

SECTION A [40p MARKS]
ANSWER ALL QUESTIONS

Question 1

[25]

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.**

i. A student observed a cell under a microscope as shown in the figure. Which structure would you select from the list provided to conclude that the cell is a prokaryotic cell?



A cell wall
B flagellum
C cell membrane
D mitochondria

ii. A doctor observed that a patient's Loop of Henle was not functioning properly. What will this affect?

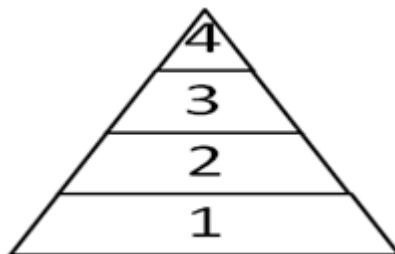
A urine will be dilute
B urine will be concentrated
C urine will not form
D no change in the urine formed

iii. The dark reaction of photosynthesis is dependent on light reaction. Which of the following reasons support the above statement?

1. *Carbon dioxide is reduced to glucose*
2. *Oxygen is produced from water*
3. *ATP provides energy for sugar synthesis*
4. *NADPH provides electron for dark reaction*

A 1 and 2
B 1 and 4
C 2 and 3
D 3 and 4

iv. The given figure represent organisms in an ecosystem. If a frog eats insects that feed on grass, which level in the pyramid would frogs occupy?



A 1
B 2
C 3
D 4

v. Which of the following list of organisms are omnivores?

A vulture, hyena and crow.
B deer, sheep and goa
C peacock, lion and cat.
D human, bear and dog.

vi. The figure given below shows a population having equal number of yellow and brown winged butterflies which gradually evolved to brown winged butterflies. From your understanding on evolution, the gradual increase in the brown winged butterflies is caused by



A adaptation.
B genetic drift.
C Mutation eat lost.
D natural selection.

vii. One variety of apple trees bears large fruits but are not resistant to fungal infections while another variety of apple trees are resistant to fungal infection but bears small fruits. The two desirable traits can be infused into a single plant by

A cloning.
B hybridization.
C DNA technology.
D vegetative propagation.

viii. Sonam studied a red blood cell and observed that substances were entering and leaving the cell, while some substances were blocked from entering. What is the nature of the cell membrane?

A freely permeable
B selective secretion
C selective permeability
D selective reabsorption

ix. Arable land in Bhutan is under serious threats of land degradation. Proper land management approach is needed to control soil erosion problems. The most suitable way to mitigate soil erosion is by

A mulching.
B afforestation.
C avoiding overgrazing.
D avoiding shifting cultivation.

x. The table below shows the parts of the digestive system with their functions. The organ correctly paired with its function is

	<i>Structure</i>	<i>Function</i>
I	<i>Mouth</i>	<i>Secretes pepsin</i>
II	<i>Oesophagus</i>	<i>Transports bolus into the stomach</i>
III	<i>Small intestine</i>	<i>Removal of waste</i>
IV	<i>Large intestine</i>	<i>Maximum absorption</i>

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

xi. Which of the following is **TRUE** with respect to sex-linked inheritance?

A expressed mostly in males
B non heritable disease
C caused due to environmental factors
D expressed mostly in females

xii. Digestion of which of the following will be affected, if the liver is severely damaged?

- A carbohydrates
- B fats
- C minerals
- D proteins

xiii. A student suffering from sore throat was asked to gargle with warm saline water. Name the physiological process involved.

- A diffusion
- B deplasmolysis
- C endosmosis
- D plasmolysis

xiv. A student in a class was diagnosed with anemia. This is caused by having less

- A erythrocytes.
- B leucocytes.
- C lymphocytes.
- D monocytes.

