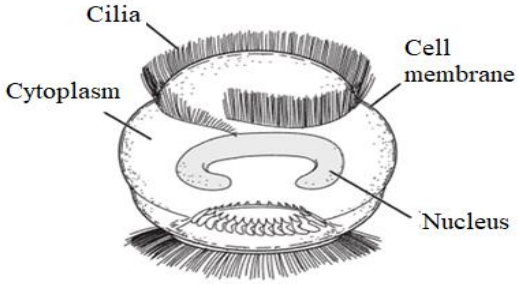
SECTION A [40 MARKS]

ANSWER **ALL** QUESTION

Question 1

a) **Directions: For each question, there are four alternatives A, B, C and D. Choose the correct alternative and circle it. Do not circle more than ONE alternative. If there are more than one circled, NO score will be awarded.** **[25]**

i. A scientist discovered a new organism as shown in the figure.



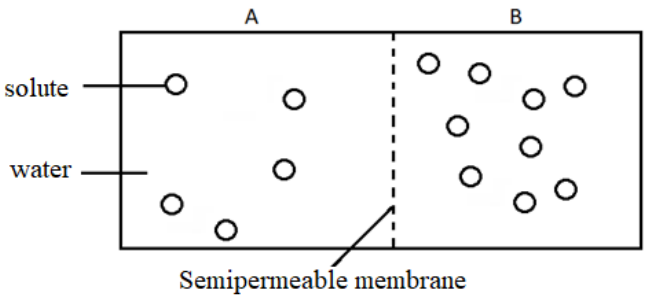
The organism is

A eukaryotic because it has cilia.
B eukaryotic because it has a nucleus.
C prokaryotic because it has cytoplasm.
D prokaryotic because it has a cell membrane.

ii. The microorganisms with appropriate metabolic capabilities can be one of the solutions to overcome oil spill contamination in water bodies. This technique is called

A biomimicry.
B bioremediation.
C biodegradation.
D bioaccumulation.

iii. Figure below shows the movement of water molecules across a semipermeable membrane.



Which of the following statement is **TRUE** with regard to the figure?

A movement of water molecules will take place from B to A
B movement of water molecules will take place from A to B
C semipermeable membrane is not necessary for this process to occur
D the movement of water molecules is against the concentration gradient

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iv. One of the ways to increase the shelf life of fruits is to coat a thin film of wax over its outer membrane. This is usually practiced to

I decrease the membrane transport process
II increase the membrane transport process
III decrease the rate of transpiration
IV increase the enzyme activity

A I and IV.
B II and III.
C II and IV.
D I and III.

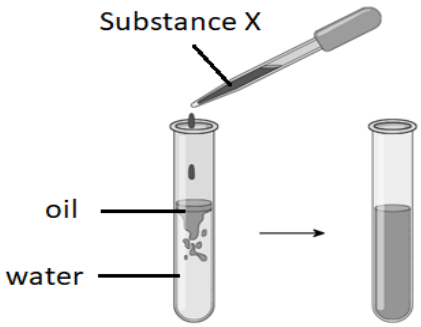
v. The products required for the Calvin cycle from the first phase of photosynthesis are

A O_2 and ATP.
B NADP and ADP.
C NADPH and CO_2.
D NADPH and ATP.

vi. When it is cold outside, the rate of photosynthesis is lowered. The factor that limits the rate of photosynthesis is

A water.
B stomata.
C temperature.
D carbon dioxide.

vii. A student in a biology class performed an experiment as shown below. Upon adding substance X in the test tube containing oil and water, the oil breaks down and dissolves in the water.



The substance X could be

A trypsin.
B bile juice.
C salivary amylase.
D hydrochloric acid.

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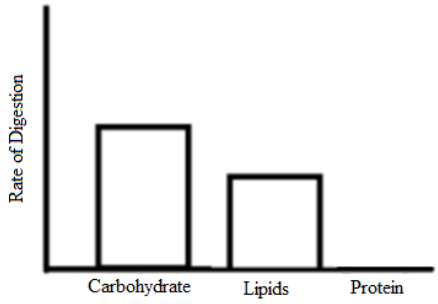
viii. The graph shown below is the digestion of different types of food in a particular site of the alimentary canal.

