

Candidate's Name:
Index No: Signature:

P530/1
BIOLOGY
(Theory)
Paper 1
2 ½ Hours

ASSHU – KASESE JOINT EXAMINATIONS BOARD (AKJEB)

MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

BIOLOGY
(THEORY)
Paper 1
2 Hours 30 Minutes

INSTRUCTIONS:

*This paper consists of 40 questions in section A and 6 questions in section B.
Answer all questions in both sections A and B.*

SECTION A:

Answers to this section must be written in the boxes provided.

SECTION B:

Write answers to this section in the spaces provided and nowhere else.

No additional sheets of paper should be inserted in this booklet.

No mark is awarded to any answers written out of its right space.

For Examiner's Use Only		
Question	Marks	Examiner's Initials & No.
Section A: 1- 40		
Section B: 41		
42		
43		
44		
45		
46		
Total		

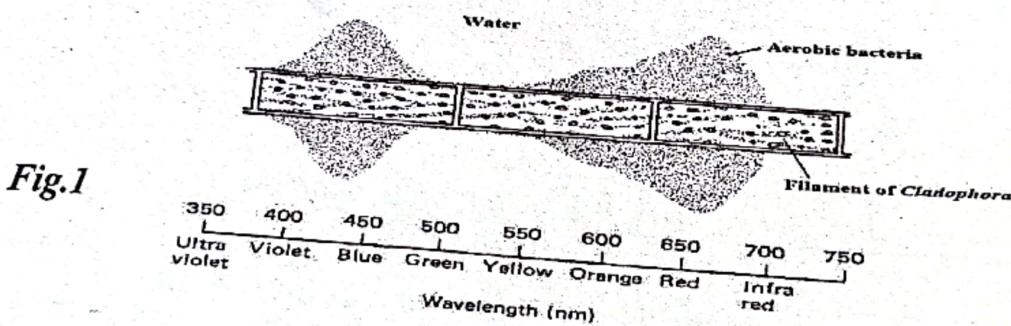
SECTION A: (40 Marks)

1. The cell theory states that:
 - A. cells form as organelles and molecules become grouped together in an organized manner.
 - B. the normal functioning of an organism depends on its individual cells.
 - C. the cell is the basic unit of life.
 - D. only eukaryotic organisms are made of cells.

2. The cell wall and capsule of bacteria:
 - A. are located inside the plasma membrane.
 - B. compensate for the lack of a plasma membrane.
 - C. provide easy access to the cytoplasm.
 - D. have projections called pili.

3. An example of chemical cycling occurs when:
 - A. Plants absorb solar energy and make their own food.
 - B. energy flows through an ecosystem and becomes heat.
 - C. hawks soar and nest in trees.
 - D. death and decay make inorganic nutrients available to plants.

4. In figure 1, filaments of the green alga *Cladophora* of the genus *Pseudomonas* were placed in a drop of water on a slide, then illuminated with light of different wavelengths and observed under the microscope. More aerobic bacteria accumulated near blue and red light because:



- A. in blue and red light, greater rates of photosynthesis occurs in chloroplast rapidly releasing large amounts of oxygen; for proliferation of the bacteria
- B. blue and red light work better with chlorophyll molecules
- C. much light is reflected than is absorbed
- D. light from ultra-violet, green and infra-red regions of the spectrum is hardly absorbed by chlorophylls.

- Which of these exhibits an increasingly more inclusive scheme of classification?
- A. Kingdom, phylum, class, order.
 - B. Phylum, class, order, family.
 - C. Class, order, family, genus.
 - D. genus, family, order, class

6. Male moths recognize females of their species by sensing chemical signals called pheromones. This is an example of:
- A. gamete isolation.
 - B. habitat isolation.
 - C. behavioral isolation.
 - D. mechanical isolation.
7. The many species of Galápagos finches are each adapted to eating different foods. This is the result of:
- A. gene flow.
 - B. adaptive radiation.
 - C. sympatric speciation.
 - D. genetic drift.
8. How is the process of natural selection different from that of artificial selection?
- A. Natural selection produces more variation.
 - B. Natural selection makes an individual better adapted.
 - C. Artificial selection is a result of human intervention.
 - D. Artificial selection results in better adaptations.
9. Which of the following is NOT a property of the elements most commonly found in living organisms?
- A. The elements have a low atomic mass.
 - B. The elements have an atomic number less than 21.
 - C. The elements possess eight electrons in their outer energy level.
 - D. The elements are lacking one or more electrons from their outer energy level.
10. What aspect of triglyceride structure accounts for their insolubility in water?
- A. The **COOH** group of fatty acids.
 - B. The non-polar **C—H** bonds in fatty acids.
 - C. The **OH** groups in glycerol.
 - D. The **C=C** bonds found in unsaturated fatty acids
11. Which of the following is NOT a difference between DNA and RNA?
- A. Deoxyribose sugar versus ribose sugar.
 - B. Thymine versus uracil.
 - C. Double-stranded versus single-stranded.
 - D. Phosphodiester versus hydrogen bonds.
12. Why are carbohydrates important molecules for energy storage?
- A. The **C—H** bonds found in carbohydrates store energy.
 - B. The double bonds between carbon and oxygen are very strong.
 - C. The electronegativity of the oxygen atoms means that a carbohydrate is made up of many polar bonds.
 - D. They can form ring structures in the aqueous environment of a cell.
13. Plasmodesmata in plant cells and gap junctions in animal cells are functionally similar in that:
- A. each is used to anchor layers of cells.
 - B. they form channels between cells that allow diffusion of small molecules.
 - C. they form tight junctions between cells.
 - D. they are anchored to the extracellular matrix.

