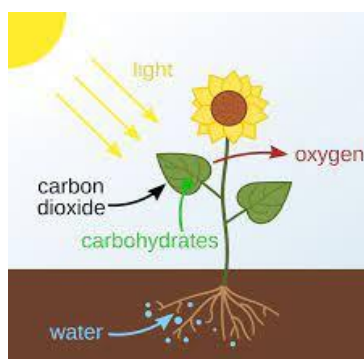


SECTION A [40 MARKS]
ANSWER ALL QUESTIONS

Question 1

a) **Direction: For each question, there are FOUR responses: A, B, C and D. [25]**
Choose the corresponding letter of your response and CIRCLE it neatly. NO
score will be awarded if you circle more than ONE letter.

- i. The statement that accurately compares prokaryotic and eukaryotic cells is
- A prokaryotic cells are larger in size than eukaryotic cells.
 - B eukaryotic cells have nucleus, while prokaryotic cells lack nucleus.
 - C both prokaryotic and eukaryotic cells contain membrane-bound organelles.
 - D prokaryotic cells are found only in multicellular organisms, whereas eukaryotic cells are found only in unicellular organisms.
- ii. The daily life experience that best demonstrates the process of diffusion is
- A water boiling in a pot on a stove.
 - B the sound of music traveling through the air.
 - C a tree absorbing water through its roots from the soil.
 - D the smell of *ema datsi* curry spreading throughout a room.
- iii. The figure given below illustrates a natural phenomenon which can be the solution to improve



- A crop yield.
- B quality of water.
- C quality of soil.
- D quality of light.

- iv. Which of the following is NOT an external factor affecting photosynthesis?
- temperature.
 - chlorophyll content.
 - oxygen concentration.
 - carbon dioxide concentration.
- v. The part of the phloem in a plant that can be compared to the oesophagus in human beings is
- phloem fibre.
 - sieve element.
 - companion cell.
 - phloem parenchyma.
- vi. Which statement accurately describes the process of translocation in plants?
- Translocation is facilitated by stomata
 - Translocation occurs from the leaves to the roots
 - Translocation is driven by active transport of sugars in the phloem
 - Translocation involves the movement of water and minerals in the xylem
- vii. Which of the following strategies can be effective in improving digestion of food?
- Consuming a high-protein diet
 - Limiting fluid intake during meals
 - Avoiding physical exercise after eating
 - Eating mindfully and chewing food thoroughly
- viii. The blood report of Sonam is given in the table below. Read the report and answer the question.

HEMATOLOGY COMPLETE BLOOD COUNT			
Test Name	Result	Normal	Unit
White blood cell	5.6	4.0-10.0	%
Lymphocyte %	40	20-40	%
Monocyte%	12	1-9	%
Neutrophil%	50	40-60	%
Eosinophil%		0-5	%
Basophil%		1.5-4.0	%

The report indicates that Sonam is suffering from

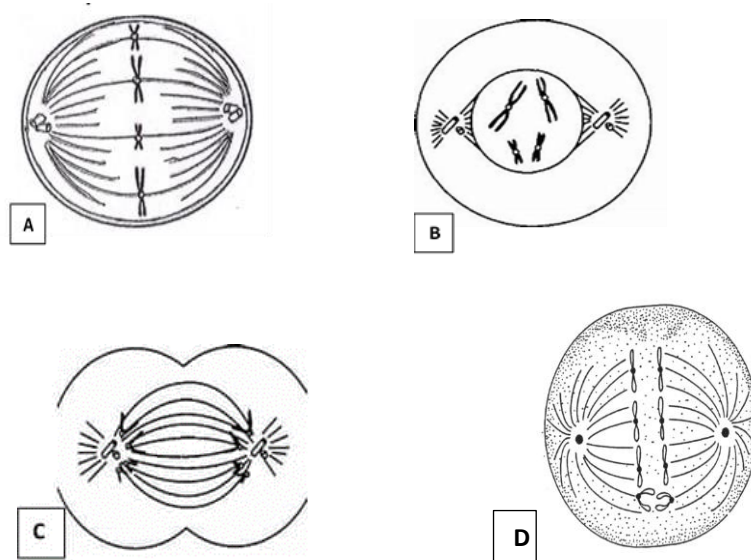
- A diabetes.
 - B infection.
 - C insomnia.
 - D hypertension.
- ix. What can be the drawback of using excessive amount of synthetic plant hormones?
- A Reduced flower and fruit production
 - B Increased resistance to pests and diseases
 - C Enhanced root development and nutrient uptake
 - D Risk of unintended side effects and negative environmental impact
- x. An article in the Kuensel dated on January 4th, 2017 states “Hospital records show that kidney failure related deaths in the country is on the rise. There were 25 kidney failure related deaths across the country last year”
Which of the following statements holds true regarding kidney failure?
- A Unhealthy lifestyle choices do not have any impact on kidney
 - B Lifestyle choices can affect kidney health in older individuals only
 - C Genetic factors are the sole contributors to kidney failure, regardless of lifestyle
 - D Making positive lifestyle changes can help prevent or delay kidney failure in some cases
- xi. Maintaining and protecting biodiversity is essential for the long-term sustainability of ecosystems, and the services they provide to humanity. All the examples given below demonstrate the strong relationship between biodiversity and the health, stability, and resilience of ecosystems **EXCEPT**
- A poaching.
 - B ecosystem services.
 - C ecological interdependence.
 - D resistance to invasive species and diseases.

