A) creating an improved product
- (B) increasing promotional activities
- (C) matching the prices of the marketing lead
- (D) becoming the supplier of the marketing lead

END OF TEST

Item	Specific Objective	Key		Item	Specific Objective	Key
1	1.1.2	A		26	1.2.7	A
2	1.1.3	D		27	1.2.9	C
3	1.1.6	B		28	1.2.10	A
4	1.1.1	A		29	1.2.11	D
5	1.1.4	C		30	1.2.4	B
6	1.1.7	B		31	1.3.1	A
7	1.1.10	A		32	1.3.1	D
8	1.1.4	A		33	1.3.4	A
9	1.1.11	A		34	1.3.1	D
10	1.1.10	B		35	1.3.4	B
11	1.1.8	A		36	1.3.2	C
12	1.1.9	B		37	1.3.2	A
13	1.1.6	D		38	1.3.3	A
14	1.1.12	C		39	1.3.5	C
15	1.1.7	A		40	1.3.3	D
16	1.2.11	A		41	1.3.4	B
17	1.2.1	C		42	1.3.5	C
18	1.2.2	A		43	1.3.6	B
19	1.2.2	C		44	1.3.6	D
20	1.2.3	A		45	1.3.5	A
21	1.2.5	C				
22	1.2.6	D				
23	1.2.5	D				
24	1.2.8	C				
25	1.2.8	D				

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

AGRICULTURAL SCIENCE

SPECIMEN 2022

TABLE OF SPECIFICATIONS

Unit 1

Paper 02

Module	Question	Specific Objectives	Content	Skills	
				KC	UK
1	1 (a)	1.1.2	- Farming systems	8	
	1 (b)	1.1.10	- Business concepts	-	10
	1 (c)	1.1.3	- Modernization of Agriculture	-	12
			30 marks	8	22
2	2 (a)	1.2.3	- Non-conventional crop farming systems	8	
	2 (b)	1.2.10	- Crop rotation	-	10
	2 (c)	1.2.12	- Climate smart agriculture	-	12
			30 marks	8	22
3	3 (a)	1.3.1	- Postharvest management	8	
	3 (b)	1.3.4	- Processing crops	-	10
		1.3.6	- Food safety		
	3 (c)	1.3.4 1.3.6	- Manufacturing practices - Food safety	-	12
			30 marks	8	22
Grand Total 90 marks				24	66

KC - Knowledge and Comprehension
UK - Use of Knowledge

SPECIMEN 2022



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

C A R I B B E A N A D V A N C E D P R O F I C I E N C Y E X A M I N A T I O N[®]

A G R I C U L T U R A L S C I E N C E

UNIT 1 – Paper 02

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Answer ALL questions.
2. Write your answers in the spaces provided at the end of each question in this booklet.
3. Do NOT write in the margins.
4. You may use a silent, non-programmable calculator to answer questions.
5. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
6. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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

Copyright © 2021 Caribbean Examinations Council
All rights reserved.

02102020/CAPE/SPEC 2022

“*”Barcode Area*”
Sequential Bar Code

Module 1 — The Science and Business of Agriculture

1. (a) (i) State TWO characteristics of an intensive farming system.

.....

.....

.....

.....

[2 marks]

- (ii) List THREE advantages and THREE disadvantages of an intensive farming system.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

GO ON TO THE NEXT PAGE

(b) The price of tomatoes fell from \$10 per kg to \$4 per kg within a month.

(i) Outline THREE possible reasons for the reduction in the price of tomatoes.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

(ii) As a result of the drop in the price of tomato, a farmer decided to produce tomato paste. The farmer estimated that it would cost \$20 000 to produce 150 bottles of paste. He intends to sell a bottle of paste for \$115 per bottle.

Calculate the breakeven cost for the product. You must include an interpretation of the breakeven cost in light of the proposed selling price of \$115.

.....

.....

.....

.....

.....

.....

[4 marks]

GO ON TO THE NEXT PAGE

- (c) The Ministry of Agriculture would like farmers to utilize more modern agricultural practices aimed at increasing the efficiency of crop production.

In an essay of 250–300 words, evaluate THREE modern agricultural practices which can be utilized by farmers in the Caribbean.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

GO ON TO THE NEXT PAGE

[12 marks]

GO ON TO THE NEXT PAGE

Module 2 — Horticultural Practices

2. (a) Figure 1 shows a simple hydroponic system.

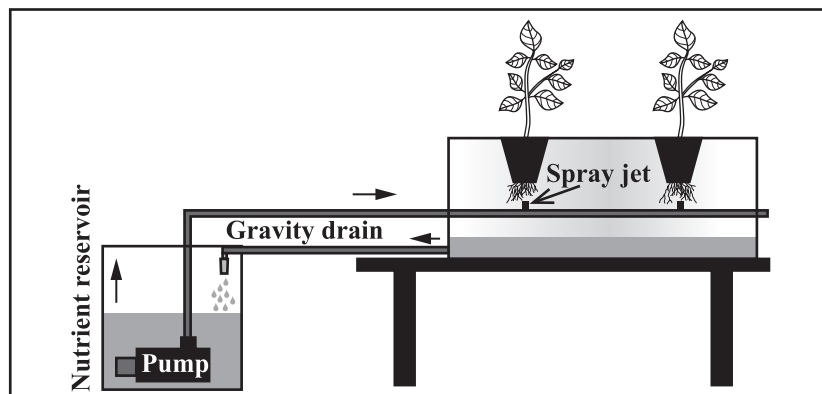


Figure 1. Simple hydroponic system

- (i) Outline the function of the water pump in Figure 1.

.....
.....
[2 marks]

- (ii) List THREE growing mediums that can be used in a hydroponic system.

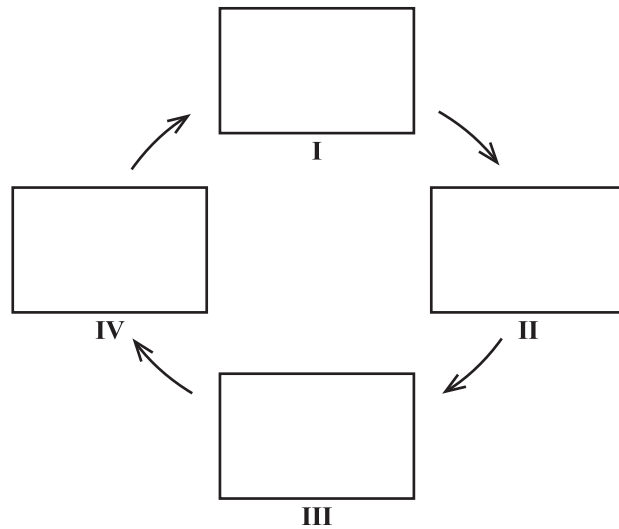
.....
.....
[3 marks]

- (iii) List THREE benefits of a hydroponic system to a farmer.

