



Instructions:

This paper contains two parts, A and B.

Part A: 40 multiple choice questions with one answer; Total Marks 100.

Part B: 20 multiple choice questions with more than one answer; Total Marks 100.

Answer All Questions Time 2 hours

Part A - Multiple Choice Questions

In the questions of this part, one response is correct. Mark the correct response in the answer sheet using a X.

(1) Which one of the following "molecule and structure" combinations is correct?

- (1) Glycogen - Linear
- (2) Cellulose - Branched
- (3) RNA - Branched
- (4) Hemicellulose - Branched
- (5) Amylopectin - Linear

(2) Some features of living cells are given below.

- a. Mitotic cell division
- b. Presence of 70S ribosomes
- c. Presence of subcellular components
- d. Presence of several kinds of RNA Polymerase
- e. Presence of polysaccharides and proteins in the cell wall

Which of the above features can be seen in prokaryotic cells?

- (1) a and d only. (2) b and c only. (3) b, d and e only.
- (4) b, c, and e only. (5) b, c and d only

(3) In a reaction mixture, the concentrations of enzyme and inhibitor remain constant. Which of the following takes place in competitive inhibition and non-competitive inhibition when the concentration of the substrate is increased?

Competitive inhibition

- (1) decreases
- (2) decreases
- (3) increases
- (4) remains the same
- (5) remains the same

Non-competitive inhibition

- increases
- remains the same
- decreases
- increases
- remains the same

- (4) A few events that take place during mitosis are given below.
- Nuclear envelop gets fragmented.
 - Formation of mitotic spindle begins.
 - Spindle microtubules get depolymerized.
 - Cell elongates and non-kinetochore microtubules are lengthened.
 - Centrosomes reach the opposite poles of the cell.

Which of the following shows the correct sequence of the above events?

- (1) a→b→e→d→c (2) b→a→c→d→e (3) b→a→e→c→d
(4) a→e→b→d→c (5) b→a→e→d→c
- (5) Which of the following statements regarding photosynthesis is correct?
- Chlorophyll-a is important for photoprotection.
 - Carotenoids do not absorb red wavelengths of the visible spectrum.
 - PS I and PS II are involved in cyclic electron flow.
 - CO₂ fixation occurs twice in both C₃ and C₄ plants.
 - Productivity yield is usually greater in C₃ plants than in C₄ plants.
- (6) Which of the following statements is correct regarding anaerobic respiration?
- The first step of ethyl alcohol fermentation is glycolysis.
 - The first hydrogen acceptor in ethyl alcohol fermentation is pyruvate.
 - The end products of lactic acid fermentation are lactic acid, CO₂, NADH and ATP.
 - ATP is synthesized when pyruvate is converted to lactic acid.
 - The end products of ethyl alcohol fermentation are ethyl alcohol, CO₂, NADH and ATP.
- (7) Select the correct statement regarding the evolution of biological diversity.
- Observations in chemistry, biology and physics have provided evidence for biochemical evolution
 - Abiotic synthesis of small organic molecules occurs even today.
 - Life arose in the early atmosphere.
 - Meteorites may also have been a source of organic compounds in early oceans.
 - DNA with self-replicating capability made inheritance possible for the protocells.
- (8) Which of the following 'era-event' combinations is correct?
- Mesozoic era - Diversification of early vascular plants
 - Paleozoic era - Radiation of reptiles
 - Paleozoic era – Evolution of Dinosaurs
 - Paleozoic era – Domination of cone-bearing gymnosperms
 - Cenozoic era – Diversification of flowering plants
- (9) Which of the following has both the Darwin-Wallace theory and Lamarck theory in common?
- Changes can be very useful and help organisms to survive.
 - Changes that occur in an organism during the life are passed on to the offspring.
 - All acquired traits are transferred to the next generation.
 - Heritable changes accumulate gradually over very long time periods.
 - Variations in a population occur primarily by gene mutations.

