2002 **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.	2	11.	2	21.	4	31.	2	41.	2	51.	2
02.	3	12.	3	22.	2	32.	5	42.	4	52.	4
03.	1	13.	5	23.	5	33.	4	43.	3	53.	4
04.	3	14.	3	24.	3	34.	2	44.	5	54.	1
05.	1	15.	5	25.	4	35.	5	45.	2	55.	4
06.	4	16.	5	26.	5	36.	2	46.	5	56.	1
07.	3	17.	3	27.	3	37.	2	47.	4	57.	5
08.	5	18.	2,4	28.	1	38.	2	48.	4	58.	5
09.	2	19.	2	29.	4	39.	4	49.	3	59.	2
10.	4	20.	5	30	3	40.	5	50.	5	60.	2

2002 **Biology II** **Answers**

Part A - Structured Essay

01.

(A) (i)

A	B	C	D
Major stages of aerobic respiration	End products	Site in prokaryotic cell.	Site in eukaryotic cell
1. Glucolysis	Pyruvic acid/ $CH_3COCOOH$ $2NADH_2$	cytoplasm	cytoplasm
2. Krebs cycle	CO_2, ATP $NADH_2$, $FADH_2$	Cell membrane mesosome cell / cytoplasmic	matrix of mitochondria
3. Electron transport chain	34 ATP, H_2O	Cell membrane/ mesosome	Inner membrane of mitochondria / cristae

(ii) Glucose $\xrightarrow{\text{combustion}}$ $CO_2 + H_2O$ ΔG = -2880 kJ mol^{-1}

ATP $\longrightarrow$ ADP ΔG = -30.6 kJ mol^{-1}

In one ATP = 30.6 kJ

38 ATP = 30.6 × 38 ..... (1)

(36)

Efficiency = $\frac{30.6 \times 38 \times 100}{2880}$ = 40.375% ..... (2)

or

= 40% or 38%

(B) (i) 1- Carbohydrate 2- Lipids
3- Nucleic acids 4- Proteins

(ii) **Carbohydrate** - Starch/glycogen/ cellulose/ chitin/ pectin

Protein - Any named enzyme/fibrinogen/ albumen /globulin/insulin/immunoglobin/ collagen/myoglobin/keratin

Nucleic acid -DNA /RNA

(iii) They are (large) molecules of molar mass > 10^4
Polymers / are made up of repeating units.

(iv)

Organelle	Major groups of organic compounds
Ribosomes	Protein
Chloroplast	Nucleic acid [Not RNA] Lipid Carbohydrate; Protein; Nucleic acid[Not DNA]

(C) (i) • It is a protein,
• Which catalyses biological/ biochemical reactions **or** increases the rate of metabolic reactions

(ii)

Enzyme	Substrate	End products
Amylase complex	Starch	Maltose/ Amylase/ Glucose
Catalase	Hydrogen peroxide	Water and Oxygen
Trypsin	Protein/ peptones / peptides/ polypeptides	Dipeptides/ tripeptides/ smaller polypeptides

(D) 1. Mix (5 $cm^3$of) amylase [or saliva which contains amylase] solution with (10 cm^3 of) starch solution, in a container / test tube
2. Remove a drop of this mixture at intervals of 2 minutes (or 3 min), on to a white tile and test with iodine solution
3. After some time, the colour will change from blue to red-brown [colour of iodine]
4. indicating amylase activity.
5. Heat (5 cm^3 of) amylase/ saliva solution to 60° C for a few minutes/ 10 minutes, and mix with starch solution [10 cm^3]
6. Mix amylase and starch and heat to 60° C for some time
7. After some time/ few minutes, remove a drop onto a white tile, and test with iodine
8. Solution remains blue indicating the inactivation of enzyme by heat