- xii. Kitchen and municipal wastes have become one of the growing concerns in Bhutan. Such issues need to be resolved at the earliest before they become a serious threat to biodiversity and the nation as a whole. One of the methods depicted in the figure below is



- A recycling.
B landfilling.
C source reduction.
D anaerobic digestion.
- xiii. Which is the measure to reduce the impacts of deforestation on biodiversity using competency-based approach?
- A Develop an awareness campaign without concrete action plans
B Implement a national ban on all logging activities, regardless of their sustainability practices
C Impose strict penalties on companies engaged in deforestation without considering their social and economic circumstances
D Collaborate with local communities to establish sustainable agroforestry practices and promote the economic value of standing forests
- xiv. In an ecosystem, one of the biotic components which is always placed at the base of a food pyramid is
- A autotroph.
B heterotroph.
C carnivorous.
D decomposer.

- xv. The formation of matured ovum in female gametes is halted at prophase I until puberty. Which of the following describes the DNA content of a female's gametes during her childhood?
- A 23 chromosomes, 23 chromatids
 - B 23 chromosomes, 46 chromatids
 - C 46 chromosomes, 46 chromatids
 - D 46 chromosomes, 92 chromatids
- xvi. The sister chromatids separate and move towards opposite poles of the cell due to the shortening of spindle fibers. From the figure given below, choose the most appropriate diagram as described by the statement.



- xvii. What is the main difference between body cells and sex cells regarding genetic composition?
- A Body cells undergo recombination during genetic exchange, while sex cells remain unchanged
 - B Body cells contain a unique set of chromosomes, while sex cells contain identical chromosomes
 - C Body cells possess both maternal and paternal genetic information, while sex cells carry only one set
 - D Body cells have haploid chromosome number, while sex cells have diploid chromosome number

- xviii. Sex-linked diseases are genetic disorders that are linked to the sex chromosomes, specifically the X chromosome. Which of the following statements is true regarding sex-linked diseases?
- A They are not influenced by gender
 - B They are more commonly seen in males
 - C They are more commonly seen in females
 - D They are equally prevalent in males and females
- xix. If a female carrier of a sex-linked disease (heterozygous) has a child with an unaffected male, what is the probability that the son will have the disease?
- A 0%.
 - B 25%.
 - C 50%.
 - D 100%.
- xx. In Mendelian inheritance, when a parent with a dominant phenotype is crossed with a parent with a recessive phenotype, all the offspring show the dominant phenotype. What can be concluded about the genotype of a dominant parent?
- A Heterozygous
 - B Homozygous dominant
 - C Homozygous recessive
 - D It cannot be determined
- xxi. Natural selection is the process by which organisms adapt better to their environment to survive and reproduce more successfully. Which of the following is an example of natural selection?
- A A dinosaur evolving into a bird
 - B A lioness teaching her cubs to hunt
 - C A plant growing towards a light source
 - D A giraffe developing a long neck to reach leaves on tall tress

- xxii. In the context of natural selection, what does “fitness” refer to?
- A Physical strength and endurance
 - B Intelligence and cognitive abilities
 - C The overall health and longevity of an individual
 - D The ability to survive and reproduce in a given environment
- xxiii. Refer the following table to answer the question. A family wanted a pet cat that sheds the least amount of hair with a calm personality. Which cats should the breeder select to be the parents of the cat for the family?