.....
.....
.....
.....
.....
[3 marks]

GO ON TO THE NEXT PAGE

- (b) (i) Complete the following flow chart to illustrate a suitable sequence for a crop rotation system for a farmer who cultivates cabbages, sweet potatoes, beans and tomatoes.



[4 marks]

- (ii) Explain TWO benefits of using crop rotation systems.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

GO ON TO THE NEXT PAGE

- DO NOT WRITE IN THIS AREA**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

[12 marks]

GO ON TO THE NEXT PAGE

Module 3 — Postharvest Technology

3. (a) (i) Define the term ‘postharvest management’.

.....

.....

.....

[2 marks]

- (ii) State TWO principles governing postharvest management.

.....

.....

.....

.....

[2 marks]

- (iii) Outline TWO postharvest activities.

.....

.....

.....

.....

.....

.....

[4 marks]

GO ON TO THE NEXT PAGE

- (b) The Clarke family plans to expand its hot pepper business to include the processing the hot peppers to create a hot pepper sauce.

- (i) Outline the steps that would be involved in the bottling of hot pepper sauce.

.....

.....

.....

.....

.....

.....

[4 marks]

- (ii) Recommend TWO corrective measures for TWO **named** hazards that may occur during the production of pepper sauce. Give ONE reason for EACH recommendation provided.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

GO ON TO THE NEXT PAGE

- DO NOT WRITE IN THIS AREA**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

[12 marks]

END OF TEST

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

GENERAL PROFICIENCY

KEY AND MARK SCHEME

MAY/JUNE 2021

AGRICULTURAL SCIENCE

SPECIMEN PAPER

UNIT 1 - PAPER 02

KEY AND MARK SCHEME

Question 1

(a) (i) **Characteristics of intensive farming system**

- Little land use or landless farming
- Greater use of inputs – increased need for capital and labour – fertilizer, pesticides, and high-efficient technologies (machinery/equipment)
- Higher crop yields per unit land area, increased animal productivity
- Use of scientific and modern methods leading to higher production
- Higher use of supplementary feeds for livestock and inorganic fertilizers for crop production
- **Any other relevant characteristic**

Any two stated, 1 mark each = 2 marks (KC)

(ii) **Advantages of intensive farming systems**

- Higher crop yields
- Greater variety in crops produced
- It is less expensive
- More efficient land use
- **Any other relevant advantage**

Any 3, 1 mark each = 3 marks (KC)

Disadvantages of intensive farming systems

- Insufficient space for animals
- Risks to human health
- Negative environmental impact
- Possible negative impact on food quality
- **Any other relevant disadvantage**

Any 3, 1 mark each = 3 marks (KC)

AGRICULTURAL SCIENCE
SPECIMEN PAPER
UNIT 1 - PAPER 02
KEY AND MARK SCHEME

Question 1 continued

(b) (i) **Possible reasons for the reduction in the prices of tomatoes**

- An abundance/ glut of tomatoes on the market may lead to a reduction in the price of tomatoes **(1)** as farmers drop the prices to guarantee the products are sold **(1)**.
- A change in taste or preference **(1)**. Consumers no longer demand tomatoes/They prefer another commodity **(1)**.
- A change in income **(1)**. Consumers demand fewer tomatoes because of an increase or decrease in their income **(1)**.
- **Any other plausible reason**

Award 1 mark for only stating the reason

Award 2 marks for a complete outline

Any 3, 2 marks each

6 marks (UK)

(ii) **Breakeven cost**

The breakeven cost

= \$20 000 / 160 **(1 mark)**

= \$125 for each bottle **(1 mark)**

When the bottles are sold at \$115 the farmer, the farmer would operate at a loss **(1 mark)** because the price would be below the cost of producing each bottle **(1 mark)**.

1 mark for cost of production/number of bottles

1 mark for the correct calculation

1 mark for identifying loss

1 mark for linking loss to break even cost

4 marks (UK)

AGRICULTURAL SCIENCE
SPECIMEN PAPER
UNIT 1 - PAPER 02
KEY AND MARK SCHEME

Question 1 continued

(c) **Modern agricultural practices to include but not limited to**

Intensive tillage has benefited crop production by creating a surface that is appropriate for seeding or planting. This practice destroys weeds, mixes fertilizers and organic materials into the soil profile, breaks up plough hardpans and surface crusts and improves air and water movement, soil temperature and residue decay. Nevertheless, deterioration of soil structure leading to soil crusting and subsurface plough pans can lead to increased erosion of soil destruction of soil microorganisms.

Synthetic fertilizers speed up the growth process of the plants because they are fast-acting and aid plants in severe distress from nutrient deficiencies. They are usually dry granular pellets which make them easy to apply. They are designed to provide even, consistent release of nutrients to the soil. Overuse of synthetic fertilizers over time can deplete soils of natural microorganisms and nutrients. Heavy applications can burn plants and build up toxic salt concentrations in the soil.

Advances in irrigation technologies are used to supply water to crops during times of dry weather/droughts/insufficient natural rainfall for growing most crops. Irrigation has greatly boosted the food supply. Drawing water from underground wells, building reservoirs and distribution canals and diverting rivers have improved yields and increased the area of available farmland. However, excessive seepage into the ground raises the water table and this in turn completely saturates the crop root zone which causes waterlogging, lowers the temperature, and makes the locality damp, which reduces the aeration of the soil.

Any other modern practice

For EACH modern practice evaluated, award marks as follows

Benefits

- **2 marks** - Candidate **elaborates** on accurate and relevant points which support the benefits of the practice. Award 1 mark for only stating a benefit.

Limitations

- **2 marks** - Candidate elaborates on accurate and relevant points which support the limitations of the practice. Award 1 mark for only stating a limitation.

**4 marks each for THREE modern practices
12 marks (UK)
Total 30 marks**

AGRICULTURAL SCIENCE

SPECIMEN PAPER

UNIT 1 - PAPER 02

KEY AND MARK SCHEME

Question 2

(a) (i) **Function of the air pump**

- The air pump moves the solution from the reservoir into the growing tray **(1 mark)** to carry nutrients to the plant roots **(1 mark)**.