Alternative answer

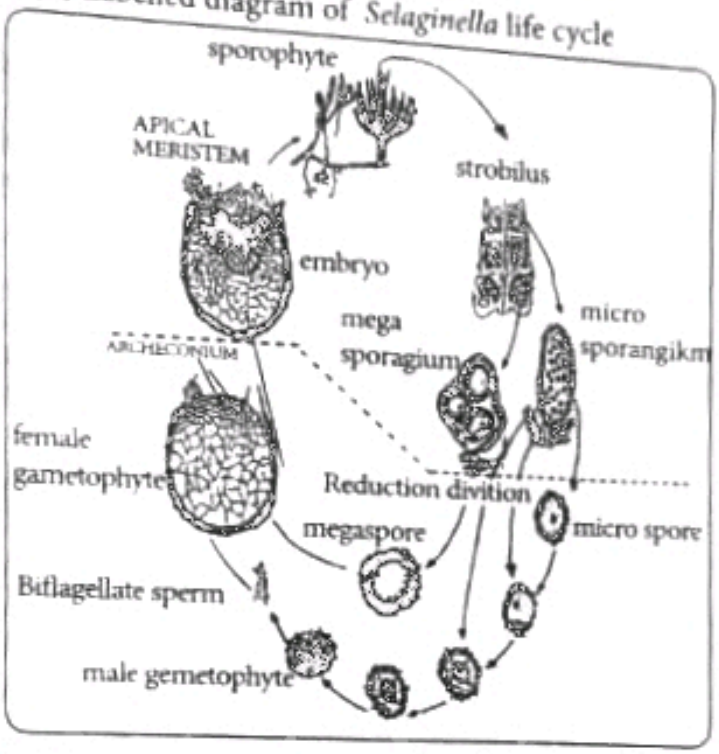
(D) 1. Take three tubes containing starch and add amylase to one , amylase heated to 60°C to the second , and water to the third.
2. Leave for sometime
3. Add one or two drops of iodine solution to each tube
4. Colour change in tube with unheated amylase (from blue to red-brown)
5. indicates amylase activity
6. No colour change / remains blue , in tube with heated amylase
7. This indicates inactivation of amylase
8. colour does not change in the tube containing water

(A) (i) Fusion of two gametes (or nuclei) of different organisms causes mixing of genes.
- Crossing over , and
- independent segregation during meiosis
- leads to variations and greater chances of evolution

(ii) a) Fragmentation
b) Budding
c) Conidia formation
d) Fragmentation
e) Binary fission
f) Budding

(B) (i)
- Alternative occurrence in the same life cycle of
- a sporophytic (diploid / 2 n) generation / asexually reproducing generation, and
- a gametophytic (haploid /n) generation / sexually reproducing generation.

(ii) Labelled diagram of *Selaginella* life cycle



(C) (i)
- It is the Growth of plant tissue
- culture medium / nutrient medium to produce new plants under sterile/ aseptic conditions

(ii)
- The plants produced will be disease free since they were grown under sterile conditions.
- they would be exactly similar to the patent plant/ no genetic variations
- A large number of plants can be obtained at once within a short time. Hence propagation is quick.
- Requires less Space since a large number of plants can be grown in a small vessel containing the medium
- These plants mature, independently so that they have no bearing, to the maturity of the parent plant
- This method is used to propagate plants which are difficult to obtain from seeds of other methods

(D) (i)
- Embryo
- Root apex
- leaves
- (Axillary) buds
- Short apes

(ii) Sugar cane - Stem cutting
Rubber - Bud grafting
Mango - Grafting / bud grafting / stem grafting
Potato - Tubers / seed potato

03.

(A)(i)
- It is a three dimensional, net work / lattice, made up of micro tubules , micro filaments and intermediate filaments (in eukaryotes) and found within the cytoplasm /cell

(ii)
- Maintains the shape of the cell
- Helps in movements of protoplasm within the cell, Helps in transport of organelles within the cell. Helps in the arrangement of organelles by providing means of suspension.

