Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

BIOLOGY 9190/3

PAPER 3 OPTIONS

JUNE 2017 SESSION 1 hour 30 minutes

Additional materials:
Answer paper
Scientific calculator

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on all separate answer paper used.
Answer the questions set on **one** of the options.
Within the chosen option, Questions **1** and **2** are to be answered in the spaces provided on the question paper. Question **3** is to be answered on the separate answer paper provided.
The answers to Question **3** should be illustrated by large, clearly labelled diagrams wherever suitable.
At the end of the examination
(a) fasten the separate answer paper securely to the question paper,
(b) enter the number of the option you have answered in the grid below.

INFORMATION FOR CANDIDATES

The intended number of marks is given in brackets [ ] at the end of each question.
The options are:

1 - Biotechnology

2 - Applications of Genetics

3 - Human Health and Disease

4 - Applied Plant and Animal Science

You are reminded of the need for good English and clear presentation in your answers.

OPTION ANSWERED	
FOR EXAMINER'S USE	
1	
2	
3(a)	
3(b)	
TOTAL	

This question paper consists of 19 printed pages and 1 blank page.

Option 1: Biotechnology

For Examiner's Use

1 (a) Aeroponics, a soil-less culture technique, has been implemented as an alternative to the water intensive hydroponic system worldwide.

(i) State the features of aeroponics.

[3]

(ii) Outline any **three** advantages of aeroponics over the water intensive hydroponic system.

[3]

(iii) State any **three** commercial uses of the aeroponics system.

[3]

For Examiner's Use

(b) **Fig. 1.1** shows an industrial air-lifter fermenter.

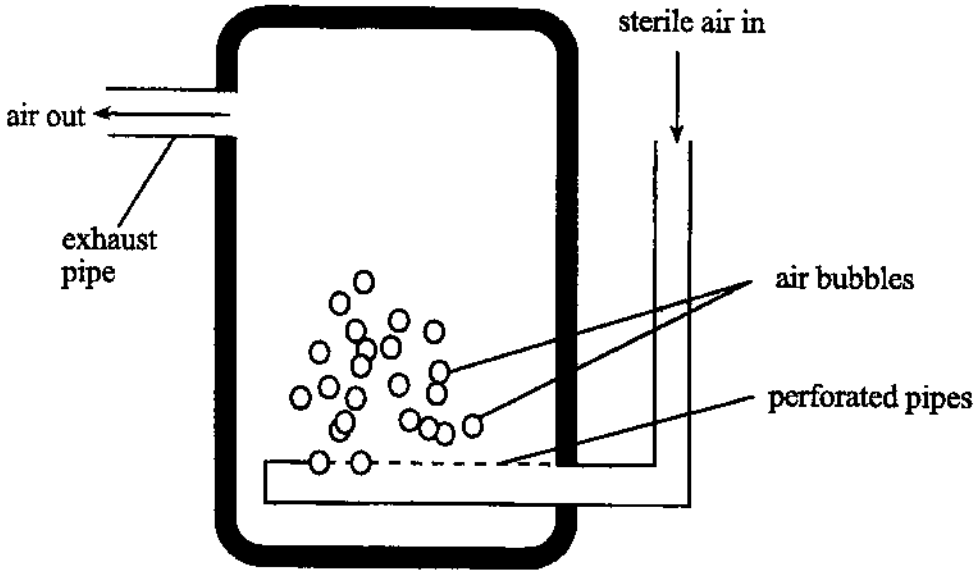

Fig. 1.1

(i) Explain how an air-lifter fermenter works.

_____

_____

_____

_____ [3]

(ii) Explain why the air supplied must be sterile.

_____

_____ [1]

(iii) Name a device that should be fixed into the exhaust pipe and state its purpose.

Name of device_____

purpose_____

_____ [2]

[Total: 15]

2 **(a)** State any **two** reasons for maintaining gene banks

For Examiner's Use

_____

_____

_____

_____ [2]

(b) A seed bank is one form of a gene bank. Samples of seeds in a seed bank are germinated at regular intervals to check their viability. Viability of the sample is set at 75% germination. Some seeds fail to germinate due to dormancy.

(i) Explain why it is not possible to achieve 100% germination.

_____

_____

_____

_____

_____ [3]

(ii) Identify any **three** physical methods used to break seed dormancy.

1. _____

2. _____

3. _____

[3]

(c) **(i)** Explain the term *biosensor*.