2 marks (KC)

(ii) **Growing mediums**

- Perlite
- Vermiculite
- Sand
- Coconut coir
- Clay pellets
- Gravel
- Rook wool
- Shredded plastic containers
- Rice hull/husks
- **Any other relevant growing medium**

Any three, 1 mark each = 3 marks (KC)

(iii) **Benefits of a hydroponic system to a farmer**

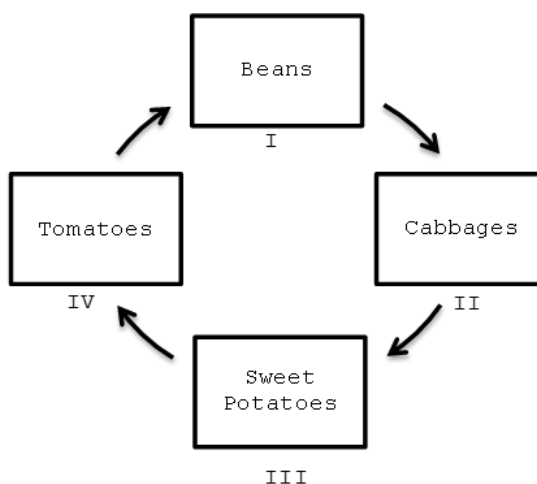
- Saves water/uses less water because water is reused or recirculated.
- Optimal use of nutrients/plants are given the nutrients required at different stages of growth
- Control of environmental conditions by adjusting temperature, light, intensity, humidity levels, allowing for year-round growing of crops.
- Faster growth rate of crops because farmers control parameters such as temperature, light, moisture and nutrients because nutrients are in direct contact with the root system.
- Zero weeds. No need to use manual, mechanical or chemical methods to control weeds.
- Fewer pests and diseases. Soil-borne pests and diseases are eliminated.
- Less use of chemicals (pesticides) because there are less pests and diseases/clean, healthy crops are grown.
- **Any other benefit**

Any three, 1 mark each = 3 marks (KC)

AGRICULTURAL SCIENCE
SPECIMEN PAPER
UNIT 1 - PAPER 02
KEY AND MARK SCHEME

Question 2 continued

(b) (i) **Crop rotation system**



1 mark for each crop in the correct sequence for a maximum of 4 marks

4 marks (UK)

(b) (ii) **Benefits of crop rotation system**

- Crop rotation helps with the depletion of nutrients available to crops in the soil **(1 mark)**. Some crops use a fair quantity of nutrients while others use less nutrients **(1 mark)**. The rotation of the crops prevents the depletion which would occur if one type of crops which require larger quantities of nutrients was the only ones being cultivated **(1 mark)**.
- Crop rotation makes the soil more nutrient rich **(1 mark)**. Crops like legumes add nutrients to the soil **(1 mark)**. Leafy crops planted after legumes benefit from the nitrogen left behind by the legumes **(1 mark)**.
- Crop rotation is useful for the control of pests and diseases **(1 mark)**. crops are affected by different pests and diseases **(1 mark)**. The use of crop rotation prevents the build-up of pests and disease-causing agents **(1 mark)**.
- **Any other relevant benefit**

Any 2 benefits, 3 marks each

3 marks, full explanation (with relevant supporting points)

2 marks, explanation which needed more development

1-mark, limited explanation (stating/no support/inaccuracies)

6 marks (UK)

AGRICULTURAL SCIENCE

SPECIMEN PAPER

UNIT 1 - PAPER 02

KEY AND MARK SCHEME

Question 2 continued

(c) **Climate Smart Agricultural Practices**

Terracing is climate smart as it protects the environment by preventing soil erosion and protects farmers from loss. Planting in alternate bands on slopes/hilly areas helps to control water flow as water fills into one ridge and then the other. This also allows for proper drainage of soil which will prevent plants from becoming waterlogged. In the Caribbean there are areas which are prone to flooding where farmers could be encouraged to utilize more hilly areas for crop production.

Water retention ponds involves the creation of areas to safely store large amounts of water during heavy rainfalls and helps to prevent flooding. The use of water retention ponds prevents the complete destruction of crops thus reducing the impact of flooding on crop production. There is also an additional benefit where the water collected can be used during drought periods. The use of water ponds in the Caribbean is applicable because the Caribbean struggled with flooding as well as droughts.

Vegetative Barriers involve the use of strips of vegetation used along concentrated flow areas. The strips help to reduce erosion and manage water flows so that farmers are not impacted by flooding. Vegetative barriers ensure that crops are protected from excess water which can destroy the crops. The use of vegetative barriers would be useful in the Caribbean, though intended for use on a slope, the barriers could also be used to restrict the movement of water to an area for flatter surfaces.

Any other relevant climate smart technology discussed

For EACH climate smart technology discussed, award marks as follows

- **4 marks** - Candidate presents a **complete** discussion. The candidate effectively **elaborates** on at least four accurate and relevant points.
- **3 marks** - Candidate presents a **satisfactory** discussion. Candidate effectively **elaborates** on three accurate and relevant points.
- **2 marks** - Candidate presents a **partial** discussion. Candidate presents **three to four** relevant points but does **not** elaborate **OR** Candidate elaborates on **two** accurate and relevant points.
- **1 mark** - Candidate presents a **limited** discussion. Candidate presents at least **one to two** relevant points but does **not** elaborate **OR** Candidate elaborates on at least **one** accurate and relevant point.

**4 marks each for THREE climate smart technologies
12 marks (UK)**

Total 30 marks

AGRICULTURAL SCIENCE

SPECIMEN PAPER

UNIT 1 - PAPER 02

KEY AND MARK SCHEME

Question 3

(a) (i) **Definition of postharvest management**

Postharvest management is a system of handling, storing, and transporting agricultural commodities after harvest.

1 mark for a partial definition
2 marks for a complete definition
Any one = 2 marks (KC)

(ii) **Principles governing postharvest management**

- Food safety
- Reduction of loss
- Maintaining quality

Any two, 1 mark each = 2 marks (KC)

(iii) **Components of postharvest management**

- **Storage** involves selecting appropriate measures to maintain quality of produce.
- **Sorting** involves manually inspecting crops to remove crops that have been damaged.
- **Cleaning** involves the removal of substances which can host disease causing organisms.
- **Any other relevant activity**

1 mark for identifying the component
1 mark for related description
Any two, 2 marks each = 4 marks (KC)

AGRICULTURAL SCIENCE

SPECIMEN PAPER

UNIT 1 - PAPER 02

KEY AND MARK SCHEME

Question 3 continued

(b) (i) **Steps involved in the canning/bottling of hot pepper sauce**

- Set a pot or water bath canner with a canning rack on a stove.
- Wash jars and place them in the pot/canner. Add water and boil the jars for ten minutes to sterilize.
- Heat canning lids in a small pot over low heat. Keep canning jars and lids warm until they are ready to use.
- Strain the sauce through a fine sieve for a smoother sauce or pour into bottles for a thicker sauce.

