

# *UNIT 1 BIOLOGY*

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## *WORKSHEET ONE*

**TIME : 2 ½ hours permitted**

**CAPE BIOLOGY RESOURCES**

**12/16/2011**

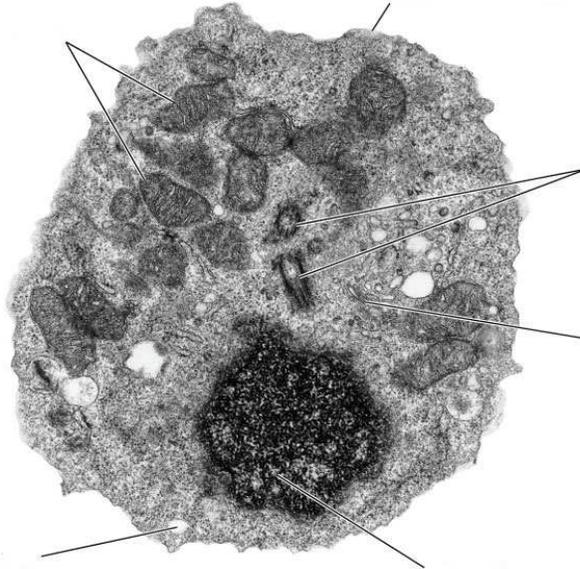
PROPERTY OF ADVANCED BIOLOGY RESOURCES FOR CARIBBEAN STUDENTS

SECTION A

Answer ALL questions. You must write your answers in the spaces provided.

1 (a) **Figure 1** below is an electron micrograph of an animal cell.

(i) **On the figure**, identify the structures labeled A, B, C and D



**Figure 1. Electron micrograph of an animal cell**

[3 marks]

(ii) With reference to the structures labeled in **Figure 1** which structure is believed to be prokaryotic in origin?

[1 mark]

(iii) In **Figure 1** there are organelles which work in the bulk transport of large quantities of materials into or out of the cells. Name TWO of these structures.

[1 mark]

- (iv) The liver is known to produce important proteins including *Human serum albumin*, which is the most abundant protein in human blood plasma. Using the principles of exocytosis explain how it is possible for liver cells to deliver these proteins into the blood stream.

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[ 2 marks]

- (b) A group of sixth form biology students wanted to conduct an experiment to investigate the effects of temperature on the rate of an enzyme catalyzed reaction. The following shows the sequence of steps they will use to carry out the investigation:

**TEMPERATURE AND ENZYME ACTIVITY**

- Measure and cut equal pieces of liver so that they will fit into the test tubes. Record the mass of each piece of liver.
- Put a piece of liver in first test tube and add 2 mL of water. Record The amount of gas produced if necessary. This will be the control test tube.
- Put a piece of liver in second test tube, heat to desired temperature and record.
- Add 2 mL of hydrogen peroxide. Collect gas produced in a syringe.
- Repeat for 6 trials.

- (i) For the experiment above list TWO other variables other than temperature that should be kept constant during this experiment.

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[2 marks]

- (ii) From the experiment above identify ONE possible source of error.

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[1 mark]

- (c.) The students from (b.) conducted the experiment which produced the following results as shown by the Table 1 below.

**TABLE 1: EFFECT OF TEMPERATURE ON THE RATE OF AN ENZYME CATALYSED REACTION**

Temperature (°C)	Amount of oxygen gas produced per unit time ( cm <sup>3</sup> )
20	1.5
25	2.3
30	3.0
35	3.5
40	3.4
45	2.4

- (i) Using the graph paper provided show the results given in Table 1. **[3 marks]**
- (ii) Using the letter 'X' mark the optimum temperature of the enzyme on the graph. **[1 mark]**
- (iii) Using the letter 'Y' mark the point of denaturation of the enzyme on the graph. **[1 mark]**

**Total 15 marks**

2. (a.) Miss Pam, a local poultry farmer of Big Yam village decided to start a local hatchery, with all her stock consisting of all white *Leghorn Fowls*. When the first batch of white *leghorn hens* was inseminated, the eggs hatched produced chicks which all became white fowls. However when the second generation was crossed she was shocked to notice that with time some of the chicks grew to be black, others brown and the rest white. She then called a local agricultural officer who explained to her that some of the hens might have 'inhibiting genes'.

He further explained to her that plumage colour of *Leghorn chickens* is controlled by two sets of genes; one set which is responsible for colour and the other set responsible for color deposition.

