

**ADVANCED LEVEL BIOLOGY NATIONAL EXAMINATION PAPER 2005**  
(Biology-Chemistry)

**SECTION A: Attempt ALL questions in this section /55 marks**

01. a) In what part of a Eukaryotic cell does DNA replication take place? 1 mark  
b) What other types of molecules apart from nucleotides are needed for DNA replication to take place. 2 marks

**Answer:**

- a) The DNA replication takes place in a eukaryotic cell in:  
The nucleus or mitochondria or chloroplasts.
- b) Other types of molecules, a part from nucleotides which are needed necessary for DNA replication to take place are: enzymes or DNA polymerase or helicase and ligase.
02. Testudo ehippium is one of the species of large tortoise. Complete the table below to show its classification.

KINGDOM	ANIMALIA
-----	Chordata
-----	Reptilia
-----	Chelonia
Family	Testudinadae
Genus	-----
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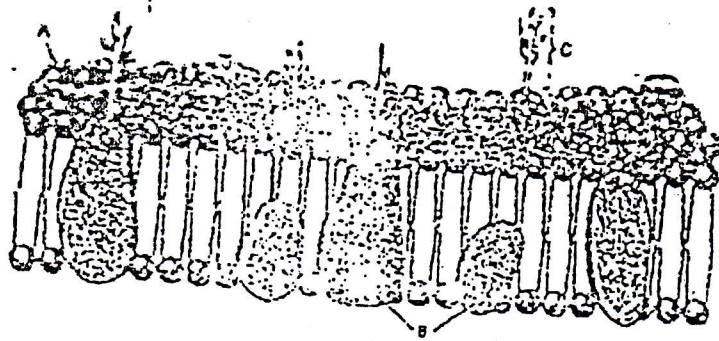
3 marks

**Answer:**

Testudo ehippium is one of the species of a large tortoise. We complete the following table as follows to show its classification:

KINGDOM	ANIMALIA
Phylum	Chordata
Class	Reptilia
Order	Chelonia
Family	Testudinadae
Genus	Testudo
Species	Ehippium

03. The diagram below shows the structure of a cell surface membrane



- a) Name the structures labeled A, B and C

A-----

B-----

C-----

3 marks

- b) Explain how the properties of phospholipids are important in the formation of membranes. 2 marks

Answer:

- a) The diagram below shows the structure of a cell surface membrane  
 A: lipid or phospholipid or pole or hydrophilic polar head.  
 B: Prosthetic group or carbohydrate.  
 C: Glycoprotein.
- b) Properties of phospholipids are important in the formation of membranes.
04. a) Cells in the pancreas produce enzymes. These cells are associated with large amounts of rough endoplasmic reticulum and golgi bodies. Explain why. 3 marks
- b) What does Q10 mean with respect to enzyme reaction? 2 marks

Answer:

- a) The cells in the pancreas produce enzymes. These cells are associated with large amounts of rough endoplasmic reticulum and golgi bodies because it is an adaptation to the secretory cells, in effect, ribosomes synthesize proteins. The proteins are injected into endoplasmic reticulum that leads to the Golgi body cues undergo maturation or sorting, storage, packing, export.
- b) For each 10°C, the temperature, the rate of reaction catalyzed by enzymes to double the optimum temperature.
05. a) Small organisms do not need a circulatory system like large organisms. Why do large organisms need a circulatory system? 2 marks
- b) Mammals have a double circulation. What does this mean? 2 marks

Answer:

- a) Large organisms need a circulatory system to transport materials or nutrients, gases, metabolic wastes because they have a large number of cells among the organs thick.  
 - Regulation

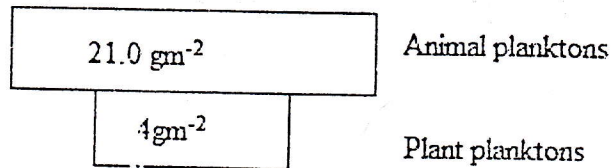


- Breathing
- Nutrition
- Communication
- Exchange

b) The double circulation in mammals means that:

- 2 times the blood passes into the circulatory system during a cycle.
- In mammals, there is a great circulation and a small circulation.

06. The diagram below shows an inverted pyramid of biomass.



Suggest a reason for this inversion. 2 marks

Answer:

The diagram shows an inverted pyramid of biomass.