1 mark for each correct step in sequence = 4 marks (UK)

(ii) **Corrective measures**

- Discard pepper sauce batch and make a fresh batch **(1 mark)** correct for physical hazards such as pepper stems, dirt, pieces of glass or metal, toothpicks, jewellery, or hair are seen in the sauce **(1 mark)**. The presence of debris in canned/ bottled food can cause physical harm to consumers **(1 mark)**.
- Manage site of contamination by promptly sorting crop items to remove produce that was not contaminated **(1 mark)** as a corrective measure for chemical hazards **(1 mark)**. Chemical can cause harm to human health **(1 mark)**.
- **Any other relevant corrective actions.**

1 mark for naming a hazard

1 mark or a relevant corrective measure

1 mark for a reason for the measure suggested

3 marks each = 6 marks

AGRICULTURAL SCIENCE
SPECIMEN PAPER
UNIT 1 - PAPER 02
KEY AND MARK SCHEME

Question 3 continued

(c) **Manufacturing practices that help to prevent spoilage and contamination**

- Proper sanitation is critical when processing crop commodities. The objective of proper sanitation is to provide customers with a product that is attractive clean, and with minimal risk of microbial contamination. The processing area needs to be clean from debris, and tools, equipment and surfaces need to be sanitized after use. Proper sanitation helps to guarantee that food can be consumed safely and protects the consumers from food related illnesses.
- Proper storage is important as it extends the shelf life of the product. Proper storage slows down the product respiration rate or minimizing moisture loss from the product and reducing the risk of microbial growth. Storage areas are to be kept clean, cool, and dry as microorganisms grow in conditions which are not suitable. It is also important to store produce in containers used solely for produce and no other purpose to prevent contamination.
- Temperature must be monitored when processing crop commodities to prevent spoilage as it helps to manage bacterial growth. It is important to cook food properly as cooking kill all or most bacteria. Keeping food hot after cooking prevents the most dangerous bacteria from growing. Food cooked in water should be cooked in boiling water and kept in that water long enough for all of it all to reach a temperature high enough to kill bacteria.

Any other relevant practice discussed

For EACH practice discussed, award marks as follows

- **4 marks** - Candidate presents a **complete** discussion. The candidate effectively **elaborates** on at least four accurate and relevant points.
- **3 marks** - Candidate presents a **satisfactory** discussion. Candidate effectively **elaborates** on three accurate and relevant points.
- **2 marks** - Candidate presents a **partial** discussion. Candidate presents **three to four** relevant points but does **not** elaborate **OR** Candidate elaborates on **two** accurate and relevant points.
- **1 mark** - Candidate presents a **limited** discussion. Candidate presents at least **one to two** relevant points but does **not** elaborate **OR** Candidate elaborates on at least **one** accurate and relevant point.

**4 marks each for THREE practices
12 marks (UK)**

Total 30 marks



TEST CODE **02202010**

SPECIMEN 2022

CARIBBEAN EXAMINATIONS COUNCIL
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®
AGRICULTURAL SCIENCE

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. In addition to this test booklet, you should have an answer sheet.
3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.
4. 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.
5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

Sample Item

Which of the following is NOT a threat to the environment posed 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 (A) has been shaded.

6. If you want to change your answer, erase it completely before you fill in your new choice.
7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.
8. You may do any rough work in this booklet.
9. Figures are not necessarily drawn to scale.
10. You may use a silent, non-programmable calculator to answer items.

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

1. Which of the following gases is NOT considered a green house gas?
 - (A) Methane
 - (B) Nitrogen
 - (C) Hydrogen
 - (D) Carbon dioxide
2. Which of the following is responsible for monitoring air pollution?
 - (A) MARPOL
 - (B) UNCLOS
 - (C) Kyoto Protocol
 - (D) Paris agreement
3. Which of the following recommendations can be emphasized to farmers so as to reduce air pollutant emissions from the use of machinery?
 - I. Utilize alternative fuels.
 - II. Eliminate the use of fossil fuels.
 - III. Utilize renewable energy sources.
 - (A) I and II only
 - (B) II and III only
 - (C) I and III only
 - (D) I, II and III
4. Agrotourism is important to farmers and by extension to the economies of the Caribbean because it
 - (A) is a complementary source of income
 - (B) is a new way to market agricultural products
 - (C) encourages farmers to give tours of their farm
 - (D) links agricultural production or processing with tourism
5. The clearing of forests is a necessary activity for the production of food but it also results in the destruction of habitats and ecosystems.

Which of the following will have the LEAST impact on the destruction of habitats and ecosystems?

 - (A) Green spaces
 - (B) Organic farming
 - (C) Integrated farming
 - (D) Regulations for land use
6. The Montreal Protocol is a treaty that is aimed at
 - (A) reducing greenhouse gases
 - (B) eliminating global warming
 - (C) reducing the carbon footprint
 - (D) eliminating ozone-depleting substances
7. After a two-year moratorium on hunting, the population of neo-tropical animals has not recovered.

Which of the following strategies would MOST likely increase the population of neo-tropical animals?

 - (A) Reduction of bag limits
 - (B) Enforcement of hunting laws
 - (C) Establishment of national parks
 - (D) Reduction in the number of hunting permits issued

GO ON TO THE NEXT PAGE

8. Which agricultural operation contributes to the rapid production of the greenhouse gas methane?
- (A) Aquaculture
 - (B) Livestock feedlot
 - (C) Poultry production
 - (D) Vegetable production
9. Sediments from crop cultivation on sloping land contribute to water pollution. Which of the following methods would MOST likely reduce this type of water pollution?
- I. Fallowing
 - II. Strip cropping
 - III. Riparian buffers
- (A) I and II only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II and III
10. Which of the following is NOT a measure that will improve air quality?
- (A) rotating crops
 - (B) reducing tillage
 - (C) planting cover crops
 - (D) covering soil with manure
11. Which of the following can assist in the reduction of water pollution due to pesticide use?
- (A) Use a well-calibrated spray-can.
 - (B) Follow the manufacturers' instructions.
 - (C) Apply pesticide early morning or late evening.
 - (D) Dispose of excess pesticides at the far end of the farm.
12. Which of the following pollutants is MOST common in the Caribbean?
- (A) Oil spills
 - (B) Animal waste
 - (C) Industrial waste
 - (D) Agricultural chemicals
13. Which of the following is NOT considered a renewable source of energy?
- (A) Solar energy
 - (B) Biomass energy
 - (C) Fossil Fuel energy
 - (D) Hydropower energy
14. Sustainable agriculture is aimed at producing adequate food for society without causing severe damage to the ecosystem through
- I. improved technological methods
 - II. stabilization of small scale farming
 - III. use of genetically modified organisms
- (A) I and II only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II and III
15. Studies which find that older farmers are least likely to change to becoming organic shows that the use of sustainable agriculture is influenced by
- (A) demographics
 - (B) ethnicity
 - (C) heritage
 - (D) religion

GO ON TO THE NEXT PAGE

16. The process in which semen is collected from the male and inserted into the female of a species is called

(A) artificial selection
(B) natural fertilization
(C) artificial insemination
(D) selective insemination

17. There are 50 does on a rabbit farm. In order to cater to the demands of the market the farmer wishes to have a supply of kittens during the month of June. Which of the following is the BEST technique to achieve this?

