GROUPE SCOLAIRE MARIE REINE RWAZA

TEL. 0788548407

P.O BOX 45 RUHENGERI

E-mail: mariereinerwaza@yahoo.fr

BIOLOGY QUESTIONS BANK S4 MCB

UNIT 1: Introduction to biodiversity.

1) Define the following terms: biodiversity, species, niche, population, and community.

2) Distinguish between:

a) Community and population

b) Ecological niche and habitat

3) Describe the two main components of an ecosystem.

4) Hippopotamus has different habitats. It was found that the resting habitat is different from the mating habitat, and these two habitats are different from the area where this animal gets food. This means that Hippopotamus has more than two habitats. Explain the ecological term given to this set of habitats.

5) Define the following terms:

a) An ecosystem,

b) Extinction?

6) Discuss the benefits of biodiversity for human being and the causes of extinction of Species in Rwanda?

7) Discuss the major factors leading to the degradation of ecosystems in Rwanda.

8) What would happen if biodiversity is completely lost?

9) Explain how forests contribute to the availability of clean water?

10) Discuss the contribution of ecosystems to cultural traditions in Rwanda.

11) In Rwanda different plants are used in traditional medicine to treat different diseases. Make a research to list at least 20 medicinal plants and specify the diseases they treat.

12) Pollution is one of the causes of aquatic biodiversity loss.

a) What do you understand by water pollution?

b) Outline human activities leading to water pollution.

c) Discuss how polluted water affects aquatic living organisms?

13) Explain the difference between species richness and species evenness

14) Suggest what precautions you may need to take when measuring populations of aquatic animals or plants.

15) Explain why a habitat with high diversity tends to be more stable than one with lower diversity.

16) In a survey of trees in a tropical forest, students identified five tree species (A to E). They counted the numbers of trees in an area 100 m × 100 m and found these results:

Tree species	Number of individual species
A	56
B	48
C	12
D	6
E	3

Calculate the Simpson‘s Index diversity for identified species and explain the advantage of using data on species diversity and abundance when calculating an index of diversity.

17) Answer by true or false

1) Abiotic factors are the non-living physical aspects of the environment.

2) Mark–release–recapture is a method used to integrate the numbers of mobile animals

in aparticular place.

3) A correlation coefficient of 0 means that there isno correlation at all.

4) A sample is a portion, piece, or segment that is representative of a whole area of study.

5) In the Simpson'sindex, N represents the total number of organisms of a particular species.

18. a) What do you understand by the term biodiversity?

b) What do you think would happen to plants if there were no insects?

19) Describe how diversity is threatened by climate change and human activities.

20) What do you understand by endangered species? Describe one of them.

21) a. Define the term « **Genetic diversity**»?

b. Biodiversity is extremely important to people and the health of ecosystems**.**

List three practical reasons why humans should maintain Biodiversity.

22) The peppered moth occurs in two forms, a dark melanic form and the normal non-melanic form. In a mark-release-recapture experiment in an industrial area, the following results were obtained.

	Number captured,marked,released	**Number recaptured one week later**	**% recaptured**
Melanic form	**180**	**101**	**–**
Non-melanic form	**75**	**15**	**–**

1. Copy and complete the table by calculating the figures in the percentage recaptured column**.**

2. Suggest two reasons for the difference in the percentage recaptured.

1. **a)** The Latin name for African bush elephant is ***Giraffa Camelopardalis.*** Using this information and your knowledge of classification.

Fill in the gaps in the table below:

Domain	-
Kingdom	-
Phylum	-
Class	-
Order	Artiodactyla
Family	Giraffidae
-	Giraffa
-	*Giraffa Camelopardalis*

b) The system of classification shown in (3.a) is described as **hierarchical**. What does this mean?

24.a) A survey was made of Benghal day flower, *Commelina benghalensis*, Growing on a lawn and in a field of young soybean plants. Ten 1.0m^2 quadrats were placed randomly in each area, and the number of dayflower plants in each quadrat was counted. The results are shown in the table.

Quadrat	1	2	3	4	5	6	7	8	9	10
Number of dayflowers on lawn	0	0	4	3	0	1	2	4	0	3
Number of dayflowers in fields	0	0	0	2	5	0	0	1	0	0

1. Calculate the species frequency and the species density of dayflower plants in each of the two areas.
2. Explain why it is important to use randomly placed quadrats?
3. Differentiate species richness to the species evenness.
4. Give a reason why two species of in an ecosystem cannot occupy the same niche.

25) **a.** Define the term« **variation**»

b.Variation may be caused by environmental conditions and genetic constitution.

Give two causes of genetic variation.

26) Explain why variation caused by the environment cannot be passed from an organism to its offspring?

27) Why is fungi recognized as a separate kingdom from plantae?

28. a) Define the term « **Correlation**»

b) Stoneflies, **Plecoptera spp.,** lay eggs in freshwater streams and rivers. The eggs hatch into nymphs which live in the water for several years before changing to adults. Stonefly nymphs are known as good indicators of pollution since they are very sensitive to a decrease in the oxygen concentration of the water. S4 MCB students at a certain school wanted to find out whether stonefly nymphs would be suitable as an indicator of water hardness. She collected samples from **12 streams** and obtained values of calcium carbonate concentration from the local water authority. The number of **stonefly nymphs** and the **concentration of calcium carbonate** for each of the **12 streams** are in the table below.

Steam	**Number of stonefly nymphs**	**concentration of calcium carbonate/arbitrary units**
1	**42**	**17**
2	**40**	**20**
3	**30**	**22**
4	**9**	**28**
5	**12**	**42**
6	**10**	**55**
7	**8**	**50**
8	**7**	**75**

9	**3**	**80**
10	**6**	**90**
11	**5**	**140**
12	**2**	**145**

1. Draw a scatter graph to see if there is a correlation between the number of stonefly nymphs and the hardness of the water**.**
2. State a null hypothesis for this investigation.
3. Use the data in the table to calculate the Spearman's rank correlation, r_s. Show your working.

What can you conclude from your calculation?

UNIT 2: INTRODUCTION TO CLASSIFICATION.