(i) State the term used to describe the interaction of the two genes above

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[1 mark]

(ii) Explain why the agriculture officer might have referred to these genes as 'inhibiting genes'

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[2 marks]

(iii.) Providing that two sets of genes which the agriculture officer explained included:

**SET ONE: W** (white) dominant over **w** (results in colour deposition)

**SET TWO: B** (black) dominant over **b** (brown)

And the progeny of the F<sub>2</sub> generation

Determine the possible genotype of all  $F_1$  Leghorns 'which all became white fowls.'

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[2 mark]

Hence using a Punnett Square determine the phenotypic ratio of the  $F_2$  generation produced between a cock and a hen, which Miss Pam 'was shocked to notice'. Suggest ONE genotype for each phenotype given.

Ratio \_\_\_\_\_

Genotypes White \_\_\_\_\_

Black \_\_\_\_\_

Brown \_\_\_\_\_

[5 marks]

- (iv) Comment on why the normal phenotypic ratio of 9:3:3:1 was not observed.

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**[2 marks]**

- (i) In the testicles of a *White Leg Horn Cock* primary spermatocyte undergo Meiosis I to form secondary spermatocytes. These secondary spermatocytes eventually form sperm. In terms of 'n' name the number of chromosomes in the primary spermatocyte.

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**[1 mark]**

- (ii) Explain how the events which occur during Prophase I of Meiosis I in the testicles of the *White Leg Horn Cock* might contribute to heritable variation.

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**[2 marks]**

**Total 15 marks**

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3. (a) (i) During biology class Johanna scribbled the following statement in her notebook.

Read the statement and answer the questions that follow.

*“... Sexual reproduction is the fusion of two gametes to form a zygote which develops into a new organism...”*

With reference to the above statement and including a NAMED example, explain how asexual reproduction differs from sexual reproduction.

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**[2 marks]**

Horticulture is the industry and science of plant cultivation including the process of preparing soil for the planting of seeds, tubers, or cuttings. Horticulturists work and conduct research in the disciplines of vegetative propagation and cultivation crop production plant breeding and genetic engineering plant biochemistry and plant physiology.

- (b) (ii) Define the term ‘vegetative propagation’

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**[1 mark]**

- (iii) State ONE characteristic of the tissue of tubers which make them suitable for vegetative propagation.

[1 mark]

Figure 2 below is a sweet potato



Figure 2: Anterior view of stem tuber of a sweet potato

- (iv.) Label the 3 parts of the potato tuber shown above.

[3 marks]

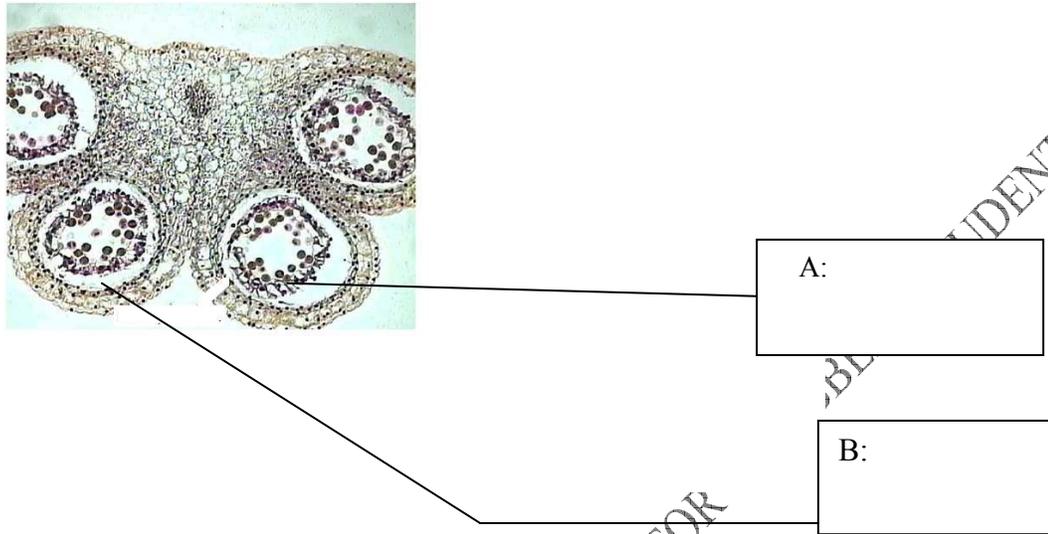
- (v.) State ONE function, other than vegetative propagation that would be carried out by the potato tuber in Figure 2.

