SECTION A [50 MARKS]

ANSWER **ALL** QUESTIONS

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. The same tiger roaming in a national park in southern Bhutan was also observed in the northern parts of the country. Select the best possible reason for this.

A The two National Parks share a similar type of ecosystem.
B National Parks of Bhutan are widespread across the country.
C National Parks of Bhutan are connected by biological corridors.
D The only favourable habitat of tigers is in these two national parks.

ii. A man with an attached earlobe (Aa) marries a woman with a free earlobe (aa). What percentage of children will inherit free earlobe character?

A 25%
B 50%
C 75%
D 100%

iii. Under unfavourable conditions, bacteria form endospores. What is the function of the endospore?

A for reproduction
B to prevent from predation
C to withstand change in temperature
D to infect other organisms as a pathogen

iv. DMPA injection is an example of a hormonal contraceptive method. This injection helps in preventing

A the egg from maturing.
B sexually transmitted diseases.
C the release of an egg from the ovaries.
D the implanation of the fertilized egg in the uterus.

v. Which one of the following is the correct sequence of lactic acid removal by the liver once the supply of oxygen to the muscle is adequate?

A Lactic acid → Glucose → Oxygen
B Lactic acid → Pyruvic acid →Glucose
C Lactic acid → Glucose → Pyruvic acid
D Lactic acid → Pyruvic acid → Oxygen

vi. A farmer desires to delay the ripening of his orange fruits so that he can fetch a better price. Which of the following hormones would you suggest?

A Auxin
B Ethylene
C Gibberellin
D Abscisic acid

vii. The cell wall of a bacteria is composed of

A chitin.
B cellulose.
C peptidoglycan.
D hemicellulose.

viii. Which organism is classified as a primary consumer?

A carnivore
B omnivore
C herbivore
D detritivore

ix. There are many genetic varieties of ladybug species with different colours. After many years, it was observed that there was a reduction in the genetic variation and only one variety of coloured species remained. Such a phenomenon of the genetic drift is called

A speciation.
B extinction.
C founder effect.
D bottle-neck effect.

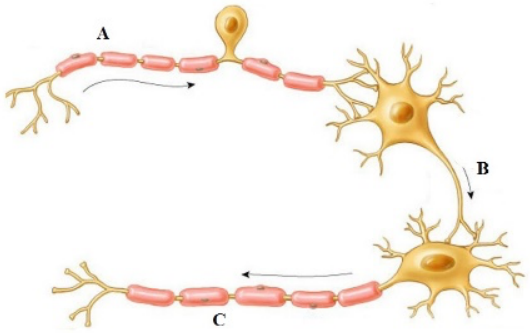
x. Some animals and plants secrete poisonous substances that can be useful for making a vaccine. A vaccine made from such a substance is called

A toxoid vaccine.
B subunit vaccine.
C inactivated vaccine.
D live attenuated vaccine.

xi. The source of oxygen produced during photosynthesis comes from the

A photolysis of water.
B conversion of G3P to glucose.
C photophosphorylation of ATP.
D conversion of NADP to NADPH.

xii. The diagram below shows different neurons labelled A, B and C through which impulses travel when we receive a stimulus. If the part labelled C is damaged, which of the following activity will be affected?



A sending impulse to the effector
B detection of stimulus by receptor
C sending impulse from the receptor
D detection of impulse by the central nervous system

xiii. Study the information given in the table below and identify the types of food represented by X, Y and Z.

Type of food	Mouth	Stomach	Small Intestine
X	√	×	√
Y	×	√	√
Z	√	√	√

A X- carbohydrate, Y- protein, Z- fat
B X- protein, Y- carbohydrate, Z- fat
C X- fat, Y- carbohydrate, Z- protein
D X- carbohydrate, Y- fat, Z- protein

xiv. What is the important role played by scavengers in the ecosystem?

A feed on the producer
B recycle inorganic materials
C control the population of herbivores
D consume dead animals and plant materials

xv. Female horses are interbred with male donkeys to produce superior mules who can work in all weather and conditions, and often more intelligent than their parents. This technique of genetic mutation is called

A hybridization.
B genetic engineering.
C random fertilization.
D somatic hybridization.

