Answers to Biology I - 2010

1 - 1	16 - 3	31 - 3	46 - 5
2 - 5	17 - 3	32 - 3	47 - 2
3 - all	18 - 5	33 - 3	48 - 1
4 -5	19 -5	34 - 4	49 - 3
5 - 1	20 - 5	35 - 3	50 - 5
6 - 3	21 - 3	36 - 1	51 - 1
7 - 4	22 - 3	37 - 5	52 - 3
8 - 4	23 - 2	38 - all/4/2	53 - 3
9 -2	24 - 2	39 - 4	54 - 1
10 - 3	25 - 5	40 - 1	55-2
11 - 2	26 - 1	41 - 1	56 - 5
12 - 3	27 - 2	42 - 5	57 - 4
13 - all	28 -5	43 - 5	58 - 2
14 - 3	29 -1	44 - 2	59 - 1
15 - 4	30 - 5/4	45 - 4	60 - 3

G.C.E. A/L
Biology III Answers August 2010
Part A - Structured essay

A. (i) A = glycolysis
B = Kreb's cycle / TCA cycle / citric acid cycle
C = electron transport chain

(ii) A ⟶ cytosol / cytoplasm
B ⟶ matrix of mitochondrion
C ⟶ cristae of mitochondrion

(iii) Stage A ⟶ 4 ATP molecules formed (out of which 2 are re used)
C ⟶ 34

(iv) NAD; FAD; cytochrome.

(v) Lactic acid; Ethanol; Carbondioxide (any 2)

(vi) $\frac{38 \text{ x } - 30.6 \text{ x } 100}{-2880}$ = 40. 37 % or 40. 4 %

or $\frac{36 \text{ x } - 30.6 \text{ x } 100}{-2880}$ = 38. 25 % or 38. 3 %

B. (i) A = rough endoplasmic reticulum
B = golgi body / golgi complex

(ii) A ⟶ protein synthesis
⟶ transport of proteins
⟶ formation of vesicles (any 2)

B ⟶
- glycolipid synthesis / glycoprotein synthesis,
- collection, packaging and distribution or transport of molecules,
- formation of lysosomes (any 2)

(iii) A cytoskeleton is a 3D lattice network in the cytoplasm, and is made up of protein filaments or micro tubules. (Protein fibres or micro fibres or intermediate filaments are also considered.)
- Give support to the cell.
- Help to keep cell organelles in place so that there is a proper arrangement of cellular organelles.
- Helps the organelles to move within the cell.
- Gives the cell its shape. (any 3)

(iv)
- Mutation of somatic cells, so that proper functions may not occur.
- Errors in DNA replication, which would lead to mutational faults.
- Accumulation of toxins due to environmental factors.
- Free radicals formed (and accumulated) during metabolism. (any 3)

(vi)
- Presence of 70 s ribosomes which are similar to those found in bacteria.
- Presence of circular DNA which is similar to bacterial DNA.

C. (i) It is the variability of all living organisms (plants, animals, microbes) on earth.
or It is the totality of organisms and ecosystem to which they belong.

(ii)
- Loss of habitats (may be due to deforestation or bush fires or floods)
- Introduction of alien species or invasive species which compete with and destroy existing species.
- Over harvesting and over exploitation.
- Environmental pollution which makes it impossible for survival.
- Climatic changes like global warming etc. These may affect breeding patterns in addition to problems of mere survival.
- Improper agricultural practices like (excessive) use of pesticides or insecticides.

(iii) It is an inventory showing the threats posed to, or vulnerability of plants or animals.
or It is an inventory of global conservation status. or vulnerability status.

(iv) Endangered (species)
Critically endangered (species) / on the verge of getting extinct
(Species that are) extinct
(Species that are) extinct in the wild
Vulnerable (species)
Low risk (species)
Conservations dependent
Data insufficient
Not evaluated (any 4)

(v) It is a region of the world, which is rich in biodiversity, with many endemic species and species under threat.

