NESA | NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2023-2024

SUBJECT: BIOLOGY II

PAPER II: THEORY

COMBINATIONS:

- BIOLOGY-CHEMISTRY-GEOGRAPHY **(BCG)**

- MATHEMATICS-CHEMISTRY-BIOLOGY **(MCB)**

- PHYSICS-CHEMISTRY-BIOLOGY **(PCB)**

- ASSOCIATE NURSING PROGRAM **(ANP)**

DURATION: 3 HOURS

Instructions to candidates:

1) Write your names and index number on the answer booklet as written on your registration form and **DO NOT** write your names and index number on additional answer sheets if provided.

2) Do not open this question paper until you are told to do so.

3) This paper consists of **TWO** sections: **A** and **B**.

   SECTION A: Attempt **ALL** questions. **(70 marks)**

   SECTION B: Attempt only **THREE** out of **FIVE** questions. **(30 marks)**

4) Use only a **blue** or **black** pen.

SECTION A: Attempt all questions (70 marks)

(1) Facultative parasites are more difficult to control than the obligatory parasites because they: **(2 marks)**
   a) Are capsulated.
   b) Have many hosts.
   c) Can change the mode of feeding.
   d) Live in colonies.

(2) A particular species of unicellular organism inhabits the intestines of termites where the unicellular organisms are protected from predators. Wood that is ingested by the termites is digested by the unicellular organisms, forming food for the termites. The relationship between these two species is described as: **(2 marks)**
   a) Harmful to both species.
   b) Parasite/host.
   c) Beneficial to both species.
   d) Predator/prey.

(3) Identify the interrelationships described below. **(5 marks)**

Description of the relationship	Relationship
Frog feeding on small insects	
Blood sucking lice living among the feathers of a bird.	
Tuis feeding on nectar from kowhai flowers	
Ants feeding on a dead cricket	
A small crab living between the shell of a mussel, stealing its food but causing no damage to the crab	

(4) Read through the passage below and then fill in the gaps with the most appropriate word or words from the following: **target, blood stream, steroid/amine, endocrine glands, hormones.** **(5 marks)**

Chemical control in animals brought about by ___. These chemicals are usually either protein or ___. They are produced by ___ which release them into the ___ where they travel around the body until they reach the ___ organ. This is where they bring about a response.

(5) The oxidation of a respiratory substrate occurs according to the following equation: $C_{18}H_{36}O_2 + 26O_2 \rightarrow 18CO_2 + 18H_2O$. What is its respiratory quotient after complete oxidation in the body? **(2 marks)**

a) 0.7

b) 0.8

c) 0.9

d) 1

(6) Fill the following table with appropriate words **(8 marks)**

Animal	Excretory organ	Excretory nitrogenous substrate
Reptile		
Paramecium		
Earthworm		
Cockroach		

(7) Which one of the following substances is not transported by the blood circulatory system in arthropods? **(2 marks)**

a) Nutrients.

b) Hormones.

c) Respiratory gas.

d) Nitrogenous wastes.

(8) Match the elements of column **A** and **B** in each case. **(4 marks)**

COLUMN A	COLUMN B
1. Gram-positive bacteria	i. Stain red or pink
2. Gram-negative bacteria	ii. Stain blue or purple
3. Spore staining	iii. Malachite Green and Safrin
4. Differential staining	iv. Multiple staining reactions are used

(9) Fill in the blank with the term that best completes the sentence, from the following list: **Higher maximum; Immigration; Carrying capacity**. **(3 marks)**

a) The _____ is the maximum population size that can be supported in an area without harming the environment.

b) Populations gain individuals through births and _____.

c) Under ideal conditions, populations can grow at _____ rates.

(10) The table below compares monosaccharides and amino acids. Copy and complete it by putting a tick **(√)** where the statement is correct and putting a cross **(X)** where the statement is incorrect. **(7 marks)**

| Statement	Monosaccharides	Amino acids
Always contain nitrogen		
May be polymerised into macromolecules		
Released by complete hydrolysis of nucleic acids		
Insoluble in water		
May be linked by glycosidic bonds		
Released by complete hydrolysis of cellulose		
Always contain carbon, hydrogen and oxygen		

(11) State the roles of each of the following hormones in the bodies of human beings. **(4 marks)**
   a) Testosterone
   b) Prolactin
   c) Oestrogen
   d) Oxytocin

(12) Give any two negative impacts of monoculture and intensive livestock on ecosystems. **(2 marks)**

(13) One day, John caught and marked **90** butterflies in a population. A week later, he returned to the population and caught **80** butterflies, including **16** that had been marked previously. What is the size of the butterfly population? **(3 marks)**

(14) The control of blood glucose concentration involves a negative feedback mechanism.

   a) What are the stimuli, receptors and effectors in this control mechanism?

   (3 marks)

b) Explain how negative feedback is involved in this homeostatic mechanism.