Cat	Low hair shedding	Smaller than average	Higher hair shedding	Calm	Hyperactive
1		Yes		Yes	
2			Yes	Yes	Yes
3	Yes	Yes			
4		Yes			

- A 1 and 3
 - B 1 and 4
 - C 2 and 3
 - D 2 and 4
- xxiv. What happens to the frequency of advantageous alleles in a population over time under the influence of natural selection?
- A Increases
 - B Decreases
 - C Fluctuates randomly
 - D Remains constant
- xxv. In a population, the frequency of the dominant allele is 0.7. What is the frequency of the recessive allele?
- A 0.3
 - B 0.7
 - C 0.09
 - D 0.49

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

i.	For thousands of years, perishable foods such as fish, olives, and vegetables have been preserved in salt or brine. The bacteria cell when placed in a solution, gets killed by dehydration before they spoil the food.
ii.	Dorji had rice for breakfast. The carbohydrate present in the rice cannot be directly absorbed by the cells. The final product of carbohydrate which can be absorbed by the cells is
iii.	The name of the hormone that is commonly used today in agriculture to promote growth and development in plants and enhance agricultural productivity is
iv.	A farmer found the stem swollen above ring of the bark which he removed from the stem. The part removed along with bark is
v.	The pattern of inheritance of characters in an organism is based on Mendel's law of inheritance. Based on it, when the alleles of a gene are different, the individual is said to be for that gene.

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

i.	Microorganism found in curd is slightly bigger than eukaryotic cell.	
ii.	The dark reaction of photosynthesis can occur both during the day and night.	
iii.	COVID-19 is also known as the novel coronavirus. It is safe to gather in large groups without masks if everyone is fully vaccinated.	
iv.	Gene technology has a profound impact on the evolution of organisms. It is faster and more precise than the natural evolutionary processes.	
v.	Hardy–Weinberg law mathematically explains the occurrence and consistency of gene frequency for a particular gene. An example of the only strongest lion getting a chance to mate with a lioness holds true to this law.	

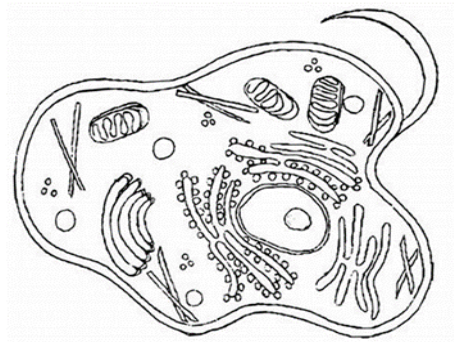
- d) Match each item under Column A with the item in Column B. Write the correct pairs by writing the letter against the number in the answer column. [5]

Answer	Column A	Column B	
i.	i. The liquid portion of blood, composed of water, proteins and various other substances	a. plasma	
ii.	ii. Carries oxygen and carbon dioxide throughout the body	b. platelets	
iii.	iii. Active reabsorption of sodium and passive reabsorption of water	c. red blood cells	
iv.	iv. Reabsorption of water and solutes to maintain concentration gradient	d. white blood cells	
v.	v. Reabsorption of water under the influence of antidiuretic hormone	e. proximal tubule	
		f. loop of Henle	
		g. distal tubule	
		h. collecting duct	

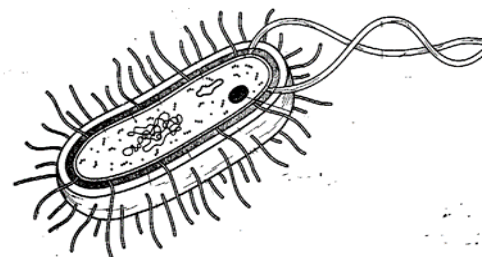
SECTION B [60 MARKS]
ATTEMPT ANY SIX QUESTIONS

Question 2

- a) Study the figure below and answer the following questions.



a.



b.

- i. Identify the cells. [1]

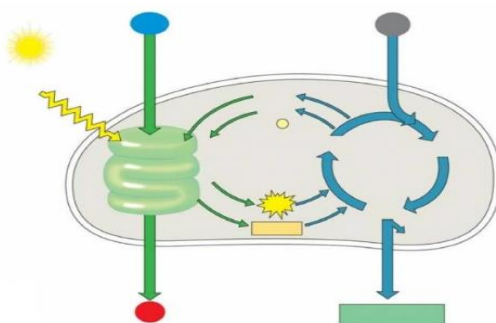
a.	
b.	

