Answers to Biology I
2011 New syllabus

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G.C.E. A/L Biology - August 2011 - Biology II (New syllabus) - Part A

1 A. (i)
- Order and organisation.
- Metabolism
- Growth and development
- Irritability and co - ordination.
- Adaptation - (to changes in environment, etc)
- Reproduction
- Heredity and evolution.

(ii) C, H, O, N, P, S.

(iii)
- It acts as a reactant (eg. photosynthesis)/or participates in chemical reactions (eg digestion).
- Helps to maintaion turgidity (specially in stems with less mechanical tissues or in very young leaves).
- Serves as a solvent / provides the medium for chemical reactions.
  (eg. ions and simple molecules are absorbed into cells in aqueous medium).
- It is a component of protoplasm / It is the medium of protoplasm.

(iv) Proteins - functions are :-
- Structural - cytoplasm
- Catalytic - enzymes are organic catalysts.
- Some proteins are hormones / they perform endocrine function.
- Some serve as antibodies.
- Serve for transport - blood plasma.
- Some proteins from toxins (which afford protection from enemies)
- Sometimes proteins can be an energy store.

Nucleic acid:-
- Store genetic material and transmit the genetic material or genetic information, or genetic characters to the following generation.
- Affect protein synthesis. (Proteins are synthesised by ribosomes, according to the triplet codes of t - RNA which have read the triplet codes on m - RNA. This m - RNA has got its information from the DNA strand.

B (i)
- All (new) cells arise from pre - existing cells.
- All organisms are composed of / made up of (one or more) cells.
- Cell is the basic structural and functional unit of an organism.

(ii)
- They do not have an organised nucleus
- No membrane bound organelles (like mitochondria, chloroplasts, other plastids , golgi bodies, ER)
- No cytoskeleton (in the cytoplasm)

- Cell wall is made up of mucopeptide / glycopeptide / peptidoglycan.
- Some members can fix atmospheric nitrogen.

(iii) - Cellulose, pectin, hemicellulose.

(iv)a) - They are membrane bound vesicles with oxidising enzymes.

b)

Microbody	Function
• Peroxysome	• Photorespiration in plants / or detoxification of peroxides.
• Glyoxisome	• Convert fats into carbohydrates.

(v) a) These are the structures at which cytoplasm of adjacent cells are joined.

b)

Type of cell junction	Function
• Anchor junctions.....	• Attach cytoskeletons of adjoining cells.
• Tight junctions.....	• Connect plasma membranes of adjacent cells tightly /prevent leakage through intercellular spaces.
• Gap junctions	• Allow exchange between adjacent cells / allow signals to be exchanged between cells touching each other.

C(i)a) It is the degradation (break down) of complex molecules to simpler molecules, releasing energy in the process.

b) $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ + energy.

(ii) a) Synthesis of (manufacture of) complex molecules from simple compounds,using up energy / ATP energy.

b) $6CO_2 + 6H_2O$ +light energy $\longrightarrow C_6H_{12}O_6 + 6O_2$

or $6CO_2 + 6H_2O \xrightarrow{\text{light energy}} C_6H_{12}O_6 + 6O_2$

(iii) a) Ribose (sugar), adenine (nitrogenous base), phosphate group

b) Chloroplast, mitochondria, cytoplasm / cytosol

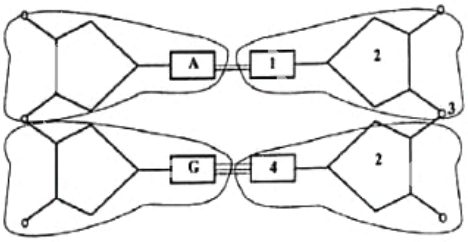
(iv) They carry the reactants through an alternative path which requires lesser activation energy for that reaction.

(v) • Competitive inhibitors compete successfully with the substrate and combine with the active site of the enzyme, and inhibit the enzyme - substrate complex formation.

Non competitive inhibitors combine with another part of the enzyme (other than the active site) and will inhibit the enzyme from reacting with the substrate (probably by altering the shape of the active site of the enzyme)

2 A a)(i) 1..... Thymine,
2..... Deoxyribose
3..... Phosphate,
4..... Cytosine

b)(i)



Any circle involving a deoxyribose sugar, a phosphate group and a nitrogenous base.