29) An African bush elephant belongs to order Proboscidae and family Elephantae.Its scientific name is Loxodonta africana.

a) Make a table indicating the hierarchy classification of African bush elephant.‖

c) Indicate how classification of living things is hierarchical.

30) Classify each of the following organisms under the following kingdom, phylum and Class taxa: honey bee, cockroach, maize, and spider.

31) Describe the system of naming species that Linnaeus developed.

32) The kingdom protoctista contains groups which do not appear to show an evolutionary Relationship. On this basis, is the five kingdom classification a natural or artificial classification?

33) What are the three methods that protists use to obtain food?

34) Identify three characteristics of protists

35) Do you think protists are unicellular or multicellular organisms?

36) The following is a list of organisms belonging to various kingdoms: housefly (Musca domestica), maize (Zea mays), Frog (Rana spp), Bat and Eagle.

a) Classify these organisms into their kingdoms

b) Name any two organisms that are not closely related and give a reason.

c) What does the name mays represent?

d) Define the term species

37) How are fungi different from members of kingdom plantae?

38) Which kingdom includes only prokaryotes? Which includes only heterotrophs?

39) Bacteria are both useful and harmful to humans. Discuss the validity of the statement.

40) How do Bacteria cause diseases?

41) Describe the 3 ways by which Bacteria spoil food

42) Explain how Bacteria is important in soil fertility and genetic engineering.

43) Suppose there is cholera outbreak in your village and the executive secretary invited you to Sensitize people about preventive measures against cholera. Prepare a brief presentation for this purpose and include causes, mode of transmission and then preventive measures.

44) Mr. Green lives in one of the slums in a certain city. He prepares and sells chapattis on street. He is usually very clean, but one morning, he is late for work so he does not bother to wash his hands after visiting the toilet. That day he prepares 400 chapattis all of which are sold. Few hours later, his customer Sandra suffered from a disease with the following signs and symptoms: severe diarrhea, excessive loss of water leading to dehydration, and vomiting, after five days. Later, all his customers were rushed and admitted in hospital due to the same problem.

1) Suggest the disease that Mr. Green‘s customers were suffering from and what caused the disease?

2) Name three other ways this disease might be spread around city.

3) After reading this scenario, what message do you have for people who are like Mr. Green?

4) Suppose you were the health officer for the area in town with such a problem.What steps would you take to prevent the disease from spreading further?

45) House flies are described as vectors. Describe, how houseflies transmit diseases to humans.

46) Discuss the reasons why viruses are not classified in any of the five kingdoms of living organisms.

47) What is meant by the term virus?

48) What are the parts of a virus?

49) Describe the two ways of how viruses cause infection.

50) What are differences between a bacteriophage and a prophage?

51) What is a retrovirus?

52) Do you think viruses should be considered as a form of life? Describe the reasons for your opinion.

53) Which one of the following living organisms belong to domain bacteria?

a) Euglena

b) Vibrio cholera

c) Paramecium

d) molds

54) The group of classification where organisms resemble one another and are capable of interbreeding together to produce viable offspring is known as:

a) Species

b) kingdom

c) Genus

d) Phylum

55) Which one of the following is a characteristic feature common to fish, reptiles and birds but absent in mammals?

a) Possession of scales

b) Has no limbs

c) Possession of feathers.

d) Undergo internal fertilization.

56) Which one of the following statements about fish is not correct?

a) Fish live both in water and on land and undergo external fertilization.

b) Most fish have bones while others are cartilaginous

c) Most fish have streamlined body, lateral line and swim bladder.

d) Gills are organs for gaseous exchange in fish

57) Which one of the following is not a characteristic of all insects?

a) They have three body parts namely head, thorax and abdomen.

b) They have three pairs of jointed legs attached on segment of the thorax.

c) They have four pairs of jointed legs

d) They have a pair of antennae attached on the head.

58) The following are characteristics of all mammals except;

a) They have mammary glands to secrete milk feed their young ones.

b) Their skin is covered with hair.

c) Undergo internal fertilization and internal development of the embryo.

d) They have a pair of wings made up feathers.

59) The point where the leaf joins the stem is called;

a) Apex

b) Margin

c) Leaf base

d) Lamina

a) Length of petiole.

53) Which of the following is less considered while identifying feature to construct a

dichotomous key of leaves?

b) Nature of margin

c) Nature of apex

d) Size and color of leaf

60) The following are characteristics of arachnids except;

a) Four pairs of jointed legs

b) Two body parts

c) Three body parts

d) Do not have wings.

UNIT 3: MICROSCOPY.

61) Work out the following measurements:

1) 1 millimetre (mm)=..... metre (m)

2) 1micrometre (µm)=..... metre (m)

3) 1 nanometre (nm) =.....metre (m)

4) 1 metre (m) = ...mm=..... µm =.....nm,

5) 1 kilometre (km) = ...m

62) Calculate the magnification of an image measuring 50mm, while the object measures 5µm.

63) If a nucleus measures 100mm on a diagram, with a magnification of X10 000, what is

the actual size of the nucleus?

64) Make a comparison between light and electron microscope, highlighting the advantages and disadvantages for each type of microscope.

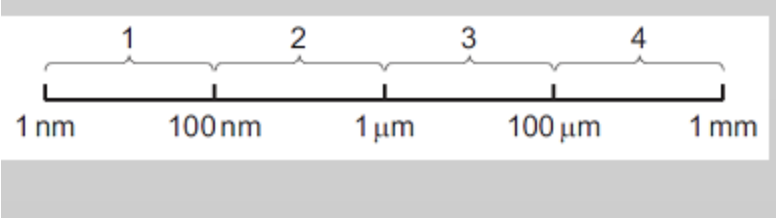
65) Discuss the advantages and disadvantages (limitations) of an electron microscope.

66) Discuss the advantages and disadvantages of the types of electron microscopes in medicine and biology research.

67) Many hospitals in Rwanda use light microscope instead of electron microscope. Discuss the credibility of the results found by the end of the study.

68) Make a comparative study between light and electron microscope focusing on the advantages of each type of microscope.

69) Which size ranges can be viewed using a light microscope?



a) 4 only

b) 1 and 2 only

c) 2 and 3 only

d) 3 and 4 only.

70) The diagram bellow shows a mitochondrion drawn from an electron micrograph. Observe the graph and answer the questions that follow.

