

BIOLOGY (THEORY)

Answer all questions from Part I.

Part II is subjective section. Section A has five questions you may choose any three from them. Section B has four questions you may choose any two from them.

The intended marks for questions or parts of questions are given in brackets.

PLEASE ATTACH THE QUESTION PAPER

Part I

Answer all questions

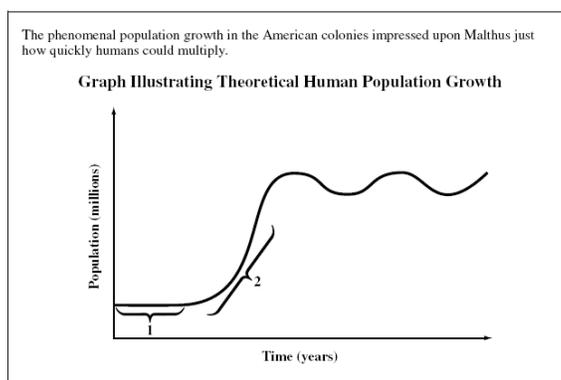
NAME: _____

DATE: _____

A. Choose the right option (in the question paper)

5

1. Use the following information to answer.



Which of the following rows identifies the region of the graph above that illustrates exponential growth of a population and the type of graph illustrated?

Row	Exponential growth	Type of graph
A.	1	S-shaped
B.	1	J-shaped
C.	2	S-shaped
D.	2	J-shaped

2. Which group could be a single population?

- all the animals and plants on an isolated island
- all the birds counted in one day in a garden
- all the bacteria in a colony of *Bacillus subtilis*
- all the insects occupying three hectares of farmland

3. Which statement is true of all enzymes?

- They are denatured at temperatures above 60 °C.
- They are inactivated at low pH values.
- They catalyse the breakdown of large molecules into smaller ones.
- They reduce the amount of energy required to start a reaction.

4. The diagram shows a tropical ocean food chain with 10 % efficiency of energy transfer between trophic levels.

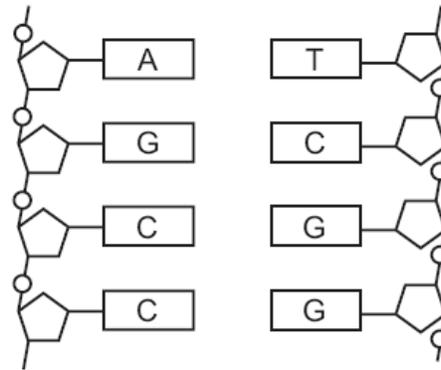


Net primary production of phytoplankton is $1300 \text{ g m}^{-3} \text{ yr}^{-1}$.

What is the net primary production per year for the carnivorous zooplankton and the tuna?

	net primary production of carnivorous zooplankton $/\text{g m}^{-3} \text{ yr}^{-1}$	net primary production of tuna $/\text{g m}^{-3} \text{ yr}^{-1}$
A	1.3×10^1	1.3×10^{-1}
B	1.3×10^0	1.3×10^{-2}
C	1.3×10^{-1}	1.3×10^{-2}
D	1.3×10^{-2}	1.3×10^{-4}

5. The diagram shows part of a DNA molecule.



How many hydrogen bonds are involved in holding these strands of DNA together?

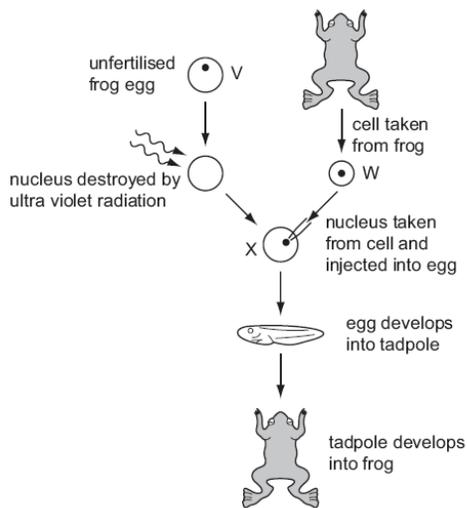
- 11
 - 9
 - 8
 - 4
6. Spindle shaped body is a characteristic of
- Cyclostomata
 - Chondrichthyes
 - Osteichthyes
 - Cetacean
7. In earthworm the ganglia in the nerve cord begins from the
- 1st segment
 - 3rd segment
 - 5th segment
 - 6th segment