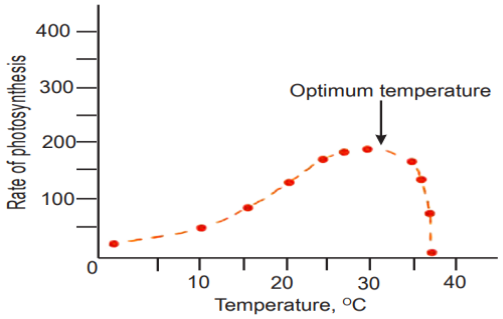
xvi. Which one of the following is **NOT** a hormonal contraceptive method?

A I-pill
B condom
C vaginal ring
D birth-control patch

xvii. Pema an anaemic patient is recommended iron pills to maintain her normal haemoglobin level in the blood. Identify the role of haemoglobin.

A clotting of blood
B production of white blood cells
C destruction of infectious pathogens
D transportation of oxygen and carbon dioxide in the body

xviii. The graph below shows the effect of temperature on rate of photosynthesis.



The rate of photosynthesis increases with increase in temperature and stops at 40˚C as the

A enzymes are inactive.
B enzymes get denatured.
C carbondioxide is insufficient.
D chemical reactions are too fast.

xix. The table given below shows a list of animals surveyed by a group of Biology students in a forest near their school. Which level of biodiversity does it represent?

A Genetic Diversity
B Species Diversity
C Diversity of habitat
D Ecosystem Diversity

Animals	**Count**
Deer	*5*
Bear	*2*
Wild Boar	*6*
Eagle	*3*

xx. An example of a reflex developed during a lifetime in response to a specific stimulus is

A typing.
B yawning.
C sneezing.
D coughing.

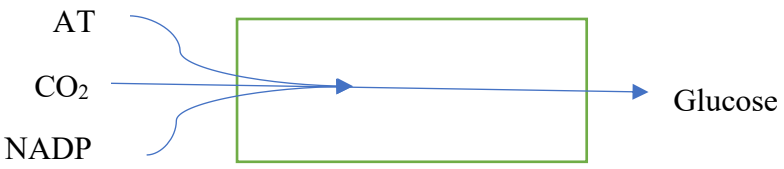
xxi. The four human blood groups are determined based on the type of antigens. Select the features that best describe antigens.

I. attack foreign antigens
II. proteins produced by lymphocytes
III. antigens are of two types A and B
IV. protein found on the surface of RBCs

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

xxii. The diagrammatic representation below shows a part of a phenomenon occurring in plants. Name the part of the organelle where this occurs.

A grana
B stroma
C cytoplasm
D mitochondria



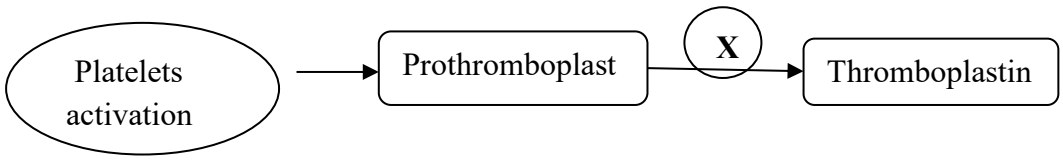
xxiii. The fertility drug containing follicle stimulating hormone is used to treat infertility in women. What is the role of follicle stimulating hormone?

A ovulation
B pubertal maturation
C stimulation of maturation of an egg in the ovary
D preparation of implantation of the fertilized egg in the uterus

xxiv. 'Selective reabsorption is a necessary process during urine formation.'
The most suitable explanation to support the above statement is

A active transport takes place across the tubule walls.
B walls of the tubule is permeable to all the substances.
C the glomerular filtrate contains a mixture of small and large size substances.
D the presence of useful substances such as glucose and amino acids in the glomerular filtrate.

xxv. The substance X in the flow chart is



A calcium ion.
B hydrogen ion.
C potassium ion.
D magnesium ion

b) 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]**

Column A	Column B
i. Conservation of Red Panda in its natural habitat	a. Mutation
ii. A change in the genetic makeup of bacteria to develop resistance to antibiotic drugs	b. Haemophilia
iii. Synthetic hormone for producing masculinising effect	c. Karyokinesis
iv. Disorder caused by delay in blood clotting	d. Exsitu
v. Nucleus division during mitosis	e. Steroids
	f. Insitu

i.	
ii.	
iii.	
iv.	
v.	