14. The protein sorting pathway involves the following organelles/compartments in order:
- SER, RER, transport vesicle, Golgi.
 - RER, lysosome, Golgi.
 - RER, transport vesicle, Golgi, final destination.
 - Golgi, transport vesicle, RER, final destination.
15. Eukaryotic cells are composed of three types of cytoskeletal filaments. How are these three filaments similar?
- They contribute to the shape of the cell.
 - They are all made of the same type of protein.
 - They are all the same size and shape.
 - They are all equally dynamic and flexible.
16. The specific function of a membrane within a cell is determined by the:
- degree of saturation of the fatty acids within the phospholipid bilayer.
 - location of the membrane within the cell.
 - presence of lipid rafts and cholesterol.
 - type and number of membrane proteins.
17. If a cell is in an isotonic environment, then:
- the cell will gain water and burst.
 - no water will move across the membrane.
 - the cell will lose water and shrink.
 - osmosis still occurs, but there is no net gain or loss of cell volume.
18. A bacterial cell that can alter the composition of saturated and unsaturated fatty acids in its membrane lipids is adapted to a cold environment. If this cell is shifted to a warmer environment, it will react by:
- Increasing the amount of cholesterol in its membrane.
 - Altering the amount of protein present in the membrane.
 - Increasing the degree of saturated fatty acids in its membrane.
 - Increasing the percentage of unsaturated fatty acids in its membrane.
19. If one strand of a DNA is 5'ATCGTTAACGCGAGTCA3', then the complementary strand would be:
- 5'TAGCAATTCTGCTCAGT 3'.
 - 5'ACTGAGCGAACCTTGCTA 3'.
 - 5'TGACTCGCTTAACGAT 3'.
 - 5'ATCGTTAACGGAGTCA 3'.
20. Which of the following does *NOT* contribute to the selective permeability of biological membrane?
- Specificity of the carrier proteins in the membrane
 - Selectivity of channel proteins in the membrane
 - Hydrophobic barrier of the phospholipid bilayer
 - Hydrogen bond formation between water and phosphate groups

21. A cell can use the process of *facilitated diffusion* to:
- A. concentrate a molecule such as glucose inside a cell.
 - B. remove all or a toxic molecule from a cell.
 - C. move ions or large polar molecules across the membrane regardless of concentration.
 - D. move ions or large polar molecules from a region of high concentration to a region of low concentration.

22. Enzymes have similar responses to both changes in *temperature* and *pH*. The effect of both is on the:

- A. rate of movement of the substrate molecules.
- B. strength of the chemical bonds within the substrate.
- C. three-dimensional shape of the enzyme.
- D. rate of movement of the enzyme.

23. Feedback inhibition is an efficient way to control a metabolic pathway because the

- A. first enzyme in a pathway is inhibited by its own product.
- B. last enzyme in a pathway is inhibited by its own product.
- C. first enzyme in a pathway is inhibited by the end-product of the pathway.
- D. last enzyme in a pathway is inhibited by the end-product of the pathway.

24. Glycolysis produces ATP by:

- A. phosphorylating organic molecules in the priming reactions.
- B. the production of glyceraldehyde 3-phosphate.
- C. substrate-level phosphorylation.
- D. the reduction of NAD^+ to $NADH$.

25. The reactions of the Krebs cycle occur in the:

- A. inner membrane of the mitochondria.
- B. intermembrane space of the mitochondria.
- C. cytoplasm.
- D. matrix of the mitochondria.

26. A water molecule has a *V-shaped* structure as shown in figure 2 below.

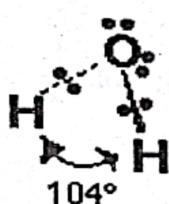


Fig.2

The molecule forms weak hydrogen bonds with other water molecules between the oxygen atom and hydrogen atom of adjacent water molecule. Which of the following statements explains why the water molecule is relatively unreactive?