- (10) Both Mollusca and Arthropoda have
- (1) exoskeletons made up of organic compounds.
 - (2) dioecious organisms.
 - (3) segmented bodies.
 - (4) internal skeleton.
 - (5) closed circulatory system.
- (11) Select the correct statement regarding nutrition in animals.
- (1) Phylum Platyhelminthes includes bulk feeders.
 - (2) Association between barnacles and whales is an example for mutualism.
 - (3) Human tongue is highly flexible to aid in feeding as it mainly consists of smooth muscles.
 - (4) In man, digestion starts after the food reaches the stomach.
 - (5) Class Aves includes fluid feeders.
- (12) Which of the following statements is correct regarding the digestive system of man?
- (1) *Helicobacter pylori* causes gastritis by stimulating gastric glands to secrete HCl.
 - (2) Vitamin E helps to avoid disorders in the alimentary canal.
 - (3) Gastrin regulates the digestion that takes place in the duodenum.
 - (4) Pepsin is secreted by chief cells in the gastric glands.
 - (5) Vitamins A and K are produced in the colon.

- (13) Some invertebrates (A-F) and the types of circulatory systems (P-Q) of animals are given below.

Invertebrates	Types of circulatory systems
A - Spider	P - Open circulatory system
B - Flatworm	Q - Closed circulatory system
C - Clam	
D - Leech	
E - Hook worm	
F - Brittle star	

Select the response with correct combinations.

- | | | |
|------------------------|------------------------|------------------------|
| (1) A-P, B-Q, C-P, E-Q | (2) A-P, C-P, D-Q, E-Q | (3) A-P, C-P, D-Q, F-Q |
| (4) A-P, C-Q, D-Q, F-Q | (5) C-P, D-Q, E-P, F-Q | |
- (14) Which of the following statements regarding the human respiratory system is correct?
- (1) Mucus escalator helps to transport air out of the lungs.
 - (2) Epiglottis is open all the time except during swallowing of food.
 - (3) White blood cells are present in alveoli.
 - (4) Air is pushed into lungs during inhalation.
 - (5) Main breathing regulating centre is located in the hypothalamus.
- (15) In man,
- (1) destruction of microbes due to inflammation is an example for adaptive immunity.
 - (2) some blood cells such as neutrophils are involved in adaptive immunity.
 - (3) mucus acts as a chemical barrier for invading microbes.
 - (4) natural killer cells, which is a type of lymphocyte are involved in acquired immunity.
 - (5) interferons stimulate cells of the immune system to produce antibodies.

- (16) Which of the following statements is true regarding acquired immunity in man?
- (1) Antibodies produced in insects are used in developing artificially acquired passive immunity.
 - (2) Naturally acquired passive immunity can be developed in an unborn baby.
 - (3) Artificially acquired active immunity is developed when anti-venom is used to treat snake bites.
 - (4) Artificially acquired passive immunity is a secondary immune response.
 - (5) Memory T cells are involved in developing naturally acquired passive immunity.
- (17) Which of the following statements regarding the human nephron is correct?
- (1) Glomerular filtrate of a normal healthy person does not contain plasma proteins.
 - (2) Reabsorption of water mostly takes place in the ascending limb of the loop of Henle.
 - (3) Secretion of metabolic substances not required by the body mainly takes place in the collecting duct.
 - (4) NaCl is actively reabsorbed in the descending limb of Loop of Henle.
 - (5) Passive secretion of K^+ usually occurs in the distal convoluted tubule.
- (18) When the body temperature of normal healthy person decreases below the normal range,
- (1) sweat glands secrete more sweat.
 - (2) arterioles in the epidermis constrict.
 - (3) erector pili muscles contract.
 - (4) blood flow through skin capillaries increases.
 - (5) Ruffini corpuscles are stimulated.
- (19) Thalamus
- (1) acts as a relay station for nerve impulses.
 - (2) controls autonomic nervous system.
 - (3) coordinates running.
 - (4) controls vomiting.
 - (5) helps in maintaining balance.
- (20) Select the correct statement regarding the human endocrine system.
- (1) ADH synthesized in the pituitary is involved in osmoregulation.
 - (2) Regulation involving PTH is an example for positive feedback mechanism.
 - (3) Regulation of body temperature is an example for homeostatic regulation that does not involve endocrine system.
 - (4) Type II diabetes can be controlled by periodic injection of insulin.
 - (5) Basal metabolic rate increases due to excess secretion of TRH.
- (21) Three accessory glands associated with the human male reproduction system are as follows.
A – Seminal vesicles B - Prostate glands C - Bulbourethral glands
Secretions of which of the above glands provide/provides nutrients to sperms?
- (1) A only.
 - (2) A and B only.
 - (3) A and C only.
 - (4) B only.
 - (5) B and C only.
- (22) If the reproductive cycle of a normal healthy non-pregnant non-menopausal woman is 28 days, highest levels of LH and progesterone in blood are respectively found around the
- (1) 14th day and 21st day.
 - (2) 21st day and 14th day.
 - (3) 14th day and 28th day.
 - (4) 1st day and 14th day.
 - (5) 28th day and 14th day.