c) Fill in the blanks. **[5]**

i.	Two bacterial cells can exchange their DNA with the help of an extra-chromosomal circular DNA which is called …….
ii.	……. molecules of carbon dioxide are required to produce one molecule of glucose during photosynthesis.
iii.	During transduction, receptor cells in eye convert light energy into …… impulse.
iv.	Canned food contaminated with Clostridium botulinum causes a disease called …….
v.	The variation in human gender is of two types, male and female. Such variation is an example of ……. variation.

d) Correct the following statements by changing ONLY the underlined word(s). Re-write the correct word(s) only. DO NOT copy the whole sentence. **[5]**

i. Metaphase is the resting phase of a cell division where cell enlarges and gathers protein.

ii. During blood clotting, prothrombin forms thrombin using vitamin C.

iii. Receptors sensitive to stimuli like pain, pressure, touch and vibration is known as chemoreceptors.

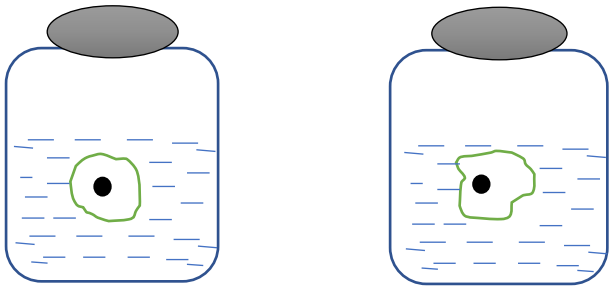
iv. The administration of germ or germ substance into the body for developing immunity against a particular disease is called immunization.

v. If two population of tigers of the same species are geographically separated for many years, it could result in the formation of sympatric speciation.

i.	
ii.	
iii.	
iv.	
v.	

e) Answer the following questions.

i. The diagram below represents two types of tonicity.



Hypotonic Hypertonic

1. If you were to observe plasmolysis of a cell in one of the solutions, in which of the solution will you put the cell to deplasmolyse it. Support your answer with a suitable reason. **[0.5]**

2. How can you change hypertonic solution to isotonic solution? **[0.5]**

ii. How are the end products of photosynthesis utilized?

1. Glucose: **[1]**

2. Water: **[1]**

iii. A pea plant having pure round seed (RR) is crossed with pure wrinkled seed (rr).

1. Draw a punnet square of F2 generation. **[1]**

2. Determine the phenotypic and genotypic ratio of the F2 offsprings. **[2]**

iv. Give reasons for the following statements:

1. All animals including human beings are consumers in the food chain. **[1]**

2. Sustainability of biological diversity is important for the survival of humans, plants and animals. **[2]**

v. Complete the table given below. **[1]**

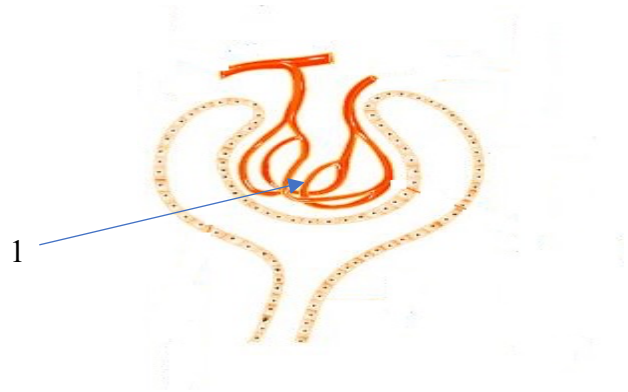
`Blood Group	**Donate Blood to**	**Receive Blood from**	
AB	1…….	AB, A, B and O	
O	O, A, B and AB	2.	

SECTION B [50 MARKS]

ATTEMPT **ANY FIVE** QUESTIONS

Question 2

a) The diagram below represents a section of nephron.