(ii) RNA has ribose sugar (DNA has deoxryibose suger) RNA has uracil (instead of Thyamin in DNA) [Single strand,three types etc are structural differences and do not come under chemical differences.]

(iii)

Type of RNA	Function
• m - RNA	• Copies gentic information from DNA and carries this code to the cytoplasm to synthesise proteins.
• t - RNA	• Pairs up with m - RNA in triplet codons so that amino acids are transfered to the m- RNA on the ribosome.
• r - RNA.....	• Component of ribosomes / provides the site on the ribosome for the assembly of amino acids in protein synthesis.

(iv) • It is in every cell of every organism / universal
- It contains a codon / triplet of nitrogenous bases.
- It is non - overlapping

(v) • (DNA) helicase - (to unwind the double helix)
- DNA polymerase - (to from the complimentary strand of DNA)

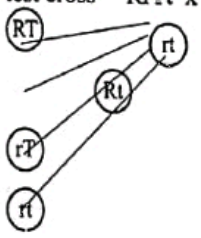
B (i) Parents RRtt x rrTT

a) Gametes Rt rt

(F_1) Progeny RrTt

(i) b) Parental genotypes of test cross RrTt x rrtt

Gametes



∴ Genotypes of F_2 progeny RrTt, Rrtt, rrTt, rrtt
Percentage frequency 40 10 10 40
(One parent round fruits and tall plant. The other parent in the test cross dwarf elongated)But in the question, the earlier parental types were
dwarf round and tall elongated
t R T r
Then genotypes of progeny RrTt, Rrtt, rrTt, rrtt would be earlier parental types round elongated
dwarf tall
40% 40%
which is 80% of the former parental types
∴ The recambinants are 10% RrTt and 10% rrtt

c) Linkage or crossing over

(ii) Causing genetic variation in evolution.
Maintenance of the chromosome number in a particular species, a constant.

C (i) ◦ Nutritional versatility / metabolic versatility. They have different nutritional methods like photosynthetic, symbiotic, saprophytic, chemo synthetic, and parasitic. This means that they can use a vast variety of food types.

◦ Fast growth rate / ability to reproduce fast / Low generation time. Then even if most of these microbes are destroyed from a place, any remaining can form a large number in a short time to cause an effect.

◦ Physiological diversity / ability to live either in the presence or absence of oxygen /aerobic microbes and anaerobic microbes / diversity of respiration. That means, you cannot get rid of microbes by controlling the oxygen content.

◦ Ability to live in different environments. Some bacteria can live in sub zero temperatures while others can thrive in boiling water in hot springs. Also, some can live in acids.

(ii) ◦ Bad smell
◦ Slimy feeling / gum formation
◦ Change of texture / softening of the food / becoming runny
◦ Colour changing / pigmentation

(iii) a) **Food borne infections** - are caused by consuming food containing pathogenic (disease - causing) micro organisms, which grow and multiply inside the body of the consumer.
Causative bacterium - *Vibrio cholera / Schigella / Salmonella typhi.*

b) **Food intoxication** - Caused by consuming food containing toxins already present in the food - These toxins had been produced by pathogens, before the consumption.
Causative bacterium - *Staphylococcus aureus / Clostredium botulinum.*

(iv) **Mechanism** — **Antibiotic**

◦ Inhibit protein synthesis..... ◦ Erythromycin, ◦ Tetracyclin, ◦ Streptomycin (any one), ◦ Chloramphenicol

◦ Inhibit DNA synthesis ..... ◦ Ciprofloxacin

◦ Inhibit synthesis of bacterial cell wall..... ◦ Penicillin

◦ Inhibit permeability of cell membrane..... ◦ Polymyxin

3 A. (i) ◦ Uterine wall / endometrium
◦ Chorion
◦ Allantois

(ii) **Hormone** — **Function**
◦ Human chorionic Or hCG — Maintenance of corpus luteum/ maintenance of embryo

(iii) ◦ Progesterone, Oestrogen, Placental lactoge

(iv) a. **Substance** — **Function**
◦ Prostaglandins, — ◦ Enhance contraction of uterine wall /enhance contraction of myometrium.