(A) Cloning
(B) Sperm sexing
(C) Natural service
(D) Oestrus synchronization

18. A class has six pregnant does at the school farm. On the 27th day of pregnancy, the class observe five of the six does using fur to build nests. Which of the following strategies should be used with the sixth doe that has not commenced building a nest?

(A) Cull the sixth doe.
(B) Increase the sixth doe's ration.
(C) Introduce dried grass into the nest.
(D) Transfer the sixth doe to another hutch.

19. Which of the following MOST likely accounts for the difference in milk production between cows?

(A) The breeds of the animals
(B) The nutritional quality of the feed
(C) The stocking density of the pastures
(D) The pests and diseases management practices

20. Gloria is designing an experiment to determine the average daily gain (ADG) of the goats on the school farm. The MOST important factor to consider is the amount of

(A) feed given
(B) water consumed
(C) droppings produced
(D) supplements provided

Items 21 and 22 refer to the following information.

Constituents	Percentage			
	Feed I	Feed II	Feed III	Feed IV
Protein	20	23	23	14
Fat	2.0	2.5	3.0	4.0
Fibre	3.0	3.0	3.0	3.0
Minerals	0.6	0.9	0.4	0.6

21. Which of the feeds above is BEST suited for broiler birds at 1–2 weeks of age?

(A) Feed I
(B) Feed II
(C) Feed III
(D) Feed IV

22. Which constituent in the feed helps to boost digestion and the absorption of nutrients?

(A) Fat
(B) Fibre
(C) Protein
(D) Minerals

GO ON TO THE NEXT PAGE

23. Which roof design is BEST suited for animals in the tropics?

(A) A flat roof without eaves
(B) A raised roof without eaves
(C) A flat roof with extended eaves
(D) A raised roof with extended eaves

24. On a school tour to a rabbitry a student noticed a buck in the corner scratching his ear. On examination, there was a scab inside the ear. This was MOST likely caused by

(A) the presence of mites
(B) a wound from fighting
(C) insufficient vitamins in the diet
(D) a build-up of dirt in the rabbit's ear

25. Which of the following is NOT a driver of food insecurity?

(A) Food prices
(B) Food hoarding
(C) Food preferences
(D) Food contamination

Item 26 refers to the following table which shows the number of goats produced using different reproductive techniques.

Reproductive Technique	Number of Goats Produced		
	Oct.	Nov.	Dec.
Embryo transfer	70	90	130
Oestrus synchronization	80	60	100
Natural breeding	50	70	80
Artificial insemination	70	80	100

26. Which is the BEST reproductive technique for producing goats over the months of October to December?

(A) Natural breeding
(B) Embryo transfer
(C) Artificial insemination
(D) Oestrus synchronization

27. Which of the following diseases is caused by a unicellular protozoan?

(A) Mastitis
(B) Snuffles
(C) Anthrax
(D) Coccidiosis

28. Which of the following management practices is LEAST likely to assist with the prevention and control of diseases of farm animals?

(A) Breeding
(B) Sanitation
(C) Medication
(D) Vaccination

GO ON TO THE NEXT PAGE

29. Which of the following statements does NOT refer to the feed conversion ratio (FCR) in pigs?
- (A) It varies depending on the breed of the pig.
 - (B) It is usually higher for boars than for sows.
 - (C) It drives an increase in the price of pork products.
 - (D) It is the relationship between consumption and weight gain.
30. Which of the following is a NEGATIVE effect of feeding excess legumes to cattle?
- (A) Excess protein which cannot be utilized
 - (B) A build-up of gas which causes bloating.
 - (C) A high level of energy which makes the animals more active.
 - (D) The legumes are tasty and palatable so the animals overeat.
31. Loss of produce can be prevented during transport by
- (A) using suitable containers
 - (B) packing containers tightly
 - (C) exposing produce to the sun
 - (D) blocking the movement of air
32. Carcass fabrication refers to
- (A) the portioning of large cuts of meat
 - (B) providing adequate facilities for the storage of carcasses
 - (C) the variations in tenderness in different cuts of meat
 - (D) reducing the temperature of meat to increase tenderness
33. Which of the following are reasons why farmers stop feeding their broilers 24 hours before slaughter?
- I. It makes cleaning the carcasses easier.
 - II. The birds are kept at a desired weight.
 - III. It allows time for the last meal to be eliminated.
- (A) I and II only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II and III
34. Which of the following BEST represents a benefit of ante-mortem inspection?
- (A) To ascertain the quality of the meat after slaughter
 - (B) To determine the sanitation of the slaughtering facilities
 - (C) To decide which method is best for slaughtering the animals
 - (D) To establish the general condition of the animals before slaughter
35. The chickens in a processing plant have a bad smell, even though they are placed in a chiller for 24 hours. This is MOST likely because
- (A) some of the chickens were diseased
 - (B) the chickens were not washed properly
 - (C) the chickens were not allowed to bleed properly
 - (D) some of the chickens are of a different breed