D. (i) garbage
sewage
chemical fertilizers, agro chemicals, insecticides.

(ii) **Basal convention** - Trans boundary movement of hazardous substances or hazardous waste.
Montreal protocol - Protection of ozone layer / reduction of emission of substances that destroy / deplete the ozone layer.
Ramasar convection - Conservation of wetlands.
CITES - International Trade of Endangered species.

(iii)
- Introduction and spread of pathogens / pathogenic microbes
- Accumulation of organic products / biodegradable or decomposition products.
- Depletion of O_2 in water / increase in biological oxygen demand or BOD / anaerobic decomposition adversely affecting aquatic organisms.
- Eutrophication (which causes BOD)
- Emmenation of bad smell.
- Accumulation of heavy metals or toxic matter..... (any 4)

(iv) Central environmental authority.

2 A.(i)
- Plants show indeterminate growth, growing throughout life.
- Plant growth is usually by cell division and cell enlargement of meristems, and not throughout the body as in animals.

(ii) Annual plant
- Completes its life cycle within one year or within one season.
- does not show secondary growth.
- growth is determinate.

(iii) From periphery inwards -
protoderm (epidermis) , ground meristem, procambium (any 3)
or, epidermis, cortex, endodermis, pericycle, protoxylem, protophloem, pith (or ground tissue)

(any 6)

(iv)

Stem apex	Root apex
○ Protected by leaf primodia....	Protected by root cap
○ Several procambial strands...	Single procambial strand
○ New cells produced only inwards	New cells produced in all directions.
○ Meristem at the extreme end or apex...	Meristem is a little away from the apex

(any 3)

B. (i) It is a vascular bundle of a dicotyledonous stem.

(ii) a..... Sclerenchyma
b..... Phloem
c..... Cambium
d..... Xylem

(iii)

Seive tube element	Xylem vessel
○ No lignin in cell wall.....	Cell wall contains lignin
○ Cross walls present as seive plates.....	No cross walls. Perforation plates present.
○ No secondary cell wall	Secondary cell wall (of lignin) present.
○ Cytoplasm present as it is a living cell.	No cytoplasm as the cell is dead.

C. (i) Cohesion - adhesion - tension theory.

(ii) Pressure flow hypothesis

(iii)

Xylem conduction	Phloem conduction
○ Occurs in one direction unidirectional.....	Occurs in both (opposite) directions - bidirectional.
○ Passive transport / Hence ATP is a not used.....	Active transport [loading and unloading] Hence ATP is used
○ It is a suction, and occurs under a negative pressure	Takes place under a positive pressure.
○ Transpiration and hence transpiration pull, helps in this	No help from transpiration.

(iv) Root hair cell (or root hair), cortical cells (or cells of cortex), endodermal cells, pericycle cells, xylem cells, bundle sheath cells, mesophyll cells. [5 in correct order]

(v) Mesophyll cells, bundle sheath cells, phloem paranchyma cells, companion cells (transfer cells), seive tube elements, compainion cells, paranchyma (storage) cells. (any 5 in correct order)

(vi)
1. ..... A,B,C
2. .....A,B,C,D,E
3. ..... A,C,D,E
4. .....C,
5. ..... A,C
6. .....D,E
7. ..... B,D
8. .....A,B,C
9. ..... C,D,E
10. .....D,E

3.A. (i) It is a specific organ or a structure, that can receive or detect a stimulus.

(ii) dermis, joints, tendons, muscles, mesentries (of gut.) (any 3)

(iii)

Phylum	Photorecepter
Coelentratea	eye spots
Annelida	simple eyes
Arthropoda.....	Compound eyes, simple eyes

(iv) Mollusca

B (i) a..... Cornea;
b..... Lens;
c ..... iris;
d..... ciliary body;
e..... Sclera;
f..... choroid ple x us; g.....
retina

(ii) a..... to refract rays of light.
c..... to control the amount of light entering the eye.
e.....
- to protect the inner parts of the eye
- for the attachment of muscles.
- to maintain the shape of the eye (any 2)

f.....
- to provide nutrition
- to provide oxygen
- to prevent reflection of light rays inside the eye or, absorbing light rays.