(23) Some stages of human embryonic development are given below.

A B C D

Fertilization → Cleavage → Morula reaches the uterus → Blastocyst → Implantation

The approximate time periods denoted by A, B, C and D are respectively,

- (1) 1 day, 2-3 days, 1-2 days and 2 days.
- (2) 24 hours, 3-4 days, 5 days and 7 days.
- (3) 24 hours, 3-4 days, 6 days and 8 days.
- (4) 24 hours, 2-3 days, 5 days and 7 days.
- (5) 1 day, 3-4 days, 5 days and 8 days.

(24) Some places where joints are present in the human body are given below.

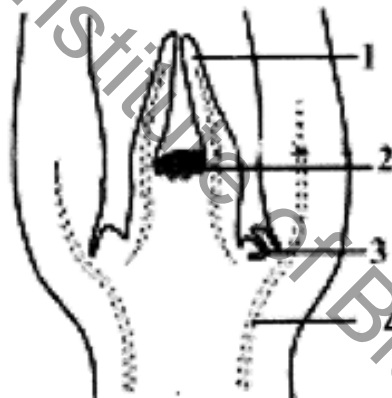
A - Between the phalanges B - Between the radius and carpal bones

C - Between the skull and vertebral column D - Between the parietal and temporal

Of the above places, hinge joints are present in

- (1) A only.
- (2) A and B only.
- (3) A, B and C only.
- (4) A, B and D only.
- (5) A, B, C and D.

(25) Select the correct response based on the diagram given below.



- (1) Both mitosis and meiosis occur at 2.
- (2) 2 produces primary tissues at initial stages and secondary tissues at later stages.
- (3) 2 produces central core of vascular bundles.
- (4) Always xylem, phloem and cambium are formed by 4.
- (5) Lateral branches are formed by 3.

(26) In angiosperm life cycle

- (1) male gametes are produced by meiosis.
- (2) Female gametophyte is more differentiated than male gametophyte.
- (3) Parthenogenesis produces haploid pericarp.
- (4) Self-pollination occurs when pollen from one flower is transferred to stigma of another flower on the same plant.
- (5) Ovule contains four functional megaspores.

(27) Select correct response regarding response of plants to light.

- (1) Phytochrome can detect the ratio of far-red to red light.
- (2) Forest canopy absorbs far-red light.
- (3) Proportion of far-red light simulates vertical growth.
- (4) Phytochromes promote hypocotyl elongation.
- (5) Only light stimulus a plant can detect is the different wavelengths of the action spectrum

- (28) Select the correct adaptation of plants due to abiotic stresses.
- (1) Cytoplasmic sugar levels are reduced in frost-tolerant plants during winter.
 - (2) Plants that grow in saline environments have higher concentration of organic compounds in cell sap.
 - (3) Leaves of frost-tolerant plants roll into a tube-like shape during winter.
 - (4) Fluidity of the cell membrane increases in cold temperatures.
 - (5) Extracellular water potential of the cells increases during freezing.
- (29) Which of the following plant growth substances show opposite actions to each other in regulating growth and development?
- (1) Auxin and Gibberellins in stem elongation
 - (2) Auxin and Cytokinin in apical dominance
 - (3) Auxin and Cytokinin in cell division
 - (4) Auxin and Gibberellins in growth inhibition
 - (5) Auxin and Gibberellins in fruit growth and development
- (30) A water molecule moves all the way from soil through root and leaf of a plant to air and passes through a living cell only once. This living cell would be a part of which of the following structures?
- (1) Casparian strip
 - (2) Guard cell
 - (3) Root hair cell
 - (4) Endodermis
 - (5) Root cortex
- (31) Select a mismatching combination.
- (1) Dominant - One allele suppresses the action of the other allele
 - (2) Pleiotropy - One allele shows many phenotypic expressions
 - (3) Linkage - Two alleles in a chromosome are very close together
 - (4) Mutation - Changes in the genetic material
 - (5) Epistasis - One gene suppresses the expression of another gene
- (32) Which of the following is not effective for changing allele frequency in populations?
- (1) Small population
 - (2) Mutations
 - (3) Selection
 - (4) Migration
 - (5) Random mating
- (33) Which of the following statements is correct?
- (1) The wild varieties of rice always have negative consumer requirements.
 - (2) Inbreeding population gives rise to more heterozygotes.
 - (3) Heterozygotes cannot be obtained through hybrid breeding.
 - (4) Mutation breeding gives very highly desirable characters.
 - (5) Polyploid plants have higher growth rates than diploid plants.
- (34) Which of the following is correct regarding Short Tandem Repeats (STR) markers?
- (1) Dinucleotide repeats are very common.
 - (2) Very rare in the genome.
 - (3) Show less polymorphic.
 - (4) Few STR markers are available.
 - (5) Only present in sex chromosomes.