(iv) b. **Hormone** — **Sites of synthesis**
◦ Oxytocin — ◦ Mother's hypothalamus, ◦ foetus

(v) ◦ Progesterone

B. (i) Milk gands development..... ◦ Progesterone
Ducts of milk glands - development .....◦ Oestrogen.

(ii) a) **Hormone** — **Site of production**
◦ Prolactin — ◦ Anterior pituitary
b) Progesterone

(iii) ◦ Lactoferine, antibodies / immuno globuline, ◦ fat, ◦ lactose ◦ minerals, ◦ lactalbumin, ◦ casein ..... (any 4

(iv) ◦ Six months

(v) ◦ Two years

C (i) a)

Method	Example
◦ By conidia.....	◦ Fungi / *Penicillium* / *Aspergillus*/ *Euroteum*
◦ By zoospores.....	◦ *Allomyces*
◦ By fission / binary fission / multiple fission	◦ Bacteria / *Amoeba* / *Paramecium* / *Plasmodium*
◦ By budding.....	◦ Yeast /*Saccharomyces* / *Hydra*
◦ By fragmentation.....	◦ Ribbon worm / *Planaria* / *Spyrogyra*

b) ◦ Progeny / offspring are genetically identical.
◦ Large numbers of offspring can be obtained within a short time / - rapid multiplication
◦ Only one parent is required / no need to find a partner of the opposite sex.

(ii) Sugar cane ——— stem cuttings
Mango ——— Grafting / bud grafting etc.
Potato ——— from tubers
Banana ——— from rhizomes

(iii) ◦ A haploid gametophyic generation alternating with a diploid sporophytic generation in one life cycle.

(iv) a - strobilus
b - megaspore
c - microspore
d - egg / ovum
e - sperm /s
f - embryo

(v) formation of b and c / megaspore and microspore.

4 A (i)

Skeleton type	Phylum
a. Endo skeleton.....	Echinodermata
b. Exoskeleton.....	Arthropoda
c. Hydrostatic skeleton.....	Annelida / Nematoda

(ii) This question was removed from the paper

(iii) ◦ Protection of internal organs (like the skull protecting the brain)
◦ Support
◦ Movement (by providing attachment for muscles which bring about various movements)
◦ Storage / release of calcium ions
◦ Storage / release of phosphate ions
◦ Production of red blood cells (in the bone marrow)

B(i)
a - mandible
b - maxillary
c - frontal
d - parietal
e - occipital

(ii) ◦ Protects the cerebellum / brain.
◦ Provides a passage for the spinal cord.
◦ Articulates the skull with vertebral column / with atlas vertebra.

(iii) a) f - styloid process
g - zygomatic process / zygomatic arch

Function:- attachment of muscles.

b) ◦ They make the bones light / less heavy
◦ They make it easy for the skull / head to balance on the vertebral column.
◦ Make the voice resonate.

C (i)

Type of movement	Example
Tropic -	◦ Phototropic / bending towards or away from light.
	◦ Geotropic / bending towards or away from gravity
	◦ Thigmotropic / Twining around objects / roots turning away from obstacles.
	◦ Hydrotropic / roots growing towards areas which are wet.
Tactic	◦ Movement of gametes / sperms in higher plants / *Chlamydomonas* swimming.
Nastic	◦ Folding of *Mimosa* leaflets and leaf
	◦ Folding of *Sesbenia* leaflets
	◦ Opening and closing of petals of a flower

(ii) a) Indole Acetic Acid
b) ◦ Shoot apex, ◦ young leaves, ◦ root apex

(iii) ◦ Apical dominance - / inhibition of growth of lateral branches.
◦ Cell elongation.
◦ Induction of activity of cambium.
◦ Induction of growth of fruits.
◦ Regulation / causing tropic movement.
◦ Initiation of root growth.
◦ Causing pathenocarpy /development of fruit without fertilisation

(iv) ◦ Parthenocarpy - (Specially for grapes in wine industry)
◦ Initiate fruiting
◦ Initiate and regulate fruit development.
◦ Induction of rooting - (of stem cuttings)
◦ As weedicides - (eg to kill dicot weeds in a plantation with monocot crop)

(v) ◦ Abscisic acid
◦ Cytokinin
◦ Gibberaline / Gibberallic acid
◦ Ethene / Ethylene