- A. Two hydrogen atoms are covalently bonded to one oxygen atom by sharing electrons, forming a stable molecule.
- B. The molecule is not electrically neutral, since the oxygen atom being more electro negative.

- C. There is no net negative charge on the oxygen atom and a net positive charge on the hydrogen atom.
- D. Water is neutral hence does not alter the pH of cellular components on their environment.
27. Which of the following is NOT a true statement regarding cellular respiration?
- Enzymes catalyze reactions that transfer electrons.
 - Electrons have a higher potential energy at the end of the process.
 - Carbon dioxide gas is a by-product.
 - The process involves multiple redox reactions.
28. The direct source of energy for the ATP produced by ATP synthase comes from:
- the electron transport chain.
 - a proton gradient.
 - substrate-level phosphorylation.
 - the oxidation reactions occurring during respiration.
29. How is a reaction center pigment in a photosystem different from a pigment in the antenna complex?
- The reaction center pigment is a chlorophyll molecule.
 - The antenna complex pigment can only reflect light.
 - The reaction center pigment loses an electron when it absorbs light energy.
 - The antenna complex pigments are not attached to proteins.
30. The ion Ca^{2+} can act as a second messenger because it is:
- produced by the enzyme calcium synthase.
 - normally at a high level in the cytoplasm.
 - normally at a low level in the cytoplasm.
 - stored in the cytoplasm.
31. The main difference between bacterial cell division and eukaryotic cell division is that:
- because bacteria only have one chromosome, they can count the number of copies in the cell.
 - eukaryotes mark their chromosomes to identify them and bacteria do not.
 - bacterial DNA replication and chromosome segregation are concerted processes but in eukaryotes they are separated in time.
 - because bacteria have two chromosomes, thus they can count the number of copies in the cell.
32. Crossing over involves each of the following with the exception of:
- the transfer of DNA between two non-sister chromatids.
 - the transfer of DNA between two sister chromatids.
 - the formation of a synaptonemal complex.
 - the alignment of homologous chromosomes.

33. When you cross true-breeding tall and short tobacco plants you get an **F1** that is intermediate in height. When this **F1** is self-crossed, it yields an **F2** with a continuous distribution of heights. What is the best explanation for these data?

- A. Height is determined by a single gene with incomplete dominance.
- B. Height is determined by a single gene with many alleles.
- C. Height is determined by the additive effects of many genes.
- D. Height is determined by epistatic genes.

34. Down syndrome is the result of trisomy for chromosome 21. Why this trisomy viable and trisomy for most other chromosomes is not?

- A. Chromosome 21 is a large chromosome and excess genetic material is less harmful.
- B. Chromosome 21 behaves differently in meiosis I than the other chromosomes.
- C. Chromosome 21 is a small chromosome with few genes so this does less to disrupt the genome.
- D. Chromosome 21 is less prone to nondisjunction than other chromosomes.

35. Figure 3 below shows curves representing the changes during mitosis in an actively dividing somatic cell.

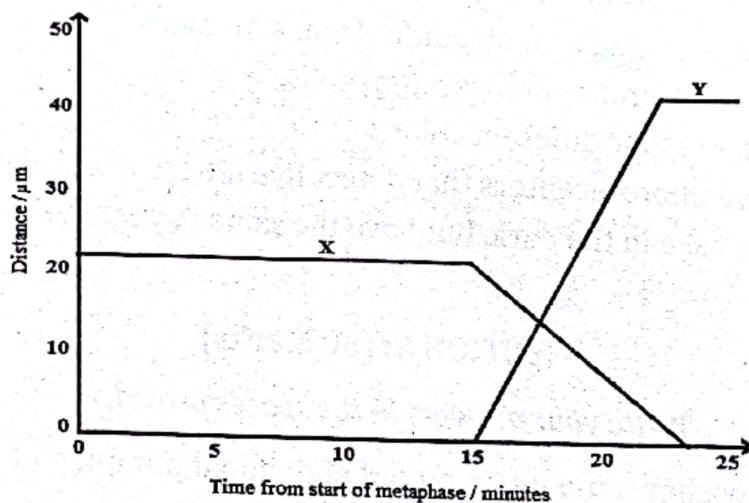


Fig.3

What does curve **X** represent?

- A. Distance between centromeres of sister chromatids
- B. Distance between centromeres of chromatids and cell poles
- C. Distance between centromeres of non-sister chromatids and cell poles
- D. Distance between centromeres of sister chromatids

36. The enzyme that forms peptide bonds is called peptidyl transferase because it transfers:

- A. a new amino acid from a tRNA to the growing peptide.
- B. the growing peptide from a tRNA to the next amino acid.
- C. the peptide from one amino acid to another.
- D. the peptide from the ribosome to a charged tRNA.