8. A square metre of grassland receives about 1 047 000 kJ of solar light energy each year. The table shows what happens to this energy.

	kJ
used in evaporation of water	523 500
transmitted to the ground	335 000
reflected by the leaves	165 000
used for growth	21 500
used for other life processes	1 500
respiratory heat losses	500

How much energy is used by the grass in photosynthesis?

- 2000 kJ
 - 19 500 kJ
 - 21 500 kJ
 - 23 500 kJ
9. The diagram shows how genetically identical frogs can be developed from unfertilised frog eggs. The diploid number ($2n$) for frogs is 26.



Which combination of numbers correctly identifies the number of chromosomes in each of the types of cell in the diagram?

	V	W	X
A	13	13	26
B	13	26	13
C	13	26	26
D	26	26	13

10. Which is the correct indication for Mendel's law of segregation?

- a. A cross cross between parents pure for certain traits will produce hybrids due to independent assortment.
- b. Homologous chromosomes move away during anaphase II.
- c. For genes that are not on the same chromosome, alleles assort independently of one another into gametes.
- d. Alleles of a gene are assorted independently during sex cell formation and then recombine with another allele during fertilization.

B. Differentiate between the following:

4

1. Ascospore and Basidiospore (Based on development)
2. Pollen grain and Microspore
3. Codominance and Multiple alleles
4. Amylose and Glycogen (Based on structure)

C. Mention the appropriate location following.

2

1. VNTR
2. Kinetochore
3. Tergum
4. Okazaki fragments

D. Mention the function of the following:

2

1. Assimilatory root
2. Radula
3. Uricose glands
4. Hyaluronic acid

E. Give suitable reason of the following.

3

1. All enzymes are not proteins.
2. Frog can perform cutaneous respiration also.
3. In case of sickle cell anaemia, heterozygous individuals are naturally protected against malaria.

F. Give the contribution of the following scientists.

2

1. Blakeslee
2. Bentham & Hooker
3. E. Chargaff
4. Temin and Baltimore

G. Elaborate the following.

2

1. SCID
2. MAB
3. ICFRE
4. PCR

Part II
Section –A

(Attempt any three from the following)

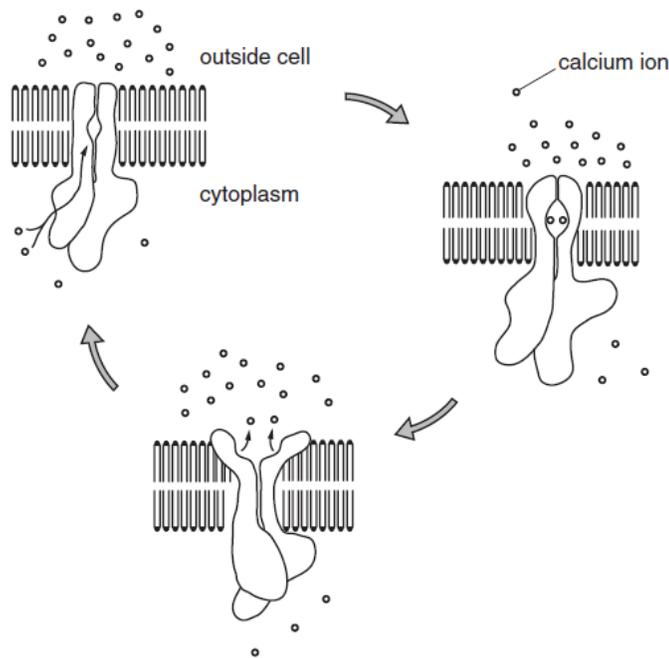
2. a) By giving suitable examples, explain the following intraspecific interaction (3)

- i) Visual communication
- ii) Parental care by male
- iii) Aggregation

b) With the help of suitable figures explain the process of competitive inhibition of enzymes. (2)

c) Cell surface membranes are involved with the movement of substances into and out of cells. Calcium pumps in cell surface membranes maintain a concentration of calcium ions inside the cytoplasm that is a thousand times lower than outside the cell.