- (35) Which one of the following enzymes is **not** used in DNA replication?
(1) Helicase (2) Topoisomerase (3) Primase
(4) RNA polymerase (5) DNA polymerase
- (36) Which of the following is correct regarding Polymerase Chain Reaction (PCR)?
(1) >1kb DNA fragments can easily be amplified than small fragments.
(2) No need to denature the DNA sample before the PCR .
(3) PCR is not an essential technique in gene cloning.
(4) To anneal primers temperature of the reaction needs to be increased.
(5) At the end of the 1st cycle, PCR amplified fragments are shorter than target DNA segment.
- (37) What is the most serious consequence of a decrease in global biodiversity?
(1) Increase in global warming
(2) Depletion of ozone layer
(3) Potential loss of ecosystem services on which people depend
(4) Desertification due to human activities.
(5) Reduction of recreational potential of forests
- (38) The numbers of trees of four different species (X, X, Y and Z) in five forest communities are given below. If these forest communities consist of only those species, which of the following forest communities would be the most diverse?
(1) 25W, 25X, 25Y, 25Z
(2) 40W, 30X, 20Y, 10Z
(3) 50W, 25X, 15Y, 10Z
(4) 70W, 10X, 10Y, 10Z
(5) 100W, 0X, 0Y, 0Z
- (39) Select the correct statement regarding the use of microorganisms in environmental management.
(1) Bioremediation is always a man-made process used to degrade or detoxify pollutants.
(2) Bioremediation is used to purify drinking water.
(3) In garbage piles bacteria anaerobically degrade waste.
(4) Waste is always aerobically degraded by microorganisms.
(5) Composting involves complete breakdown of organic matter by mineralization.
- (40) Select the correct statement regarding vaccines
(1) Some vaccines contain toxins.
(2) Booster immunization is required for Chickenpox vaccine .
(3) Booster immunization is not required for measles vaccine.
(4) Toxoid vaccines are live attenuated vaccines.
(5) Vaccines provide protection as they induce the production of B cells.

Part B – Multiple Choice Questions with more than one correct answer

In the questions of this part, one or more responses are correct. Mark the correct responses in the answer sheet using X. When any response is wrong, no marks shall be awarded to that question.

- (1) Select the correct statement/statements regarding cell connections.
- (1) Anchor junctions are mechanically attached to the cytoskeleton.
 - (2) Tight junctions prevent leakages of extracellular fluids.
 - (3) Desmosomes are present in skin epithelium.
 - (4) Desmosomes provide cytoplasmic channels to adjacent cells.
 - (5) Plasmodesmata is present in heart muscle cells.
- (2) Which of the following statement/statements regarding the allosteric regulation of enzymes is/are correct?
- (1) The shape of the active sites of the enzyme complex stabilizes when the activator binds to the active site.
 - (2) The shape of the active sites of the enzyme complex destabilizes when the inhibitor binds to the active site.
 - (3) When the activator binds to the allosteric sites the shape of the active sites of the enzyme complex gets stabilized.
 - (4) When the inhibitor binds to the allosteric sites the active sites of the enzyme complex get stabilized.
 - (5) The shape of both allosteric and active sites get destabilized when the inhibitor binds to the allosteric site.
- (3) Select the correct statement/statements regarding the C₄ pathway of photosynthesis.
- (1) Oxaloacetate contains a C atom from atmospheric CO₂.
 - (2) PEP carboxylase acts only in mesophyll cells.
 - (3) In bundle sheath cells, CO₂ is released from pyruvate.
 - (4) Net output of the Calvin cycle is one molecule of Glyceraldehyde – 3 Phosphate (G3P).
 - (5) Before CO₂ enter the Calvin cycle ATP is generated in the C₄ pathway.
- (4). You are given the task of designing an aerobic, mixotrophic protist that can perform photosynthesis in freshwater, and can also crawl about and engulf small particles. Which of the following structures should be provided to this protist?
- (1) contractile vacuole
 - (2) food vacuole
 - (3) pseudopodia
 - (4) chloroplast
 - (5) holdfast
- (5) Basidiomycota are different to Ascomycota because Basidiomycota
- (1) show heterotrophic nutrition.
 - (2) have exogenous sexual spores.
 - (3) have dikaryotic mycelium as the dominant stage of the life cycle.
 - (4) are decomposers.
 - (5) have cell wall made up of chitin .