GO ON TO THE NEXT PAGE

36. The primary purpose for the aging of meat is to
- (A) promote the flavour of the meat
 - (B) extend its shelf life during storage
 - (C) maintain the fresh colour of the meat
 - (D) prevent the growth of harmful organisms
37. In an effort to extend the shelf life of the carcass of his lamb, a farmer decided to use brine in his process. Which method of preservation is he employing?
- (A) Curing
 - (C) Sour chilling
 - (D) Pasteurization
 - (B) Vacuum packing
38. Which of the following is the BEST reason for processing broilers at 5–6 weeks?
- (A) It reduces the incidence of praedial larceny.
 - (B) There is a high demand for processed chicken.
 - (A) After that age the FCR of broilers begins to increase.
 - (D) Broilers become more susceptible to diseases after this period.
39. At which of the following stages of slaughtering would broiler processors MOST likely need to identify a critical control point?
- (A) Hanging
 - (B) Scalding
 - (C) Stunning
 - (D) Head removal
40. The MAIN purpose of developing a marketing plan is to
- (A) determine the value of the product
 - (B) identify the cost and market outlook
 - (C) gain the trust and confidence of the target market
 - (D) provide a road map that guides promotion and sales activities
41. Small farmers in the Caribbean are suffering because there are several sellers who control all or most of the sales in the industry. Which of the following BEST describes the type of market being displayed?
- (A) Oligopoly
 - (B) Monopoly
 - (C) Perfect competition
 - (D) Imperfect competition
42. Which of the following BEST represents the goals of food security?
- (A) Efforts to prevent food poisoning
 - (B) Efforts to prevent praedial larceny
 - (C) Access to healthy food for all persons
 - (D) Efficient utilization of animal products
43. A farmer has recently started a table eggs business, but is having trouble selling the eggs. Which aspect of the farmer's market research was MOST likely faulty?
- (A) Pricing
 - (B) Product
 - (C) Promotion
 - (D) Distribution

GO ON TO THE NEXT PAGE

44. Newgrow, an animal feed company, realized a decrease in sales of its product after another company introduced a new, competitive product. Which of the following strategies should Newgrow employ to reduce their losses?
- (A) The product from the market.
 - (B) Increase advertising for the product.
 - (C) Allow more time for sales to increase.
 - (D) Modify the product to renew customer interest.
45. Animal products and by-products are beneficial to small entrepreneurs because they can
- I. reduce unemployment
 - II. provide a source of income
 - III. provide raw materials for manufacturing industries
- (A) I and II only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II and III

END OF TEST

Item	Specific Objective	Key		Item	Specific Objective	Key
1	2.1.2	B		26	2.2.6	B
2	2.1.6	C		27	2.2.7	D
3	2.1.3	B		28	2.2.10	A
4	2.1.1	D		29	2.2.7	C
5	2.1.7	C		30	2.2.10	B
6	2.1.6	D		31	2.3.1	A
7	2.1.8	B		32	2.3.2	A
8	2.1.10	B		33	2.3.2	C
9	2.1.4	D		34	2.3.3	D
10	2.1.3	D		35	2.3.3	B
11	2.1.4	B		36	2.3.3	B
12	2.1.4	D		37	2.3.4	A
13	2.1.10	C		38	2.3.5	B
14	2.1.9	D		39	2.3.5	C
15	2.1.11	A		40	2.3.6	D
16	2.2.6	C		41	2.3.6	A
17	2.2.6	D		42	2.3.6	C
18	2.2.5	C		43	2.3.	C
19	2.2.5	A		44	2.3.	B
20	2.2.7	A		45	2.3.	D
21	2.2.7	B				
22	2.2.7	B				
23	2.2.9	D				
24	2.2.10	A				
25	2.2.11	C				

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

AGRICULTURAL SCIENCE

SPECIMEN 2022

TABLE OF SPECIFICATIONS

Unit 2

Paper 02

Module	Question	Specific Objectives	Content	Skills	
				KC	UK
1	1 (a)	2.2.2	- Air pollution	8	
		2.2.3	- Improving air quality		
	1 (b)	2.1.7 2.1.8	- Importance of forests - Neotropical animals	-	10
	1 (c)	2.1.10	- Alternative sources of energy	-	12
			30 marks	8	22
2	2 (a)	2.2.3	- Micro-livestock	8	
	2 (b)	2.2.5	- Reproductive management	-	10
		2.2.7	- Technology in reproduction		
	2 (c)	2.2.8	- Nutrition management	-	12
			30 marks	8	22
3	3 (a)	2.3.1	- Ante-mortem inspection	8	
	3 (b)	2.3.1	- Slaughtering	-	10
	3 (c)	2.3.6	- Market research	-	12
			30 marks	8	22
Grand Total 90 marks				24	66

KC - Knowledge and Comprehension
UK - Use of Knowledge

SPECIMEN 2022



TEST CODE 02202020

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

AGRICULTURAL SCIENCE

UNIT 2 – Paper 02

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. You may use a silent, non-programmable calculator to answer questions.
5. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
6. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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

Copyright © 2021 Caribbean Examinations Council
All rights reserved.

Module 1 — Agriculture and the Environment

1. (a) (i) List FOUR sources of air pollution on a farm.

.....

.....

.....

.....

.....

.....

.....

.....

[4 marks]

- (ii) List FOUR measures that farmers may implement to maintain good air quality.

.....

.....

.....

.....

.....

.....

.....

.....

[4 marks]

GO ON TO THE NEXT PAGE

- (b) The following video entitled “Trees are Rainmakers” shows the impact of deforestation in Australia.

<https://www.youtube.com/watch?v=4HdV6a3wI3g>

- (i) Suggest FOUR roles of the forest in sustaining the environment.

.....

.....

.....

.....

.....

.....

.....

[4 marks]

- (ii) Recommend TWO strategies for mitigating the negative effects of deforestation on neo-tropical animals.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

GO ON TO THE NEXT PAGE

- [illegible]

DO NOT WRITE IN THIS AREA

[12 marks]

02202020/CAPE/SPEC 2022

GO ON TO THE NEXT PAGE

Module 2 — Animal Production and Management

2. (a) (i) Define the term ‘microlivestock’.

.....

.....

.....

[2 marks]

- (ii) List THREE economic benefits of microlivestock farming.

.....

.....

.....

.....

[3 marks]

- (ii) List THREE challenges of microlivestock farming.

.....

.....

.....

.....

[3 marks]

- (b) A sheep farmer observed that ewes that are 3 years old have not been getting pregnant easily and usually produce one offspring.

- (i) Outline how the following factors may influence the reproductive challenges being experienced by the farmer.

Nutrition

.....

.....

.....

.....

Disease Management

.....

.....

.....

.....

[4 marks]

- (ii) Explain TWO reasons why the ewes in this scenario would be ideal for embryo transfer.

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

GO ON TO THE NEXT PAGE

- DO NOT WRITE IN THIS AREA**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

L

[12 marks]

02202020/CAPE/SPEC 2022

GO ON TO THE NEXT PAGE

Module 3 — Livestock Products

3. (a) (i) Define the term ‘ante-mortem inspection’.

.....

.....

.....

.....

[2 marks]

- (ii) Outline THREE objectives of ante-mortem inspection.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

- (b) (i) Recommend TWO procedures that should be followed during slaughtering to ensure that the carcass is not battered or discoloured. Give ONE reason for EACH procedure recommended.

.....

.....

.....

.....

.....

.....

.....

.....

