2000 Biology - I Answers

Que. No	Ans. No	Que. No	Ans. No	Que. No.	Ans. No	Que. No.	Ans. No	Que. No.	Ans. No	Que. No	Ans. No
01.	5	11.	all	21.	4	31.	1	41.	3	51.	3
02.	3	12.	3	22.	5	32.	2	42.	all	52.	4
03.	1	13.	2	23.	3	33.	2	43.	5	53.	5
04.	5	14.	5	24.	4	34.	3	44.	3	54.	1
05.	3	15.	1	25.	4	35.	2	45.	4	55.	2
06.	4	16.	4	26.	2	36.	1	46.	3	56.	2
07.	5	17.	4	27.	3	37.	1	47.	4	57.	2
08.	2	18.	5	28.	2	38.	1	48.	1	58.	1
09.	3	19.	1	29.	1	39.	5	49.	5	59.	4
10.	2	20.	1	30	1,4	40.	4	50.	4	60.	3

2000 Biology II Answers

Part A - Structured

01.

(A) (i) • Photosynthesis is a metabolic process
• by which solar energy is converted in to chemical energy
• in organic compounds
• using carbon dioxide
• and water(as row materials)
• in the presence of chlorophyll / photosynthetic pigments

or $6CO_2+6H_2O \xrightarrow[\text{Chorophyll}]{\text{Solar energy}} C_6H_{12}O_6+6O_2$

(ii) • Provides food/ energy for all heterotrophs/ other organisms.
• maintain balance of CO_2 and O_2 in the atmosphere/ Provides O_2 in the atmosphere.

(B) (i) 1. Grana 2. Stroma 3. Lamellae

(ii) (a) Grana/ Thylakoid membrane
(b) Stroma

(C) • Absorption of light by Photosynthetic pigments/ chlorophylls, carotenoids (occur in antenna complexes/ Source of light absorption).
• Present in Granal Thylakoide membrane.
• absorption of light in Photosystem - II/ chlorophyll P680
• causes an electron to be boosted to high energy level
• which passes through several electron acceptors of low energy.
• ATP is released/ produced during this process
• This electron is accepted by Photosystem I P700
• re-boosted by light absorbed at photosystem I P700
• and passes through several electron acceptors of low energy and finally accepted by NADP to from $NADPH_2$
• Photolysis (taking place at the same time in Grana) results in.
• the Production of Protons, electrons and oxygen
• These electrons replace the electrons released by Photosystem II

(D) (i) 1. Carbon dioxide accepted by RUBP
2. takes place in stroma
3. catalyzed by RUBP carboxylase.
4. Produce an unstable compound (6-c) finally producing 2 PGA molecules.

(ii) • Reduction of PGA → PGAL
• using all $NADPH_2$ and
• Part of ATP

(iii) • Part of PGAL Converted to RUBP/ use for regeneration of RUBP
• through RUMP
• using the remaining ATP
• (Rest of) PGAL Converted to Carbohydrates

02.

(A) • Totally of organisms and the ecosystems to which they belong/ variety of organisms and ecosystems found on earth or biosphere.
It consists of
• species diversity
• genetic diversity and
• ecosystem diversity

(B) (i) (a) • species found only in one country / locality
• found growing naturally
• no where in the world

(b) • species that play an important role on the stability/ functioning of an ecosystem
• If this species is removed/ be come relict, ecosystem tend to collapse.

(c) • species that has a symbolic value in the culture of the country
• species that serve as symbols for stimulating environ mental awareness.

