ATLAS HALL

Science I - Solutions

	1	2	3	4	5
1.				X	
2.				X	
3.		X			
4.		X			
5.			X		
6.			X		
7.		X			
8.					X
9.				X	
10.			X		
11.				X	
12.		X			
13.			X		
14.		X			
15.	X				
16.		X			
17.			X		
18.			X		
19.			X		
20.	X				

	1	2	3	4	5
21.				X	
22.				X	
23.		X			
24.					X
25.			X		
26.				X	
27.		X			
28.	X	X	X	X	X
29.					X
30.		X			
31.		X			
32.				X	
33.					X
34.		X			
35.				X	
36.					X
37.					X
38.	X				
39.			X		
40.					X

	1	2	3	4	5
41.	X				
42.			X		
43.				X	
44.					X
45.					X
46.		X			
47.		X			
48.	X				
49.		X			
50.		X			
51.					X
52.			X		
53.		X			
54.	X				
55.				X	
56.					X
57.					X
58.					X
59.					X
60.				X	

Important:

Biology II - Model Answers

Part A- *Structured Essays*

1. A. (i) Grouping of organisms based on their common characteristics

(ii) In natural classification evolutionary relationships are revealed while in artificial classification these are not revealed.

(iii) Species

(iv)
- Cellular organization
- Arrangement of cells
- Type of nutrition

(v)

	Organism	Kingdom
(a)	*Plasmodium*	Protista
(b)	*Saccharomyces*	Fungi
(c)	*Ulva*	Protista
(d)	*Oscillatoria*	Monera

B. (i) *Lingula*

(ii) Relict species

(iii) Phylum ..... Annelida
Class..... Oligochaeta

(iv)

Class	Unique external feature	Example
Polychaeta	parapodia	*Nereis* (ragworm)
Hirudinea	anterior and posterior suckers	*Hirudo* (leech)

C. (i) A food chain is obtained when a few organisms are lined up through producer - consumer relationships.
Or
Is a sequence of feeding relationships that shows the energy flow of an ecosystem. This should be a series including several organisms.

(ii) Primary producer, primary consumer, secondary consumer, tertiary consumer etc.

(iii) Graphical presentation of relationships of different trophic levels of an ecosystem.

(iv) (a) energy pyramid

(b) as there is an energy waste when energy flows through the trophic levels of an ecosystem.

D. (i) agriculture and animal husbandry / domesticating animals

(ii) about 10,000 years ago.

(iii) between 18% - 22%

(iv)
- tropical rain forests / evergreen forests
- trophical intermediate moist forests / intermediate evergreen forests
- dry mixed evergreen forests / moist forests
- montane forests
- mangrove forests
- thorny scrubs

(v)
- reducing the green house effect / absorption of CO_2 / regulating balance of CO_2 and O_2
- control of soil erosion and landslides
- conservation of biodiversity / providing environment for animals and plants
- influence on climate / rainfall
- protection of water quality

2. (A) (i) The process by which raw material are obtained for energy generation and for building up of cells/ process by which raw material is obtained for metabolic activity.

(ii)
- ingestion , digestion, absorption, assimilation, egestion

(iii)
- one which contains the correct proportion and quantity of the various nutrients (protein, carbohydrates, lipids, minerals, vitamins), water and dietary fiber required to maintain health.

(iv)

incisors	canines	premolars	molars	
$\frac{2}{2}$	$\frac{1}{1}$	$\frac{2}{2}$	$\frac{3}{3}$	$= 32$

(v) to digest (convert) starch into maltose

(B) (i) stomach

(ii) connective tissue

(iii) (a) acute angle between stomach and oesophagus
(b) closing of the cardiac sphincter situated between the oesophagus and stomach.

(iv)
- providing an acidic medium
- kills many pathogenic microorganisms
- converting pepsinogen into active pepsin
- halting action of tyalin
- protection of stomach wall
- helping in absorption of vitamin B_{12} by providing

(v)
- secretion of mucus / basic secretion

(C) (i)

part	main function
a. Gall bladder	collects bile
b. Pyloric phincter	controls food entering small intestines
c. Pancreatic duct	transport of pancreatic juice
d. Rectum	storage of faeces

(ii)
- being long
- bearing villi
- bearing micro villi
- having circular foldings

(iii) food in the alimentary canal is pushed forward by the rhythmic contractions of the muscles.