Fig. shows the movement of calcium ions across a cell surface membrane.



i) Explain why calcium ions do not pass through the phospholipid bilayer? (1)

ii) Name and describe the process by which calcium ions are moved across the membrane. (2)

d) In 1905 George Shull, a botanist at Princeton university, conducted a genetic study of weed known as shepherd's purse, a member of the mustard family. One trait he followed was the shape of the seed capsule, which can be triangular or a small ovate shape. When he first crossed a true breeding plant with triangular capsule to a plant having ovate capsule, the F1 generation all had triangular capsules. The surprising result came in the F2 generation. Shull observed a 15:1 ratio of plants having triangular capsules to ovate capsules. Explain this ratio. (2)

3. a) Identify the following interspecific interaction and give one example other than given. (3)

- i) To obtain data on the burrowing owl population, researchers reached into the burrows to collect and count baby owls. When they did this, the researchers heard a hiss like a rattlesnake coming from the baby owls in the burrow. The owls were attempting to scare off the intruders. (The hissing behaviour of the baby owls)
- ii) The organ pipe cactus has flowers that open at night. Bats and insects pollinate these flowers. The fruit of the cactus is eaten by birds and small mammals, which scatter and distribute the fruit seeds. The coyote, in turn, feeds on the birds and small mammals. (the relationships between the organ pipe cactus and insects)
- iii) Mites (*Acaropsis woodii*) can live in the trachea of a bee. These mites obtain nutrients from bee tissue. Beekeepers worry when mite populations reach numbers that have the potential to destroy the bee colony. (The relationship between bees and mites)

b) Draw a well labeled diagram of fluid mosaic model of cell membrane showing following mode of transport. (3)

- i) Active transport by carrier protein
- ii) Pinocytosis
- iii) Facilitated diffusion by channel protein
- iv) Simple diffusion

c) Given below is a DNA sequence. (Refer to appendix) (2)

TACTGGGTGCTACCCACT

- i. How will the sequence change if a frame-shift mutation occurs in the third triplet?
- ii. What will be the final amino acid sequence if there is a transition in the fourth triplet?

d) Discuss two ways of vector less gene transfer. (1)

e) What is biocontainment? (1)

4.a) Draw the stages of cell reproduction showing following events. (2)

- i) Pairing of homologous chromosome
- ii) Separation of cross over chromatids.
- iii) Movement of homologous chromosomes towards the pole.
- iv) Duplication of centriole.

b) The N base sequences in a transcribed RNA are the following.

5' A U C G C A U 3'

Construct the source DNA molecule and draw it as a double strand molecule including ribose sugar, phosphate and appropriate N base (2)

c) What is the difference between gene expression in eukaryotes and prokaryotes? (3)

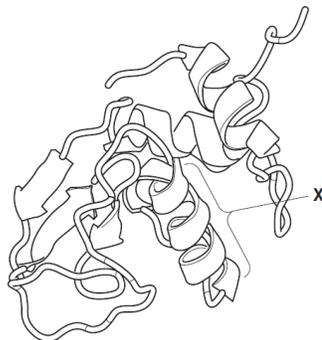
d) Read the passage below. Parts of the passage are in **bold type**. These are examples of ecological terms and are labelled **A** to **F**.