Part B

5 a)
- Mutations are sudden changes in the DNA/ genome / genetic material of an organism,
- which can be inherited / are heritable / can be carried from one generation to the next.

b) Types of mutations are:-
- Chromosomal mutations
- Changes in the nucleotides or structure of chromosome
- Changes in chromosomal / nucleotide structure are called gene mutations or point mutations.
- These could be addition of bases,
- deletion or loss of bases
- rearrangement or inversion of bases
- or substitution of bases.
- all of which are usually the results of errors in DNA replication.
- due to errors occurring during cell division / mitosis / meiosis / segregation
- which causes changes in the base sequence or nucleotide sequence of the DNA molecule.
- Chromosomal mutations occur due to change in the number of chromosomes,
- by either the loss or gain of one chromosome / Aneuploidy.
- Chromosome number may change due to the presence of an extra X chromosome/
- or loss of one X chromosome / presence of a single X chromosome where there should be two
- or presence of an extra somatic chromosome / autosome
- or the increase in the entire set of chromosomes / polyploidy / 3n or 4n.
- This is common in plants.
- Some mutations are recessive and
- are expressed phenotypically in the homozygous conditions only.
- Some mutations are dominant, and
- are expressed phenotypically in both homozygous and heterozygous conditions.
- Some mutations are lethal and
- result in the death of organism due to harmful effect on cellular activities. eg. Gene responsible for the synthesis of either haemoglobin or chlorophyll, getting mutated means that these pigments are not formed. Then the animals or the plant will die.
- Mutations occurring in somatic cells are somatic mutations.
- and they are not inherited.
- Usually mutations occur spontaneously / randomly
- Mutations can also be induced
- By mutagens / external agents / u v rays / chemicals / X rays.

5c)
- Mutations are the major source of genetic variations.
- Some mutations are useful / beneficial,
- as they create / generate favourable characters which get successfully passed on to future generations.
- Some mutations are harmful
- as they create / generate unfavourable characters or remove favourable characters.
- These processes allow natural selection,
- which leads to evolution of species / speciation.

d)
- Down's syndrome
- Exhibited by individuals with an extra autosomal chromosome. (Caused by the non disjunction of chromosome 21)
- Turner's syndrome
- Exhibited by people with only one sex chromosome in the form of one X (XO)(They are females which lack oviaries and do not show sexual maturity).
- Kleinfelter's syndrome
- With people having an extra X chromosome. (XXY - males with no secondary sexual characters). (XXX - extremely tall females with menstrual irregularities)

Single gene genetic disorders are:-
- Huntington's disease
- Caused by an autosomal dominant allele.
- Cystic fibrosis
- Caused by an autosomal recessive allele.
- Sickle cell anemia
- Caused by an autosomal recessive allele.
- Thalassemia
- Caused by an autosomal recessive allele
- Haemophilia
- and colour blindness
- both caused by a recessive allele present on the X - chromosome Hence they are sexlinked.
- Albinism results in the inheritance of recessive autosomal allele, but different genes may have got mutated.

6 a) **Physiological group**
Example

- Aerobic microbes.....
- *Acetobacter / Pseudomonas*

- Facultative anaerobes.....
- *Saccharomyces / Escherichia coil*

- Obligate anaerobes.....
- *Clostredium*

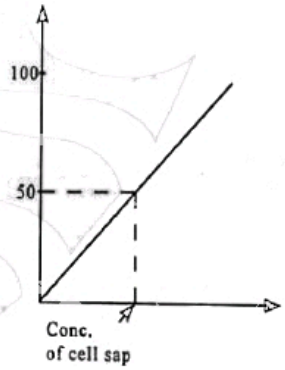
- Microaerophilic microbes.....
- *Lactobacillus*

b) Glass ware
- Pipettes
- Petridishes
- Flasks
- Test tubes / boiling tubes
- are sterilized using a
- hot air oven / dry air oven
- at 160° C
- for 1-2 hours

Culture media:-
- Sterilization using
- steam / moist heat
- under a pressure of
- 15 lb / square inch
- at 121° C
- for 15 minutes
- using a pressure cooker
- or an autoclave.
- The above is suitable only for culture media that are thermo stable.
- For thermo labile liquids (those that get destroyed by heat)
- and thermo labile culture media,
- the liquids are filtered through membrane filters
- which have a pore size of 0.45 µm