(ii) • Elephant

(C) (i) • Monera
• Protista
• Plantae
• Animalia
• Fungi

(ii) • Common name of an organism can vary.
• Scientific name is the internationally accepted name
• This ensures precise identification

(iii) Each organism is named by its generic name (Genus) and specific epithet (specific name)

(iv) • Name of species must be written in Roman English alphabet.
• Underlined when hand writing
• Italics when printed
• first letter of the first name (Generic name) must be a capital letter and
• that of the second name (specific epithet/ specific name) must be a simple letter
• No two kinds of organisms can have the same name

(D) (i) • Presence of fully developed vascular system
• Fertilizaton not dependent on external water/ presence of pollen tube
• Highly differentiated in to roots, stem and leaves
• Presence of seeds/seed habit
• Presence of cuticle

(ii) • Dry (scaly) skin without glands
• scaly skin/scales /epidermal scales
• Present of organ for internal fertilization/penis
• Eggs with shells
• Embroys with foetal membrane
• Internal respiratory surface

03.

(A) (i) • Release of energy
• as ATP
• by breakdown of organic molecules in organisms cells
• by (a series of) enzyme catalyzed reactions

(ii)

	Aerobic respiration	Anaerobic respiration
Oxygen	Required	not required
energy released or ATP Produced	36/38	2
End products	CO_2 and H_2O/ complete oxidation	CO_2 and ethanol or lactic acid/ incomplete oxidation
Electron acceptor	O_2	an organic compound

(B) (i) • Permeable to respiratory gases.
• should be moist.
• should be thin.
• large Surface area
• highly vascularized

(ii)

Respiratory organ	Phylum
Gills	Arthropoda/ Annelida/ Mollusca
Trachea/book- lungs	Arthropoda
Body Surface	Annelida/ Nematoda/ Platyhelminthes
Trachea	Arthropoda
Tube feet	Echinodermata

(C) (i) • P - Nasal Cavity
• Q -Larynx
• R -Trachea
• S - Bronchus
• T - Bronchiole

(ii) • Transport of air/ respiratory gases
• moisturizes(inhaled) air
• removes particles in (inhaled) air/ dust removes
• Warms (inhaled) air

(iii) • Production of sound/ voice

(D) (i) (a) The amount of air taken in during one normal inspiration, or expelled during one normal expiration

(b) The amount of air that remains in the lungs after a maximum / deep expiration

(ii) Diaphragm , inter-costal muscles

04.

(A) (i) (a) An organisms which can synthesise its own food using Inorganic carbon / CO_2 and chemical energy of energy obtained from inorganic chemical reactions

(b) An organism which can synthesise organic compounds
carbon from organic carbon compounds, and using
energy from organic carbon compounds - by decomposition

(c) An organism which can synthesise its own organic foods using Light energy / energy from sun light, and Inorganic carbon / CO_2

(d) An organism which can synthesise organic compounds using carbon from organic carbon compounds, and light energy / energy from sunlight

(ii) (a) chemoautotroph : *Nitrobacter, Nitrosomonas/ Thiobasilus*

(b) chemoheterotroph : Fungi/ Animal (Any) Protozoa, bacteria.

(c) Photoautotroph : Algae / Cyanobacteria/ Photosynthetic Bacteria/ Higher Plants

(B) (i) They are considered as essential elements because
• they are components of structural materials of plants and
• a plant cannot complete its life cycle without these elements

(ii) • These elements are needed in relatively large amounts for plant growth
• others are needed in relatively small amounts therefore are called micronutrient elements.

(iii)

Macro nutrient elements	Major function
C	components of organic compounds/ carbohydrates Lipids/Proteins
O	Components of organic compounds
H	Components of organic compounds
N	Component of enzymes /Proteins / nucleic acid/ nucleotides / chlorophyll / Coenzymes

K	Helps in synthesis, amino acid and proteins / enzyme activator / involved in opening and closing of stomata
Ca	Components of cell wall (middle lamella)/ enzyme cofactor/ involved in cell permeability
P	Formation of ATP, Component of Phospholipids, coenzymes/ Genetic meterials.
Mg	Enzyme activator/ component of chlorophyll
S	Component of some amino acids and protein and coenzyme-A/ Enzymes.