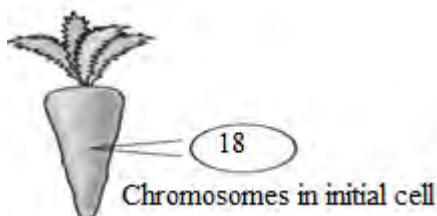
xv. ‘One of the causes of genetic variation is sexual reproduction’. During sexual reproduction

- A genetic materials of two individuals are mixed up.
- B offsprings produced are genetically identical.
- C offsprings develop from single parent.
- D there is no variation between offsprings.

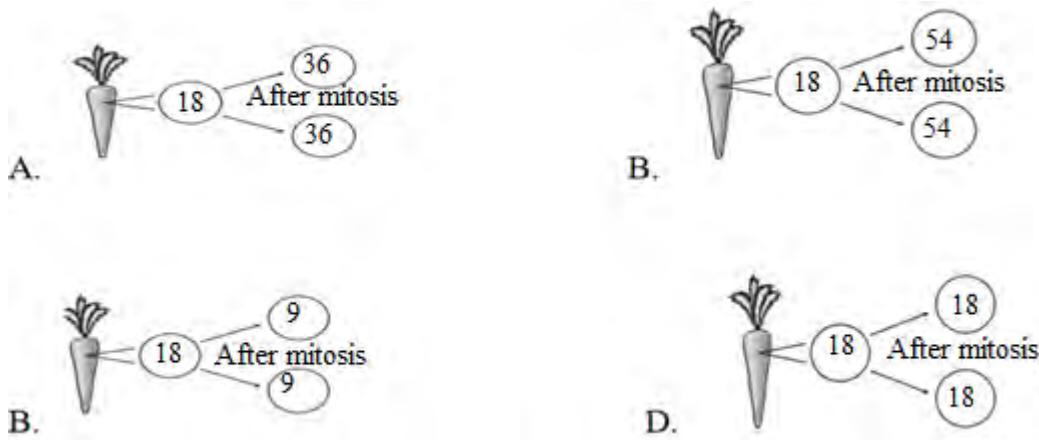
xvi. Which of the following is responsible for the transport of water from roots to the upper region in a plant?

- A sieve tube
- B xylem fibres
- C xylem parenchyma
- D tracheids and vessels

xvii. A carrot contains 18 chromosomes as shown below.



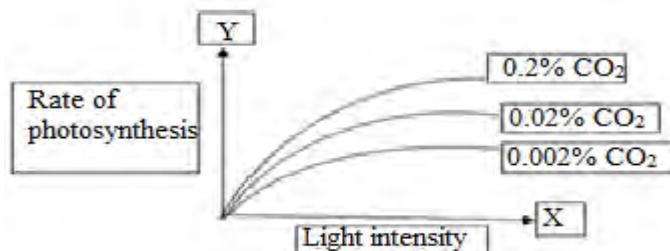
The correct number of chromosomes in new cells produced by mitosis would be



xviii. Which one of the following statement about hormones in the reproductive system is **FALSE**?

- A progesterone are produced in ovaries
- B testosterone are produced in testes
- C progesterone helps in maintaining thin endometrium
- D testosterone is responsible for secondary sexual characteristics in male

xix. The figure shows how light intensity and carbon dioxide affects the rate of photosynthesis.



The rate of photosynthesis will increase

- A with increase in light intensity and carbon dioxide concentration.
- B with increase in carbondioxide.
- C with increase in light intensity.
- D and remains constant after a certain time.

xx. '*Antibiotics are used against the diseases caused by bacteria. However, some bacteria becomes resistant to frequently used antibiotics as it survives and even multiply in the presence of antibiotics*'. The part of a bacteria which becomes resistant to antibiotics is

- A granule.
- B mesosome.
- C plasmid.
- D ribosome.

xxi. Pigeons were introduced in a village and overtime their population increased taking over the native birds. What would be the most logical explanation for the increase in number?

- A Additional pigeons were introduced.
- B Pigeons had many competitors.
- C Pigeons had few predators.
- D Pigeons died too fast.

xxii. Which of the following statements best explains why geographic isolation can lead to speciation?