One reason for this reversal:

- Plankton animals weighing more than plankton plants.
- Or plant plankton are consumed by plankton animals.
- Or plankton animals are not consumers.
- Plant plankton or reproduce much faster.

07. Down syndrome can be caused by non-disjunction. Explain the term non-disjunction and describe how it causes Down syndrome. 4 marks

Answer:

Down syndrome can be caused by the non-disjunction. The non-disjunction means non separation or segregation of homologous chromosomes. The non-disjunction causes Down syndrome: the pair of homologous for chromosome 21 are passed through a nucleus of the cell or gamete. At the time of fertilization, the zygote will end up with 3 on chromosome pair 21.

08. Two groups of enzymes digest proteins. They are called endopeptidases and exopeptidases. Explain exactly what these enzymes do. Which group is secreted first and why? 6 marks

Answer:

Two groups of enzymes digest proteins: The endopeptidases and exopeptidases.

What are the endopeptidases:

- Break peptide bonds of amino acids in the middle of a long chain.
- Transforming the long polypeptide chain into short peptides.

What do exopeptidases:

- They cleave peptide bonds found at the end of a polypeptide chain.
- Or they transform amino acids into polypeptides.

The group which is secreted first is endopeptidase because they reduce long polypeptide chain into short chains.

These enzymes break down proteins into polypeptides and amino acids

09. a) Name the factors that make malaria a difficult disease to control. 3 marks  
b) Explain why there is a high risk of cholera in refugee camps. 2 marks

Answer:

- a) The factors that make malaria a disease difficult to control are:

- High number of vectors or Anopheles
- Favorable weather conditions for the multiplication of vectors (high temperature or warm)
- Lack of means of prevention (mosquito net, mesh, produced as preventive drugs and vaccines)
- Resistance of the vector.
- Resistance of the microbe.
- Poor sanitation.
- Non-disease survival (non-respect of dose)
- Lack of information about the disease.
- Poverty (lack of means for treatment, non-accessible, lack of health or infrastructure).
- Complex life cycle (the signs occur late, long incubation period)

- b) There is high risk of cholera in refugee camps because:

- Isolation of patients difficult
- Overcrowding or concentration of people in a small space or overcrowding.
- Lack of drinking water.
- Alt unhealthy lack of toilets, lots of rubbish, garbage, breath of hygiene, dirty food
- A lack of health interventions (drugs insufficient, insufficient nurses, doctors insufficient).

10. The table below shows the core temperature of two animals at various times on a hot sunny day. Animal A was allowed to drink water, but animal B was deprived of water.

Time of day	Core temperature/ °C	
	Animal A	Animal b
9.00	36.0	34.8
12.00	37.7	38.6
15.00	39.2	40.1
24.00	35.8	37.0

- a) i) Explain why the body temperature of animal A does not rise as high as that of animal B. 2 marks

- ii) Explain how the body temperature of animal B is controlled. 2 marks

Answer:

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a) The table above shows the core temperature of 2 animals at various times on a hot sunny day. Animal A was allowed to drink water but animal B was deprived of water.

i) The temperature of the body of the animal does not rise as high as that of the animal B because:

Water plays the role of thermostat or temperature regulator or temperature stabilizes, the specific heat is high.

Water temperature is opposed to rise (cools the body, realized the thermolysis).

ii) The temperature of the animal's body B is controlled as follows: hiding in the shadows or run away.

Sweating or panting mouth or he will open his mouth.

11. The diagram below shows the main stages of aerobic respiration.

a) State precisely where reactions in boxes A, B and C occur in the cell.

A-----

B-----

C----- 3 marks

b) Name the substance X-----1 mark

c) A total of 38 molecules of ATP are produced during the complete breakdown of one molecule of glucose. State how many molecules of ATP formed at each stages A, B and C.

A-----

B-----

C----- 3 marks

Answer:

a) The diagram shows the main stages of aerobic respiration:

A: cytoplasm, cytosol or hyaloplasm.

B: mitochondrial matrix.

C: mitochondrial membrane or mitochondrial peak.

b) The substance X is called  $\text{CO}_2$  or carbon dioxide or coenzyme A

c) 38 molecules of ATP are produced in total during the complete decomposition of a molecule of glucose. The number of ATP formed:

A: 2 ATP

B: 2 ATP

C: 34 ATP

12. Flowering plants reproduce both sexually and asexually. What are the advantages of this to such plants. 4 marks

Answer:

Flowering plants reproduce both sexually than asexually.