(C) (i)
- Apoplast
- Symplast
- VacuolarPath

(ii) The water potential (ψ_w) of the root hair cell is less than that of the surrounding soil. since various substance are dissolved in the cell sap. Water enters the root hair cell, since water moves along a water potential gradient / from a place of higher (ψ_w)to a place of lower ψ_w.
When water enters a cell, its pressure potential (ψ_p) increases and its solute potential (ψ_s) decreases. Enter of water into the cell continues until
$\psi_r = \psi_s / \psi_w$ = zero

(iii)

Movement of water	Movement of minerals
Occurs along a concentration gradient / from a place of its high concentration to a place of its low concentration	May occur against a concentration gradient.
Passive process/ does not require metabolic energy	active process / requires metabolic energy

(D)
- Cut potato strip of equal breadth and thickness and measure the length.
- Prepare graded sucrose solutions [eg .1 .2, .3, .4, .5, 6 etc mol dm^{-3}]
- Place a strip of potato in each of the above solutions for a known constant time (e.g 20 or 30min]
- Take out each strip, and measure the length (taking care that you are measuring the length of the same side that you measured earlier.)
- Draw a graph of change in length vs concentration of sucrose.
- The point of intersection gives the conc. of sucrose[from x axis] whose water potentialis equal to that of the potato strip (mean value).
- Using tables calculate the water potential

Part B- Essay

01. In the buccal cavity (mouth)
- Mechanical crushing/ chewing (by teeth) (and tongue movements) mixes food with saliva which contains ptyalin / salivary amylase
- which digests starch cooked (to maltose- partial digestion)
- Food bolus formed
- Enters the pharynx
- And then passes to the oesophagus
- Involuntarily
- When the bolus is swallowed.
- Involuntary peristaltic movements pass the bolus to the stomach.

In the stomach
- Bolus is broken up, and
- Mixed with gastric juices
- The acidity in the stomach (due to HCl)
- Stop further digestion of the starch
- Food is retained temporarily in the stomach, and Then passes to the duodenum / small intestine

In the duodenum/small intestine
- Food (chyme)is mixed with intestinal juice and pancreatic juice
- pH is increased
- Starch is digested/ broken down to maltose by amylase
- Maltose is digested/ broken down to glucose by maltase
- Sucrose is digested/ broken down to glucose and Fructose by Sucrase
- Lactose is digested/ broken down to glucose and galactose by lactase
- Monosaccharides absorbed in to the cells of the epithelium of the small intestine actively or passively by carriers
- Some disaccharides are absorbed into epithelial cells
- and digested to monosaccharides (within cells)
- These monosaccharides pass in to blood stream/ blood capillaries in villi
- Undigested carbohydrates / matter passes to large intestine and to rectum and passes out (through arms)

02.

(i) Bacteria
cyanobacteria
Fungi
Algae
Protozoa
Virus

(ii) - Microbes decompose Organic matter of dead plants and animals And make the nutrients available to the soil so that plants can absorb them
e.g. They recycle minerals

like N, C, P (Mg/ Fe / Ca, S etc.).
- Fixation of atmospheric nitrogen /conversion ofN2 to organic- nitrogen compounds, is done by symbiotic microbes like *Anabaena* / *Rhizobium* and free living micro-organism like *Nostoc* / *Azotobacter*
- Microbes associated with roots Produce plant growth substances Like gibberellins/ IAA /indole acetic acid
- Also secreted some inhibitor Which resist plant pathogens.
- Some microbes produce binding substance like slim/ gum /fungal filaments Which, improves the soil texture / improves porosity / from soil aggregates.
- Mycorrhizal associations with root of higher plants Convert insoluble phosphate to PO_4^{3-} / ions / make available some soluble nutrients.
- Some soil microbes are pathogenic, and adversely affect plant- growth

03.