- A Physical separation of populations reduces competition for each group.
- B Physical separation of populations prevents interbreeding and mixing of gene pools.
- C Physical separation of populations provides more space for each group's size to increase.
- D Physical separation of populations stresses the organisms and causes mutations in their genetic code.

xxiii. When a person is not able to walk, the part of the brain affected is

- A pons.
- B cerebellum.
- C cerebrum.
- D medulla oblongata.

xxiv. A student while studying about the evolution learned that there are several factors contributing to the formation of new species. Which one of the following does not lead to formation of new species?

- A genetic drift
- B hybridization
- C asexual reproduction
- D sexual reproduction

xxv. Microorganisms such as bacteria and fungi are useful as well as harmful to human health. Which of the following describes the useful nature of bacteria and fungi?

I As a source of food.
 II As a source of medicine.
 III As a causative agent of some disease.

A I & II
 B I & III
 C II & III
 D I, II & III

b) Fill in the blanks with appropriate words or phrases.

[5]

i.	Farmers breed cows to produce high volume of milk. This is an example of	
ii.	Production of more amount of vasopressin in distal convoluted tubule of nephron leads to volume of urine formation.	
iii.	The natural process involved in the recycling of kitchen waste is digestion.	
iv.	The type of relationship between orchids and the trees is	
v.	The genetic composition of two sperm cells from a person will be	

c) State whether the following statements are TRUE or FALSE.

[5]

i.	The form of food transported from source to sinks is glucose.	
ii.	Indoor plants such as spider plants and peace lilly are exclusively kept as an object of decoration.	
iii.	The genetic information of cheek cell and skin cell are same.	
iv.	Bacteria can also be used in the treatment of waste water.	
v.	Accumulation of excessive lactic acid in muscle cells can be removed by intake of more oxygen.	

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 provide. [5]

Column A	Column B
i. Universal recipient	a. Endosmosis
ii. Thermo receptors	b. Sickle-celled anemia
iii. Sex-linked disease	c. Blood group AB
iv. Natural selection	d. Skin
v. Salting of pickles	e. Color blindness
	f. Exosmosis
	g. Night blindness

i.	
ii.	
iii.	
iv.	
v.	

SECTION B [60 MARKS]
ATTEMPT ANY SIX QUESTIONS

Question 2

a) There is no digestion of carbohydrates in the stomach. Explain.

[1]

Base your answers to question (b) on the news report extracted from Kuensel dated July 17, 2021.

Three men working at the Gelephu Industrial Service Centre (ISC) were driven out of their bed at 2 am yesterday after a herd of elephants wrecked their makeshift camp and entered the bedroom.

They spent the night at the neighbour's place. A mechanic had to sleep inside the car he was repairing, as the herd damaged the camp and loitered around the place for around half an hour.

"We were only an inch away from the herd. My friend saw the elephants coming and we fled the camp immediately. They ate the leftover rice and left," said Bharat Verman.

There were eight of them. The residents and workers living at the ISC said that the same group was seen loitering and causing problems to the community for the past three days.

b) As a concerned citizen, how can you stop the elephants from disturbing human settlements? Suggest any **TWO** ways.

[2]

c) Explain the dominance of dark-colored moth over the light colored moth after the industrial revolution from the point of natural selection.

[3]

d) Answer the following questions:

i. Plants respond to their environment in many different ways. In one of the Science [2] projects, you are asked to study the production of fruits by varying the temperature and keeping the other factors constant in a greenhouse. How can you increase the productivity of a potted plant by altering the temperature?

ii. If you study the genetic composition of a hair cell and a skin cell, the genetic [1] composition will be the same. What type of cell division is responsible for the production of cells with the same genetic composition?

iii. Two students on seeing ice-cream react differently. One salivates while the other [1] does not. Explain.

Question 3

a) How is an onion cell different from a bacterial cell? Write **ANY TWO** structural differences between the cells. [2]

b) Why decomposers are important in an ecosystem. Support with **TWO** points. [2]

c) The figure represents a food chain of a terrestrial ecosystem.