A class of students carried out an ecological study of **a defined area of seashore (A)** in Brittany, France. One group decided to study a **rockpool (B)** and recorded information such as the **oxygen concentration and temperature of the seawater (C)**. After investigating **all the different living organisms (D)** present in the rockpool, the students decided to study in more detail the **group of limpets, *Patella vulgata* (E)**. They collected information about the **role of the limpets within the rockpool, including interactions with other organisms (F)**. For example, limpets grazed on green seaweeds, while the shore crab, *Carcinus maenas*, fed on small limpets.

(a) State the correct letter, A to F, from the passage above that corresponds to each of the ecological terms below. Copy the format in the answer sheet. (3)

- | | |
|-------------------|---|
| habitat | <input style="width: 30px; height: 25px;" type="text"/> |
| ecosystem | <input style="width: 30px; height: 25px;" type="text"/> |
| abiotic component | <input style="width: 30px; height: 25px;" type="text"/> |
| ecological niche | <input style="width: 30px; height: 25px;" type="text"/> |
| population | <input style="width: 30px; height: 25px;" type="text"/> |
| community | <input style="width: 30px; height: 25px;" type="text"/> |

5. a) Lysozyme is an enzyme found in many places within the human body. It consists of a single polypeptide folded into a complex shape. Figure shows a ribbon model of lysozyme.



- i) State the name given to the level of organisation shown by the whole polypeptide and at region X. (3)
Mention the types of bond which maintain the given shape of enzyme. (3)
- b) What do you mean by hot spots of biodiversity? (1)
- c) Introduction of exotic species can be threat to biodiversity. Explain with example. (1)
- d) Give a difference between biosphere reserves and national park. (1)
- e) What is an aporepressor? Discuss its role in the functioning of Operon. (2)
- f) Describe the structure reported by Balbiani. (2)

6. a) Differentiate between the followings: (3)
- i) r and k strategies of reproduction
 - ii) Ecotone and edge effect
 - iii) Pioneer community and climax community

b) Starch, and cellulose are all polysaccharides. They are made from monomers that are joined by covalent bonds. Copy and complete the table below to show which of the statements apply to each of the polysaccharides. (3)

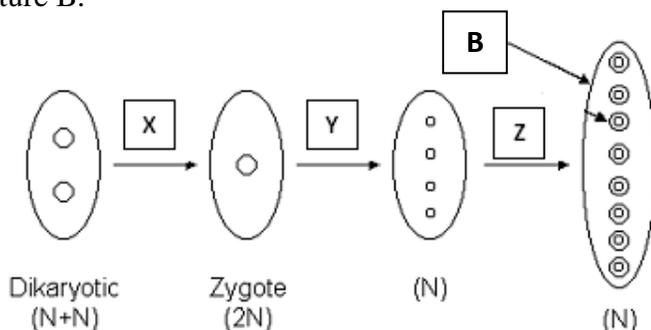
Fill in each box using a tick (✓) to show that the statement applies and a cross (X) if it does not.

Statement	Cellulose	Starch
Glycosidic bonds between monomers		
Monomer is glucose		
Exists in two forms – branched and unbranched chains		

- c) Given below is a DNA sequence of the sense strand - (refer appendix) (2)
CCTGAGGAG
- i. Mention the sequence after transcription.
 - ii. What will be the formed after translation?
 - iii. Name the enzyme that initiates the process.
- d) Discuss the importance of rDNA technology in genetic diseases, giving example. (2)

Section B
(Attempt any 2)

7. a) Following figure showing some stages of the life cycle of Ascomysetes. Identify the processes X, Y, Z and the structure B. (2)



b) Differentiate between male and female gametophyte on the basis of structure, development and amount in angiosperms. (3)

c) Compare the animals with canal system and water vascular system. (3)

d) Cockroaches are cursorial and are capable of flying. Give adaptations for each characteristic. (2)

8. a) Draw a well labeled diagram of LS of pistillate flower. (2)

b) Earthworms are hermaphrodite whereas in cockroaches are dioecious however both exhibit external fertilization. Explain. (3)

c) A student collected two animal specimens and made the following observations. **Identify the phylum, class and name the animal based on the observations.** (3)

i. Body bilaterally symmetrical, segmented, shows presence of a shell, ventral flat foot and external gills.