(i) - The structure is a double stranded helix. Each single stand is a linear string of nucleotides. Each nucleotide consists of a phosphate group,
A(5- C) deoxyribose sugar and a nitrogenous base
- The nitrogenous base could be a purine, Or a pyrimidine.
- Purines are adenine and guanine
- Pyrimidines are Thymine and Cytocine.
- The sugar molecules of adjacent nucleotides are joined by phosphate groups.
- The facing bases of the two stands are complementary
- Hydrogen bonds / H- bonds are present between the complementary bases so that A= T and C≡G
- The two stands are anti parallel

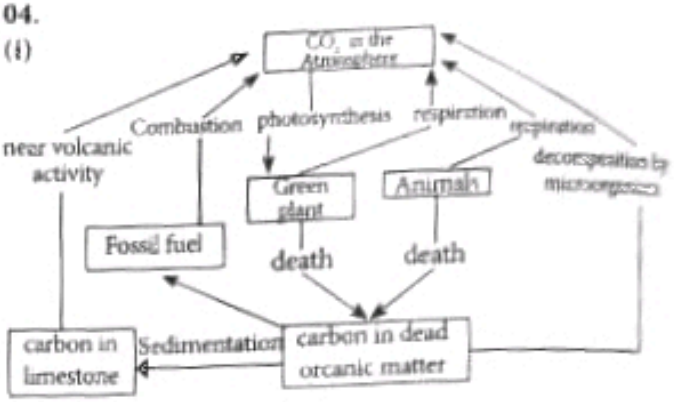
(ii) - This involves manipulation of the genome of an organism / changing the information contained in a gene by introducing genes of one species into another species
- The DNA is isolated in the organism and cut into pieces in the required manner, Using restriction endonuclease enzyme.
- These pieces are joined (or annealed) into bacterial plasmids or viral genomes, using DNA ligase enzyme
- The plasmid containing the new gene is then introduced into another organism usually a bacterium and allowed to multiply, so that identical copies are produced This is referred to as cloning.

(iii) **In medicine**
- Gene responsible for the production of growth hormones/ insulin production taken from an animal is introduced to bacterial cell
Where the growth hormone / insulin is produced in large quantities
- In gene therapy a defective gene responsible for an inherited disease, can be replaced by a healthy gene

In agriculture
A Gene responsible for resistance to insects, herbicides, insecticides, or a gene responsible for the production of specific amino acids or polypeptides or toxins is taken from one plant and introduced from one plant into another plant
- To produce resistance to pests, drought, etc., or to produce proteins of high nutritional value

04.

(i)

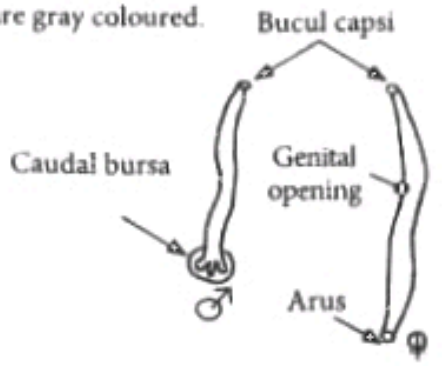


(ii) - A natural balance between CO_2 and O_2 in air is maintained by Using CO_2 by plants for photosynthesis in which O_2 is released during daytime
- Deforestation Increases the CO_2 concentration in the atmosphere.
- Burning of fossil fuel at factories / industries and in vehicles also increase CO_2 concentration
- While contributing to the green house effect / global warming.
- The increase in environmental temperature causes a rice in sea -level, due to melting of glaciers / ice caps, and thermal expansion of water
- This results in flooding of coastal areas and drastic change in weather - patterns.
- Biodiversity would be adversely affected

05.

(i) - (Thread- like), long slender
- Cylindrical body.
- With a pointed anterior end containing a buccal capsule with cutting plates (or teeth)/ and anus at the hind end.
- Female is larger than the male With the genital caperture situated mid-ventrally.