[4 marks]

- (ii) Other than the carcass being battered and discoloured, explain TWO possible effects of the improper handling of meat during post-slaughter activities.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

GO ON TO THE NEXT PAGE

- (c) One of the challenges when creating new ventures in agriculture is the ability of farmers to conduct proper market research. In an essay of 250–300 words, discuss THREE reasons why farmers who do NOT engage in market research before introducing a new processed animal product are likely to experience failures.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

GO ON TO THE NEXT PAGE

[12 marks]

END OF TEST

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 EXAMINATIONS®

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

GENERAL PROFICIENCY

KEY AND MARK SCHEME

2022

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 1.

(a) (i) **Sources of Air pollution on a farm**

- Carbon monoxide- gas produced from burned fuel in engines, motor vehicles and generators
- Chlorofluorocarbon- found in aerosols, air-conditioning, and refrigeration units
- Asbestos-pipes, buildings, equipment, machinery
- Pesticides
- Volatile organic compounds- emitted as gas from petroleum fuels and hydraulic fluids.

**Any 4, 1 mark each
4 marks (KC)**

(ii) **Measures to improve or maintain air quality**

- reduce the use of aerosols
- reduce the use of fossil fuel on the farm
- provide adequate ventilation of animal pens and storage facilities
- eliminate burning of land and remnants on the farm
- service farm vehicles and machinery regularly
- use of electric/hybrid vehicles
- limit the use chemicals and harmful pesticides
- practice organic farming
- plant more trees
- use renewable energy and energy efficient equipment.
- **Any other reasonable measure**

**Any 4, 1 mark each
4 marks (KC)**

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 1 continued

(b) (i) **Role of the forest in sustaining the environment.**

- Forest plays a major role in reducing various types of pollution such as water, air and noise pollution.
- Forests retain moisture from rainfall, allowing it to recharge water tables and regulate the flow of water into rivers and other waterways.
- Loss of forests often results in increased flooding and soil erosion. The soil sediments enter rivers and disrupt the rivers ecosystems.
- Forests help in soil formation by breaking down dead trees and other plant material and recycling the nutrients.
- Forests provide habitats and food for wildlife.
- Forests aid in ecological services, including pollination and decomposition of plant material by insects.
- Forests play a vital role in nature's food webs and nutrient cycles.
- **Any other correct role of the forest suggested**

**Any 4, 1 mark each
4 marks (UK)**

(ii) **Strategies to mitigate the negative impact of deforestation on neo-tropical animals.**

- Replanting trees is a useful strategy for mitigating the negative impact of deforestation. Trees serve as a habitat for many neo-tropical animals so the replanting of trees will ensure that the animals have safe habitats. Replanting trees also helps to prevent landslides which can harm neo-tropical animals.
- Create awareness and training to the local communities to protect and preserve the forest. Trees provide shade and colder temperatures for animals which may not survive with the heat of direct sunlight. Trees also provide animals with food and shelter they need to survive.
- **Any other correct strategy explained**

**3 marks each
3 marks, full explanation (with relevant supporting points)
2 marks, explanation which needed more development
1-mark, limited explanation (stating/no support/inaccuracies)
6 marks (UK)**

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 1

(c) **Alternative sources of energy**

Biomass energy is generated or produced from living organisms, that is, plant and animal remains. Biomass would be useful in the Caribbean because it would be a useful way to use agricultural waste to contribute to a clean healthy environment, help mitigate climate change, and provide a secure, competitive energy source. However, the use of biomass energy is not as efficient as fossil fuels, and biomass plants requires a significant amount of land space which may prove challenging in the Caribbean to produce the energy it requires.

Solar energy is energy from the sun that is converted into thermal or electrical energy. Solar energy can be used in agriculture in several ways, saving money, increasing self-reliance, and reducing pollution as it reduces electricity bills, can be stored in solar cells and it does not generate waste or cause air or water pollution. One of the challenges with using solar energy in the Caribbean is that Caribbean weather is not predictable and there may be challenges during periods of heavy rainfalls.

Wind energy is where the wind turbines are used to harvest the wind to generate electricity. Electricity generated can be used by farmers to lower their costs and save money. The wind is a renewable energy source, and windmills do not produce harmful environmental emissions. A major challenge with the use of windfarms in the Caribbean is that it requires a specific type of environment to produce energy which may not be readily available.

***Any other relevant source discussed**

For EACH alternate source evaluated, award marks as follows

Benefits

- **2 marks** - Candidate **elaborates** on accurate and relevant points which support the benefits of the source of energy. Award 1 mark for only stating a benefit.

Limitations

- **2 marks** - Candidate **elaborates** on accurate and relevant points which support the limitations of the source of energy. Award 1 mark for only stating a limitation.

**4 marks each for THREE modern practices
12 marks (UK)**

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 2.

(a) (i) **Definition of Micro livestock**

Micro livestock refers to farm animals that are inherently small, as well as breeds of cattle, sheep, goats, and pigs that are half the size of most common breeds that are reared for food.

2 marks for a complete definition

1 mark for a partial definition

2 marks (KC)

(ii) **Economic Benefits of Micro livestock**

- Small initial investment for farmers who have limited money.
- Animals grow and mature quicker than large livestock therefore farmers obtain faster returns on their investment.
- Several batches of animals can be reared annually therefore farmers can have a steady income throughout the year.
- Farmers can cater to an exotic niche market, as such they can obtain a good price for their product.
- Meat from micro livestock animals is high in protein and low in fat. A high price can be obtained for the health benefits.
- **Any other relevant benefit**

Any 3, 1 mark each

3 marks (KC)

(iii) **Challenges with micro-livestock farming**

- Caring for smaller animals can be labour intensive
- Animals that are smaller require more feed
- Smaller animals are usually prey.
- Disease management can be challenging
- The market demand for the product may be limited.
- **Any other relevant challenge**

Any 3, 1 mark each

3 marks (KC)

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 2 continued

(b) (i) **Factors influencing reproductive challenges**

Nutrition

- Animals that are responsible for breeding require proper nutrition as reproduction requires energy. Animals that are overfed or underfed may have difficulties reproducing.

Disease Management

- Animals that are diseased may also have challenges with reproducing. Farmers must ensure that the animals are not infested with any parasites or have challenges with their reproductive systems.