(iv) increases peristalsis

(D) (i) those amino acids that cannot be synthesized in the body but must be essentially included in food.

(ii) trypsin, chymotrypsin, carboxypeptidase

(iii) to activate trypsinogen

(iv)
- converting small polypeptides into dipeptides and amino acids
- converting dipeptides into amino acids

(v)
- bile pigments (biliverdin and bilirubin)
- bile salts (sodium glycocholate and sodium taurocholate)
- cholesterol

3. (A) (i)
- to maintain a constant number of chromosomes of a species
- to increase genetic variation.

(ii)
(a) *Mucor* • gametangia
(b) *Agaricus* • production of basidiospores in basidiocarp
(c) *Pogonatum* • spore production in capsule

(iii) (a) strobilus (b) microspore (c) megaspore (d) antheridium (e) archegonium

(iv) (i) flower (ii) pollen grains (iii) embryo sac

(B) (i)

	Floral feature	Plant
(a)	Gamopetalous flower	Ixora
(b)	Epigynous flower	sunflower /guava
(c)	Unilocular ovary	bean
(d)	Capitulum	sunflower
(e)	Spadix	coconut

(ii)
(a) Induce flowering - ethylene
(b) keeping flowers fresh for a long time - cytokinins
(c) Induse fruiting - auxin / gibberellin
(d) maintaining seed dormancy - abscisic acid
(e) breaking seed dormancy - gibberellin

(C) (i)
a. apical meristem / apical initial cells
b. protoderm
c. ground meristem
d. procambium
e. endodermis

(ii)
xylem - procambium
Interfascicular cambium - (free marks)
Lateral roots - procambium

(iii)

Part	Function
a	- generation of new cells
b	- general of capillary layer / epidermis
c	- generation of cortex

(D) (i)

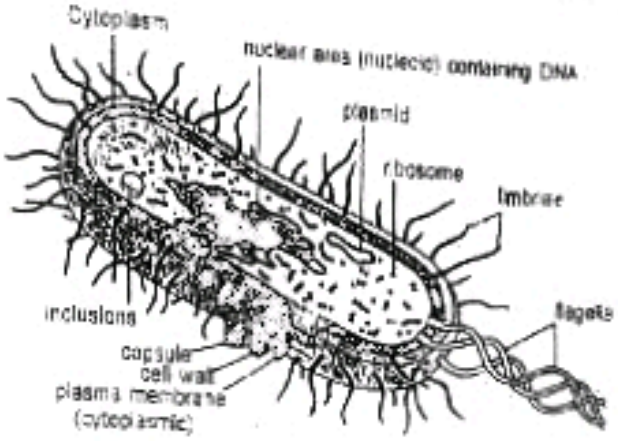
Type of cell	Function
Xylem vessel element	transport of water and minerals
Tracheids	transport of water and minerals
parenchyma	storage function
Fibers	mechanical support

(ii)

Type of cell	Function
Sieve tube element	Transport of food
Companion cells	carrying out all cellular functions of sieve tube elements
Parenchyma	storage function
Fibers	mechanical support

(iii) sucrose, amino acids, K^+/PO_4^- ions, vitamins, growth substances/ growth hormones (any three)

(A) (i) **Electron microscopic view**



(ii) Nucleus (with chromosomes, nucleolus, and nuclear membrane)
Endoplasmic reticulum (E.R.)
Centriole
Mitochondria
Cellular skeleton
Lysosomes
Micro bodies / peroxisomes (any five)

(iii) (a) smooth endoplasmic reticulum (SER) - peroxisomes
(b) lysosomes

(iv) 1. Remove an epidermal peel
2. Put this into a watch glass with water
3. Put a drop of water onto a glass slide and mount the epidermal peel on it.
4. Carefully place a cover slip on this so that air bubbles are not trapped. (using a filter paper, carefully remove excess water around the cover slip)
5. Observe under low power of microscope.