(6) Locations of the stratified squamous epithelium, cartilage and pseudostratified epithelium are respectively,

- (1) skin, larynx and salivary glands.
- (2) vagina, intervertebral discs and trachea.
- (3) Bowman capsule, larynx and lining of the mouth.
- (4) anus, trachea and nasal passage.
- (5) proximal convoluted tubule, intervertebral discs and trachea.

(7) Which of the following cells is/are involved in internal non-specific defense in man?

- (1) Macrophages (2) T lymphocytes (3) Natural killer cells
- (4) Memory B cells (5) Plasma cells

(8) Select the correct statement/statements regarding the human circulatory system.

- (1) Blood pressure of a normal healthy adult person is 80/120 mmHg.
- (2) Lymph contains lesser amount of antimicrobial proteins than the interstitial fluid.
- (3) Pelvis is a site of production of red blood cells.
- (4) Rh⁺ individuals do not have anti Rhesus antibodies.
- (5) Serum differs from blood plasma due to absence of antibodies.

(9) When the blood pH value is lower than the normal level,

- (1) H⁺ ions will be actively reabsorbed in the proximal convoluted tubule.
- (2) HCO₃⁻ ions will be actively reabsorbed in the distal convoluted tubule.
- (3) H⁺ ions will be passively secreted in the in the proximal convoluted tubule.
- (4) H⁺ ions will be actively secreted in the distal convoluted tubule.
- (5) HCO₃⁻ ions will be passively reabsorbed in the proximal convoluted tubule.

(10) Some features (P-T) of nervous coordination (A) and hormonal coordination(B) are given below.

Feature	Type of coordination
(P) Localized response	(A) Nervous coordination
(Q) Long duration of the response	(B) Hormonal Coordination
(R) Use of chemical transmitters	
(S) Use of electrical transmitters	
(T) Fast action	

Select the response/responses with correct combinations

- (1) P-A, Q-B, R-A, S-A, T-A (2) P-A, Q-A, R-A, S-B, T-B
- (3) P-B, Q-B, R-B, S-A, T-B (4) P-B, Q-A, R-A, S-B, T-A
- (5) P-A, Q-B, R-B, S-A, T-A

(11) Some human hormones are given below.

- | | | | | |
|----------|---------|------------------|---------------|---------|
| (A) ACTH | (B) ADH | (C) Aldosterone | (D) CRH | (E) FSH |
| (F) GnRH | (G) LH | (H) Progesterone | (I) Prolactin | |

Some of the above hormones stimulate the secretion of some other hormones. Select the response/responses that indicates/indicate the correct sequence of such stimulations.

- (1) D → A → B (2) D → A → C (3) E → H → F
- (4) F → G → H (5) F → G → I

(12) Which of the following statements is/are correct regarding the human skull?

- (1) Temporal bone contributes to form the zygomatic arch.
- (2) Mandible articulates with zygomatic bone.
- (3) Sinuses are present in the maxillary and parietal bones.
- (4) Middle ear is present within the zygomatic bone.
- (5) Temporal bone contains higher number of processes than the mandible.

13. When supplied to the soil as a fertilizer which of the following forms can readily be absorbed by the plant?

- (1) PO_4^{3-}
- (2) NO_3^-
- (3) CO_3^-
- (4) MoO_4^{2-}
- (5) Fe^{3+}

14. In *Pogonatum*,

- (1) egg is not released from the archegonium.
- (2) protonema absorbs food from gametophyte.
- (3) both sporophyte and gametophyte are autotrophic.
- (4) gametes are formed by mitosis.
- (5) meiosis occurs within the archegonium.