The site of digestion represented in the figure is



A mouth.
B stomach.
C oesophagus.
D small intestine.

ix. The blood component that help in the body's immunity is

A plasma.
B erythrocyte.
C leucocyte.
D thrombocyte.

x. Neuroscience and engineering shows the functional similarities between the human brain and man-made computers. Which of the following is **NOT** true with regard to the given statement?

A both take inputs from sensors
B both provide outputs as response
C both can make their own decision
D both depend on electrical charges to function

xi. All of the following are side effects of synthetic steroids **EXCEPT**

A spotting.
B infertility.
C irregular periods.
D muscle development.

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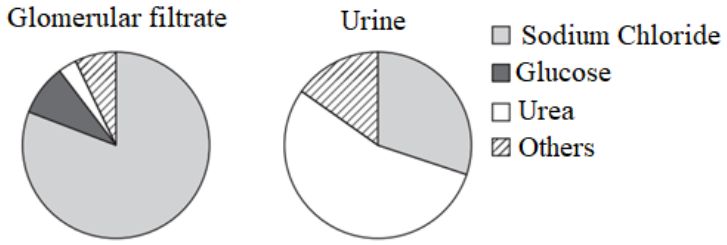
xii. Figure below shows the composition of glomerular filtrate and urine. Which of the following is **TRUE** with regard to the figure?



A urea is reabsorbed by the body
B glucose is secreted by the body
C glucose is reabsorbed by the body
D most of the NaCl is secreted by the body

xiii. Anaerobic digestion of bio-waste by bacteria is gaining attention nowadays as a solution to environmental concerns and also as an energy resource. This is possible because bacteria can degrade

A organic matters in presence of oxygen.
B organic matters in absence of oxygen.
C both organic and inorganic matters in absence of oxygen.
D both organic and inorganic matters in presence of oxygen.

xiv. The risk of HIV/AIDS is tied to one's behaviour. All of these behaviours can put a person at risk **EXCEPT**

A hugging.
B unprotected sex.
C sharing of shaving blades.
D injecting drugs with the same needle.

xv. Biotic and abiotic factors interact in a particular place to make

A a niche.
B a habitat.
C an ecosystem.
D biodiversity.

xvi. In order to promote the sustainability of the biodiversity in a locality, which one of the following activities would you minimize?

A planting of trees
B pollution of habitat
C destruction of habitat
D introduction of invasive species

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xvii. The consequences of building high-raised dam are

i. loss of biodiversity
ii. fall in the groundwater level
iii. soil erosion leading to the infertility of land
iv. depletion of the natural habitats of wild animals

A i and ii.
B ii and iii.
C iii and iv.
D i and iv.

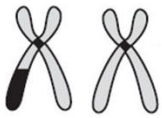
xviii. The transportation of food and water in plants are influenced by the rate of photosynthesis. The increase in rate of photosynthesis would

A increase the rate of food transport.
B decrease the rate of food transport.
C decrease the rate of water transport.
D not affect the rate of food and water transport.

xix. Figure below shows a certain phenomenon taking place during meiosis.

Which of the following diagrams show the correct phase after the event?

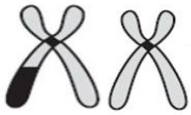
A



B

C

D



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xx. When you get a cut on your hand due to an injury, your body will make new skin cells by

A repairing the injured cells.
B replacing the injured cells through meiosis.
C enlarging the surrounding cells on the injured spot.
D dividing the surrounding cells on the injured spot.

xxi. A couple has 50% of children suffering from haemophilia and the rest are carrier of the disease. The possible reason for this is

A diseased father and normal mother.
B normal father and diseased mother.
C normal father and carrier mother.
D diseased father and carrier mother.

xxii. X-linked inheritance is associated with genes found on X- chromosomes. X-linked diseases are found

A only in males.
B only in females.
C more in males than females.
D more in females than males.