(iii) Aqueous humor

C (i)

Cells	Rods	Cones
Approximate numbers	120×10^6	6×10^6
Pigments	visual purple / rhodopsin	Photopsin / iodopsin
Funtion	visibility in low or poor light / night vision / initiation of stimuli due to light	Colour vision

(ii) Blind spot

(iii) Fovea

D(i) 1. Broadening of lens / lens curvature getting more.
2. Elongation of eyeball.

(ii) By using concave lenses. (in spectacles or contacts)

(iii) 1. Eye ball getting shorter.
2. Thining of lens / lenes curvature getting less.

(iv) Using convex lenses (spectacles or contact lenses)

4 A(i) Troposphere, Stratosphere, Mesosphere, Thermosphere

(ii) a) ..... Troposphere;
b) ..... Stratosphere;
c) ..... Troposphere;
d) ..... Thermosphere;

(iii) 70 - 75%

(iv) a) ..... 3 %
b) 2.25%

B (i) a) Primary producer; Primary consumers; Secondary consumers; Decompossers / Detritus feeders.

b) Air, Water, Soil, Light, Temperature ..... (any 4)

(ii)
- Flow of energy.
- Cycling / re cycling of elements.
- Interactions among organisms.
- Interaction between biotic and abiotic components, or interaction between living organisms and the environmental components.

(iii)a) At each trophic level there is about only 10% of energy available compared to the previous level.
Producer ⟶ grass hopper ⟶ toad ⟶ snake 800×10^6 ⟶ 800×10^5 ⟶ 800×10^4 ⟶ 800×10^3 $K.Jha^{-1}.r^{-1}$

b) With eagles removed, there will be more snakes surviving, that eat more toads. Hence more grasshoppers will swrivive. Answer - increase.

C(i) (In a population), it is the presence of more than two alleles of a gene.

(ii) $I^A I^A$ or $I^A i$..... blood group A
$I^B I^B$ or $I^B i$..... blood group B
$I^A I^B$ ..... blood group AB
ii ..... blood group O

(iii) Shape, height, skin colour, colour of eyes, mass, intelligence / IQ (most of the characteristics that show a continuous variation)

(iv) (a) 4 pairs of dominant alleles
∴ 8 dominant alleles'.
Number of height classes
= no. of dominant alleles + 1 = 8+1 =9

b) Shortest will be one having all recessive alleles. When 'n' number of genes are involved male gametes will have 2^n gamete types. Female gametes are also the same. Hence combination types are

∴ $2^n \times 2^n = 2^{2n}$

Total types = $2x^{2x4}=2^8 = 256$

∴ shortest proportion

$= \frac{1}{256}$

or 1:256

D (i) In an ideal population, the frequency of alleles (or genotypes) remain constant.

(ii) $p^2+2pq + q^2=1$ $q^2 = \frac{1}{2500} = .0004$

∴ q = .02 p =1-.02 = 0.98

Heterozygous is 2pq = 0.02x0.98x2 = .0392
This expressed as a percentage is 3.98%

(iii)
- Small population size
- Selective mating - Non random mating
- Mutation
- Immigration and emigration / migration.

(v) a) Oparin / Haldane
b) Charles Darwin / Russel Wallace
c) Charles Lyell
d) Lamark