If the length of the mitochondrion from X to Y is 3000 nm. What is the magnification of the drawing of the mitochondrion?

a) ×100

b) ×1000

c) ×10 000

d) ×100 000

71) A light microscope is used to observe two membranes that are 200 nm apart.

How far apart are the membranes when the objective lens is changed from low power (×40) to high power (×400)?

a) 2 µm

b) 20 µm

c) 200 nm

d) 2000 nm

72) The electron micrograph below is that of a chloroplast.

The length of the chloroplast along the line shown is 80 mm. The actual length of the chloroplast is 10 µm. What is the magnification of the chloroplast?

a) ×8 × 102

b) ×8 × 103

c) ×8 × 104

73) What is microscope?

74) List at least six parts of light microscope in your choice and their functions.

75) What is the difference between light and electron microscope?

76) How would you set up a light microscope to view a slide under high magnification?

77) Give two advantages of the electron microscope over a light microscope.

78) What is the difference between magnification and resolution power?

79) Explain why for tissue examination under light microscope the following are necessary:

a) Cutting a tissue into thin slices

b) Staining a tissue

UNIT 4: CELL STRUCTURE AND SPECIALISATION.

80) What structures do both animal and plant cells have in common?

81) State any five principles of the cell theory.

82) Answer by true or false:

a) All organelles of a cell are well seen through a compound light microscope.

b) Chloroplasts are found in both animal and plant cells.

c) Mitochondria are found only in animal cells.

83) With your pencil, draw and show the full ultra structure of both animal and plant cells.

84) Explain why muscle cells contain a lot of mitochondria, whereas most fat storage cells do not.

85) What kind of information is contained in chromosomes?

86) Describe the functions of the endoplasmic reticulum, Golgi apparatus, chloroplasts, Mitochondria and nucleus in the cell.

87) You examine an unknown cell under the microscope and discover that the cell Contains chloroplasts. What type of organism could you decide that the cell came From?

88) What is meant by the fluid mosaic model of the cell membrane?

89) State the properties of the cell membrane.

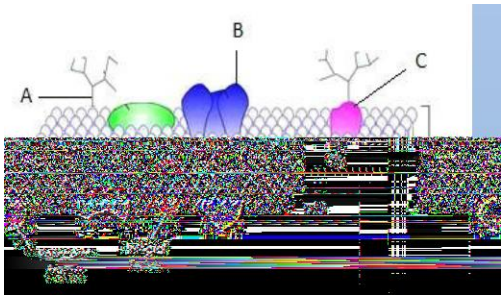
90) Discuss at least 4 types of the proteins in the cell membrane and their roles.

91) What does partially permeable membrane mean?

92) List four ways by which materials can move across the cell membrane.

93) What do the words hydrophilic and hydrophobic mean?

94) The diagram below shows the structure of a cell membrane. Observe carefully the diagram and answer the questions that follows.



1. Name the parts A,B,C and D.
2. Give the function of part B.

95. Define prokaryotic and eukaryotic cell.

1. In a form of a table,differentiate prokaryotic cells from Eukaryotic cells.
2. Explain why differentiation to produce erythrocytes involves a change in shape.
3. Red blood cells cannot divide as they have no nucleus.State two other biological processes that red blood cells cannot carry out.
4. Describe how the following are specialised for their roles:

1. Neutrophil
2. Sperm cell
3. Root hair cell.

4. How does a cell membrane differ from a cell wall?
5. Name the structures that animal and plant cells have in common,Those found in only plant cells,and those found only in animal cells.
6. List:

1. Three organelles each lack a boundary membrane.
2. Three organelles each bounded by a single membrane.

UNIT 5: DIVERSITY OF SPECIALISED TISSUES.

3. Define:

1. Differentiation
2. Cambium
3. Wood
4. Meristem.

5. Differentiate between Collenchyma and sclerenchyma.

6. Explain how the structure of parenchyma Xylem tissues are suitable to their functions.

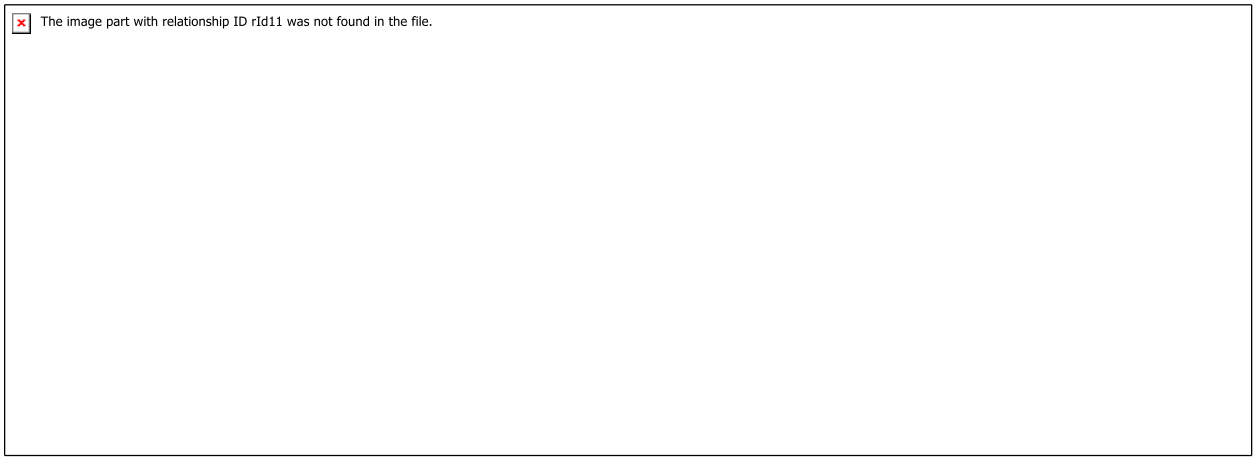
7. State the main components that make up a xylem and phloem tissues.

8. State where in a flowering plant you would find:

1. Lateral meristem
2. Intercalary meristem
3. Apical meristem.

108. Give some characteristics of meristematic cells.

109.