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[1 mark]

(d.) **Figure 3** below is an electron micrograph of the cross section of an anther

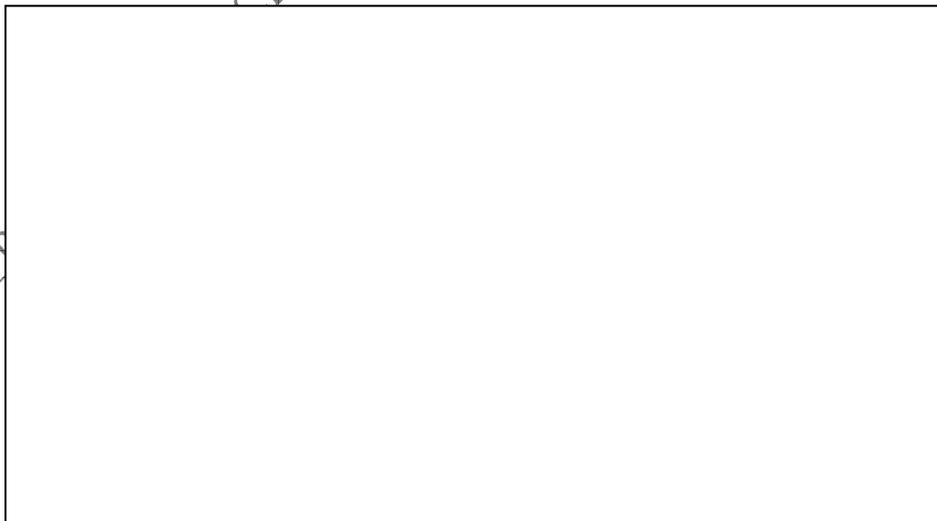


**Figure 3 : Transverse section of mature anther before dehiscence**

- (i) On maturity dehiscence of the anther occurs which allows for the release of structure C. Structure A undergoes meiosis to produce structure C, while structure B holds Structure A until maturity and is considered the source of production for Structure C. On the diagram above label structures A and B.

**[2 marks]**

- (ii) In the box provided draw and label a cross section of Structure C.



**[4 marks]**

- (iii) Apart from playing an important role in fertilization by providing a location for pollen deposition, state ONE other way in which the stigma plays a role in fertilization.

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[1 mark]

**Total 15 marks**

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**SECTION B**

**Answer ALL questions. You must write your answers in the booklet provided.**

4. (a) (i) Phospholipids consist of glycerol and fatty acid chains arranged in ‘tadpole like structures’. With the aid of a diagram explain the basic properties of phospholipids. **[3 marks]**
- (ii.) Phospholipids form a major part of cell membranes. For example the myelin sheath around nerve fibers consists of phospholipids.  
Explain the importance of the lipid bi-layer to a cell. **[4 marks]**
- (iii) State TWO functions of cholesterol in the cell membrane. **[2 marks]**
- (iv) Blood from a freshly slaughtered pig was smeared onto a glass slide, a few drops of saltwater was then added. The glass slide was then covered and left for five minutes. Upon re-examination the cells were described to be shriveled and ‘prune-like’. Account for this observation **[2 marks]**
- (v.) Explain TWO ways active transport differs from the process occurring in (iv) above. **[4 marks]**

**Total 15 marks**

5. (a) (i) Differentiate between the terms 'vector' and 'recipient' when used in genetic engineering. [1 mark]

- (ii) Discuss TWO benefits of using Genetically Modified Organisms (GMOs) [4 marks]

Read the extract below and answer the part that follows

*"..The HIV virus like all other viruses consists of a protein coat which encapsulates its RNA. In this 'capsule' important proteins such as integrase and reverse transcriptase are located. The role of integrase is to combine two or more different types DNA. The HIV virus is a parasite and eventually destroys its host cell as the host cell produces viruses through a process called budding..."*

- (b) (i) Describe the basic structure of RNA and hence suggest the basic mode of operation of HIV in a human T4 cell. [5 marks]

- (ii) Both DNA and tRNA are involved in protein synthesis. With the aid of a diagram suggest how tRNA performs its role in protein synthesis **differently** when compared to DNA. [5 marks]

**Total 15 marks**

6. (a.) (i.) Define the term '*contraceptive drugs*'

[1 mark]

(ii.) Comment on the effectiveness of '*the morning-after-pill*'

[2 marks]

(iii.) Janine who recently had sexual intercourse with her husband learned that they would be having a baby in 8 months time. Janine was confused since she had sexual intercourse with her husband two days before her time of ovulation.

Using the structure and nature of sperm explain to Janine how it was possible for conception to have taken place.

[2 marks]

(b.) Define the term fertilization and explain how it occurs.

[5 marks]

(c.) Describe **FIVE** adaptations of the human female reproduction system to deal with pregnancy.

[5 marks]

**Total 15 marks**

**END OF TEST**