37. Natural selection can lead to speciation:
- by causing small populations to diverge more than large populations.
 - because the evolutionary changes that two populations acquire while adapting to different habitats may have the effect of making them reproductively isolated.
 - by favoring the same evolutionary change in multiple populations.
 - by favoring intermediate phenotypes.
38. In terms of numbers of species, the most successful phylum on the planet earth is the:
- Mollusca.
 - Arthropoda.
 - Echinodermata.
 - Annelida.
39. A functional reflex requires:
- only a sensory neuron and a motor neuron.
 - a sensory neuron, the thalamus, and a motor neuron.
 - the cerebral cortex and a motor neuron.
 - only the cerebral cortex and the thalamus.
40. Some birds have broader color perception than humans, who are trichromatic. How does a bird that is pentachromatic differ from a human?
- They have different photoreceptor cells.
 - They can see four different colors.
 - They have photoreceptors that detect five different wavelengths of light.
 - They can't see in the dark, but have the same daylight vision as humans.

SECTION B: (60 Marks)

Write your answers in the spaces provided:

41. The table below shows the mean rate of abdominal pumping of an insect before and during flight.

Stage of flight	Mean rate of abdominal pumping ($dm^3 \text{ of air kg}^{-1} \text{ hr}^{-1}$)
Before	42
During	186

(02 marks)

- a). What is meant by 'Abdominal pumping'?

- b). Calculate the percentage increase in the rate of abdominal pumping before and during flight.

(02 marks)

(c). Account for the difference in the mean rate of abdominal pumping before and during flight. (03 marks)

(d). Explain the absence of abdominal pumping in many small insects. (03 marks)

42. (a)(i). What is meant by term "blue baby condition"? (01 mark)

(ii). Explain two causes of the blue baby condition in humans. (03 marks)

(b). Explain how the placenta functions as:

(i). Small intestine (01 mark)

(ii). An endocrine gland (01 mark)

(iii). Lung (02 marks)

(c). The blood supply of the mother and of the fetus are kept separate from each other at the placenta. Suggest and explain reasons why these two blood systems must not be joined together. (02 marks)

.....
.....
.....
.....
.....
.....
.....
.....

43. (a). State **three** exclusive features of an epithelial tissue. (03 marks)

.....
.....
.....
.....
.....
.....
.....
.....

(b). Describe the structure of a squamous epithelium. (03 marks)

.....
.....
.....
.....
.....
.....
.....
.....

(c). State **four** structural differences between a vessel element and a tracheid. (04 marks)

44. Figure 4 below shows the structure of an ATP molecule. Study it very carefully and answer the questions that follow:

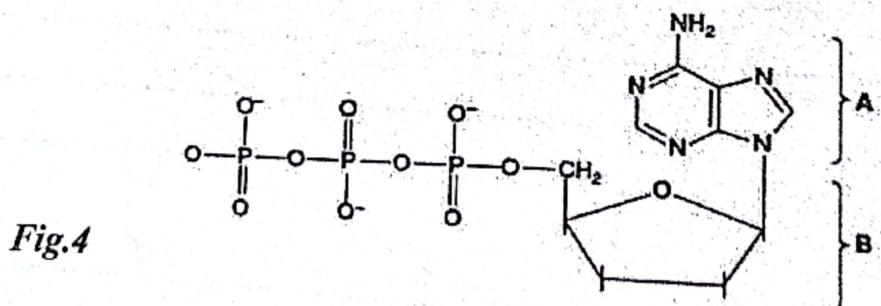


Fig.4

(a). Name components A and B

A: (02 marks)

B:

(b). State **three** roles of **ATP** in living cells.

(03 marks)

(ii). Describe how the structure of **ATP** is related to its role as energy currency. (05 marks)

45. (a)(i) What is meant by the term *Osmoregulation*?

(01 mark)

(ii) What osmoregulatory problems are faced by small *rodents* living in dry environments?

(02 marks)

(b)(i). Mention **three** physiological adaptations of arid rodents to scarcity of water.

(03 marks)

(ii). State **one** life style in those rodents to avoid extreme diurnal heat.

(01 mark)

(c). Explain why marine bony fish drink vast quantities of water unlike fresh water bony fish.

(03 marks)

46. (a). Define the following terms related to protein synthesis.

(i). Transcription.

(01 mark)

(ii). Translation.

(01 mark)

(b). Outline the features of the genetic code

(03 marks)

(c). Explain the role of *Ribonucleic Acid (RNA)* in Protein synthesis.

(05 marks)

END