110) Answer by True or False:

1. Organic chemicals are often very complex and always contain the element carbon only.

2. A tissue is a group of cells with similar structure and function.

111) Explain why the cell as level of organization of human body is said to be:

1. Basic unit of human body.
2. Structural unit of human body.
3. Functional unit of human body.

112. Discuss how unicellular organisms perform their functions.

113. Discuss the advantages and disadvantages of being unicellular organisms.

114. What do you think is an advantage of multicellular over unicellular organisms?

115. Discuss and present how epithelial tissues have adapted to their functions.

116.Discuss the statement: " Blood is not a true tissue".

117.Describe the 3 main functions of blood.

118.Complete the following table:

Categories of tissues according to their functions	**Examples of tissues**
Growth tissues	
Protective tissues	
Storage tissues	
Support tissues	
Secretory tissues	

UNIT 6: TESTING FOR BIOLOGICAL MOLECULES.

119. a) Explain all steps used to test the following: glucose,starch and sucrose.

b) Identify the role of hydrochloric acid during the test of sucrose.

120. Discuss on three importance of testing food.

121. Complete the following table that indicates some biological tests.

Procedure's tests	**Observations**	**Conclusion**
1. Take 1cm^3 of ***A*** solution, and put it into a test tube. Then, add 2 drops of iodine solution.	The solution which was initially **white**,turns **blue-black**	-
1. Take 1cm^3 of ***B*** solution, put it into test tube. Then, add two drops of iodine solution.	The solution, initially colorless becomes colored like iodine solution(**yellow/brown**)	-
3. Take 1cm^3 of ***C*** solution, put it into test tube. Then, add two drops of iodine solution.	-	There is no starch in the solution.
4. Take 1cm^3 of ***D*** solution, put it into a test tube , and add 5 drops of Benedict's solution and boil	The colorless solution turns yellow, from yellow to green, and then to orange or red-brown precipitate	-
5.Take 1 cm^3 of **E** solution, put it into a test tube and add 5 drops of Benedict's solution and boil		***E*** solution is not a reducing sugar (it is a non- reducing sugar)
6. To 1cm^3 of starch, add 1cm^3 of HCl. Boil the mixture and cool. Add 1cm^3 of Sodium Hydroxide (NaOH)	No color change	-
7.-Take 1 cm^3 of **E** solution -Add 1cm3 of dilute hydrochloric acid (HCl) -Boil the mixture and cool -Add 1cm^3 of NaOH -Shake to mix -Add 1cm^3 of Benedict's solution and boil again.	The solution which was initially blue becomes **Yellow**, from yellow to **green**, from green to **orange** or **red-brown** precipitate.	-

1. Explain why HCl has been added in tests (6 and 7)?
2. Give the role of NaOH test 6.

3. why there is no change of color in experiment (6)?
4. Name the Biological molecules A,B,C,D and E.

UNIT 7: CARBOHYDRATES AND LIPIDS.

123.a) Describe the ring forms of α-glucose and β-glucose.

b) State the roles of carbohydrates and lipids.

124. a)Differentiate between starch and cellulose.

b) Recall the elements that make up carbohydrates and lipids.

125. a)Explain the formation of glycosidic bonds.

b) Explain the proportion of hydrogen in carbohydrates and lipids and relate this to the amount of energy released when oxidized.

c) Define the terms monomer, polymer, macromolecule, monosaccharide, disaccharide and polysaccharide.

126. Describe the structure of phospholipids relate to their functions in living organisms.

127. Describe the molecular structure and formation of triglycerides and phospholipids, and give their functions in living organisms.

128. Distinguish between collagen molecules and collagen fibres.

UNIT 8: PROTEINS AND WATER.

129. Explain how hydrogen bonding occurs between water molecules and relate the properties of water to its roles in living organisms.

130. Describe the primary, secondary, tertiary and quaternary structure of proteins.

UNIT 9: VITAMINS AND MINERAL SALTS.

131. State the mineral requirements for bodily functions.

132. Identify the symptoms of mineral and vitamin deficiency.

133. identify symptoms of scurvy, night blindness and goiter.

UNIT 10: ENZYMES.

134. Define the term enzyme and explain the criteria of naming enzymes.

134. Describe the mode of action of enzymes in terms of the lock and key and the induced fit hypotheses.

135. Explain factors affecting enzyme activity.

136. Define enzyme technology and its role in industry.

UNIT 11: PRINCIPLES OF GAS EXCHANGE SYSTEMS.

137. State the characteristics of gaseous exchange surfaces.

138. Describe the effects of tar and carcinogens in tobacco smoke on the gas exchange system.

UNIT 12: GAS EXCHANGE IN PLANTS.

139. Explain the theories of opening and closure of stomata stating limitations of each.

140. Explain how stomata, lenticels and breathing roots are adapted to their function.

UNIT 13: GROWTH AND DEVELOPMENT IN PLANTS AND ANIMALS.

141. Appreciate the importance of fruit and seed dormancy and germination in the life cycle of plants.

142. Distinguish between primary and secondary growth.

143. Outline the role of enzymes in the process of germination.

144. State types of plant growth hormones and their functions.

145. Compare growth patterns in arthropods and vertebrates. Describe the

146. Describe Stages and types of germination.

UNIT 14: SUPPORT AND LOCOMOTION.

147. Explain non-muscular movement in amoeba or paramecium

148. Explain how movements and support of fish are brought about in water.

149. Explain how support structures are related to the environment of the animal.

UNIT 15: CLASSIFICATION AND PATTERNS OF DISEASE.

150 .Explain what is meant by health and disease?

151. Identify different categories of disease and give an example of each.

152. Explain the theory of the disease and the sources of diseases. Differentiate illness to a disease.

153. a) With the aid of examples,explain the following terms: Signs,symptoms,Condition,Infection.

b) Kwashiorkor is non-communicable diseases.Explain why?

154. The AIDS virus does not kill its victims

1. What leads a person infected with Aids virus to death?
2. Why should one not be afraid of sitting in the same classroom with someone infected with the Aids virus is spread?

155. Complete the following table:

Classes of diseases	Causative agents	Examples
Bacterial diseases		
Viral diseases		AIDS
Fungal diseases		

156. Cholera is water borne disease.

1. What does **Water bone disease** mean?
2. Discuss on the prevention of Cholera in 25 lines.
3. Name the bacteria which causes cholera.