What could be the possible organisms represented by A, B, C and D?

[2]

A	
B	
C	
D	

d) Answer the following questions.

i. Name the part of the urinary system that transports urine from the kidney to the urinary bladder? [1]

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ii. Outline **TWO** differences between selective re-absorption and tubular secretion during the formation of urine.

[2]

Selective re-absorption	Tubular secretion

e) Due to human wildlife conflict, a group of farmers in rural Bhutan decided to kill the tigers eating their cattle. Did the farmers make a wise decision? Support your answer with **TWO** reasons.

[2]

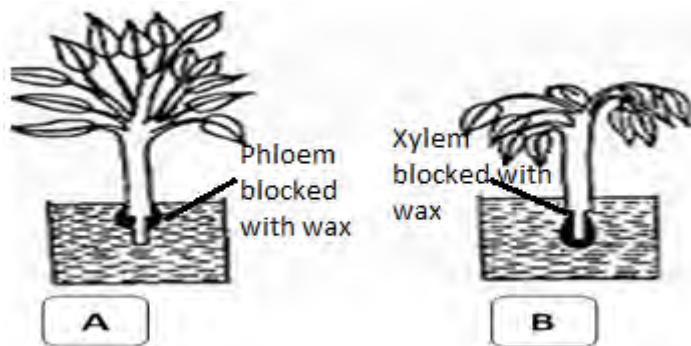
Question 4

a) Temperature is one factor that affects crop production. Optimum temperature is believed to produce maximum crop production. Mention how temperature affects the crop yield at:

i. 40°C

ii. 35°C

b) Study the figure representing a physiological process in plants and answer the questions that follow:



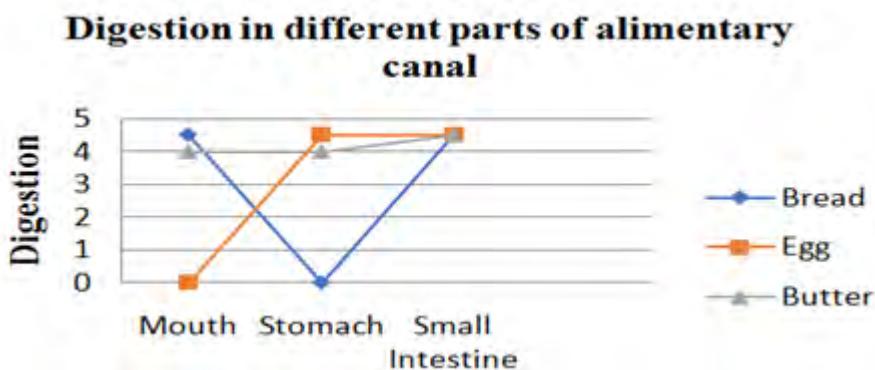
i. Write a suitable aim for the above set up.

[1]

ii. Explain your observation supported with a reason each.

[2]

c) Use the figure to study about the digestion of food in different parts of the alimentary canal.



i. Identify the part of the alimentary canal where digestion of fats and carbohydrate occur. [1]

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ii. Where does the digestion of proteins begins? [1]

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d) Use the abstract given below to answer questions i and ii.

'Along the west coast of the United States, two separate sub-species of spotted owls exist. The northern spotted owl has genetic and phenotypic differences from its close relative: the Mexican spotted owl, which lives in the south. In the north, the climate is cooler than in the south. The types of organisms in each ecosystem differ as do their behaviors and habits. Besides, the hunting habits and prey choices of the southern owls vary from the northern owls. These variances have led to have evolved differences in the owls, and formation of two species'.

i. Name the type of species formed in the above extract. [1]