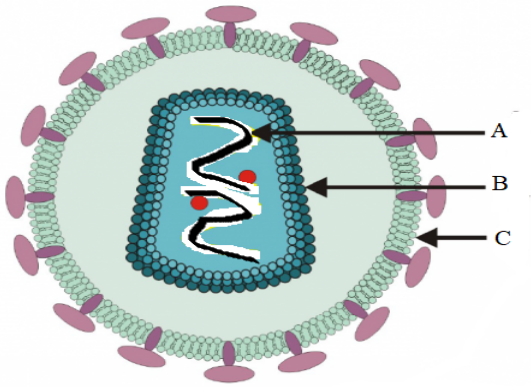


i. Identify the part labelled 1. **[0.5]**

ii. Describe the process of ultrafiltration during formation of urine. **[1]**

b) Describe Pavlov's experiment. **[2]**

c) The diagram given below is the structure of an organism. Study the diagram carefully and answer the questions that follow.



i. Label the parts marked A, B and C. **[1.5]**

A.	
B.	
C.	

ii. If you were to evaluate the benefits of this organism with fungi, which organism would be more beneficial to mankind? Justify. **[1]**

d) Define the following:

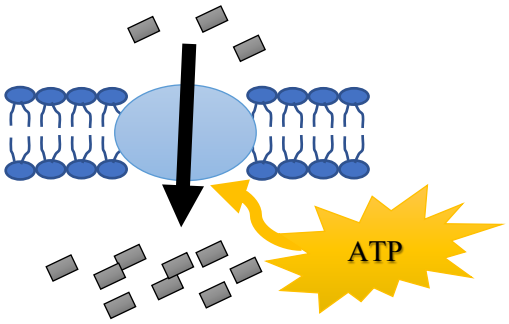
i. Gene pool **[1]**

ii. Co-dominance **[1]**

e) DNA molecule is similar in structure to a ladder in which sugar and phosphate groups make the 'railings' and the nitrogen base groups the 'rungs'. Based on the description, draw the structure of DNA and label the nitrogen base groups. **[2]**

Question 3

a) The diagram below represents one of the ways to show the movement of substances in and out of a cell. Study the diagram carefully and solve the questions that follow.



i. Name the process. **[1]**

ii. Name **ONE** substance that moves through this process. **[1]**

iii. Write down the abbreviation of ATP. **[1]**

b) Explain how the rate of photosynthesis is affected by the following factors:

i. Pollution **[1]**

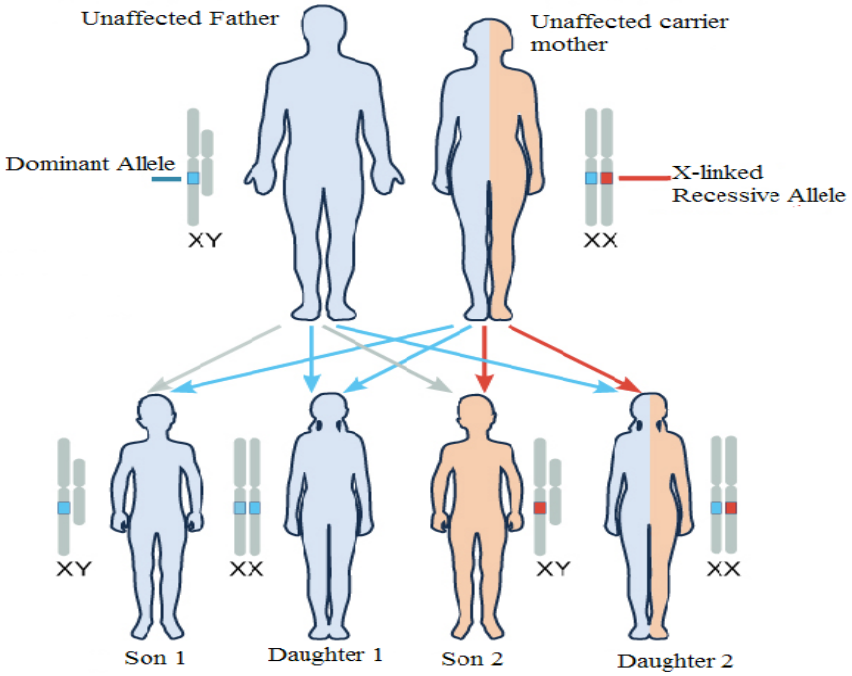
ii. Age of plant **[1]**

c) Answer the following.

i. Hormone therapy uses estrogen and progesterone in treatment of certain symptoms. State **ONE** use of Hormone Therapy in the field of medicine. **[1]**

ii. Write **TWO** disadvantages of using hormonal birth control. **[1]**

d) The diagram below represents the mechanism of sex-linked inheritance. Study the diagram properly and answer the questions that follow.