- ii. Write down any **ONE** difference between the two cells. [1]

Cell a	Cell b	

- iii. What would be the impact on the environment if prokaryotes were absent? [1]

- b) Study the figure given below that represents a physiological process that occurs in plants and answer the questions that follow:



- i. Where do the light reaction and dark reaction occur in a chloroplast? [1]

Light Reaction:	
Dark reaction:	

ii. How does light energy contribute to the light reaction of photosynthesis? [1]

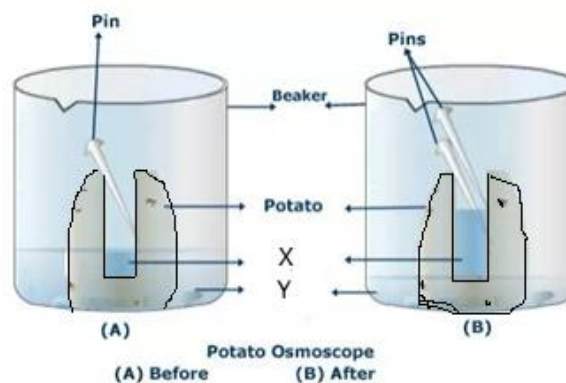
iii. How do the products of light-reaction contribute to the process of photosynthesis? [2]

iv. What would be the impact on light reaction if there is a shortage of water in plants? [1]

- v. Imagine you have been given a task to design a solution that can improve crop yield using the concept of photosynthesis. How would you approach this challenge and what factors would you consider in your design? Explain any **TWO** thought process and the key components of your solution. [2]

Question 3

- a) Study the potato osmoscope experiment illustrated below and answer the following questions.



i. What is the aim of the experiment? [1]

ii. Identify the parts X and Y. [1]

X:	
Y:	

iii. If you are setting up the control for the experiment, name any **ONE** variable that should be constant to perform a fair experiment. [1]

iv. What is the purpose of salt in the experiment? [1]

v. What happens if we place a potato in a hypotonic solution? [1]

b) Use the abstract given below to answer the following questions.

A population of Cheetah in the eastern African Savannah has a genetic information for speed. There is now so little genetic variation in the Cheetah population that any change in the environment would lead to the extinction of the Cheetah population.

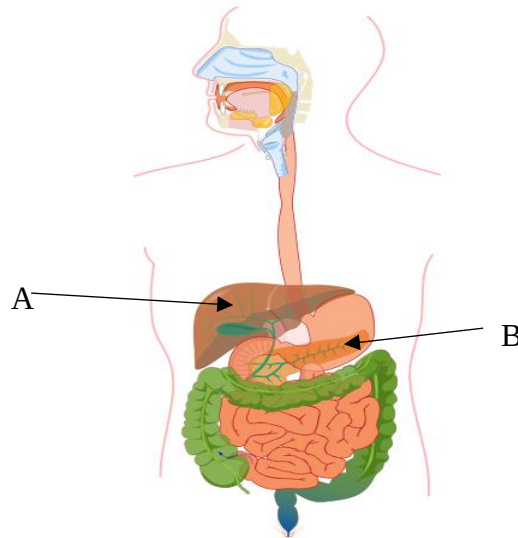
i. What is meant by "genetic variation" in the context of the Cheetah population? **[1]**

ii. How does the lack of genetic variation affect the Cheetah population? **[2]**

iii. What happens if a new predator enters the Cheetah's habitat? Why? **[2]**

Question 4

- a) Study the figure below that represents the human digestive system and answer the questions that follow.



- i. Name the part A and B [1]

Part A:	
Part B:	

- ii. What is the function of bile? [1]

- iii. What is the function of mucus in stomach? [1]

b) In a picnic, Pema had rice, beef, and beans along with water.

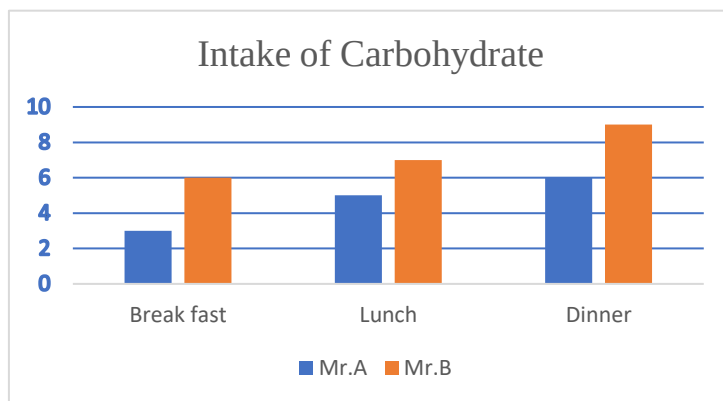
i. Which food is partially digested in the mouth? **[0.5]**

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ii. Which food is absorbed as amino acids in the small intestine? **[0.5]**

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



i. Who would gain more weight in the long run? why? **[1]**

ii. Is it good to consume excessive carbohydrates? Comment. **[1]**

d) Answer the following questions

i. What is *Helicobacter pylori*?