(iii)
- collenchyma - Cellulose, Lignin
- sclerenchyma - Cellulose, Hemicellulose
- xylem - Cellulose, Lignin

(B) (i)
- Exoskeleton
- Endoskeleton
- Hydrostatic skeleton

(ii)
- Maintains the shape of the body
- Affords protection
- Aids in locomotion (movements) by the attachment of muscles.
- Stores calcium and phosphorous/ helps in Calcium metabolism.
- Produces red blood cells and white blood cells (in the bone marrow)
- Stores fat
- Helps in conservation of water in some animals

(iii) Chitin

(C) (i) In the atlas vertebra,
- Centrum is either reduced or absent
- Neural canal is large
- Neural spine is reduced / absent.
- A facet is present for the articulation with the odontoid process of axis.
- A facet is present to articulate with the occipital condyles

(ii)
- To bear the skull
- Neural canal is large to provide space for the spinal cord which is very large in this region
- Facets are for the movement of head , up and down and side ways.

(iii) Cervical ,Lumbar

(iv) Cervical - Helps to raise the head / to keep the head upright.
Lumbar - Helps to raise the trunk / to keep the trunk upright.

(v)
- Increases the flexibility of the vertebral column / enables bending.
- Acts as a shock absorber

(vi)
- Bend the knees and lift the object
- Without leaning forward/ or bending the back

(D) (i) • Pelvis of a human being / human pelvis

(ii) a) Ileum / in nominate bone / hip bone
b) Sacrum
c) Acetabulum
d) Pubic symphysis
e) Pelvic cavity

(iii) • Ileum being large and horizontal can support abdominal organs
• by bearing their weight
• Its basic shape of basin -like structure also helps the above.

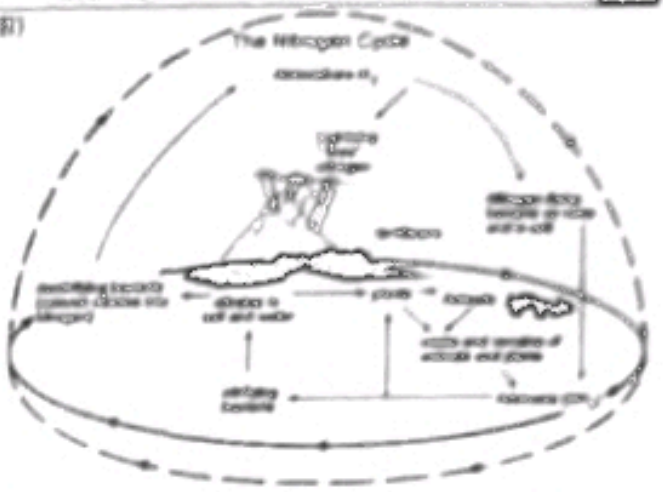
04.

(A) (i) • Very large zones in the world which have similar climatic and vegetation characteristics
or • Major terrestrial gathering of organisms/ plant and animal communities that live together in similar habitats defined largely by climates
or • They are climatically controlled
• assemblages of organisms/ plant and animal communities that have a characteristic appearance and are distributed over a wide area.

(ii)

Biome	Major vegetation Characteristics
• Tropical-rainforest/ Wet evergreen forest/ tropical wet evergreen forest	• Stratified/vegetation indistinct layers • Evergreen / Drip-tip leaves • canopy present • Licans/ root climbers present • Buttress root present • Ferns/ epiphytes/ orchids are in abundance
• Tropical monsoon forests/ /Tropical deuduous forests	• No stratification /No distinct layer separation • Deciduous and evergreen trees present • No(clear)canopy • Undergrowth develops only during the rainy season
• Tropical deserts	• Xerophytic characters shown (or any named xerophytic feature) • Sparse vegetation • Annual plants are dominant(and abundant) • Root system is deep feeding /reaching the water-table
• Savanna/ tropical (dry) grasslands	• Tall grasses abundant • Scattered trees • Which have a thick bark • Trees rather resistant to fires.