7a)
- The soil water that is absorbed through the root hairs
- moves through the cells of cortex
- and then through the endodermis and pericycle into the xylem uessels along three pathways.
- Apoplast pathway
- is through the cell walls of adjacent cells
- and through the intercellular spaces
- by mass flow
- and by diffusion, causing free movement of water
- Symplast pathway
- is through cytoplasm of cells
- and through plasmodesmata (strands that connect adjacent cells).
- In symplast pathway, the water moves by osmosis / diffusion
- through tonoplast
- and cytoplasm
- and through the plasma membrane / plasmalemma,
- by osmosis.
- Water entering by apoplast pathway
- is blocked by casparian strips of endodermis,
- enter the symplast pathway of endodermal celis
- before entering the xylem uessels / vascular cylinder.
- Water entering through symplast and vacuolar pathways
- continue through plasmodesmata
- of the endodermal cells
- into xylem vessels / vascular cylinder, through pericycle.
- This movement of water from the soil solution to the xylem occurs along /down a water potential gradient
- that exist from soil solution to cortical cells and then to xylem vessels.
- This water potential gradient first started in the cell sap of root hair cells due to substances dissolved in the cell sap,
- causing a decrease in the water potential of the root hairs.
- Thus water potential of root hair cells are much lower than the surrounding soil water.

b)
- Prepare sucrose solutions of different molarities / concentrations - graded sucrose solutions.
- Place lower epidermal peels of *Rhoeo* in each solution for 20 - 30 mins.
- Take the peels out and, using a microscope, count the number of plasmolysed cells
- And also the total number of cells in that field of view.
- Calculate the percentage of cells in each sucrose solution.
- Draw a graph with % of plasmolysed cells 'y' axis. and concentration of sucrose on 'x" axis



- The point on X axis showing 50% plasmolysis, corresponds to the concentration of cell sap.
- Using tables, read the solute potential corresponding to the concentration of cell sap obtained from the graph.

8 a) Nutrition is the process of obtaining raw materials for metabolic activities or process of obtaining raw materials to generate energy and to build up cells / for growth
or process of aquiring energy and material containing carbon.

b) Modes of nutrition:-
- Autotrophic
- where inorganic carbon [CO_2] is used

- Heterotrophic
- where organic carbon is used.
- One type of autotrophism is photo autotrophism
- where source of energy is sunlight.
- eg:- algae / green plants / cyanobacteria.
- The other type of autotrophism is chemoautotrophism
- where the energy source is inorganic chemical substances taking part in chemical reactions.
- eg:- nitrifying bacteria / *Nitrobacter* / *Nitrosomonas*
- Three type of hetetrophic nutriton are: saprophytic
- holozoic
- and symbiotic.
- In saprophytism enzymes secreted onto the food
- consisting of dead or decaying organic matter,
- digest the food extra - cellularly
- The digested end products are soluble and are absorbed.
- eg:- some fungi (like *Aspergillus, Penicillium*), some bacteria
- In holozoic nutrition, food is ingested (taken into the body /swallowed)
- and digested within the body.
- The soluble digested particles are absorbed.
- These absorbed substances / end products, are then assimilated.
- The parts which did not get digested, are ejected.
- eg:- most animals.
- In symbiosis, two organisms of different species live together for nutritional benefit. It is a nutritional association between two organisms of two species.

There are three types of symbiosis

a)
- Mutualism
- which is benificial to both partners
- eg:- legume root nodule and *Rhizobium* or cyanobacteria and fungi in lichen or higher plant root and fungi in mycorhizza.

b) Parasitism
- which is beneficial to one and harmful to the other.
- eg:- *Plasmodium* and man
  or *Necator americanus* and man
  or *Cuscuta* and a host plant
  or Head lice or bed bugs and man
  or Ticks and dogs

c) Commensalism is beneficial to one, and does not affect the other.

eg:- Epiphytes or epiphytic orchids and the plants on which they grow, or sea anemone and hermit crab

- A special type of nutrition is exhibited by insectivorous plants.
- They either actively or passively capture insects
- and digest them.
- The nutrients / nitrogen requirements are absorbed.
- eg:- *Nepenthes, Drosera / Utricularia*