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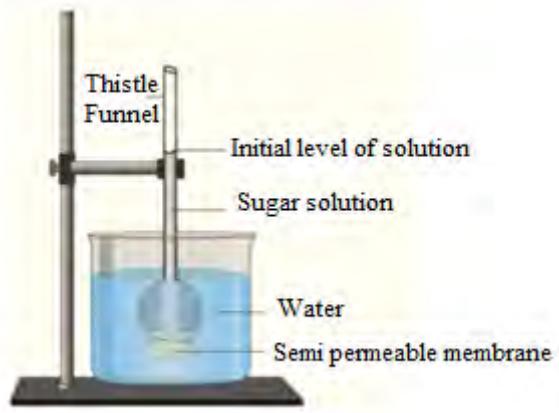
ii. Give **ANY TWO** reasons for the formation of such two new species of owl. [2]

e) Define variation. [1]

Question 5

a) A married couple is unable to bear children even after seven years of their marriage. As a science student, what advice would you give to the couple to solve their problem. [2]

b) The experimental set-up shown in the figure demonstrates osmosis using a thistle funnel. Answer the questions that follow:



i. State the hypothesis of the experiment.

[1]

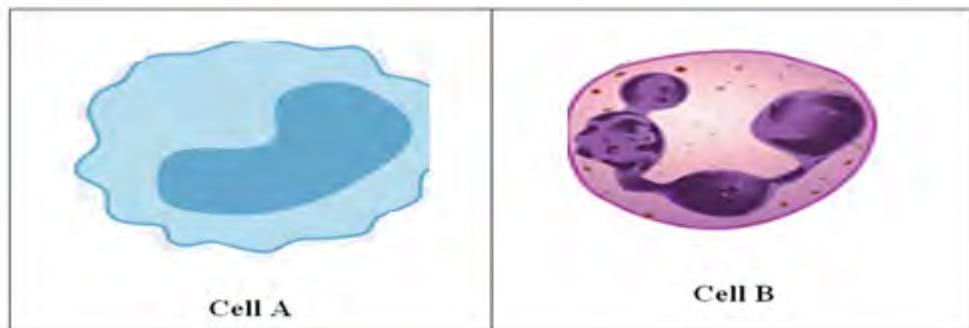
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ii. Draw a control setup for the experiment

[1]

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c) The figure shows the structure of two different cells observed under a microscope.



i. Identify the cells. [2]

ii. Why are red blood cells enucleated? [1]

d) *'In the recent few years, there were news about tons of garbage, enough to fill a few football sized grounds being dumped into the Wangchu river. And also the sewage into the river. This indicates that a lot of kitchen waste and sewage are being directly dumped into the clean rivers.'*

i. How would you solve this issue. [1]

ii. Mention **ANY TWO** other methods to prevent the above issue. [2]

Question 6

a) Differentiate the following pairs of words based on the information given in brackets.

i. White blood cell and red blood cell (function) [1]

White blood cell	Red blood cell	

ii. Blood group O and blood group A (antigen present) [1]

Blood group O	Blood group A	

b) What is plasmid? [1]

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c) Cell division leads to differences amongst organisms. Use your knowledge of meiotic division to support variations in siblings. List any **TWO** steps in meiosis which leads to variation. [2]

d) Answer the following questions.

i. 'Anaerobic digestion is efficient method to recycle waste generated in cities'. [2]
Comment on the above statement with **TWO** reasons.

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ii. Classify the following into natural and conditioned reflex. [1]
 (Blinking of eyes and tying shoe lace while conversing)

Natural reflex	Conditioned reflex	

e) 'Communities affected by mining operation say that they have little to benefit from mining in their localities, while the impacts threaten their livelihood. Mine operators disagree'. –Kuensel, 13th January, 2020.