Biology II August 2010
Part B - Essay

1(a) Phototrophic { Photoautotrophs, Photo hetero trophs }

Chemotrophic { chemoautotrops, chemoheterotrophs }

(b
- Decomposition
- of complex organic substances
- present in dead plants
- and dead animals
- by saprotrophic soil microbes (bacteria & fungi)
- release the minerals trapped in the dead organic matter.
- By this process of mineralisation,
- and also the release of CO_2 and H_2O due to their respiration,
- the nutrients are cycled in the C - cycle, N - cycle P - cycle, S cycle
- and nutrients get recycled in the soil.
- In the above decomposition process, extra cellular enzymes,
- produced by the heterotrophic (saprophytic) microbes,
- convert proteins in dead matter into amino acids - proteolysis.
- These amino acids are converted by other heterotrophic bacteria into ammonia / ammonium ion
- NH_3 or NH_4^+ to nitrite conversion
- is by *Nitrosomonas* and *Nitrococcus*
- Nitrite to nitrate conversion is
- by *Nitrobacter,* which is also a heterotroph
- Atmospheric nitrogen (N_2) is fixed to ultimately from nitrates or NH_4^+
- by free living soil bacteria.
- Eg. *Azotobacter*
- *Nostoc*
- *Clostridium* and
- *Anabaerna*
- Also, N_2 fixation is done by symbiotic bacteria
- Like *Rhizobium*
- and *Anabaena* species.
- Some micro organisms produce gums or sticky slime
- and help to form soil aggregates
- that improve soil structure / crumb structure.
- form mycorrhizal associations with roots of higher plants
- and make soil nutriants / phosphates, available.

02.
- Hypothalamus is the center that regulates our body temperature
- which is done by a negative feedback mechanism,
- in order to maintain our body temperature a constant at 36.8°6 C- 37° C / F 98.4 °F - 98.6 °F

When body temperature goes down:-
- the free nerve endings
- and Krause's end bulbs in the skin are stimulated.
- When this information (in the form of a nerve impulse) is passed to the thermoregulatory center in the hypothalamus
- the heat gain center in the hypothalamus is stimulated.
- Then processes / mechanisms that gain heat are initiated
- and processes / mechanisms that lose heat are inhibited
- Sweat production is reduced or inhibited
- which reduces heat loss by evaporation.
- Vaso constriction / constriction of blood vessels closer to (or in) the skin.
- reduces the blood (which is warmer than the surroundings) supply to the skin.
- Hence heat loss by radiation, is reduced.
- Increase in the secretion of adrenalin
- and thyroxin

- increase the metabolic rate.
- Skeletal muscles contract and causes shivering.
- Contraction of Arrector pilli muscles
- cause more heat production
- resulting in raising the body temperature back to normal.
- Stimulation of heat gain center now stops
- All these mechanims are involuntary.

When body temperature goes up

- Ruffini corpuscles
- and free nerve endings in the skin are stimulated.
- This nerve impulse goes to the thermoregulatory center in the hypothalamus
- Then the heat loss centre in the hypothalamus is stimulated
- Mechanisms for losing heat start and
- mechanisms for generating heat, are inhibited.
- Sweat production increase by stimulation of sweat glands.
- Heat is absorbed from the body for evaporation of sweat. This cools the body.
- Vasodialation occurs (blood vessels closer to the skin surface, dialate.
- This increases the (hot) blood supply to the skin
- which increases heat loss from blood by radiation.
- Secretion of adrenlin
- and thyroxin is inhibited,
- and so, metabolic rate is reduced,
- reducing the generation of heat in the body.
- This brings down the body temperature back to normal.
- Stimulation of the nerve center now stops and the above mechanisms also stops.(any 38 points out of the 40 given)

03.
- Carbohydrates are made up of C, H and O only
- with the ratio of H:O as 2:1 [General formula $C_x(H_2O)_y$]
- There are three types. monosaccharides
- disaccharides and polysaccharides.
- All monosaccharides are reducing sugars
- and are made up of single sugar units / single sugar molecules.
- They are classified according to the number of carbon atoms in the molecule
- for example, Hexoses have 6 carbon atoms like glucose, fructose, galactose.
- Pentoses have five carbon atoms only.
- Eg: ribose or deoxyribose or ribulose.
- Trioses have 3 C atoms
- Ex: glyceraldehyde
- Disaccharides are made up of two monosaccharide units
- joined together by a glycosidic bond

  Example are: glucose + glucose ⟶ maltose

  glucose + fructose ⟶ sucrose

  glucose + galactose ⟶ lactose
- Sucrose is a non reducing sugar.
- Lactose and maltose are reducing sugars.
- Pohysaccharides are macromolecules or polymer molecules,
- formed by the joining of a large number of monosaccharide units.
- The joining up is by the formation of glycosidic bonds.
- pohysaccharides are normally not water soluble'
- Starch, glycogen
- and cellulose are examples of polysaccharides.
- and all three are glucose polymers.
- Inulin is a polysaccharide polymer of fructose.
- Pectin
- is a galactouronic acid and galactose polymer.