The benefits:

- Colonizes an area very quickly.

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- Rapid reproduction (high numbers of individuals or offspring)
- Preserve the species or life of the species
- Provide the same consistency or variability of the offspring.
- The seeds can be stored in adverse conditions (ex. Weather).
- Intervention of a single parent or have an offspring from a single parent.

13. You have a solution which you know contains sugar but you do not know whether it is a reducing sugar, non-reducing sugar or a mixture of both. How can you find out. 3 marks

Answer:

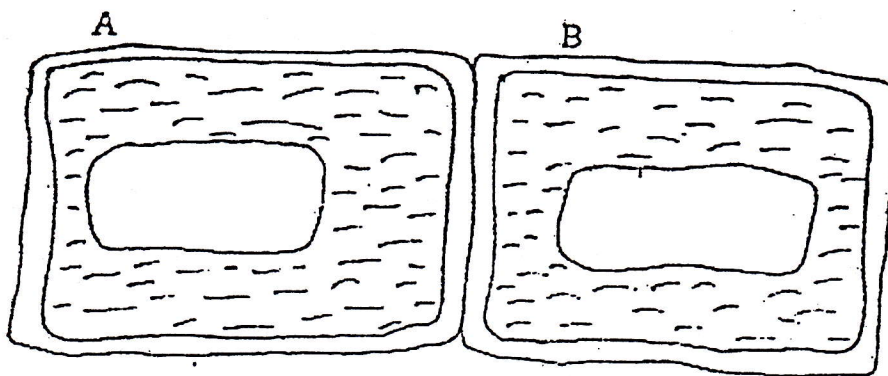
You have a solution and you know it contains sugar, but you do not know if it is a reducing sugar, a non-reducing sugar or a mixture of both. You can specify what it is to as follows:

- To the reducing sugar, mixing a sample of the Fehling's solution and heated. If you observe the red brick precipitate, this implies the presence of a reducing sugar.
- For a non-reducing sugar (starch), mixing a sample of the solution with water iodine (Lugol's solution = suitable). If there is appearance of a dark blue color (dark blue), this implies the presence of a non-reducing sugar.

For mixing every 2, the test Fehling's test and use water iodine (the 2 tests are all positive (appearance of a blue color and a reddish brick)

**SECTION B: ANSWER ANY THREE QUESTIONS ONLY. (30 MARKS)**

14. Two neighbouring plant cells are shown in the diagram.



$\Psi = -200 \text{ kPa}$

$\Psi = 400 \text{ kPa}$

- a) In which direction would there be a net movement of water molecules. 1 mark
- b) Explain what is meant by net movement? 2 marks
- c) Explain what would happen if both cells were placed in
  - i) Pure water.
  - ii) One molar sugar solution ( $\Psi = -3500 \text{ kPa}$ ) 7 marks

Answer:

- a) The diagram represents two neighbouring plant cells

The direction is the net movement of water molecules: from A to B



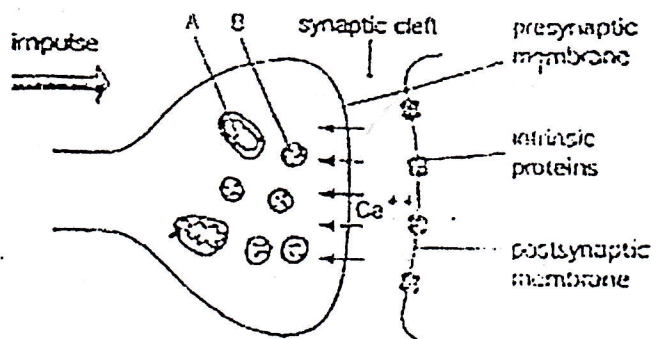
b) The net movement means the movement or transfer of a substance from one place to another.

c) What would happen if the two cells were placed in pure water?

i) For cell A: There is water inlet inside or swelling (turgor) of the cell.

ii) For the cell B: There is also water inlet inside or swelling of the cell.