(B) (i) A macro molecule formed by repeating units called monomers

(ii)

Biological polymer	**Function**
Cellulose	structural / constituent of cell wall
Starch/glycogen	storage
Pectin	structural / constituent of middle lamella

(iii)

Biological polymer	**Function**
DNA	storage of genetic information/decides on genetics
RNA	storage of genetic information/protein synthesis

(iv) Add either Benedicts solution or Felin A and B separately to maltose and sucrose and heat well. A brick red precipitate in the tube containing maltose but not so in the tube with sucrose. (in the marking scheme, it is said to boil with either Benedicts solution or Felin A and B. This is what is in

the text book by Green too. Nevertheless, if sucrose is boiled with these two solutions, sucrose will hydrolyse and produce fructose and glucose, two oxidative sugars and therefore, here too a brick red precipitate will result. Therefore in order to differentiate between sucrose and maltose, heating well is suitable but not boiling)

(C) (i) Reduces the activation energy required for a chemical reaction.

(ii)

Co-factor	Function
Inorganic ions /chloride ions	increases reaction rate
Co enzymes / NAD / NADP	electron transport / O_2 transporters
ATP	Phosphorylation
FMN/FAD/Haem/biotin/ prosthetic groups	hydrogen receptors/transporters

(iii) Concentration of substrate, enzyme concentration, temperature, pH, activators and inhibitors

(iv) Enzymes have particular shapes into which the specific substrates fit.

(v)

Enzyme	substrate	product
catalase	H_2O_2	H_2O and O_2
lipase	fat/lipids	glycerol and fatty acids
invertase	sucrose	glucose and fructose

(D) (i) Glucose

(ii) Pyruvic acid /pyruvate

(iii) 2 and 3

(iv) Oxalo acetic acid

(v)

(a)	glycolysis	in the cytoplasm
(b)	TCA cycle	in the mitrochondrial matrix
(c)	electron transport chain	inner membrane of mitochondria