2 marks each
2 marks for a complete response
1 mark for a partial response
4 marks (UK)

(ii) **Reasons for Embryo Transfer**

- Embryo transfer is suitable because the ewes have produced offspring. It is recommended that embryo transfers be done with animals that have had offspring. This means that the ewes should be able to successfully carry a pregnancy to term.
- The farmer can use embryo transfer because the farmer has adult sheep. Sheep suitable for embryo transfer must be mature sheep. Adult sheep are more likely to undergo gestation without compromising their growth.
- **Any other relevant reason**

3 marks each
3 marks, full explanation (with relevant supporting points)
2 marks, explanation which needed more development
1-mark, limited explanation (stating/no support/inaccuracies)
6 marks (UK)

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 2 continued

(c) **Nutrition Management Practices**

Based on his success Farmer A is likely to use a more succulent and nutritional forage such as a forage legume. Forage legumes are high in protein, which helps to increase the performance of the animals. Forage legumes also contain microorganisms which help to improve digestibility of crop residues. This ensures that more nutrients are available to the animals and hence makes the animals high performers.

It is likely that Farmer A provides concentrates for the animals. The use of concentrates containing high percentages of proteins, carbohydrates, fats, and fibre will improve the performance of animals and boost production levels. The use of concentrates can also compensate for animals that do not use the forage effectively. This will ensure that key nutrients needed for milk production are provided and would lead to higher milk production.

Farmer A may have utilized rotational grazing which has benefits for greater production. Rotational grazing allows the grazed paddock a rest period that permits forages to initiate regrowth, renew carbohydrate stores. The use of rotational grazing helps farmers to improve yield and persistency. Rotational grazing can help improve productivity, weight gain or milk production since grass is always available for the animals.

Any other relevant nutrition management practice discussed

For EACH management practice discussed, award marks as follows

- **4 marks** - Candidate presents a **complete** discussion. The candidate effectively **elaborates** on at least four accurate and relevant points.
- **3 marks** - Candidate presents a **satisfactory** discussion. Candidate effectively **elaborates** on three accurate and relevant points.
- **2 marks** - Candidate presents a **partial** discussion. Candidate presents **three to four** relevant points but does **not** elaborate **OR** Candidate elaborates on **two** accurate and relevant points.
- **1 mark** - Candidate presents a **limited** discussion. Candidate presents at least **one to two** relevant points but does **not** elaborate **OR** Candidate elaborates on at least **one** accurate and relevant point.

4 marks each for THREE practices
12 marks (UK)
Total 30 marks

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 3.

(a) (i) **Ante-mortem inspection**

The examination of live animals prior to being slaughtered to identify animals that are not suitable for human consumption.

2 marks for a complete definition

1 mark for a partial definition

2 marks (KC)

(ii) **Objectives of Ante-Mortem Inspection**

- Ensure that animals are properly rested, and that proper clinical information is available, which will assist in the disease diagnosis and judgment, is obtained.
- Reduce contamination on the killing floor by separating the dirty animals and condemning the diseased animals if required by regulation.
- Ensure that injured animals or those with pain and suffering receive emergency slaughter and that animals are treated humanely.
- Identify reportable animal diseases (as well as animals and those treated with antibiotics, chemotherapeutic agents, insecticides, and pesticides) to prevent killing floor contamination.
- **Any other relevant objective**

Any 3, 2 marks each

2 marks for a complete response with supporting points

1 mark for a partial response/stating the objective

6 marks (KC)

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 3 continued

(b) (i) **Procedures for slaughtering to prevent battered or discoloured carcass.**

- **Restraint of animals** ensures stability of the animal so that the stunning operation can be carried out accurately and properly to prevent injury to the animal.
- **Stunning** ensures that the animal is unconscious and insensible to pain before being slaughtered.
- **Proper utensils** should be used for slaughtering, a sharp knife should be used to make a quick clean incision to ensure that the main blood vessels of the neck are severed.
- **Bleeding** is necessary to allow blood to drain from the carcass which can cause discolouration of the meat and is an ideal medium for the growth of bacteria.
- **Any other relevant procedure**

Any 2, 2 marks each
1 mark for a relevant procedure
1 mark for relevant supporting reason
4 marks (UK)

(ii) **Effects of improper handling post slaughter activities**

- **Spoilage or contamination of meat** can occur during packaging, storage, transportation or from the use of dirty tools and equipment. The presence of microorganisms can reduce quality and shelf-life of meat.
- **Cyanosis** refers to dark, firm, and dry meat which occurs due to prolonged exposure to wind and heat, or stress related conditions during transportation/ shipping. Cyanosis reduces the value of the meat.
- **Bloody remnants/ splashes** can occur when the meat is not properly washed, drained, packed and/or stored. This makes the meat unattractive to consumers and reduces the quality of the meat.
- **Any other relevant effect**

Any 2 effects, 3 marks each
3 marks, full explanation (with relevant supporting points)
2 marks, explanation which needed more development
1-mark, limited explanation (stating/no support/inaccuracies)
6 marks (UK)

AGRICULTURAL SCIENCE

UNIT 2 - PAPER 02

KEY AND MARK SCHEME

Question 3 continued

(c) **Market Research and Processed Products**

When creating a processed product, market research is useful in deciding which processed product would be profitable. Adequate market research will indicate whether the target audience will be ready for a new competitor on the market when a similar product is being created. Farmers experience failures when they introduce a new product without having the information on the type of products that are profitable. This may lead to farmers creating a product which is not profitable and may lead to significant financial challenges.

Market research provides information which can guide the pricing of processed products. The demand for the product is used to determine the price at which the product can be sold. Market research would present information on the prices in the market, specifically the major competitors. Farmers who do not engage in market research may cost a product too high or too low and this may lead to losses as products may not be sold to yield a profit.

Market research helps the farmer to determine if there is a demand on the market for the intended product. Farmers who do not engage in research may find that consumers do not like a product they created. Farmers may intend to create a processed product, but their intended market prefers raw products, which means the products created will not perform well on the market. Market research will indicate the consumer preference and what the market preference is.

Any other relevant reason discussed

For EACH reason discussed, award marks as follows

- **4 marks** - Candidate presents a **complete** discussion. The candidate effectively **elaborates** on at least four accurate and relevant points.
- **3 marks** - Candidate presents a **satisfactory** discussion. Candidate effectively **elaborates** on three accurate and relevant points.
- **2 marks** - Candidate presents a **partial** discussion. Candidate presents **three to four** relevant points but does **not** elaborate **OR** Candidate elaborates on **two** accurate and relevant points.
- **1 mark** - Candidate presents a **limited** discussion. Candidate presents at least **one to two** relevant points but does **not** elaborate **OR** Candidate elaborates on at least **one** accurate and relevant point.

4 marks each for THREE practices

12 marks (UK)

Total 30 marks



Caribbean Examinations Council
Prince Road, Pine Plantation Road,
St Michael BB11091
Tel: (246) 227 1700
Email: cxcezo@cxc.org