xxiii. When the industrial revolution began in the 1800s, smoke and soot from the industries killed lichens and darkened tree trunks. As a result, white colored moths became more visible to predators, while the dark colored moths became more camouflaged. This example of the peppered moths demonstrates

A the change in environment never favored dark colored moths.
B a change in an environment can result in the evolution of species.
C the change in environment does not affect the evolution of species.
D evolution occurs slowly which is not possible to determine.

xxiv. Genetic engineering is a process that uses laboratory-based technologies to alter an organism. This technique may involve the modification of

A protein.
B sugar.
C phosphate.
D nucleic acid.

xxv. In a population of squirrels, some prefer to live on trees and some in grassland. This may lead to

A temporal isolation.
B ecological isolation.
C geographic isolation.
D behavioural isolation.

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b) Fill in the blanks with appropriate words or phrases. **[5]**

i.	During a hot sunny day, leaves of a plant droop to reduce transpiration. This usually occurs when the leave cells lose water and become	
ii.	..... is the process performed by plants that can contribute to minimising global warming.	
iii.	Ecosystem consists of different animals, plants and microbes living within a region. These different forms of life make ……	
iv.	…… activates pepsinogen into pepsin	
v.	A person donates blood to a patient having blood group A and O. The donor's blood group is ……	

c) State whether the following statements are **TRUE** or **FALSE.** **[5]**

i.	The rate of photosynthesis in plants will be higher at 50°C than at 20°C.		
ii.	The transportation of food materials in plants requires the use of water and energy.		
iii.	In bread making process, the oxygen released from the yeast fills the dough and increases its volume.		
iv.	A farmer uses Naphthalene Acetic Acid (NAA) to prevent early sprouting of potatoes.		
v.	Urine is formed from the blood with the help of nephron.		

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d) Match each item under **Column A** with the item in **Column B.** Rewrite the correct pairs by writing the alphabet against the number in the space provided. **[5]**

Answers	Column A	Column B
i …….	i. Daughter cells receive an equal number of chromosomes after division of a mother cell	a. selective breeding
ii ……	ii. A type of allele that will produce a certain phenotype, even in presence of other type of allele	b. evolution
iii ……...	iii. DNA undergoes significant changes in germ cells to produce a new organism	c. dominant allele
iv ……	iv. Preference of alleles for a particular trait to produce offspring with more desirable characteristics	d. mitosis
V ……	v. A change in allele frequencies in a population over time	e. meiosis
		f. speciation
		g. recessive allele

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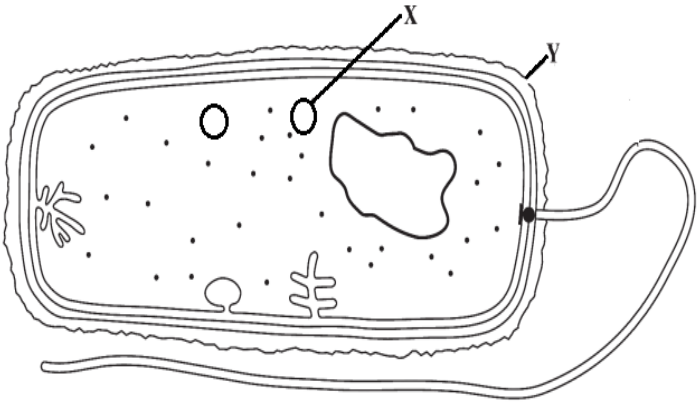
SECTION B [60 MARKS]

ATTEMPT **ANY SIX** QUESTIONS

Question 2

a) Study the figure given below and answer questions that follow.