_____

_____

_____

_____

_____ [4]

For Examiner's Use

(ii) State any **three** uses of biosensors.

1. _____

2. _____

3. _____

[3]

[Total: 15]

3 **Either**

(a) (i) Describe the activated sludge process in sewage treatment. [6]

(ii) Describe the roles of micro-organisms in composting. [6]

(iii) Explain the role of micro-organisms in the extraction of heavy metals. [8]

[Total: 20]

Or

(b) (i) Describe the major types of pathogenic organisms that affect human health. [6]

(ii) Outline the steps in the production of monoclonal antibodies. [6]

(iii) Discuss the safety and effectiveness of vaccines. [8]

[Total: 20]

For Examiner's Use

Option 2: Applications of Genetics

1 **(a)** Micropropagation is a method used in the production of plants with desired characteristics.

(i) Identify any **two** parts of the plant which may be used as a source of cells in micropropagation.

1. _____

2. _____

[2]

(ii) Describe how the plant tissue is treated before use in micropropagation.

_____

_____

_____

_____

_____

_____ [3]

(iii) State any **two** conditions that must be regulated during micropropagation.

1. _____

2. _____

[2]

(iv) Suggest any **three** advantages of micropropagation.

1. _____

2. _____

3. _____

[3]

(b) **(i)** State any **three** differences between a gene mutation and a chromosomal mutation.

For Examiner's Use

_____

_____

_____

_____

_____

_____ [3]

(ii) State the **two** forms of gene interaction.

1. _____

2. _____ [2]

[Total: 15]

2 **(a)** Mangoes can be selectively bred to produce varieties with desirable characteristics such as taste, colour and size.

For Examiner's Use

Fig 2.1 shows steps in the production of a variety of mango that is sweet, purple and large in size.

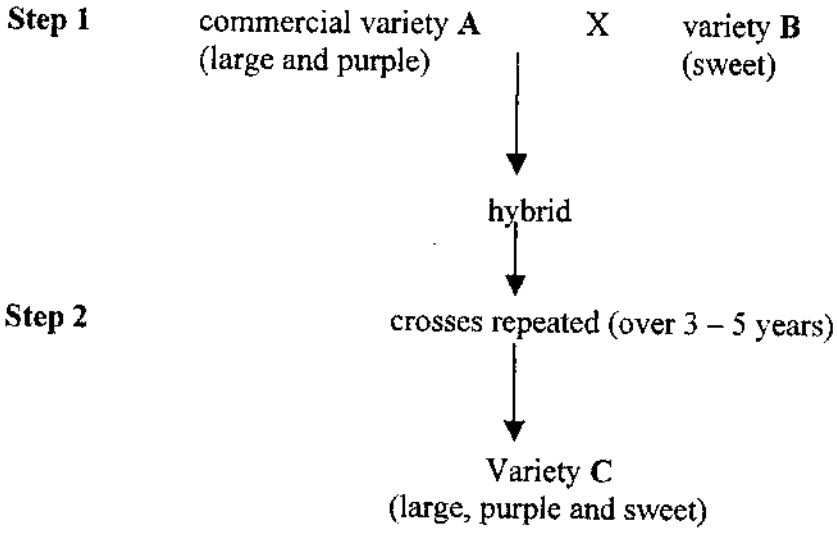

Fig. 2.1

(i) Describe how variety **A** and variety **B** plants should be treated to ensure that only their genes are passed to the hybrid.

[4]

(ii) Explain the reasons for repeating the crosses in **step 2**.

[4]

For Examiner's Use

(b) **(i)** Describe the inheritance of cystic fibrosis. (C.F.)

_____

_____

_____

_____

_____ [4]

(ii) Explain the salty taste of sweat from C.F. sufferers.

_____

_____

_____

_____ [2]

(iii) State any **one** other symptom of C.F.

_____ [1]

[Total: 15]

3 **Either**

(a) **(i)** Explain the genetic basis of discontinuous variation [8]

(ii) Describe in-vitro fertilisation and embryo transplantation in mammals. [6]

(iii) Describe how gene therapy is carried out. [6]

[Total: 20]

Or

(b) **(i)** Explain how linkage and crossing over affects phenotypic ratios from dihybrid crosses. [8]

(ii) Outline the disadvantages of genetic screening. [6]

(iii) Describe the genetic basis of resistance in eukaryotes. [6]

[Total: 20]

For Examiner's Use

Option 3: Human Health and Disease

1 **(a)** State the difference between the Reference Nutrient Intake (RNI) and the Estimated Average Requirement (EAR).