15. a) Name the following structures in the synapse



i) Structure A

ii) Structure B

iii) The contents of structure B. **3 marks**

b) The arrival of an impulse changes the permeability of the presynaptic membrane, allowing calcium ions to diffuse in as shown by the arrows on the diagram. Describe the effect caused by this influx of ions. **2 marks**

c) Explain fully why structure A is found abundantly in the presynaptic region. **5 marks**

**Answer:**

a) i) A: mitochondria

ii) B: a synaptic vesicle

iii) The contents of the structure B: neurotransmitter, a chemical mediator.

b) The arrival of a pulse changes the permeability of the presynaptic membrane, allowing calcium ions to diffuse as indicated by arrows on the diagram. The effect is caused by the influx:

- The synaptic vesicles to fuse with the membrane or synaptic vesicle movement.
- The release of neurotransmitters in the synaptic cleft.

c) The structure A is abundant in the presynaptic region because:

- To produce the energy required to absorb ions/ reform transmitter molecules and store them in vesicles.
- A production of acetylcoenzyme A, which merges with choline to form acetylcholine.

16. a) Suggest why the true total of AIDS cases worldwide may be much higher than reported. **2 marks**

b) Suggest why condoms are NOT fully effective at preventing HIV infection. **2 marks**

c) What types of advice can you offer as part of an AIDS education program? 6 marks

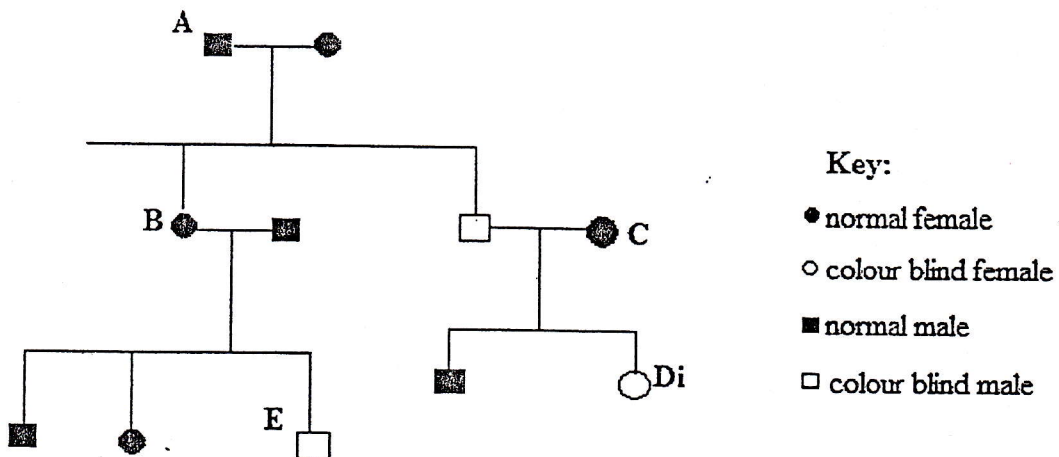
Answer:

- a) The true total of AIDS cases worldwide may be much higher than that reported because:
- Many people are afraid to do the testing.
  - Defective (poorly done early).
  - Lack of testing equipment.
- b) The condoms are not completely effective HIV prevention has because:
- They can tear during intercourse.
  - Other bad qualities are letting the virus.
  - They may be misused (misused, falls into the reproductive system).
- c) Advice that we can offer as a participant in the program of AIDS education:
- refrain from casual sex
  - Do a test
  - not conceive when the woman is already HIV positive.
  - Condom use
  - Not discredit infected person or prevent the marginalization or avoid stigma, love.
  - Ask the infected person to eat well.
  - Be circumcised.
  - Prevent a mother with HIV to breastfeed her child.
  - Test blood before transfusion
  - Create occupations.

17. a) Define the term mutation. 1 mark

b) Describe briefly the types of mutations. 4 marks

c) Red-green colour blindness is sex-linked recessive condition. The gene for colour blindness is carried on the X-chromosome. The figure below shows a family tree. Work out the genotypes of the individuals labeled A----E. 5 marks



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Answer:

- a) Mutation is sudden change in character and which is hereditary (genetic change, change of gene, materials, genetics, DNA).
- b) Different types of mutations are:
- A spontaneous mutation or natural: is random mutation.
  - Mutation caused or induced or artificial is the base of a mutagen agent.
- Other possibilities:
- Chromosomal mutation is realized at the chromosomal level (affects the number or structure): deletions, translocation, duplication, inversion.)
  - Gene mutation or point: it affects the structure and position of a gene (deletion, translocation, inversion, substitution, duplication...)
- c) The genotypes of individuals designated A to E in the figure below:

Key:

- Normal female
  - Color blind female
- Normal male
  - Color blind male

A = XY

B =  $X^dX$

C =  $X^dX$

E =  $X^dY$

18. a) Active transport and osmosis are two main ways by which substances move in and out of cells. Give two differences between these processes. **2 marks**
- b) Explain the part played by active transport and osmosis in each of the following:
- i) The uptake of substance from the soil by roots. **4 marks**
  - ii) Selective reabsorption in the proximal convoluted tubule of a nephron. **4 marks**

Answer:

- a) Active transport and osmosis are two main ways by which substances move in and out of cells.

Differences between these two processes are:

Active transport	Osmosis
Require energy	Does not require energy
Require carriers (mediators, enzymes)	Does not require carriers
Exchange of charged or uncharged substances	Water exchange
Exchange is done according to concentration gradient or against concentration gradient	Exchange is done always according to concentration gradient (from hypotonic local to hypertonic)

- b) The part played by active transport and osmosis in each of the following:
- i) the uptake of substance from the soil by roots:

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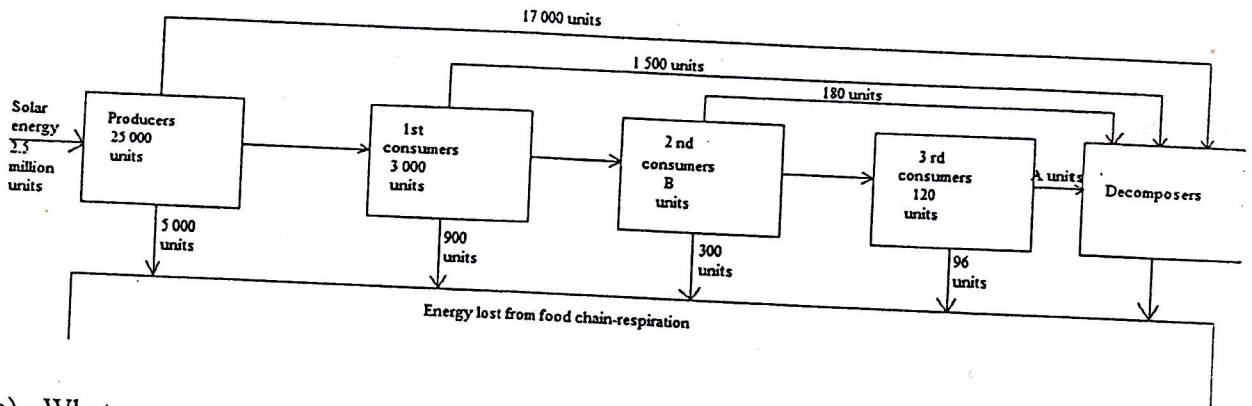
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- Osmosis allows the entry of water into root.
- Active transport allows the passage of dissolved substances or ions from the soil to the root.
- ii) Selective reabsorption in the proximal convoluted tubule of a nephron:
  - Osmosis allows water to return blood flow in (recovery or reabsorption of water).
  - Active transport can return to the movement of certain molecules that are still useful (glucose, mineral salts, chlorides).

**SECTION C: ANSWER ONE QUESTION ONLY. (15 MARKS)**

19. The diagram below shows the flow of energy through the organisms at different feeding levels in a habitat.



- a) What percentage of the solar energy falling on the habitat is trapped by the producers. **1 mark**
- b) Study the diagram and then calculating the missing energy values A and B.
  - i) A-----
  - ii) B----- **2 marks**
- c) In this habitat the 1<sup>st</sup> consumers are small invertebrates such as snails, earthworms and insects. The 3<sup>rd</sup> consumers are foxes and hawks.
  - i) Examine the proportion of their total energy intake used in respiration by the 1<sup>st</sup> and 3<sup>rd</sup> consumers. Which uses the greater proportion. Show your working. **4 marks**
  - ii) Suggest the explanation for the difference in these proportion considered in part C(i) above. **4 marks**
  - iii) There are only five feeding levels in this habitat. Suggest why we cannot have a sixth feeding level. **4 marks**