157. a) Explain this statement" Buying malarial drugs over the counter is not recommended". use ten lines to explain.

b) The ministry of health has put into place several measures to combat Malaria.Discuss any five methods have used to combat with it.

158. Give five stigmatizations that some students have on AIDS.

159. A teacher called **NKUNZEBOSE serge** at a certain school in Rwanda carried out a short period research around the school on taking illegal drugs in young peope.In his short research,it has been found that the problem of taking illegal drugs in young people becomes prevalent when they they drop out of schools.

1. What do **Illegal drugs** mean?
2. As a young generation, The future leaders of our country,What would be your advice to your friends about this case.
3. Give three examples of illegal drugs you know.
4. What are the ways in which drugs are taken?

UNIT 16: ASEXUAL REPRODUCTION IN PLANTS.

160. Describe the various methods of asexual reproduction: fragmentation, budding, and spore formation.

161.Discuss the advantages and disadvantages of asexual reproduction.

162. Describe the characteristics of vegetative reproductive parts in a flowering plant.

163. Differentiate between asexual and sexual reproduction.

164. Describe the characteristics of vegetative reproductive parts in a flowering plant.

UNIT 17: SEXUAL REPRODUCTION IN PLANTS.

165.a) Explain the meaning of the term alternation of generations.

b) Discuss the significance of alternation of generations.

166. Describe the types and structure of flowers.

167. Describe pollination and fertilisation in flowering plants.

168. Explain the events that take place in a flower after fertilisation.

169.Draw and label structures of a fruit and a seed.

170. Discuss modes of dispersal of fruits and seeds.

UNIT 18: MICROBIOLOGY.

171.Describe the basic structure of viruses.

172. Explain how a retrovirus reproduces**.**

173, Distinguish between the structure and function of viruses and prokaryotic organisms.

174. Describe how plant viruses can be transmitted.

175. Explain how and why archaebacteria are thought to have been the first forms of life.

176. Describe the main structural forms of eubacteria.

177. Distinguish between the structure of Penicillium and Mucor.

118. Explain how Mucor and Rhizopus feed and reproduce.

119.Describe the structure of a yeast cell.

120. Explain how saccharomyces reproduce.

121. Describe the structure and life cycle of Entamoeba hystolitica, Plasmodium and Trypanosoma**.**

122. Give two examples of Protozoa that cause diseases.

UNIT 19: CULTURING MICROORGANISMS.

123. Draw and interpret the graph of the population growth of bacteria.

124. Distinguish between gram negative and gram positive bacteria.

125. Explain how pure cultures of pure bacteria can be obtained.

126. a) Describe the methods of inoculation.

b)Explain the process of culturing microorganisms and the factors affecting their population growth.

UNIT 20: BIOTECHNOLOGY AND ITS APPLICATION.

127. Discuss why bacteria are useful in biotechnology and genetic engineering.

128. Describe the role of anaerobic respiration in yeast during bread-making.

129. Describe the three stages of biogas production and the role of bioreactors in economically poor rural communities.

130. Explain the biotechnology involved in production of ethanol, biogas and bread making.

GROUPE SCOLAIRE MARIE REINE RWAZA

TEL. 0788548407

P.O BOX 45 RUHENGERI

E-mail: mariereinerwaza@yahoo.fr

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17) Answer by true or false

1) Abiotic factors are the non-living physical aspects of the environment.

2) Mark–release–recapture is a method used to integrate the numbers of mobile animals

in aparticular place.

3) A correlation coefficient of 0 means that there isno correlation at all.

4) A sample is a portion, piece, or segment that is representative of a whole area of study.

5) In the Simpson'sindex, N represents the total number of organisms of a particular species.

18. a) What do you understand by the term biodiversity?

b) What do you think would happen to plants if there were no insects?

19) Describe how diversity is threatened by climate change and human activities.

20) What do you understand by endangered species? Describe one of them.

21) An African bush elephant belongs to order Proboscidae and family Elephantae.Its scientific name is Loxodonta africana.

a) Make a table indicating the hierarchy classification of African bush elephant.‖

c) Indicate how classification of living things is hierarchical.

22) Classify each of the following organisms under the following kingdom, phylum and

Class taxa: honey bee, cockroach, maize, and spider.

23) Describe the system of naming species that Linnaeus developed.

24) The kingdom protoctista contains groups which do not appear to show an evolutionary Relationship. On this basis, is the five kingdom classification a natural or artificial classification?

25) What are the three methods that protists use to obtain food?

26) Identify three characteristics of protists

27) Do you think protists are unicellular or multicellular organisms?

28) The following is a list of organisms belonging to various kingdoms: housefly (Musca

domestica), maize (Zea mays), Frog (Rana spp), Bat and Eagle.

a) Classify these organisms into their kingdoms

b) Name any two organisms that are not closely related and give a reason.

c) What does the name mays represent?

d) Define the term species

29) How are fungi different from members of kingdom plantae?

30) Which kingdom includes only prokaryotes? Which includes only heterotrophs?

31) Bacteria are both useful and harmful to humans. Discuss the validity of the statement.

32) How do Bacteria cause diseases?

34) Describe the 3 ways by which Bacteria spoil food

35) Explain how Bacteria is important in soil fertility and genetic engineering.

36) Suppose there is cholera outbreak in your village and the executive secretary invited you to

Sensitize people about preventive measures against cholera. Prepare a brief presentation for this purpose and include causes, mode of transmission and then preventive measures.

37) Mr. Green lives in one of the slums in a certain city. He prepares and sells chapattis on street. He is usually very clean, but one morning, he is late for work so he does not bother to wash his hands after visiting the toilet. That day he prepares 400 chapattis all of which are sold. Few hours later, his customer Sandra suffered from a disease with the following signs and symptoms: severe diarrhea, excessive loss of water leading to dehydration, and vomiting, after five days. Later, all his customers were rushed and admitted in hospital due to the same problem.

1) Suggest the disease that Mr. Green‘s customers were suffering from and what caused the disease?

2) Name three other ways this disease might be spread around city.

3) After reading this scenario, what message do you have for people who are like Mr. Green?

4) Suppose you were the health officer for the area in town with such a problem.What steps would you take to prevent the disease from spreading further?