- Cuticle of male is rough, and is expanded(as flaps on either side of the local opening) to form caudal bursa (or captilatory bursa) used for holding the female during copulation.
- They are gray coloured.



Life cycle

Egg → 1 st larval stage → 2nd larval stage → 3rd larval stage → enters host through skin → blood stream → heart → lung → trachea → oesophagus → small intestine of host → adult nematode

Life cycle

- Eggs laid the female ,pass out of the host's body, along with the faeces.
- Eggs hatch out in the soil to form the 1st larval stage Which moults and Enters the 2nd larval stage (filariform larvae) Which also moults to become the 3rd larval stage (which is non- feeding).This is the infectious stage,
- Which can live for a month or two in the wet soil.
- The 3rd larval stage enters the body through the skin (by piercing it) and reaches the heart through the blood stream and travels across the thin walls of the blood capillaries around the lungs, and enters the alveoli (lung cavities)
- It then travels through the bronchioles and bronchi, to the trachea, and enters the pharynx (pharyngeal region) and then goes through the oesophagus to the small intestine,where it matures.

(ii) Control measures

- Avoid walking bare- footed /cover your feet/ wear shoes or slippers.
- Wear gloves when handling soil. use toilets / don't defaecate on open ground
- Destroy the adult,using drugs.
- Do not use faecal matter as fertilizer
- Make the general public aware of the method of transmission, impact of the parasite on man, and effective methods of control.

06.

(i) - It is the regular alternate occurance in the life-cycle of
- A diploid [2n] sporophytic generation, and
- A haploid [n] gemetophytic generation

in Poganatum

The dominant phase is the haploid, Independent Gametophyte

- Which is dioceous [male and female plants occur separately] and differentiated into stem, leaves and rhizoids
- The male [n] "plant" produces antheridia at the top, (within a peri gone)
- The female [n] "plant" produces archegonia at the free-end.
- Male and female gametes [sperms and ova] are produced by mitosis
- With in the gametangia (antheridia and archegonia)

Fertilization requires external water.

- The sperm swim along the neck-canal of the archegoneum and fertilizes the ovum,
- Forming a diploid [2n] zygote, which develops into a [2n] sporophyte.
- The, sporophyte is partially dependant on the gametophyte.
- The sporophyte consist of a foot, stalk or seta, and a capsule.
- mother cells of the capsule divide by meiosis to form
- (tetrad of) haploid [n] spores which get dispersed by wind.
- These spores germinate (in the wet soil) to produce a protonema, which produce many buds,
- Each of which develops into a gametophyte.

(ii)

pogonatum	*Nephrolepis*
Relatively large dominant generation	Relatively smaller, not the dominant generation
Body divided into stem, leaves and rhizoids	Though rhizoids are present, no division into stem and leaves
Dioeceous	Monoeceous
Motile male gamete is oval and biflagellate	Motile male gamete is spirally coiled with a tuft of flagella at free end / multi flagellate.
Photosynthetic	Photosynthetic

pogonatum	*Angiosperm*
Relatively large dominant generation	Relatively smaller, not the dominant generation
Divided into stem, leaves and rhizoids	No such division
Oval shaped biflagellate male gamete- motile	Non-motile male gamete. Restricted to a male nucleus only
Photosynthetic	Non photosynthetic. Depends on the sporophyte for nutrition
Attached to soil/ substratum by rhizoids	Attached to the sporophyte. No rhizoids
Male gamete released to the external medium	not so

(iii) - Microspores are produced in micro-sporangia which are present in pollen sac of the anther.

- Sporogenous tissue cells of microsporangia became microsporocytes [2n] and undergo meiotic division
- To form tetrads of haploid [n] microspores.
- The microspore nucleus divides mitotically into two so that each microspore (or pollen grain) contains a generative nucleus and a pollen tube nucleus
- Dissolution of callose walls Splits the anther wall open.
- So that mature, pollen grains / microspore are released they get dispersed by wind Or by water Or by animals