Functions

- Carbohydrates being the primary product of photosynthesis, serve as one of the major food types for all living organisms.

Monosaccharides

- Glyceraldehyde is a triose which is an intermediate in the glycolysis stage of respiration. Also, it serves as an intermediate for synthesis of many other compounds.
- Glyceraldehyde is the derivative of the first identified product of photosynthesis
  - (phosphoglyceraldehyde) This is the major raw material for synthesis of other carbohydrates
- Pentoses are constituents of ATP / nuelceotides
- Pentose deoxy ribose is a constituent of DNA
- Pentose ribose is a constituent of RNA
- NAD/NADP/ co - enzymes are made of pentoses.
- The pentose ribulose is a constituent of RUBP which is a CO_2 aceptor in photosynthesis
- The hexose glucose is a common respiratory substrate.

Disaccharides

- Sucrose is a storage disaccharide in plants.
- It is the type of sugar involved in transport of substances through phloem.
- Lactose is also a storage carbohydrate (in milk)

Polysaccharides

- Starch is a storage carbohydrate in plants.
- Glycogen is a storage carbohydrate in animals.
- Inulin is a storage carbohydrate in some plants like Daliah or in some plants of compositae family.
- Cellulose is a structural carbohydrate in plant cell - walls
- Pectin is also another structural carbohydrate found in plant cell - walls.

4 a) ◦ Organic substances produced in plants
◦ in very small amounts
◦ that stimulate / increase
◦ or inhibit growth responses
(If "regulate growth responses" is given, it is only one point.)

b)

Substance	Site
◦ Cytokinin.....	◦ root apex, ◦ tissues where cell division occurs (any 2)
◦ fruits.....	
◦ Gibberelines... leaves / buds	◦ root apex, ◦ seeds, ◦ growing (any 2)
◦ Auxins (IAA)... / growing leaves	◦ stem apex / shoot apex ◦ young
◦ Ethylene / ethene...	◦ Seasoned or ripening fruits
◦ Abscisic acid	◦ stem, ◦ fruits, ◦ seeds..... (any 2)

c) **Cytokinins:-**
◦ delays ageing of leaves / delays senescence of leaves,
◦ along with auxins, they stimulate cell division and cell differentiation.
◦ Prevent flowers from wilting / keep flowers fresh.
◦ Increase radial growth of stems.

Gibberelines:-
◦ Cause stem elongation.
◦ mobilise food to induce germination of seeds.
◦ break seed dormancy
◦ promote cell elongation / enlargement of cells.
◦ induce parthenocarpy (development of fruits without fertilisation) in some plants.

Auxins:-
◦ maintain or cause apical dominance.
◦ induce rooting in cut shoots / induce production of roots.
◦ induce parthenocarpy / fruit development without fertilisation.
◦ induce development of fruits.
◦ Cause cell elongation / increase elongation of roots.
◦ control tropic responses specially phototropism

Ethene / ethylene:-
◦ stimulates ripening of fruits
◦ stimulates flower induction / formation

Abscissic acid:-
◦ Induces formation of abscission layer / induces abscission.
◦ Causes dormancy in seeds
◦ Causes dormancy in buds to delay their further development
◦ stimulate closure of stomata.

5 a)◦ **By tilling**
◦ which will expose all young stages of the pest (like eggs, larvae, pupae, young adult)
◦ so that they would be destroyed by either predators, or dehydration (drying up) or even due to light.
◦ **By pruning**
◦ which will remove parts of the plant which are infected with pests.
◦ **Crop rotation**
◦ Usually insect pests that damage one type or species of plant may not attack another type or species of plant. So the pests die without food.
◦ Using **trap crops** to attract pests
◦ **Sanitation of fields**
◦ will remove all stages of pests (eggs / larvae / pupae) found in debris / heaps of dirt etc.)
◦ **Covering soil with water** will drown pests and their young. or Removal of water also gets rid of pests. This is water management.
◦ **Hand picking-** This is a very slow process to remove all stages of the life - cycle of pests.
◦ Use of **biological** control like
◦ predators
◦ parasites
◦ and pathogens
◦ such as bacteria / fungi / viruses.
◦ Use of **repellents**
◦ to prevent the pests from entering the field. Repellents would deter the pests.
◦ Use of **light or sound traps**
◦ to attract pests which then get killed in the trap.
◦ **Drying**
◦ to reduce the amount of water in seeds. (pests need some water in the substratum, for their metabolic activities)
◦ **Resistant varieties** to be grown, so that the pests will perish due to lack of food substrate.