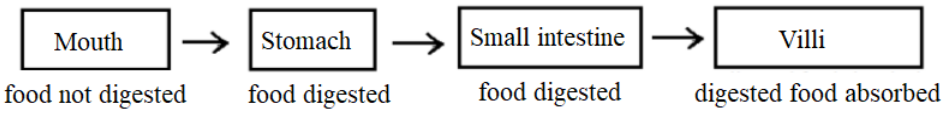


i. Determine the parts labelled X and Y. **[1]**

X :	
Y:	

ii. Give any **ONE** function of part labelled X. **[1]**

b) Study the flow chart of food digestion given below and answer the questions that follow.



i. Identify the type of food being digested. **[0.5]**

ii. Name the final product formed after the digestion. **[0.5]**

iii. Name any **TWO** enzymes that are required to break down the identified food. **[1]**

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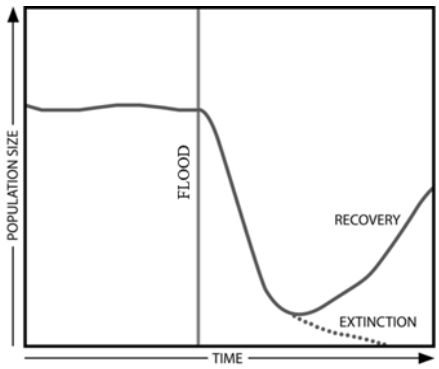
c) Read the excerpt given below from an article *Biodiversity Hotspot of Bhutan and its Sustainability* and answer the questions that follow.

Biodiversity is measured at different levels of biological set up together with genes, species and ecosystems along with their interactions. There are a total of 34 biodiversity hotspots in the world, among which the Eastern Himalayan (EH) range is one of the richest with nearly 750,000 sq. km area covering Nepal, Bhutan, and the Indian states of West Bengal, Sikkim, Assam and Arunachal Pradesh, southeast Tibet (China) and northern Myanmar. (Aparna Banerjee and Rajib Bandopadhyay, 2016).

i. What do you understand by biodiversity hotspots? **[1]**

ii. Do you think Bhutan will remain as one of the biodiversity hotspots over the years. Justify your answer. **[2]**

d) Figure below shows the change in population size of a species over a period of time. Study the figure and answer questions that follow.



i. Name the event that leads to speciation. **[1]**

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ii. Interpret the graph. **[2]**

Question 3

a) The experimental setup shown in the figure given below demonstrates osmosis using a potato osmoscope. Study the figure and answer the questions that follow:

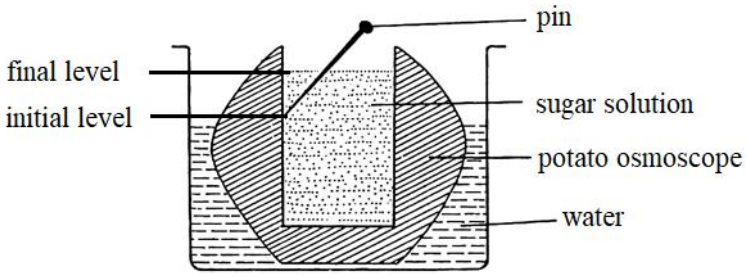

Figure 3.1

i. There is an increase in the level of sugar solution inside the potato osmoscope. Explain. **[2]**

ii. Design a control experiment for the above experiment. **[1]**

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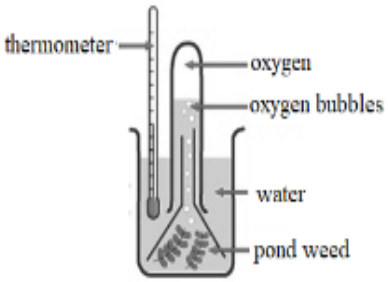
b) A student of class X performed an experiment on photosynthesis and the data gathered is as shown in table below. Study the figure and answer the questions.



Temperature (°C)	25	30	35	40	45
Number of Oxygen bubbles	5	7	9	7	5

i. State a hypothesis for the experiment. **[1]**

ii. Determine an independent and a dependent variable from the experiment. **[1]**