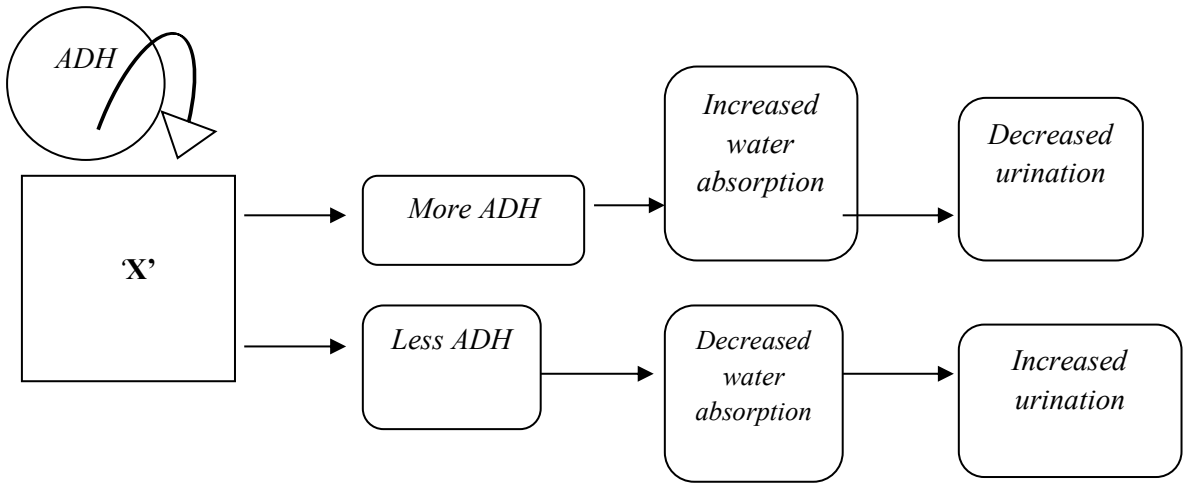
i. Put a tick mark against each child in the table based on the sex linked inherited feature they express. **[2]**

Children	**Features**			
	Normal	**Affected**	**Carrier of sex-linked genes**	
Son 1				
Daughter 1				
Son 2				
Daughter 2				

ii. Name **TWO** diseases that are caused due to sex-linked inheritance. **[1]**

Question 4

a) Study the flow chart of osmoregulation below and answer the questions that follow.



i. Label the part marked 'X'. **[0.5]**

ii. Name the disease caused by the less secretion of ADH in 'X'. **[0.5]**

iii. Explain the role of ADH in osmoregulation **[1]**

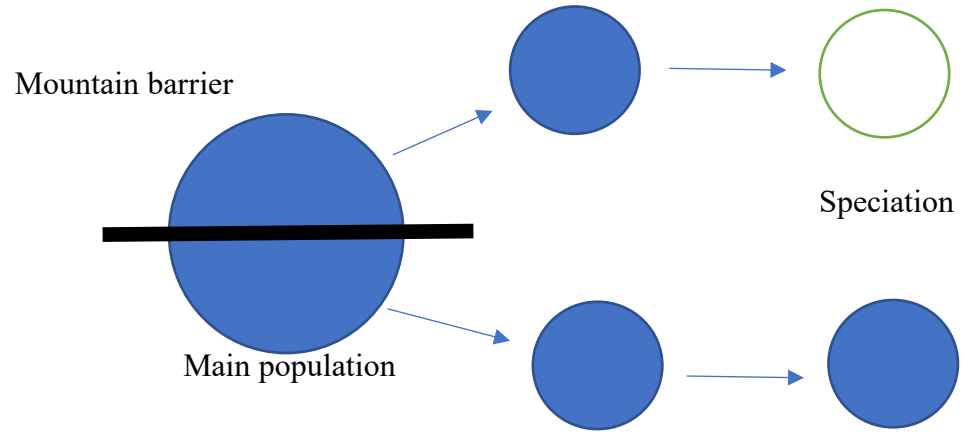
iv. There is another hormone secreted into 'X'. Name and write the role of this hormone. **[1]**

b) Answer the following questions.