[1]

ii. Why is it important to screen for *Helicobacter pylori*?

[2]

iii. How can *Helicobacter pylori* infection be diagnosed?

[1]

Question 5

a) Answer the following questions

i. Mention **TWO** challenges related to the management of mineral resources.

[2]

- ii. Discuss **ONE** potential solution to address the issues of the management of natural resources. [1]

- b) The figure given below is a *lantana camara*, a highly invasive plant species that has become a significant concern in Bhutan.



- i. What do you mean by invasive plant? [1]

- ii. How are invasive plants a threat to the environment? [2]

iii. Write any **TWO** ways on how Bhutan is taking measures to control the spread of *lantana camara*? [2]

c) Draw the relationship between the health of ecosystem and biodiversity? [2]

Question 6

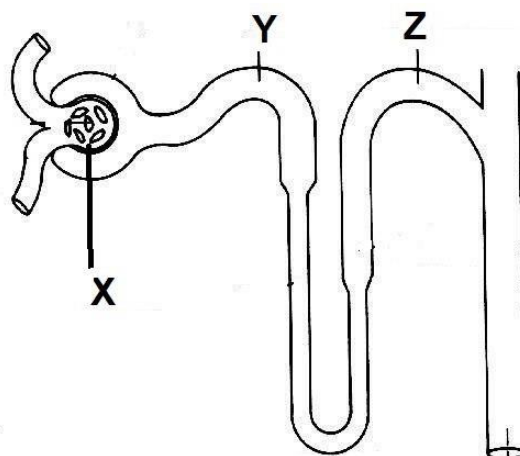
- a) A patient with the blood group O positive cannot receive blood from any other blood groups except O positive. Explain. [2]

- b) A man, who had an accident was taken to the hospital immediately as he was bleeding excessively. The doctor asked the attendant to find a blood donor whose blood group should not contain antibody A, antigen B, and Rh factor.

- i. Determine the blood group of the patient. [1]

- ii. What will happen to the patient if he receives a blood containing antibody A? [1]

- c) Study the figure below and answer the questions that follow.



- i. Name the part Y and Z.

[1]

Part Y:	
Part Z:	

- ii. What will happen to the process of urine formation if the part 'X' is damaged?

[1]

- d) The figure given below is a picture of a liger, a hybrid of a male lion and a female tiger.



- i. Is it ethical to create a liger through artificial selection? Comment. [2]

- ii. How does creating ligers through artificial selection impact the natural populations of lions and tigers? [2]

Question 7

- a) The original cell contains chromosome number as shown in the figure below,



Original Cell

- i. What chromosome number do you think the egg cell would have? [1]

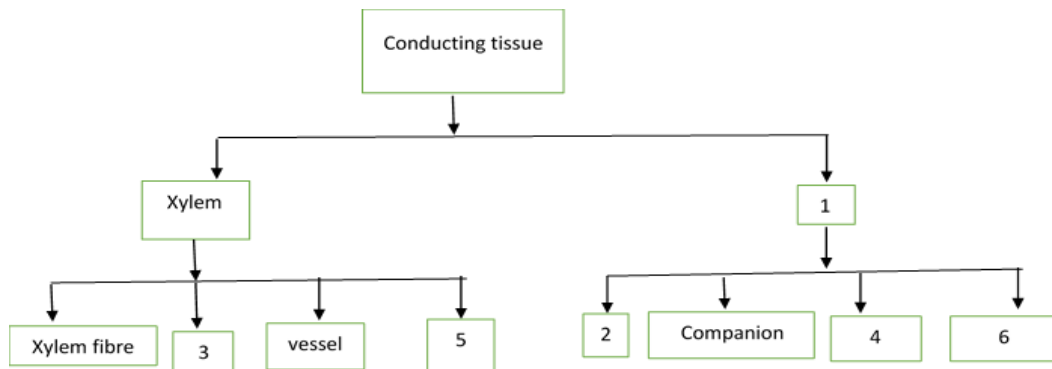
- ii. How does meiotic division contribute to the maintenance of chromosome number across generations? [2]

- iii. How does mitotic division differ from meiotic division? [2]

Mitotic division	Meiotic division	

- iv. If you take two of a person's skin cells, would they have the same genetic composition? Why? [2]

- b) The figure given below shows a flow chart of conducting tissue. Study the figure and complete it. [3]



1.	
2.	
3.	
4.	
5.	
6.	

