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.

The phenomenal population growth in the American colonies impressed upon Malthus just how quickly humans could multiply.

Graph Illustrating Theoretical Human Population Growth

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?

<table>
<thead>
<tr>
<th>Row</th>
<th>Exponential growth</th>
<th>Type of graph</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>1</td>
<td>S-shaped</td>
</tr>
<tr>
<td>B.</td>
<td>1</td>
<td>J-shaped</td>
</tr>
<tr>
<td>C.</td>
<td>2</td>
<td>S-shaped</td>
</tr>
<tr>
<td>D.</td>
<td>2</td>
<td>J-shaped</td>
</tr>
</tbody>
</table>

2. Which group could be a single population?
   a. all the animals and plants on an isolated island
   b. all the birds counted in one day in a garden
   c. all the bacteria in a colony of Bacillus subtilis
   d. all the insects occupying three hectares of farmland

3. Which statement is true of all enzymes?
   a. They are denatured at temperatures above 60 °C.
   b. They are inactivated at low pH values.
   c. They catalyse the breakdown of large molecules into smaller ones.
   d. 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.

phytoplankton → herbivorous zooplankton → carnivorous zooplankton → small fish → tuna

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

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

<table>
<thead>
<tr>
<th></th>
<th>net primary production of carnivorous zooplankton /g m(^{-3})yr(^{-1})</th>
<th>net primary production of tuna /g m(^{-3})yr(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.3 \times 10^1</td>
<td>1.3 \times 10^{-1}</td>
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<tr>
<td>B</td>
<td>1.3 \times 10^9</td>
<td>1.3 \times 10^{-2}</td>
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<tr>
<td>C</td>
<td>1.3 \times 10^{-1}</td>
<td>1.3 \times 10^{-2}</td>
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<tr>
<td>D</td>
<td>1.3 \times 10^{-2}</td>
<td>1.3 \times 10^{-4}</td>
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</table>

5. The diagram shows part of a DNA molecule.

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

a. 11  
b. 9  
c. 8  
d. 4

6. Spindle shaped body is a characteristic of
   a. Cyclostomata  
b. Chondrichthyes  
c. Osteichthyes  
d. Cetacean

7. In earthworm the ganglia in the nerve cord begins from the
   a. 1\(^{st}\) segment  
b. 3\(^{rd}\) segment  
c. 5\(^{th}\) segment  
d. 6\(^{th}\) 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.

<table>
<thead>
<tr>
<th>Used for</th>
<th>kJ</th>
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<tr>
<td>used in evaporation of water</td>
<td>523 500</td>
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<tr>
<td>transmitted to the ground</td>
<td>335 000</td>
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<tr>
<td>reflected by the leaves</td>
<td>165 000</td>
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<tr>
<td>used for growth</td>
<td>21 500</td>
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<tr>
<td>used for other life processes</td>
<td>1 500</td>
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<tr>
<td>respiratory heat losses</td>
<td>500</td>
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</table>

How much energy is used by the grass in photosynthesis?

a. 2000 kJ
b. 19 500 kJ
c. 21 500 kJ
d. 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?

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<tr>
<td>C</td>
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<td>26</td>
</tr>
<tr>
<td>D</td>
<td>26</td>
<td>26</td>
<td>13</td>
</tr>
</tbody>
</table>
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:
   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.
   1. VNTR
   2. Kinetochore
   3. Tergum
   4. Okazaki fragments

D. Mention the function of the following.
   1. Assimilatory root
   2. Radula
   3. Uricose glands
   4. Hyaluronic acid

E. Give suitable reason of the following.
   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.
   1. Blakeslee
   2. Benthem & Hooker
   3. E. Chargaff
   4. Temin and Baltimore

G. Elaborate the following.
   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.

(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:
   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.

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

<table>
<thead>
<tr>
<th>Statement</th>
<th>Cellulose</th>
<th>Starch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycosidic bonds between monomers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monomer is glucose</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Exists in two forms – branched and unbranched chains</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

   c) Given below is a DNA sequence of the sense strand - (refer appendix)

   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.
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.

![Diagram of Ascomysetes life cycle]

b) Differentiate between male and female gametophyte on the basis of structure, development and amount in angiosperms.
c) Compare the animals with canal system and water vascular system.
d) Cockroaches are cursorial and are capable of flying. Give adaptations for each characteristic.

8. a) Draw a well labeled diagram of LS of pistillate flower.
b) Earthworms are hermaphrodite whereas in cockroaches are dioecious however both exhibit external fertilization. Explain.
c) A student collected two animal specimens and made the following observations. Identify the phylum, class and name the animal based on the observations.
   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.

9. a) Mention the fungal source of the followings.
   i) LSD
   ii) Penicillium
   iii) Roquefort cheese
   iv) Citric acid
b) Classify the flowering plants according to their habitat. Give one example of each.
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.
d) Give a comparative account of the excretory organs in earthworm and cockroach.
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.

![simple leaf]

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.

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

<table>
<thead>
<tr>
<th></th>
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<th>II</th>
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<tbody>
<tr>
<td>Habitat</td>
<td>Terrestrial</td>
<td>Terrestrial</td>
</tr>
<tr>
<td>Embryo develops in</td>
<td>Water</td>
<td>Egg</td>
</tr>
<tr>
<td>Mates</td>
<td>In water</td>
<td>On land</td>
</tr>
<tr>
<td>Epidermis covered with</td>
<td>Slime or mucus</td>
<td>Scales</td>
</tr>
</tbody>
</table>

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.

![system in amphibians]

i. Identify the system.

ii. Identify the part X and give its importance.
### Appendix-1

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<th>Second Base</th>
<th>Third Base</th>
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