9 a)
- The cerebrum, which s the largest part of the brain, consists of two hemispheres - right and left hemisphere
- Separated by a deep longitudinal furrow or cleft,
- and joined (on its underside) by corpus. callosum.
- Peripheral region consists of grey matter
- forming the cerebral cortex.
- The large number of cell bodies of nerve cells (neurones) in the cortex makes it look dark or grey.
- Cortex also contains many fissures / furrows
- and gyri
- which increases the surface area.
- Inner to the cortex is the white matter
- consisting of nerve fibres.
- Each hemisphere contains a ventricle
- filled with cerebro spinal fluid.
- There are four lobes - namely frontal lobe
- parietal lobe
- temporal lobe
- and occipital lobe
- Boundaries of lobes are marked by deep furrows.

b)
- Intelligence
- Memory
- Sense of responsibility
- Reasoning ability
- Moral senses
- Learning
- Perception of pain
- Perception of heat or cold / temperature
- Perception of touch
- Perception of hearing
- Perception of taste
- Perception of smell

} Sensory perceptions

Speech
- Initiation of voluntary muscle contraction
- Control of voluntary muscle contraction.
- recognition of sensory information
- interpretation of sensory information.

10 a)
- C_4 pathway is seen in some monocot plants like *Zea mays, Saccharum*, millet, sorghum
- For this, the primary acceptor of CO_2 during photosynthesis is PEP (phospho enol pyruvate)
- with the formation of a C_4 compound - oxalo acetic acid
- as the first product of CO_2 fixation
- C_4 plants fix CO_2 in photosynthesis by two steps in different types of cells.
- At first, PEP fixes CO_2 in the mesophyll cells forming oxaloacetate

- which is reduced to malate using NADPH .
- Malate is then transported through plasmodesmata to bundle sheath cells,
- C_4 plants possess a special feature in that there are two rings of cells around each vascular bundle. The inner ring contains chloroplasts that differ from those in the outer ring which is a part of the mesophyll "Kranz anatomy".
- In the bundle sheath cells, malate is converted to pyruvate
- releasing NADPH and CO_2.
- Within the bundle sheath, this CO_2 is then fixed with RuBP (a 5C compound) to from PGA / GP by the Calvin cycle
- Pyruvate is transported back to mesophyll cells
- where it is converted to PEP (to be reused)

Significance -

- Photosynthesis of C_4 plants is more efficient
- PEP carboxylase having a much higher affinity for CO_2 than the enzyme in C_3 plants, makes PEP a better acceptor of CO_2 than RuBP.
- So, photosynthesis can take place even at low CO_2 concentrations.
- Photorespiration (in which RuBP would combine with O_2 instead of with CO_2 resulting in less GP entering the Calvin cycle) does not occur in C_4 plants.
- In C_4 plants, photosynthesis can take place efficiently under high light intensities.
- CO_2 is fixed twice in C_4 plants (as opposed to only once in C_3)
- Hence, the yield is high in C_4 plants.

b) Major nitrogenous excretory products:-

- Ammonia ∘ urea ∘ Uric acid ∘ Creatinine ∘ Ammonia is very toxic
- It is the excretory substance of many aquatic animals like aquatic vertebrate larvae / fresh water fish / aquatic invertebrates.
- No carbon is lost from the body in this excretion.
- No energy is required for its synthesis.
- Large amount of water is required for excretion.
- Urea is less toxic than ammonia,
- and less water (than ammonia) is needed to excrete.
- Energy is needed for its synthesis
- and much carbon is lost from the body, as urea contains carbon.
- This is the excretory product of mammals and adult amphibians.
- Uric acid is the least toxic
- No water is required for excretion of this product.
- Carbon loss is high.
- This is the excretory product of insects, birds and reptiles.
- Creatinine is produced by the breakdown of creatine in muscles (of vertebrates)

c) ∘ Scientific method is a standard sequence of steps followed by scientists in investigating a particular problem.

- 1 st step is the identification of the problem.
- Then by questening in various ways, a hypothesis is formulated.
- Next is the conduction of experiments
- with proper controls.
- to test the hypothesis.
- Various predictions are then made, based on the findings.
- Further testing and further observations.
- can lead to the formulation of a theory.