(2 marks)

(15) Figure below shows stages **(a)** and **(b)** in mitotic cell division.
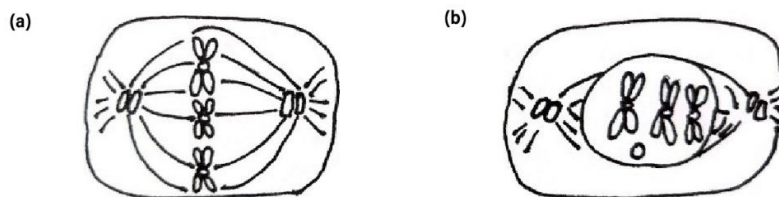
a) Name the stages (a) and (b). **(2 marks)**

b) What is the significance of mitosis in living things? **(2 marks)**

(16) List any three disadvantages/risks of gene technology. **(3 marks)**

(17) a) Describe the structure of a xylem vessel. **(2 marks)**

b) Why do xylem vessel walls have pits? **(1 mark)**

c) Why do sieve tube elements have only a thin layer of cytoplasm? **(2 marks)**

(18) a) Why do muscle cells need to be able to take up glucose rapidly? **(2 marks)**

c) Why are cell membranes described as partially permeable rather than semi-permeable? **(2 marks)**

SECTION B: Attempt any three out of five questions. (30 marks)

(19) a) Explain why enzymes are so specific in the reactions they catalyse.

(2 marks)

b) Suggest why all enzymes are protein molecules. **(2 marks)**

c) Describe how lock-and-key hypothesis of enzyme action differs from the induced-fit hypothesis. **(2 marks)**

d) Explain how enzymes reduce the activation energy of a reaction. **(2 marks)**

e) Explain why the reduction in activation energy provided by enzymes, is essential to living organisms. **(2 marks)**

(20) a) Explain how proteins and lipids are metabolized for energy during respiration process. **(3 marks)**

b) Explain why the body does not use fats to produce energy as carbohydrates, given that they produce much energy than carbohydrates.

(2 marks)

c) What are the major differences between cellular respiration and photosynthesis? **(5 marks)**

(21) The diagrams show a sarcomere in different states of contraction.
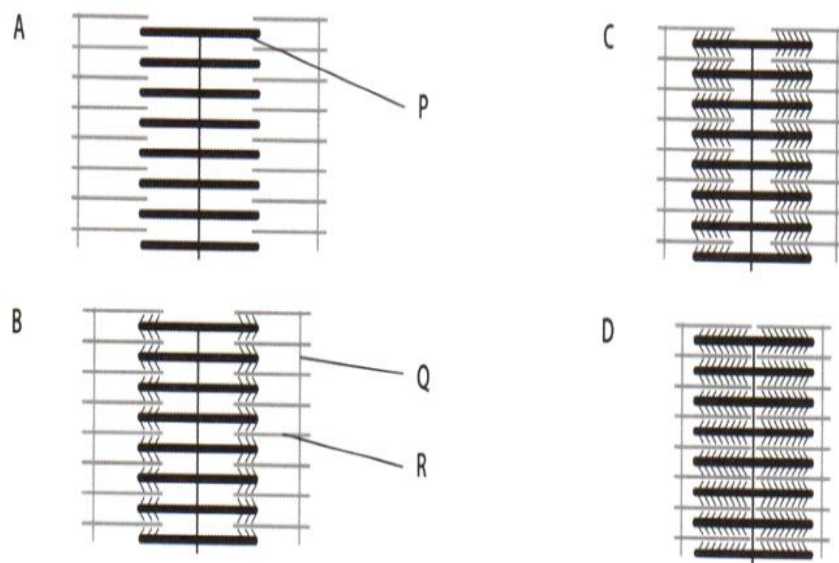
a) Name the parts labeled **P**, **Q** and **R**. **(3 marks)**

b) Explain why there are no actin-myosin cross-bridges visible in diagram **A**.

(2 marks)

c) Muscle fibers are able to contract with more force in some stages of contraction than others. Suggest which of the diagrams shows the state that can develop the greatest force and explain the reasons for your answer. **(2 marks)**

d) A muscle can contract with force, but it cannot pull itself back to its original relaxed length.

i. With reference to the mechanism of muscle contraction, explain why this is so. **(2 marks)**

ii. Suggest how the muscle in diagram **D** could be returned to the state shown in diagram **A**. **(1 mark)**

(22) Using diagrams briefly describe each of the following types of a sexual reproduction:

a) Binary fission in amoeba. **(4 marks)**

b) Budding in yeast. **(3 marks)**

c) Spore formation in *Rhizopus nigricans.* **(3 marks)**

(23) In hamsters, the allele for black coat colour (B) is dominant over the allele for white coat colour (b). The allele for rough coat (R) is dominant over the allele for smooth coat (r).

If you cross a hamster that is heterozygous black and homozygous rough, with one that is heterozygous black and heterozygous rough, what will be the phenotypes and genotypes of the offspring? **(10 marks)**

-END-

BLANK PAGE