38) House flies are described as vectors. Describe, how houseflies transmit diseases to

humans.

39) Discuss the reasons why viruses are not classified in any of the five kingdoms of living organisms.

40) What is meant by the term virus?

41) What are the parts of a virus?

42) Describe the two ways of how viruses cause infection.

43) What are differences between a bacteriophage and a prophage?

44) What is a retrovirus?

45) Do you think viruses should be considered as a form of life? Describe the reasons for your opinion.

46) Which one of the following living organisms belong to domain bacteria?

a) Euglena

b) Vibrio cholera

c) Paramecium

d) molds

47) The group of classification where organisms resemble one another and are capable of

interbreeding together to produce viable offspring is known as:

a) Species

b) kingdom

c) Genus

d) Phylum

48) Which one of the following is a characteristic feature common to fish, reptiles and birds but absent in mammals?

a) Possession of scales

b) Has no limbs

c) Possession of feathers.

d) Undergo internal fertilization.

49) Which one of the following statements about fish is not correct?

a) Fish live both in water and on land and undergo external fertilization.

b) Most fish have bones while others are cartilaginous

c) Most fish have streamlined body, lateral line and swim bladder.

d) Gills are organs for gaseous exchange in fish

50) Which one of the following is not a characteristic of all insects?

a) They have three body parts namely head, thorax and abdomen.

b) They have three pairs of jointed legs attached on segment of the thorax.

c) They have four pairs of jointed legs

d) They have a pair of antennae attached on the head.

51) The following are characteristics of all mammals except;

a) They have mammary glands to secrete milk feed their young ones.

b) Their skin is covered with hair.

c) Undergo internal fertilization and internal development of the embryo.

d) They have a pair of wings made up feathers.

52) The point where the leaf joins the stem is called;

a) Apex

b) Margin

c) Leaf base

d) Lamina

a) Length of petiole.

53) Which of the following is less considered while identifying feature to construct a

dichotomous key of leaves?

b) Nature of margin

c) Nature of apex

d) Size and color of leaf

54) The following are characteristics of arachnids except;

a) Four pairs of jointed legs

b) Two body parts

c) Three body parts

d) Do not have wings.

56) Work out the following measurements:

1) 1 millimetre (mm)=..... metre (m)

2) 1micrometre (µm)=..... metre (m)

3) 1 nanometre (nm) =.....metre (m)

4) 1 metre (m) = ...mm=..... µm =.....nm,

5) 1 kilometre (km) = ...m

57) Calculate the magnification of an image measuring 50mm, while the object measures 5µm.

58) If a nucleus measures 100mm on a diagram, with a magnification of X10 000, what is

the actual size of the nucleus?

59) Make a comparison between light and electron microscope, highlighting the advantages and disadvantages for each type of microscope.

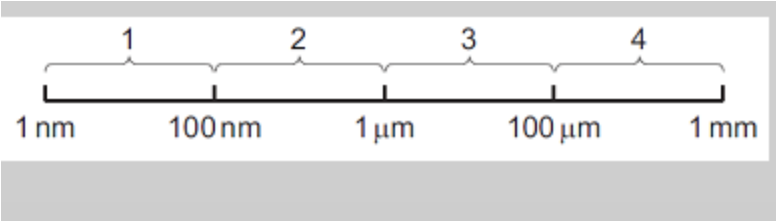
60) Discuss the advantages and disadvantages (limitations) of an electron microscope.

61) Discuss the advantages and disadvantages of the types of electron microscopes in medicine and biology research.

62) Many hospitals in Rwanda use light microscope instead of electron microscope. Discuss the credibility of the results found by the end of the study.

63) Make a comparative study between light and electron microscope focusing on the advantages of each type of microscope.

64) Which size ranges can be viewed using a light microscope?



a) 4 only

b) 1 and 2 only

c) 2 and 3 only

d) 3 and 4 only.

65) The diagram bellow shows a mitochondrion drawn from an electron micrograph. Observe the graph and the questions that follow.

If the length of the mitochondrion from X to Y is 3000 nm. What is the magnification of the drawing of the mitochondrion?

a) ×100

b) ×1000

c) ×10 000

d) ×100 000

56) A light microscope is used to observe two membranes that are 200 nm apart.

How far apart are the membranes when the objective lens is changed from low power (×40) to high power (×400)?

a) 2 µm

b) 20 µm

c) 200 nm

d) 2000 nm

67) The electron micrograph below is that of a chloroplast.

The length of the chloroplast along the line shown is 80 mm. The actual length of the chloroplast is 10 µm. What is the magnification of the chloroplast?

The length of the chloroplast along the line shown is 80 mm. The actual length of the Chloroplast is 10 µm. What is the magnification of the chloroplast?

a) ×8 × 102

b) ×8 × 103

c) ×8 × 104

68) What is microscope?

69) List at least six parts of light microscope in your choice and their functions.

70) What is the difference between light and electron microscope?

71) How would you set up a light microscope to view a slide under high magnification?

72) Give two advantages of the electron microscope over a light microscope.

78) What is the difference between magnification and resolution power?

79) Explain why for tissue examination under light microscope the following are necessary:

a) Cutting a tissue into thin slices

b) Staining a tissue

80) What structures do both animal and plant cells have in common?

81) State any five principles of the cell theory.

82) Answer by true or false:

a) All organelles of a cell are well seen through a compound light microscope.

b) Chloroplasts are found in both animal and plant cells.

c) Mitochondria are found only in animal cells.

84) With your pencil, draw and show the full ultra structure of both animal and plant cells.

85) Explain why muscle cells contain a lot of mitochondria, whereas most fat storage cells do not.

86) What kind of information is contained in chromosomes?

87) Describe the functions of the endoplasmic reticulum, Golgi apparatus, chloroplasts, Mitochondria and nucleus in the cell.

88) You examine an unknown cell under the microscope and discover that the cell Contains chloroplasts. What type of organism could you decide that the cell came From?

89) What is meant by the fluid mosaic model of the cell membrane?

90) State the properties of the cell membrane.

91) Discuss at least 4 types of the proteins in the cell membrane and their roles.