_____

_____

_____ [2]

(b) **Table 1.1** shows the Dietary Reference Values (DRVs), EAR and RNI in gday $^{-1}$ for protein for women in a country.

Table 1.1

Age group	15 – 18 years	19 – 50 years	Over 50 years
EAR/gday $^{-1}$	38.1	36.0	36.2
RNI/gday $^{-1}$	45.4	45	46.5

(i) Outline the need for publishing DRVs.

_____

_____

_____

_____ [2]

(ii) Suggest why

1. protein intake of 19 – 50 years age group may be greater than values given in the table,

_____

_____

_____

_____ [2]

For Examiner's Use

2. women over 50 years should maintain a protein intake similar to that of younger women.

_____

_____

_____

_____ [2]

(c) (i) State the **two** forms of protein energy malnutrition (PEM) common in children.

1. _____

2. _____

[2]

(ii) Explain why children with PEM are susceptible to diseases such as measles.

_____

_____

_____

_____ [2]

(iii) Supplementary feeding programmes provide children suffering from PEM with a diet rich in carbohydrate and limited quantities of high quality protein. Explain.

_____

_____

_____

_____ [3]

[Total: 15]

For Examiner's Use

2 (a) B and T lymphocytes are important components of the immune system.

Complete **Table 2.1** by indicating whether the description in each statement applies to:

only B lymphocytes
only T lymphocytes
both B and T lymphocytes

Table 2.1

statement	**can be applied to**
undergo clonal expansion	
matured in thymus	
secrete substances which kill infected cell	
produce antibodies	

[4]

(b) A breast-fed baby gets antibodies from its mother's milk.

(i) State the type of immunity that the baby acquires from the mother.

_____ [1]

(ii) Explain why this type of immunity only gives immunity to some diseases.

_____

_____ [1]

(iii) Suggest how the baby's gut is able to absorb antibodies and yet antibodies are proteins.

_____

_____

_____

_____ [2]

(c) State any **two** ways in which pathogens cause disease when they have entered the human body.

1. _____

_____

2. _____

_____

[2]

(d) **Fig. 2.1** shows a diagram of some blood cells.

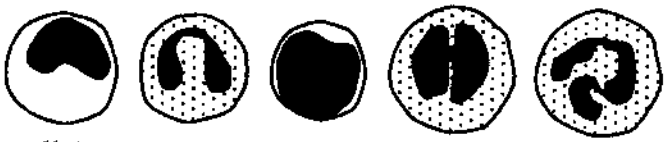

Fig. 2.1

(i) Identify the cells which are phagocytes.

_____ [1]

(ii) Explain why

1. phagocytes are described as a secondary defence against phathogens.

_____

_____ [1]

2. the response involving phagocytes is regarded as non-specific.

_____

_____ [1]

(e) Explain how phagocytes are able to pass from the blood to the site of infection.

_____

_____

_____ [2]

[Total: 15]

3 **Either**

(a) **(i)** Outline epidemiological and experimental evidence linking smoking to lung cancer. [6]

(ii) Outline the reasons for global distribution of HIV/Aids. [6]

(iii) Explain why the widespread use of antibiotics in treating infectious diseases may be undesirable. [8]

[Total: 20]

Or

(b) **(i)** Describe the global distribution of Coronary Heart Disease (CHD) and sickle cell anaemia. [6]

(ii) Describe the effects of alcohol on the peripheral nervous system. [6]

(iii) Explain how smoking leads to chronic bronchitis. [8]

[Total: 20]

Option 4: Applied Plant and Animal Science

For Examiner's Use

1 (a) State any **three** commercial applications of auxins.

_____

_____

_____ [3]

(b) The effect of growth regulator **A** and **B** on shoot development were investigated. Explants were placed in growth media that contained 0.1 mgdm $^{-3}$ of **A** and varying range of **B**. This was repeated with growth media containing 1.0 mgdm $^{-3}$ of **A** and the same range of **B**.

Fig. 1.1 shows percentage of explants that developed new shoots.