5 b)◦ They will pollute the water
◦ They will pollute soil / land
◦ Along with pests, the useful and economically important organisms also will die.
◦ They may destroy organisms which are important to the environment / ecologically important.
(both these points together is, loss of biodiversity).
◦ Some insect pests could become resistant to pesticides and insecticides, and these resistant strains would spread.
◦ Bio accumulation or bio magnification would cause harmful substances from pesticides and insecticides to get accumulated in the bodies along the food chain. This is because these substances do not get digested or decomposed inside the body.
◦ If consumed accidentally, they would be toxic to man. Hence they present a health hazard / life threating.

6 a) **Saliva**

- It is a mixtures of secretions of salivary glands and mucus glands (of the epithelial lining of the buccal cavity.)
- It has the enzyme salivary amylase / ptyalin
- that hydrolyses / converts, starch in to maltose.
- It has mineral ions like K^+/ Cl^-
- Cl^- activates salivary amylase.
- Water in the saliva
- moistens or wets the dry food. Then it is easy to swallow.
- Mucus in saliva.
- provides slipperiness / lubricates the food.
- Lysozymes present in saliva
- can destroy micro organisms / bacteria
- pH of saliva is about 6.5 to 7.5
- It contains urea / uric acid (which may account for its pH value)
- Presence of saliva on the tongue, helps in taste reception.
- Saliva on the tongue also helps in word formation / speech.
- Secretion of saliva is stimulated by para sympathetic nervous system
- and inhibited by sympalhetic nervous system.
  (Sympathetic and para sympathetic nervous systems is together is the autonomous nervous system. This would be a single point, instead of the last two points.)

6 b) **Bioremediation**

- This involves the use of micro organisms / bacteria, to remove pollutants
- from industrial effluents / flowing waste in aquatic environments / water bodies,
- and also from soil / terrestrial environments.
- By doing this, the polluted environment will be once again clean enough to be habitated. This is remediation.
- Sometimes genetically modified micro organisms are introduced into the polluted area,
- or selected natural organisms are put into polluted places .
- This process exploits metabolic potential or the use of enzymes of micro organisms.
- Example are, to remove spills in the occan and removal of toxic metals like lead, mercury or chromium, by converting them to non-toxic compounds.
- Sometimes, nutrients are added to enhance growth of microbes.
- Microbes are also used to reduce the amount of organic waste in water - ways,
- by accelerating waste-water decompositian in industrial effinents.
- Also microbes are used in compost formation from garbage, by accelerating the decomposition of waste organic mater.

C.

- Gene cloning involves first the isolation of the required gene
- which is then introduced into a live bacterium which is the host cell,
- using a bacterial plasmid or a viral genome as the cloning vector.
- As bacteria / microbes multiply fast, this allows the formation of a large number of (copies of) the desired gene.
- by culturing the host cells / bacterial cell that cantains the recombinant gene.
- The process is done as follows. DNA of the organism containng the desired gene is extracted,
- and using restriction enzymes / endonucleases,
- it is cut into pieces,
- separated / purified using gel - electrophoresis.
- Then the piece is fused or joined with the bacterial plasmid (which also has been cut previously by restriction endonuleases)
- using (DNA) ligase enzyme and
- introduced into a host cell. (transforming the host cell)
- Gene cloning is used in medicine to produce human insulin,
- to produce various proteins of medicinal values,
- to treat various diseases . eg diabetes.