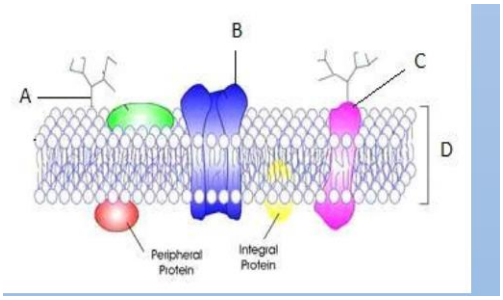
92) What does partially permeable membrane mean?

93) List four ways by which materials can move across the cell membrane.

94) What do the words hydrophilic and hydrophobic mean?

95) The diagram below shows the structure of a cell membrane. Observe carefully the

diagram and answer the questions that follows.



96) a. Define the term « **Genetic diversity**»? **/2 marks.**

b. Biodiversity is extremely important to people and the health of ecosystems**.**

List three practical reasons why humans should maintain Biodiversity. **/3 marks.**

97) The peppered moth occurs in two forms, a dark melanic form and the normal non-melanic form. In a mark-release-recapture experiment in an industrial area, the following results were obtained.

	Number captured,marked,released	**Number recaptured one week later**	**% recaptured**
Melanic form	**180**	**101**	**–**
Non-melanic form	**75**	**15**	**–**

a) Copy and complete the table by calculating the figures in the percentage recaptured column**. /4marks.**

b) Suggest two reasons for the difference in the percentage recaptured. **/1marks.**

98 a) The Latin name for African bush elephant is ***Giraffa Camelopardalis.*** Using this information and your knowledge of classification.
Fill in the gaps in the table below: /**6marks.**

Domain	-
Kingdom	-
Phylum	-
Class	-
Order	Artiodactyla
Family	Giraffidae
-	Giraffa
-	*Giraffa Camelopardalis*

b) The system of classification shown in (3.a) is described as **hierarchical**. What does this mean? /**2 marks.**

99 **a)** A survey was made of Benghal day flower, *Commelina benghalensis*, Growing on a lawn and in a field of young soybean plants. Ten 1.0m^2 quadrats were placed randomly in each area, and the number of dayflower plants in each quadrat was counted. The results are shown in the table.

Quadrat	1	2	3	4	5	6	7	8	9	10
Number of dayflowers on lawn	0	0	4	3	0	1	2	4	0	3
Number of dayflowers in fields	0	0	0	2	5	0	0	1	0	0

a) Calculate the species frequency and the species density of dayflower plants in each of the two areas. / **4 marks**.

b) Explain why it is important to use randomly placed quadrats? / **1mark**.

c) Differentiate species richness to the species evenness**. /3 marks.**

d) Give a reason why two species of in an ecosystem cannot occupy the same niche.
/1 marks.

100) a. Define the term« **variation**» / **2 marks.**

b.Variation may be caused by environmental conditions and genetic constitution.

Give two causes of genetic variation. / **2 marks.**

101) Explain why variation caused by the environment cannot be passed from an organism to its offspring? / **2 marks.**

102) Why is fungi recognized as a separate kingdom from plantae?

103. a) Define the term « **Correlation**» **/ 1 mark.**

b) Stoneflies, **Plecoptera spp.,** lay eggs in freshwater streams and rivers. The eggs hatch into nymphs which live in the water for several years before changing to adults. Stonefly nymphs are known as good indicators of pollution since they are very sensitive to a decrease in the oxygen concentration of the water. S4 MCB students at a certain school wanted to find out whether stonefly nymphs would be suitable as an indicator of water hardness. She collected samples from **12 streams** and obtained values of calcium carbonate concentration from the local water authority. The number of **stonefly nymphs** and the **concentration of calcium carbonate** for each of the **12 streams** are in the table below.

Steam	**Number of stonefly nymphs**	**concentration of calcium carbonate/arbitrary units**
1	**42**	**17**
2	**40**	**20**
3	**30**	**22**
4	**9**	**28**
5	**12**	**42**
6	**10**	**55**
7	**8**	**50**
8	**7**	**75**

9	**3**	**80**
10	**6**	**90**
11	**5**	**140**
12	**2**	**145**

i. Draw a scatter graph to see if there is a correlation between the number of stonefly nymphs and the hardness of the water**. / 2 marks.**

ii. State a null hypothesis for this investigation. **1 mark.**

iii. Use the data in the table to calculate the Spearman's rank correlation, r_s. Show your working. **/ 5 marks.**

iv. What can you conclude from your calculation? / **1 mark.**

104) Make a three-point dichotomous key to identify the organisms named below**:**

i. Millipede.

ii. Grasshopper.

iii. Snake.

105) Define prokaryotic and eukaryotic cell.

106) In a form of a table,differentiate prokaryotic cells from Eukaryotic cells.

107) Explain why differentiation to produce erythrocytes involves a change in shape.

108) Red blood cells cannot divide as they have no nucleus.State two other biological processes that red blood cells cannot carry out.

109) Describe how the following are specialised for their roles:

a) Neutrophil

b) Sperm cell
c) Root hair cell.

110) How does a cell membrane differ from a cell wall?

111) Name the structures that animal and plant cells have in common,Those found in only plant cells,and those found only in animal cells.

112) List:
a) Three organelles each lack a boundary membrane.
b) Three organelles each bounded by a single membrane.

113) Define:
a) Differentiation
b) Cambium
c) Wood
d) Meristem.

114) Differentiate between Collenchyma and sclerenchyma.

115) Explain how the structure of parenchyma Xylem tissues are suitable to their functions.

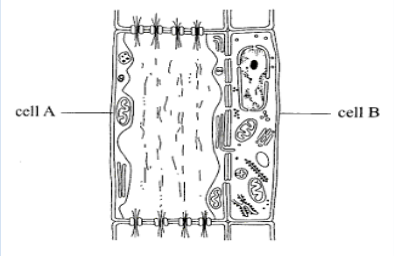
116) State the main components that make up a xylem and phloem tissues.

117) State where in a flowering plant you would find:
a) Lateral meristem
b) Intercalary meristem
c) Apical meristem.

118. Give some characteristics of meristematic cells.

119.