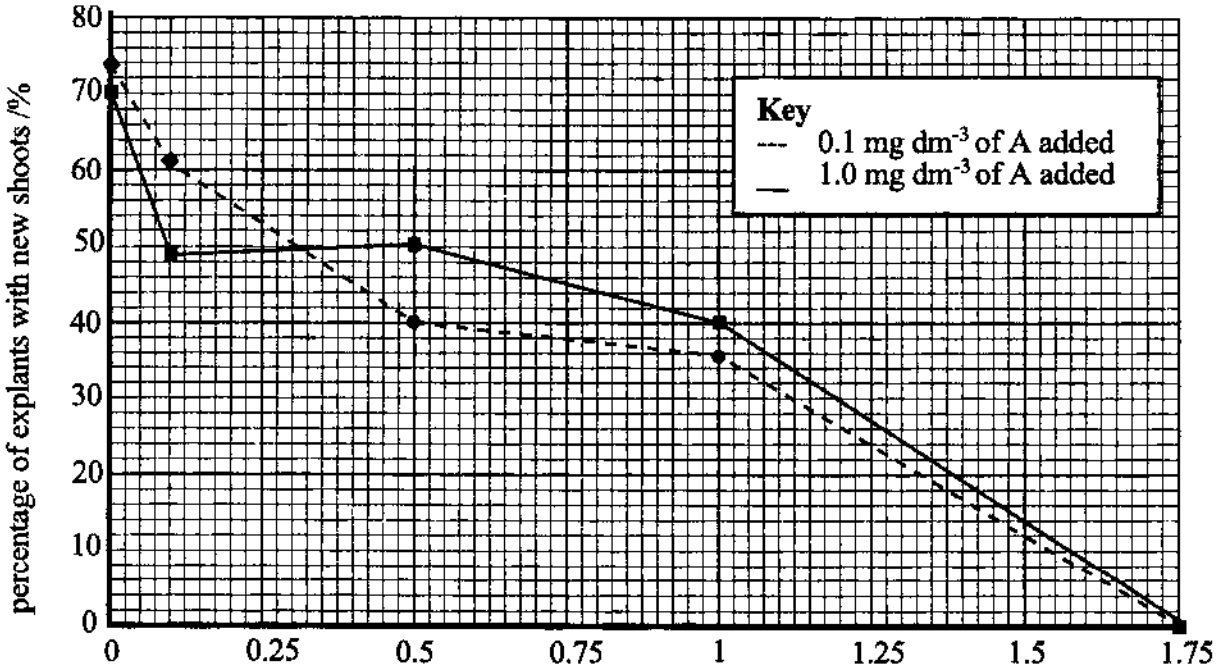

Fig. 1.1

(i) Define the term *explant*.

_____ [1]

(ii) Name the other **three** components of the growth media.

_____

_____

_____ [3]

For Examiner's Use

(iii) From the explants grown on growth medium containing 1.0 mgdm $^{-3}$, describe the effect of increasing growth regulator **B** on percentage of explants that developed new roots.

[3]

(iv) State with a reason, the effect of growth regulator **A** on the shooting of explants.

[2]

(c) Explain why explants are able to develop into new plants.

[3]

[Total: 15]

For Examiner's Use

2 (a) Describe the nutritional requirements for pigs.

[4]

(b) To ensure a balanced diet and adequate amounts of food, feed needs to be rationed for pigs. This can be calculated through ration formulation.

(i) Explain the term *food ration.*

[2]

(ii) State what a farmer needs to know before ration formulation.

[2]

(c) Suggest a reason for the following actions taken on pregnant sows.

(i) deworming 2 – 3 weeks to farrowing

_____ [1]

(ii) moved to farrowing pen 4 – 5 days prior to expected farrowing

_____ [1]

(d) Outline the advantages of extensive pig rearing.

_____

_____

_____

_____ [3]

(e) State any **one** social and **one** economic factor in the rearing of pigs.

Social _____

_____

Economic _____

_____ [2]

[Total: 15]

For Examiner's Use

3 **Either**

(a) **(i)** Describe the global distribution of

1. cassava,

2. rice and

3. wheat.

[6]

(ii) Describe the types of drainage systems used in dealing with water logged soils. [6]

(iii) Explain how soil is improved by addition of lime. [8]

[Total: 20]

Or

(b) **(i)** Describe the cultivation of maize (*Zea mays*) with reference to ploughing, fertilizer input, weed and pest control. [6]

(ii) Outline how food production in the SADC region can be improved. [6]

(iii) Discuss the advantages and disadvantages of *farmyard* manure. [8]

[Total: 20]

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