ii. Body bilaterally symmetrical and elongated, fattened and with suckers and has digestive system.

d) Draw the urinogenital system of female frog. (2)

9. a) Mention the fungal source of the followings. (2)

i) LSD

ii) Penicillium

iii) Roquefort cheese

iv) Citric acid

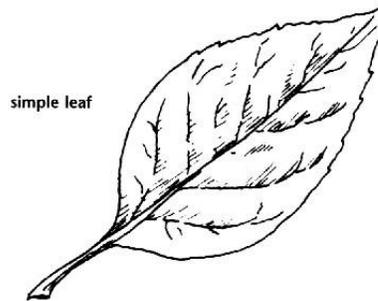
b) Classify the flowering plants according to their habitat. Give one example of each. (3)

c) Differentiate between chordates and non chordates on the basis of the given points- Coelom, Presence of alimentary canal, Anus, Heart position, respiration, and nervous system. (3)

d) Give a comparative account of the excretory organs in earthworm and cockroach. (2)

10. a) Explain in brief about the two different types of mycelium occurring in the life cycle of Basidiomycetes.

b) Given figure shows a simple leaf. (3)



i) Draw a well labeled diagram showing bipinnate, imparipinnate leaf.

ii) With the help of suitable examples explain any two modifications of leaf meant for nutrition and protection.

c) Give any two examples of edible fungi belongs to Basidiomycetes. (2)

d) Characteristics of two types of animals are given below- (3)

	I	II
Habitat	Terrestrial	Terrestrial
Embryo develops in	Water	Egg
Mates	In water	On land
Epidermis covered with	Slime or mucus	Scales

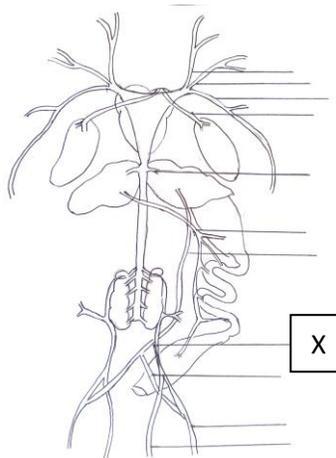
i. Name the group to which these animals belong.

ii. Mention an organism of the group that fits the characteristics.

iii. One of these has gills at certain stage of their life cycle, mention the reason.

iv. What is the difference in the method of reproduction in these two organisms?

e) Given below is a system in amphibians. (2)



i. Identify the system.

ii. Identify the part X and give its importance.

Appendix-1

		Second Base								
		U		C		A		G		
First Base	U	UUU	phe	UCU	ser	UAU	tyr	UGU	cys	U
		UUC	phe	UCC	ser	UAC	tyr	UGC	cys	C
		UUA	leu	UCA	ser	UAA	STOP	UGA	STOP	A
	UUG	leu	UCG	ser	UAG	STOP	UGG	trp	G	
	C	CUU	leu	CCU	pro	CAU	his	CGU	arg	U
		CUC	leu	CCC	pro	CAC	his	CGC	arg	C
		CUA	leu	CCA	pro	CAA	gln	CGA	arg	A
		CUG	leu	CCG	pro	CAG	gln	CGG	arg	G
	A	AUU	ile	ACU	thr	AUU	asn	AGU	ser	U
		AUC	ile	ACC	thr	AAC	asn	AGC	ser	C
		AUA	ile	ACA	thr	AAA	lys	AGA	arg	A
		AUG	met	ACG	thr	AAG	lys	AGG	arg	G
G	GUU	val	GCU	ala	GAU	asp	GGU	gly	U	
	GUC	val	GCC	ala	GAC	asp	GGC	gly	C	
	GUA	val	GCA	ala	GAA	glu	GGA	gly	A	
	GUG	val	GCG	ala	GAG	glu	GGG	gly	G	