15. Plants growing in a partially dark environment will grow toward light in a response called phototropism. Which of the following statements is/are true regarding phototropism?

- (1) It is caused due to an electrical signal.
- (2) One chemical involved in it is ethylene.
- (3) Auxin causes a growth increase on one side of the stem.
- (4) Positive phototropism strengthen photosynthesis.
- (5) The cells in the brighter side elongate faster.

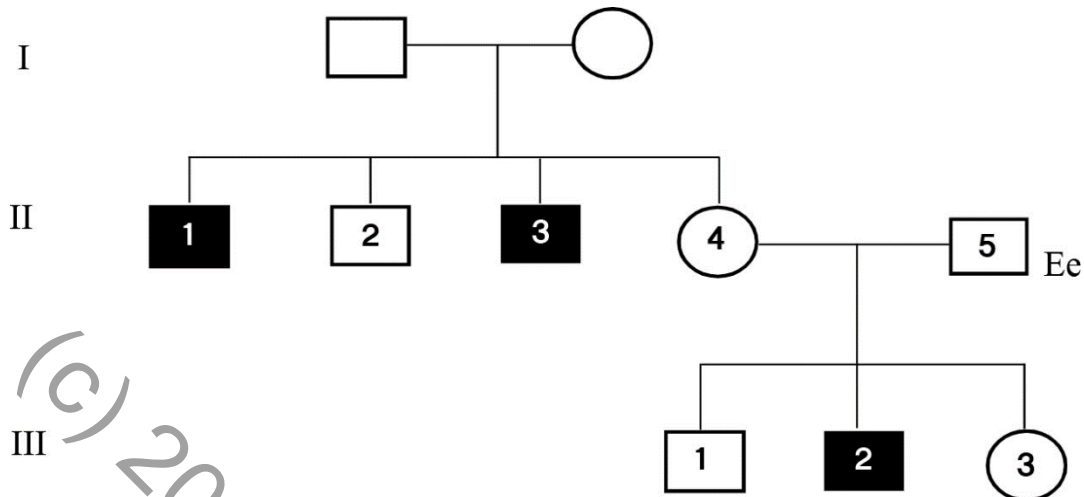
(16) Which of the following statements regarding DNA replication is/are correct?

- (1) Many ori sequences are present in the prokaryotic genome.
- (2) It takes place in tightly packed DNA.
- (3) DNA polymerases use their 3' to 5' exonuclease activity to remove incorrect nucleotides.
- (4) Okazaki fragments are formed complementary to the leading strand.
- (5) DNA polymerase I is used to remove ribonucleotides.

(17) Select correct statements regarding DNA libraries.

- (1) Different cloning vectors can be used for the preparation of DNA libraries.
- (2) cDNA library represents the entire genome of an organism.
- (3) Each clone of a library represents one DNA fragment.
- (4) Reverse transcriptase enzyme is needed to prepare cDNA libraries.
- (5) Some clones in a library contains overlapping sequences possessing fragments.

(18) The following pedigree shows the occurrence of a rare disease phenotype (shown in black). The genetic disorder is caused by a recessive autosomal allele.



Select the correct statement/statements based on the above pedigree chart.

- (1) Both grandparents are heterozygotes for the disease.
- (2) II-2 and II-4 are homozygotes for normal alleles.
- (3) III-1 and III-3 have the same probability of carrying disease allele.
- (4) The probability that II-4 carries the disease allele is 0.50.
- (5) III-1 and III-3 have 0.50 probability of having same genotype.

19. Select the appropriate combination/combinations.

- (1) Increase in the intensity of UV radiation reaching Earth – Depletion of ozone layer
- (2) Absorption of infrared radiation by atmospheric methane, carbon dioxide, and water – Greenhouse effect
- (3) Excessive nutrient runoff into aquatic ecosystems – Acid rain
- (4) Extremely high levels of toxic chemicals in fish-eating birds – Biological magnification
- (5) Habitats are divided into fragments by man-made structures – Loss of biodiversity

20. An organism obtains both carbon and energy by ingesting prey. Choose the appropriate term/terms that describes/describe this organism.

- (1) Autotroph
- (2) Heterotroph
- (3) Phototroph
- (4) Chemotroph
- (5) Parasitic