**Answer:**

- a) Percentage of solar energy falling on the habitat and is trapped by the producers:

$$\frac{25.000 \times 100}{2.500.000} = 1\%$$

- b) The energy values A = (120-96)unit = 24 unit  
= 3000-15.900 = -12.900 unit

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Or the energy values at B = (180+120+300) unit = 600units

- c) In habitat, the primary consumers are small invertebrates such as snails, earthworms and insects. The 3<sup>rd</sup> consumers are foxes and hawks.

i) The proportion of total energy consumption used in respiration

$$\text{By the first consumers} = \frac{900 \times 100}{3.000} = 30\%$$

$$\text{By the 3}^{\text{rd}} \text{ consumers} = \frac{96 \times 100}{120} = 80\%$$

Consumers who use the greatest proportion energy are the 3<sup>rd</sup> consumers.

ii) What explains the difference in the calculated proportions:

- For consumers, the low metabolic activity or diet variable thermal or poikilothermic! Active moms.

- For the third consumers, the high metabolic activity or diet thermal constant or homeothermic/ very active.

iii) There are only 5 feeding levels in this habitat.

He cannot have a sixth feeding level because:

- Decomposers are very small to be consumed.

- 3<sup>rd</sup> - the consumers provide an amount

- Very low power of ensuring survival to another trophic level.

- Decomposers often mark the end of a chain.

20. a) In a human cell, there are 46 chromosomes. Which part of the cell contain chromosomes. **1 mark**

b) Humans reproduce by sexual reproduction. Suggest two reasons why human bodies do not grow up to look exactly like either of their parents. **3 marks**

c) i) A person's sex is determined by their sex chromosomes. Explain why it is impossible for identical twins to be a girl and a boy. **3 marks**

ii) Cloning is an artificial process to produce offsprings which are genetically identical to their parents. Suggest some of the potential problems with reproducing animals by this method. **4 marks**

d) Some farmers use selective breeding to try to improve the characteristics of ..... generations of livestock.

i) Describe briefly the process of selective breeding and its importance. **4 marks**

**Answer:**

a) In the nucleus of a human cell, there are 46 chromosomes.

b) Humans reproduce by sexual reproduction. Reasons why the human body does not grow up to look exactly like either of their parents:

- Random distribution of chromosomes in sex cells.

- Random fertilization of gametes

Crossing – over or mixing intra-chromosomal.

- Co-dominance of alleles

- Mutations (phenotype: influence of the environment)

- The offspring inherits the chromosomes of two parents (this is not a clone).

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The recessive alleles, or heterozygosity.

- c) i) A person's sex is determined by sex chromosomes. It is impossible for identical twins to be a girl and a boy because:

They come from the union of one spermatozoid (X or Y) and an egg X.

- Or they come from a single zygote.

Have sex chromosomes

- Or they have the same genes.

- Or come from a single fertilized egg.

- ii) Cloning is an artificial process to produce offspring that are genetically identical to their parents. Potential problems of reproducing animals by this method are:

very complex process, very expensive (need complex materials: an electron microscope. Laser beam, difficult to collect the core charge), requires highly-qualified persons.

Sometimes the cloned cells do not produce the desired results.

- d) Selective breeding (also called artificial selection) is the process by which humans use animal breeding and plant breeding to selectively develop particular phenotypic traits (characteristics) by choosing which typically animal or plant males and females will sexually reproduce and have offspring together.

Importance of selective breeding:

Organic or natural farming does not always assure best results. Selective breeding can be one of the best options for higher production.

Selective breeding permits the encouragement of characteristics that are more beneficial to the farmer. If you have livestock like cows, it can produce more milk than typical cows, when you breed them, the cow will produce more milk and this gene can be passed on to their offspring. When it is implemented with crops, it will grow more than the typical crops. Promoting these advantages methods will surely increase the market value of these products. If you are a businessman, using selective breeding is undeniably a perfect option.

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**SECTION A: Attempt ALL questions in this section /55 marks**

01. a) What is the complementary RNA base sequence for GATCAA? 1 mark

b) From the molecules below;

Amino Acids, Nucleotide, Lipids and water.

- i) Choose the molecule that is most abundant in the cells of the human body. 1 mark

- ii) Choose the molecule that contains most energy. 1 mark

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