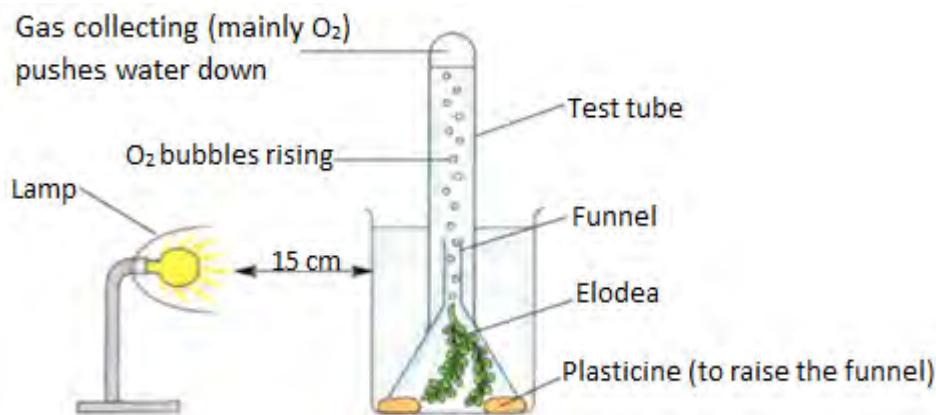
From your opinion, should mining be encouraged in your locality? Support your answer with **TWO** reasons. [2]

Question 7

a) A haemophilia carrier woman marries a normal man. Using the Punnett square, [2]
 find the possibilities of birth of a

- haemophilic son.
- normal son.

b) The experimental set-up shown in the figure is to examine the effect of light intensity on the rate of photosynthesis. Answer the questions that follow:



What will happen to the number of bubbles produced if :

i. The distance of the lamp is increased from 15 cm to 20 cm away from the plant. [1]

ii. The distance of the lamp is decreased from 15 cm to 10 cm. [1]

c)

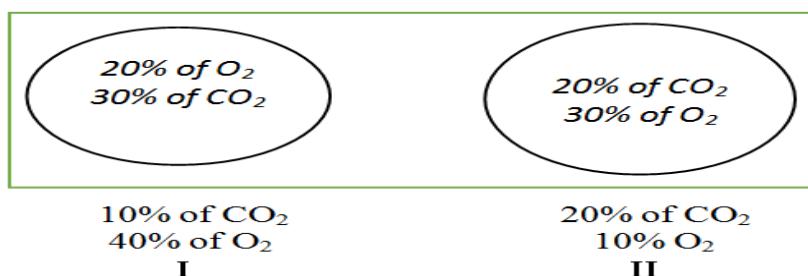
i. What is hormone therapy? [1]

ii. How is hormone therapy useful in treating health issues? Give any **ONE** reason. [1]

d) Aerobic respiration is considered more efficient than anaerobic respiration. Support the statement with **ANY TWO** reasons. [2]

e)

i. For each of the situations below, draw and use arrows to show the movement of carbondioxide into or out of the cell. [1]



ii. What process is involved in the above cases? [1]

Question 8

a) Write **any TWO** benefits of indoor plants that helps to reduce human health issues. [2]

b) Mention **ONE** purpose of diffusion and osmosis in plants. [2]

c) In humans, brown eyes are dominant over blue eyes. Homozygous brown eyed person is married to homozygous blue eyed person.

i. What is the probability of offspring having brown eyes in F1 generation? [1]

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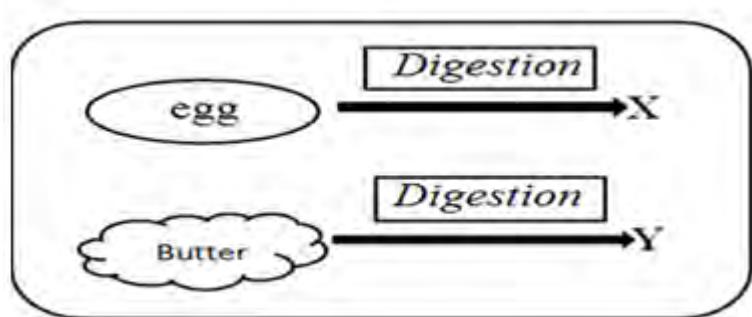
ii. Find the genotypic and phenotypic ratio in F2 generation? [2]

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d) Explain bioremediation in your own words. [1]

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e) The figure shows digestion of food in our body. Identify 'X' and 'Y' after the complete digestion of egg and butter. [2]



Question 9

a) State **ONE** importance of micro-organisms to mankind. [1]

b) Students after having learnt about cell division, were instructed by their teacher to multiply a plant cell to get new plants with desirable traits like that of a parent plant.