(B)



(C) (i) • Fixation- In industrial processes like Haber process for manufacture of
• De nitrification

(ii) • Commercial / fixed nitrogen fertilizers are water soluble. When added, it leads to leaching / the soluble ions get washed down into lower layers and also causes pollution of ground water
• Marshes / wetland are sites of de nitrification
• Filling of marshes for construction destroys marshes
• affecting nitrogen balance in the environment
• Surface water with dissolved nitrate get into waterways
• leading to eutrophication / algal blooms which destroys aquatic fauna

(D) (i) • Chlorofluorocarbons/ CFC

(ii) • Aerosol sprays
• Air conditioners
• Refrigerators

(iii)

Environmental effect	Health hazard
Entry / penetration of UV rays	Eye - cataract skin cancer

(iv) Montreal protocol/ (or ozone depletion)
Montreal convention

Part B- Essay

01.

- Absorption of water occurs mainly through roots/ root hairs by osmosis
- Water potential of root-hair cell , is low due to dissolve substances in the cell sap while the (more dilute) soil solution has a higher water potential
- Hence, water travels along a concentration gradient / from a place of higher water potential to a place of lower water potential.
- Water then passes through the cortex
- upto the endodermis (by three methods)

- (a) Apoplast pathway
- along the spaces within fibres of cell-wall, and intercellular spaces.
- In this the water, along with any dissolved or suspended substances move in one direction (unidirectional)by diffusion using the mass-flow theory (moving as one body)
- (b) Symplast pathway
- Through the cytoplasm in the cell wall and through plasmodesmata by osmosis
- (c) Vacuolar pathway
- across cytoplasm or cell membrane from vacuole to the other.
- Water passes through the endodermis by osmosis
- Casparian strips block apoplast movement allowing water to enter the pericycle through symplast and vacuolar pathway .water then enters the xylem using apoplast ,symplast and vacuolar pathways
- Transpiration from leaves causes a reduction in water potential in the mesophyll cells
- thereby creating-a transpiration pull in the xylem.
- which gives a water potential gradient between the xylem of veins and mesophyll cells.
- As a result Water moves from the xylem into the mesophyll cells
- This then creates a water potential gradient in the xylem (between the upper end and the lower end)
- Cohesion (attraction between water molecules)and adhesion (attraction between water molecules and xylem walls)
- maintains continuous (unbroken) column of water in the xylem (vessels)
- Hence a continuous water potential gradient exists from soil through the plant up to the atmosphere
- which results in the up ward movement of unbroken column of water

02.

(a) A - Production of alcoholic beverages /eg: Like toddy,beer ,wine etc /alcohol
- by alcoholic fermentation of sugar/glucose/ carbohydrates /fruit juice /molasses
- using yeast /*Saccharomyces cervisae*

B - Production of vinegar/ acetic acid
- by converting ethanol to acetic acid
- Using *Acetobacter/Gluconobacter* and yeast

C - Production of yoghurt /curd/ cheese /fermented milk /lactic acid By lactic acid fermentation
- Lactose sugar in milk
- Using *Lactobacillus / Streptococcus* species/ lactic acid bacteria

D - Production of antibiotics
- Like *penicillium / streptomycin*
- By *Penicilium notatum / Streptomyces*

E - Enzyme production
- Like amylase/cellulose
- By *Aspergillus/ Bacillus* species

F - Production of amino acids.
- like (L) glutamic acid or (L) Lysine
- By *Corynebacterium* species

G - Production of vaccines like polio vaccine B.C.G Triple vaccine or Mumps vaccine
- Using microbes as immunizing agents

H - Microbes are used as food supplements or single cell proteins (SCP) eg: *Cyanobacteria / Yeast / Spirulina / Candida / mushrooms /Agaricus / Pleurotis*

I - Hormone production like insulin / growth hormone/somatotrophine using genetically engineered microorganisms

J - Production of bio insecticides that secretes toxic proteins capable of destroying insect larvae
- Eg -*Bacillus thuriengensis*

K - Inoculation of leguminous plants to, Increase their nitrogen fixation. Using *Rhizobium*

L - To cause microbiological leaching of some metals like Cu/ Uranium [U]

M - Bacteria used for coir retting

N - Bio remediation/removal of oil spills /removal of toxic metals from waterways/ removal of pollutants from aquatic environment/ environmental applications

O - Used in the baking industry / bread making
- Using *Saccharomyces cervisae* /yeast
- making use of the by product [CO_2] released during alcoholic fermentation