Question 8

- a) In humans, the trait for earlobe is determined by a single gene. The allele for free (unattached) earlobes is dominant (E), while the allele for attached earlobes is recessive (e). A woman with free earlobes (Ee) marries a man with attached earlobes (ee).
- i. Draw a Punnett square to show the possible genotypes and phenotypes of the offsprings. [1]

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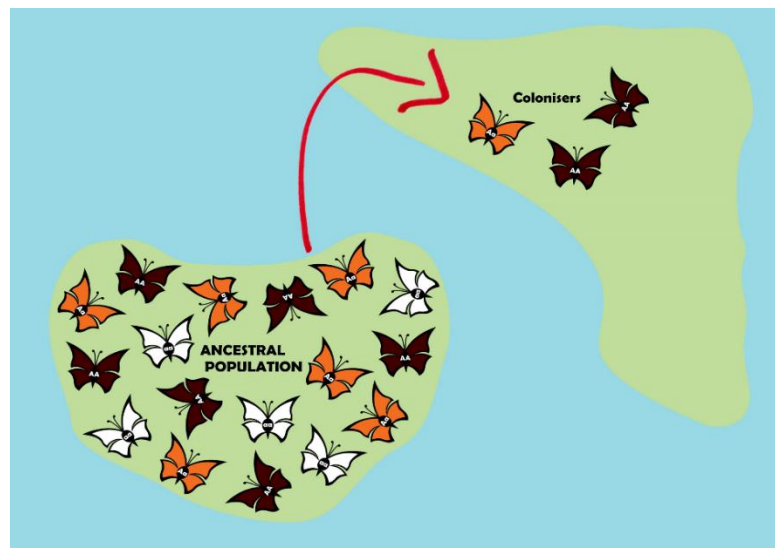
ii. What are the phenotypic and genotypic ratios of their offspring? [2]

Ratio of phenotypic offspring:	
Ratio of genotypic offspring:	

iii. Identify the phenotype of the father. [1]

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b) The figure below shows one of the mechanisms about the genetic drift.



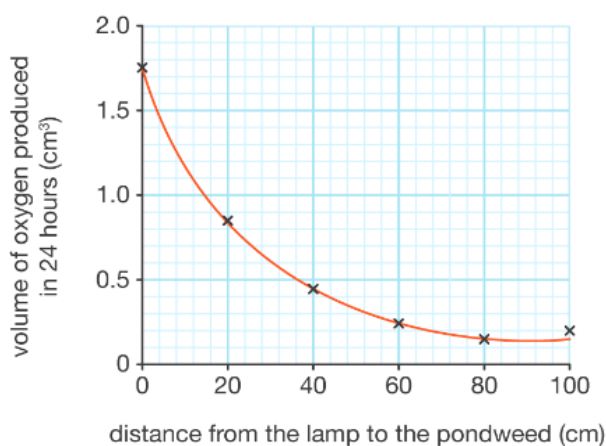
i. Identify the mechanism of genetic drift represented by the figure. [1]

ii. How does genetic drift contribute to speciation? [1]

iii. Can speciation occur in humans? Explain.

[2]

c) The figure below is a graph that shows the rate of photosynthesis of a water plant pondweed. Study the graph and answer the question.



Identify the independent variable and dependent variable.

[2]

Independent variable:	
Dependent variable:	

Question 9

a) The figure below is a computer. We can compare it to the working of receptors in the human body. By referring to the working of computer and to the receptors of human body, answer the following questions.



- i. Identify the receptor in the human body that works similar to the keyboard of a computer and explain. [2]

- ii. How do sensors in machines resemble receptors in the human body? [2]

- iii. Write any **ONE** limitation in the working of receptors in the human body or sensors in machines? [1]

- iv. How do receptors in the human body and sensors in machines contribute to scientific and technological advancements? [1]

b) Answer the following questions.

i. How does regular exercise help in enhancing digestion? **[1]**

ii. How does the presence of a gallstone affect digestion? **[1]**

iii. Is chewing gum good or bad for digestion? Comment. **[1]**

iv. How can maintaining a regular eating schedule help improve digestion and absorption? **[1]**