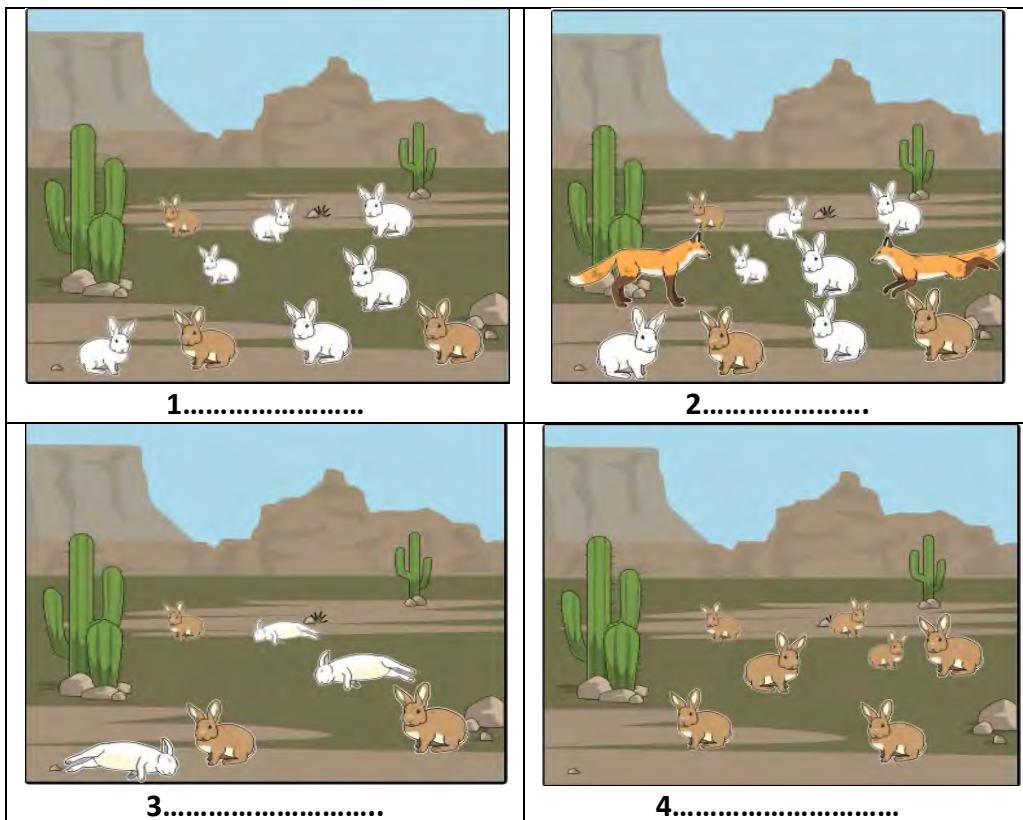
i. Name the type of cell division that would help to achieve the result. [1]

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ii. Provide **ONE** reason for choosing the above method. [1]

c) Sonam and Dechen are siblings, but Sonam looks more like her father while Dechen looks like her mother. Comment from the view of cell division. [2]

d) Use the storyboard provided in the figure to explain how natural selection leads to formation of new species.



Explain natural selection in proper sequence using the storyboard provided.

[2]

e) Read the conversation between two individuals on the matters concerning artificial selection and answer the questions that follow:

Individual 1 says: "Artificial selection is beneficial to all and should be encouraged"

Individual 2 says: "Artificial selection cause more harm than good and should never be encouraged"

Who do you think is right? Support your answer with **THREE** justifications.

[3]