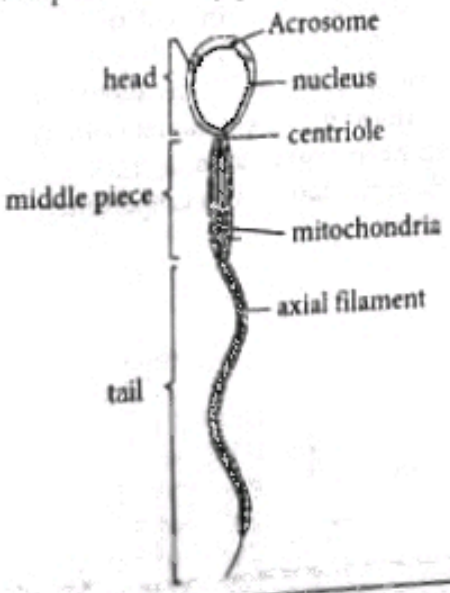
P - Production of bio-gas
Using certain bacteria / methanogenic bacteria micro organisms, on dead plant and animal matter

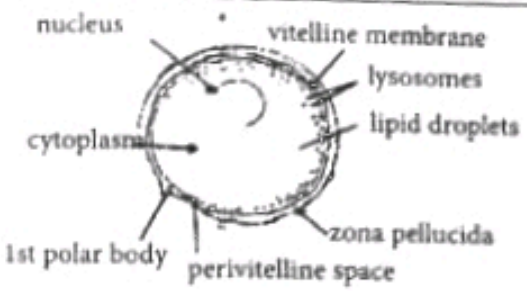
(b) - Cheap raw material (which are freely available), can be converted into useful products.
- rapidly
- at room temperature and pressure conditions. [other methods would require higher temperature and pressure which require more expenditure]
- This is due to the metabolic versatility of microbes, / ability to use different materials as substrates and their rapid growth rate multiplication

03. Structure of human sperm
- It is an elongated /long
- microscopic structure/ one celled/ 50 µm long and 25 µm diameter.
- it consists of three main parts -A head, mid piece (neck) and a tail.
- The circular head is flat and contains a large nucleus which is haploid and the (pointed) acrosome / modified lysosome
- the acrosome contains hydrolysis enzymes / protease and hyaluronidase which help to digest the egg

membrane so that the ovum can be penetrated,
- The nucleus which regulates cellular activities
- contains genetic material / (chromosomes) from the father / contains paternal genes.
- Mid piece / middle piece contains numerous mitochondria which supply energy needed for the sperm to swim towards the ovum.
- A pair of centrioles / centrosome present between the mid piece and the neck / in the neck
- These centrioles are perpendicular / at right angles, to each other.
- The axial filament starting from one centriole and extending throughout the entire length of the tail forms the flagellum. (It has the 9+ 2 structure)
- Tail is (very) long and helps in swimming, so that the sperm can reach the ovum by its movement
- The tail also helps the sperm to enter the ovum.

Structure of human ovum
- A spherical
- microsocopic / one celled structure/ 120- 140 μm in diameter
- No yolk / alecillial
- Since it gets nourished by the mother
- Contains haploid Chromosomes with maternal genes/ characters of mother
- The chromosomes regulate activities of the ovum
- The dense cytoplasm contains lysosomes / cortical granules and droplets of lipids
- It is bounded by the plasma membrane / vitelline membrane
- Outside this is the perivitelline space
- outer to which lies the zona pellucida which is an acellular/ non celled
- jelly-like coat
- Zona pellucida prevents polyspermy
- The first polar body is present in the perivitelline space
- Polar body retains excess chromosomes which was a result of meiosis
- Corona radiata, present outer to zona pellucida
- is composed of many granulosa cells;





04. (a) insect pests-
- paddy bug - Brown hopper.
- Case bearer - Yellow stem hopper
- Swarming caterpillar

(b)

A **Diseases**	B **Causative organism**
Bacterial leaf blight	*Xanthomonas*
Sheath blight	*Rhizoctonia*
Root knot disease	*Nematodes*
Greasy trumpet diseases	a virus
Deficiency disease	
Diseases caused by acidity/ alkalinity / salinity/environmental conditions	

(c))Use of-
- insecticides
- fungicides;
- bactericides
- nematicides
- biological methods
- agrochemicals
- clean, disease
- free seed paddy
- resistant varieties
- trap crops
- crop rotation
- traditional method
- inundation
- attraction to birds
- ploughing
- hand picking
- cleanliness
- Leaving fallow /leaving the field without cultivating for one or two seasons.