iii. Draw a graph using the data from the table. **[1]**

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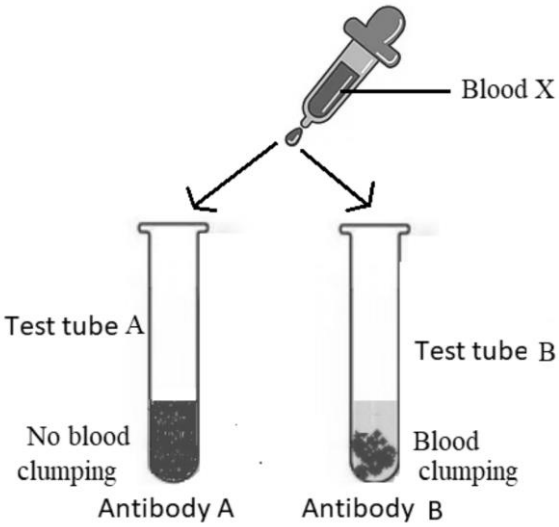
c) A doctor carried out an experiment to identify the blood group as shown below in the figure. Study the figure and answer the questions that follow:



i. Which blood group does X belong to? **[1]**

ii. Determine the recipient blood group(s) for the blood X. **[1]**

iii. Why did coagulation occur in test tube B? **[2]**

Question 4

a) Name the following.

i. The part of bacteria that helps in locomotion and mobility. **[1]**

ii. Digestive enzyme that breaks down fats in the stomach. **[1]**

iii. The process of engulfing pathogen by white blood cells. **[1]**

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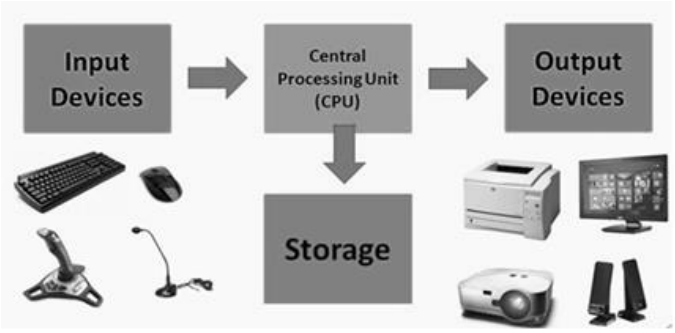
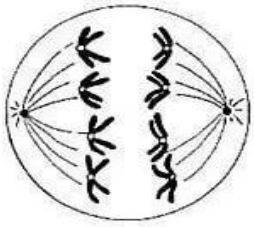
b) When computers were first developed, it soon became apparent that these machines have many features in common with the nervous system. Figure below provides information on how computers work. Study the figure and explain how the working of a computer is similar to the working of the human nervous system. **[2]**



c) Figure below shows one of the phases of cell division. Study the figure and answer the questions that follow:



i. Name the phase of the cell division. **[1]**

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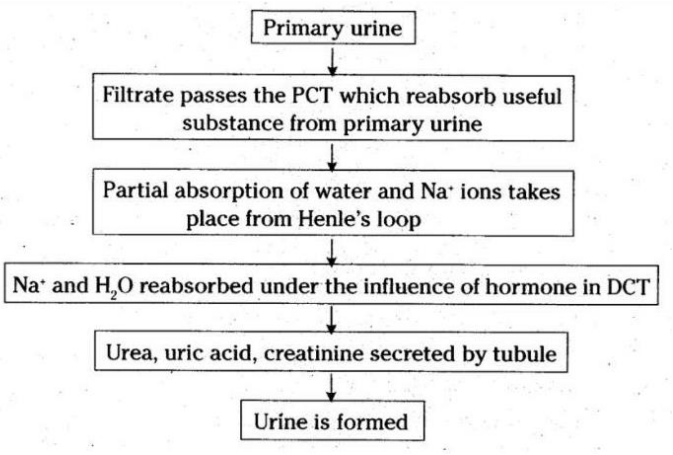
ii. Draw and name the phase prior to the phase shown in figure i. **[2]**

d) How would you increase crop productivity using the knowledge of factors affecting the rate of photosynthesis in a green house? **[2]**

Question 5

a) Figure below shows the flow chart on urine formation. Study the figure and answer the questions that follow.



i. Name the hormones involved in the following:

A. Reabsorption of sodium ion in DCT **[1]**

B. Reabsorption of water in DCT **[1]**

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ii. When the body has less amount of water, low volume of urine is excreted. Justify. **[2]**

b) Read the excerpt given below and answer questions that follow:

Bhutan has several invasive plant species and some of them are among the world's worst. What is more unsettling is these hazardous plants are growing and spreading rapidly. Ageratina adenophora, commonly known as crofton weed or sticky snakeroot, is one such plant species. The plant was recorded only in five dzongkhags in 2001, but recent surveys show it has now spread to 17 dzongkhags.
(Kuensel, May 24, 2018)

i. Identify the problem from the given excerpt. **[1]**

ii. Mention any **TWO** consequences if the problem continues to prevail. **[1]**

c) State any **TWO** unhealthy practices that lead to kidney failure. **[1]**

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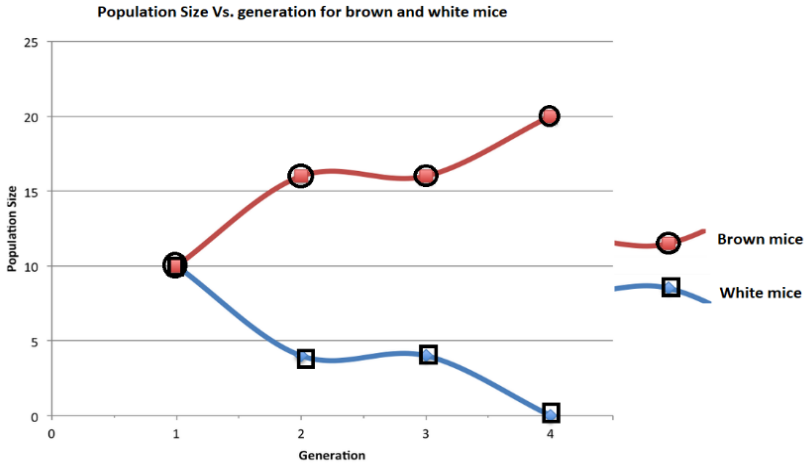
d) Figure below shows the population size of white and brown mice living in a bushy habitat. However, the population size has changed over a period of time. Study the figure and answer the questions that follow.



i. Name the evolutionary force involved in the change in the population of mice. **[0.5]**

ii. Which population of mice is favored to survive? Give a reason. **[1.5]**

e) Why are haemophilia and colour blindness considered as sex linked diseases? **[1]**

Question 6

a) People usually soak seeds in water before sowing. Give a reason based on the membrane transport concept. **[1]**

b) Read the notification issued by the Ministry of Health on July 20, 2022 regarding Helicobacter pylori.
Everyone who tested positive for *H.pylori* will be given triple therapy medicine for 14 days. Individuals aged 40 years and above who tested positive for *H.pylori* or

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have symptoms and other risk factors will be given endoscopy service as well.

i. Why is *Helicobacter Pylori* a topic of concern for Bhutanese? **[1]**

ii. Which test is done to confirm the presence of *Helicobacter pylori* in our body? **[1]**

c) You are provided with two plants, plant A (tall and bearing more fruits) and plant B (short and bearing less fruits).

i. Explain any **ONE** of the artificial selection processes that you would use to create an offspring with short height bearing more fruits? **[2]**

ii. How does artificial selection influence the evolution of plants? **[1]**

d) Bhutanese have good dietary practices. Do you agree? Justify. **[2]**

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e) Dark reaction of photosynthesis is light independent phase, however it cannot happen without light reaction. Comment. **[2]**

Question 7

a) Steroids are used by body builders to build muscles. Mention any **FOUR** psychological side effects of the excessive use of steroids. **[2]**

b) One of the evolutionary law states that, "In a large population, there won't be evolution taking place in absence of evolutionary forces such as mutation, migration, natural selection and random mating". Answer the following questions based on the given law.