i. Describe the pathway of a nerve impulse in response to touching a hot object. **[2]**

ii. How are reflex actions different from other actions such as walking and talking? **[1]**

c) The diagram below shows an isolation of species that gradually leads to speciation. Study the diagram carefully and answer the questions that follow.



i. What type of isolation is shown in the diagram? **[0.5]**

ii. Describe the process of speciation brought about by such a type of isolation. **[1.5]**

d) Differentiate the following:

i. Genetic Variation and Environmental Variation **[1]**

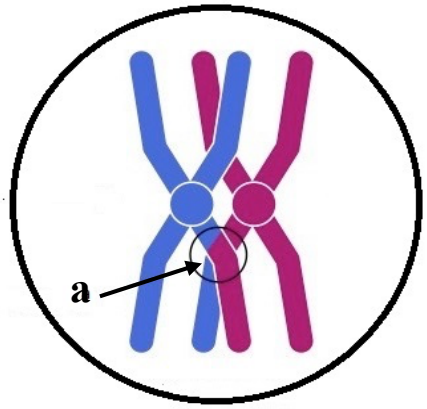
Genetic Variation	**Environmental Variation**	

ii. Somatic cell mutation and Germ cell mutation **[1]**

Somatic cell mutation	**Germ cell mutation**	

Question 5

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



i. Label the part marked 'a'. **[0.5]**

ii. What do you understand by homologous chromosome? **[0.5]**

iii. Write down the series of events that occur in this phase of cell division. **[2]**

b) Answer the following questions.

i. The table below is about the interaction of plant hormones. Study the table and fill-in the blanks. **[1]**

Process	Auxin	Cytokinin	Abscisic Acid	Ethylene	
Stem elongation	1……	Promotes	Inhibits	Inhibits	
Ageing	Delays	2…….	Promotes	Promotes	

ii. Two plant hormones oppose each other's effect. What is this called? **[0.5]**

iii. Abscisic acid is used by Renewable Natural Resource Research and Development Centres in Bhutan. Write down any **ONE** use of this hormone. **[0.5]**

iv. Give **ONE** example of a synthetic auxin and state its function. **[1]**

c) Write down **TWO** differences between type 1 diabetes and type 2 diabetes. **[2]**

Type 1 diabetes	Type 2 diabetes	

d) Answer the following questions.

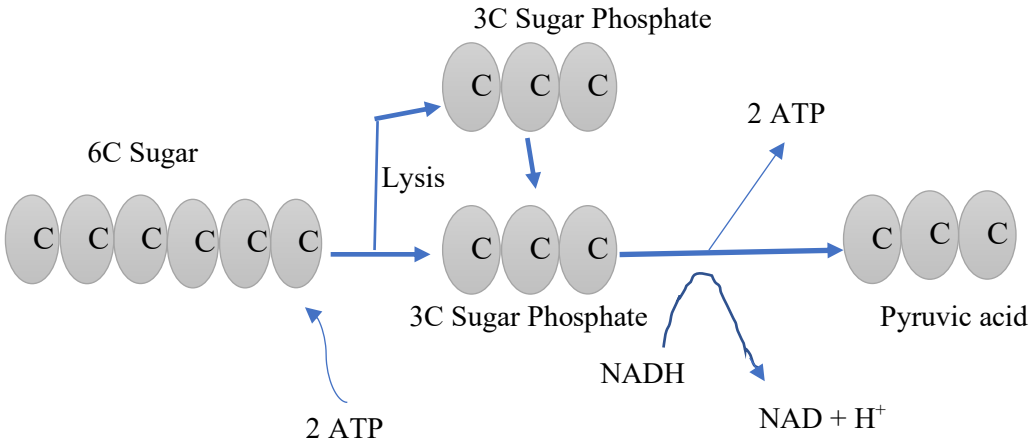
i. Study the table below and fill-in the parts labelled 1, 2 and 3. **[1.5]**