5. (a)

Dominant allele

- The allele which determine the phenotype or appearance of individual, even in the presence of the contrasting [alternative]allele in a heterozygote/ heterozygous

Recessive allele

- The allele which is responsible for the appearance of a character / phenotype only (or only in the presence of an identical allele
- The allele whose influence on the phenotype (appearance of the character) is suppressed in a heterozygote / in the presence of its contrasting allele.

Independent assortment

- Any one of a pair of genes / contrasting characters /alleles / factors can combine with either one of another pair

(b)

Parents ♂ ♀

Independent segregation / assortment $F^wF^0\,LL^s \times F^wF^0\,LL^s$

Gametes F^wL F^wL^s F^0L F^0L^s F^wL F^wL^s F^0L F^0L^s

	F^wL	F^wL^s	F^0L	F^0L^s
F^wL	F^wF^wLL White normal	$F^wF^wLL^s$ White bent	F^wF^0LL Yellow normal	$F^wF^0LL^s$ Yellow bent
F^wL^s	$F^wF^wLL^s$ White bent	$F^wF^wL^sL^s$ lethal	$F^wF^0LL^s$ Yellow bent	$F^wF^0L^sL^s$ lethal
F^0L	F^wF^0LL Yellow normal	$F^wF^0LL^s$ Yellow bent	F^0F^0LL Black normal	$F^0F^0LL^s$ Black bent
F^0L^s	$F^wF^0L^sL^s$ Yellow bent	$F^wF^0L^sL^s$ lethal	$F^0F^0LL^s$ Black bent	$F^0F^0L^sL^s$ lethal

Genotypes

- F^wF^wLL
- $F^wF^wLL^s$
- F^wF^0LL
- $F^wF^0LL^s$
- F^0F^0LL
- $F^0F^0LL^s$

Phenotypics	ratio
White normal	1
White bent	2
Yellow normal	2
Yellow bent	4
Black normal	1
Black bent	2

06.

(a) Endo symbiotic theory

- This deals with the possible evolution of mitochondria and chloroplasts of eukaryotic cells.
- There are some structural similarities between prokaryotic cells like bacteria and eukaryotic mitochondria I chloroplasts. They are -
- like in prokaryotes, DNA of the above organelles is circular
- Ribosomes of these organelles and those of bacteria, are similar
- Chloroplasts / mitochondria have double membrane and can undergo independent replication
- Hence, there is a theory that chloroplasts / mitochondria had earlier been free living prokaryotic (bacteria like) cells.
- which had been engulfed by pre-eukaryotic cells, and lived as a symbiotic organism in the cell

(b) Function of liver

- Regulates blood-glucose level
- Stores glycogen
- Regulates the amount of proteins / amino acids in the body
- Regulates temperature / heat
- Performs detoxification
- Produces bile and cholesterol
- Eliminates sex hormones / hormones
- and causes breakdown/destroy of old haemoglobin
- Stores blood , minerals like Fe or Cu and fat soluble vitamins (like A/ D/ E/ K/ B_{12})
- Synthesises plasma proteins / blood clotting factors
- Destroys red blood, corpuscles
- Produces urea (by deurination)

(c) Binomial nomenclature

- This was put forward by Linnaeus
- The name of any organisms given in two parts, namely
- The genetic name (indicating its -genus) and the specific- name(indicating its species)
- These names are in Latin, and written in English/ Roman scripts
- When hand written the names should be underlined
- When printed the letters should be in italics
- Generic name starts with a capital letter
- Specific name starts with a simple letter

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