i. Name the law mentioned above. **[1]**

ii. How would mutation lead to evolution? **[2]**

c) In a family, a trait of free earlobe is dominant (E) to the attached ear lobe (e). A father has homozygous dominant allele while the mother has heterozygous allele. Determine:

i. the genotype of father and mother. **[1]**

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ii. the percentage of free earlobe children. **[1]**

iii. phenotypic ratio of children. **[1]**

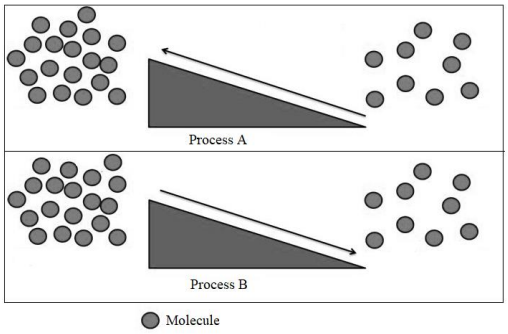
d) Give a reason for the following statements.

i. The removal of bark in woody stems result in the swelling of the upper part of the girdle. **[1]**

ii. Genetic variation in a species leads to evolution. **[1]**

Question 8

a) Figure given below represents two processes of membrane transport. Study the figure and answer the questions that follow.



i. Name the processes shown in the figure. **[1]**

Process A	
Process B	

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ii. How is the process involved in process A different from process B? **[1]**

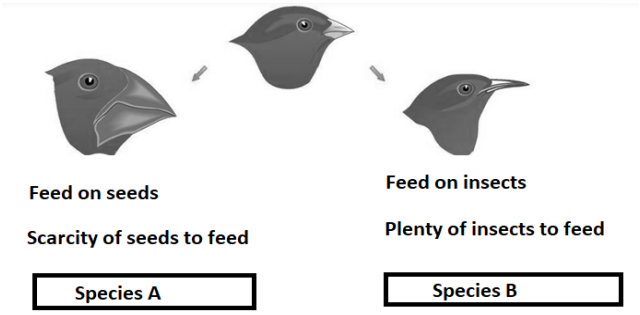
b) Constipation occurs when bowel movements become less frequent and stools become hard and difficult to pass. You as a biology student, mention at least **FOUR** solutions to avoid constipation. **[2]**

c) The excerpt given below is shared by a young patient with HIV in an article *Out of darkness and into light: My story* posted by UNICEF in one of the blogs.

I dream about a day when people in my country will stop seeing us, people living with HIV, as a threat to society.

Do you think a patient with HIV is a threat to society? Support your answer with **TWO** reasons. **[2]**

d) Figure below shows a certain phenomenon that leads to evolution of a bird species. Study the figure and answer the questions that follow.



i. Why is there a difference in shape of the beak in species A and species B? **[1]**

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ii. What would happen to the population of species A over a period of time? **[1]**

e) Extraction of timber for construction of buildings has become a threat to biodiversity. Suggest **TWO** measures that would help in minimising timber extraction. **[2]**

Question 9

a) Plant hormones have been extensively studied for their roles in the regulation of various aspects of plant development. Certain plant hormones are used by farmers to enhance crop yields. Study the table and complete it. **[3]**

Plant hormones	Functions
2, 4 dichlorophenoxyacetic	X …….
Y ……..	Early ripening of fruits and vegetables
Gibberellin	Z …….

b) A laboratory technician in a hospital was given the task to compare two sperm cells of the same patient. It was found that the genetic composition of these cells were not the same.

i. Name the type of cell division that produce sperm cells. **[1]**

ii. Why is the genetic composition of these cells not the same? **[1]**

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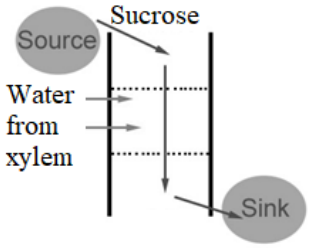
iii. Mitosis occurs in adult as well. Explain. **[1]**

c) Figure below represents the conduction of food in a plant. Study the figure and answer the questions that follow.



i. Identify the process given in the figure. **[1]**

ii. Give an example each for the following: **[1]**

Source:	
Sink:	

d) Create an ecosystem consisting of four biotic and four abiotic components. Ensure that the biotic components are dependent on the abiotic components. **[1]**

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e) Define Mendel's Laws of dominance. **[1]**

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