Name of the disease	Causative organism	Symptoms	
Typhoid	1……..	High fever, sweating, gastroenteritis and diarrhoea	
2…….	Rhino virus	Sneezing	
3…….	Trichophyton	Itchy red and scaly patches on feet	

ii. A foetus acquires antibodies from a mother's blood during its development and from the first breast milk. Name the immunity developed in the baby. **[0.5]**

Question 6

a) The diagram below is a summary of one of the phases of aerobic respiration. Study the diagram and answer the questions that follow.



i. Identify the process. **[0.5]**

ii. List down any **ONE** energy rich molecule involved in this phase. **[0.5]**

iii. Describe the process. **[2]**

iv. How will pyruvic acid, the end product be used in the next reaction? **[1]**

b) Draw the structure of a fungi and label **ANY TWO** parts. **[2]**

c) 'Sustainable development is defined as development that meets the needs of the present generation and conserves the resources for future generation'. Mention any **FOUR** activities that contributes to achieve sustainable development. **[2]**

d) How does the following initiatives help in the conservation of biodiversity:

i. Gene Bank? **[1]**

ii. sacred forests and lakes? **[1]**

Question 7

a) Support the following statements with appropriate reasons.

i. The rate of diffusion increases with the greater difference in concentration gradient of a solution. **[0.5]**

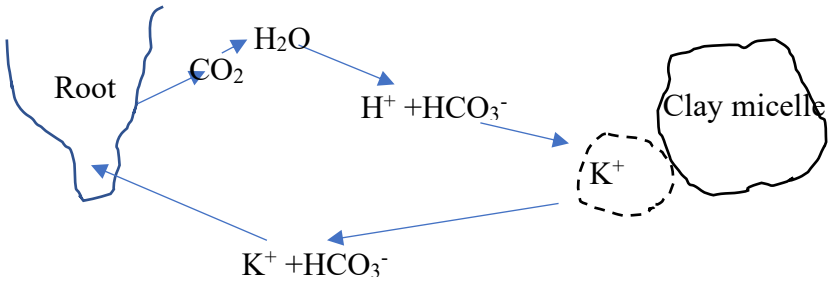
ii. During osmosis, pure water moves into a concentrated solution. **[0.5]**

iii. Mitosis cell division is also known as replicative division. **[0.5]**

iv. Meiosis cell division leads to genetic variation. **[0.5]**

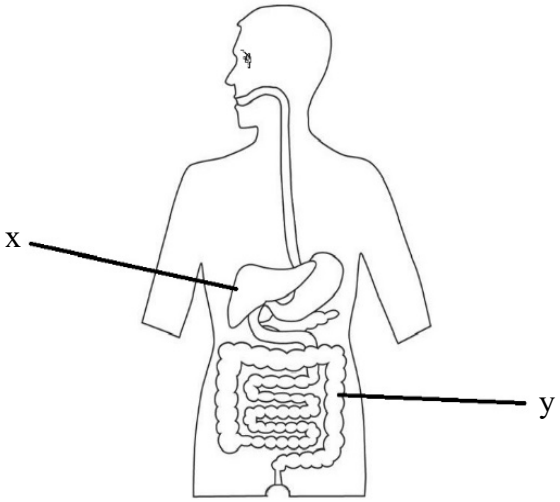
b) Answer the following questions.

i. Explain the process of mineral absorption by plants based on the diagram given below. **[2]**



ii. 'Transpiration is a necessary evil'. Comment. **[1]**

c) Study the diagram of the human digestive system given below and solve the questions that follow.



i. What is the role of the part labelled 'x' during digestion of food? **[0.5]**

ii. How will the part labelled 'y' affect the digestion process if it is non-functional? **[1]**

iii. Write down at least **THREE** special features of the small intestine that maximizes food absorption. **[1.5]**

d) Name the following:

i. a rod-shaped bacteria **[0.5]**

ii. a particular virus that contains RNA **[0.5]**

e) Describe the role of bacteria in agriculture. **[1]**