The diagram below shows a longitudinal section of two cells of phloem tissue in a plant stem.



a) Name the cells labelled A and B in the diagram

b) State the function off phloem in a plant

120) Answer by True or False:

a) Organic chemicals are often very complex and always contain the element carbon only.

b) A tissue is a group of cells with similar structure and function.

121) Explain why the cell as level of organization of human body is said to be:

a) Basic unit of human body.
b) Structural unit of human body.
c) Functional unit of human body.

122. Discuss how unicellular organisms perform their functions.

123. Discuss the advantages and disadvantages of being unicellular organisms.

124.What do you think is an advantage of multicellular over unicellular organisms?

125. Discuss and present how epithelial tissues have adapted to their functions.

126.Discuss the statement: " Blood is not a true tissue".

127.Describe the 3 main functions of blood.

128.Complete the following table:

Categories of tissues according to their functions	**Examples of tissues**
Growth tissues	
Protective tissues	
Storage tissues	
Support tissues	
Secretory tissues	

129. State the roles of carbohydrates and lipids.

130.Recall the elements that make up carbohydrates and lipids.

131.Explain the proportion of hydrogen in carbohydrates and lipids and relate this to the amount of energy released when oxidized.

132. Define the terms monomer, polymer, macromolecule, monosaccharide, disaccharide and polysaccharide.

133.Describe the ring forms of α-glucose and β-glucose.

134. Differentiate between starch and cellulose.

135. Explain the formation of glycosidic bonds.

136. Describe the structure of phospholipids relate to their functions in living organisms.

137. Describe the molecular structure and formation of triglycerides and phospholipids, and give their functions in living organisms.

138.Distinguish between collagen molecules and collagen fibres.

139. Explain how hydrogen bonding occurs between water molecules and relate the properties of water to its roles in living organisms.

140. Describe the primary, secondary, tertiary and quaternary structure of proteins.

141. State the mineral requirements for bodily functions.

142. Identify the symptoms of mineral and vitamin deficiency.

143. identify symptoms of scurvy, night blindness and goiter.

144. Define the term enzyme and explain the criteria of naming enzymes.

146. Describe the mode of action of enzymes in terms of the lock and key and the induced fit hypotheses.

146. Explain factors affecting enzyme activity.

147. Define enzyme technology and its role in industry.

148.State the characteristics of gaseous exchange surfaces.

149. Describe the effects of tar and carcinogens in tobacco smoke on the gas exchange system with reference to lung cancer and chronic obstructive pulmonary disease (COPD).

150. Explain the theories of opening and closure of stomata stating limitations of each.

151. Explain how stomata, lenticels and breathing roots are adapted to their function.

152. Appreciate the importance of fruit and seed dormancy and germination in the life cycle of plants.

153. Distinguish between primary and secondary growth.

154. Outline the role of enzymes in the process of germination.

155. State types of plant growth hormones and their functions.

156. Compare growth patterns in arthropods and vertebrates.

157. Descibe how the alveoli are protected against infection.

158.The composition of alveolar air remains fairly constant even though gases are exchanged with the blood in the capillaries that surround the alveoli.

a) Describe the process of gas exchange between alveolar air and blood.
b) Explain why the composition of alveolar air remains fairly constant.
c) Suggest 3 ways in which the gas exchange system responds to the demands of exercise.

159) Cigarette smoke contains tar,Nicotine and carbon monoxide.Tar contains carcinogens.

a) Describe the effect onicotine and carbon monoxide on the lining of the bronchi in the lungs.
b) Describe the effects of nicotine and carbon monoxide on the cardiovascular system.

160.Which eukaryotic kingdoms contain:

a) Autotrophic organisms.
b) Heterotrophic organisms.

161.Make a table to compare the features of the 4 kingdoms of eukaryotes.

162.List the ways in which cholera is transmitted from person to person.

163.One person can excrete 10^{13} Cholera bacteria a day.An infective dose is 10^{6} .How many people could one person infect in one day?

164. Expain why there is such a high risk of cholera following natural disasters such as earthquakes,hurricanes,typhoons and floods.

165.Describe the precautions that a visitor to a country where cholera is endemic can take to avoid catching the disease.

166.Which of the following does not include in single stranded RNA virus?

a) Tobacco mosaic.

b) Hiv.
c) Reovirus.
d) Both a and b are not included in single stranded RNA virus.

167.Which of the following is a pathogen of Escherichia coli?

a) Tobacco mosaic.
b) T2 bacteriophage.
c) Influenza virus.
d) Ebola.

168.Reovirus is.....

a) A double stranded DNA virus.
b) A single stranded DNA virus.
c) A double stranded RNA virus.
d) No correct answer.

169. Retrovirus is.....

a) A single stranded RNA virus.
b) A double stranded DNA virus.
c) A single stranded DNA virus.
d) Both a and c are correct.

170.Define the following Biological terms:

a) Plasmodesmata.
b) Enveloped virus.
c) Virion.
d) Capsid.
e) Bacteriophage.
f) Replication.

171. Explain why virus is not included any of classification?

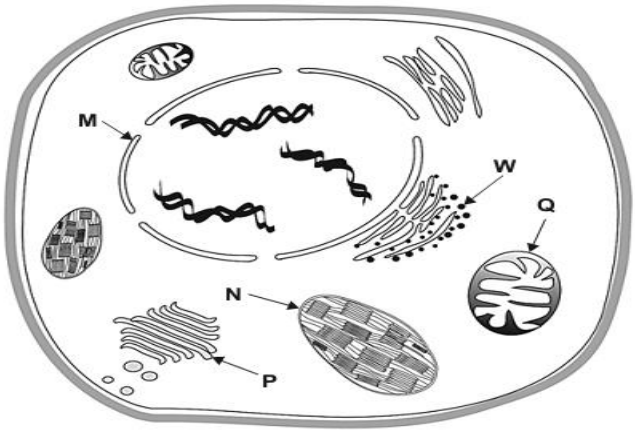
172. Hiv is called « Retrovirus».What does it mean?

173. Give one way virus cause disease.

174.Viruses are called accelular microorganisms.Expain why?

175.

Consider the following plant cell.



A process occurring at structure **W** in this plant cell would be

A. packaging of molecules.
B. aerobic respiration.
C. protein synthesis.
D. DNA replication.

END OF QUESTIONS BANK S4MCB