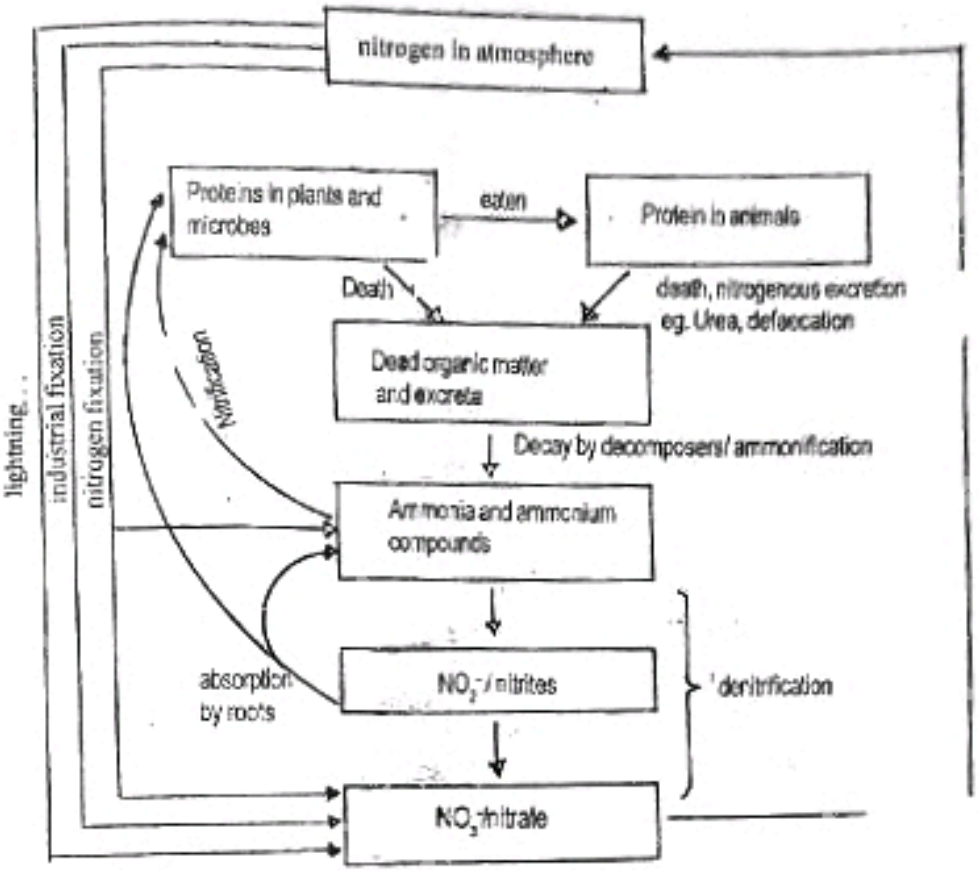
Part B - Essays

1. (a) Terrestrial plants obtain nitrogen, nitrate ions and ammonium ions from the soil solution by absorption through the roots. Aquatic plants absorb these ions from water across their body surface. Some other plants maintain mutualistic associations with nitrogen fixing organisms, and obtain ammonia / NH_4^+ fixed by such organisms for their nitrogen requirements. Examples for this are legumes and *Rhizobium* bacteria, Cicus and *Anabena, Azolla* and *Anabena.*

Insectivorous plant (pitcher plant - *Nepenthes, kandulessa, nilmonaressa*) get their nitrogen requirements from the digestion of trapped small animals, specially insects; the nitrogenous compounds are digested by enzymes for this purpose. *Cuscuta*, a totally parasitic plant, obtain nitrogen as nitrogenous compound from the host. A partially parasitic (hemiparasitic) plant, obtains mineral nitrate and ammonia from the host xylem tissue.

(b) Nitrogen is an important constituent of many plant compounds, where Nitrogen is used in the synthesis of these compounds. Chlorophyll, nucleic acids, nucleotides (nitrogenous bases), amino acids, proteins and enzymes contain nitrogen.

(c)



The atmosphere functions as the N_2 store. Free living *Azotobacter* and *Clostridium* fix this N_2 without any mutualistic association. *Rhizobium* in root nodules of legumes, *Anabena* in Cicus roots, fix atmospheric N_2 as NH_4 in the mutual association and these are absorbed by the host plants. Also, atmospheric nitrogen fixed during lightning will enter soil as nitrate ions during rains and the plants will absorb these through their roots. Nitrogen is incorporated during production of agrochemical fertilizer in the form of ammonium (NH_4^+) and nitrate and when such fertilizer is applied to the soil plants absorb these and use in protein synthesis. When protein in plants are eaten by animals, these are found as proteins in animals. The nitrogenous compounds in the protein in dead plants and animals and their excreta are decayed by decomposers such as saprotrophic bacteria and fungi. This results in NH_4^+/NH_3. This is known as ammonification. The soil bacteria (*Nitrosomonas*) will convert these into nitrite while these nitrites will be converted to nitrates by *Nitrobactor*. This process is known as nitrification. Nitrates in marshy lands are converted into molecular nitrogen by *Thiobacillus dentrificans* and *Pseudomonas denitrificans* and released to the atmosphere. This is known as denitrification.

2 (a)
- Posses diverse metabolic paths / shows metabolic versatility
- Ability to convert substrates into products at high speed
- Biochemical conversions are carried out at normal temperatures, pressure and normal environmental Conditions
- High growth rate
- Easy to grow

(b) **Food and beverages:**

Ethyl alcohol, wine, beer and toddy are products formed by alcoholic fermentation of carbohydrate substrates by yeast *Sachcharomyces cerevisiae*

Species of *Acetobacter* and *Gluconobacter* are used to convert ethyl alcohol to acetic acid in the production of vinegar.

Production of curd, yogurt, cheese by fermentation of milk using lactic acid bacterial such as *Lactobacillus bulgaricus* and *Streptococcus lactis*

Many industrial products such as antibiotics, enzymes, amino acids, organic acids are produced by various micro-organisms.

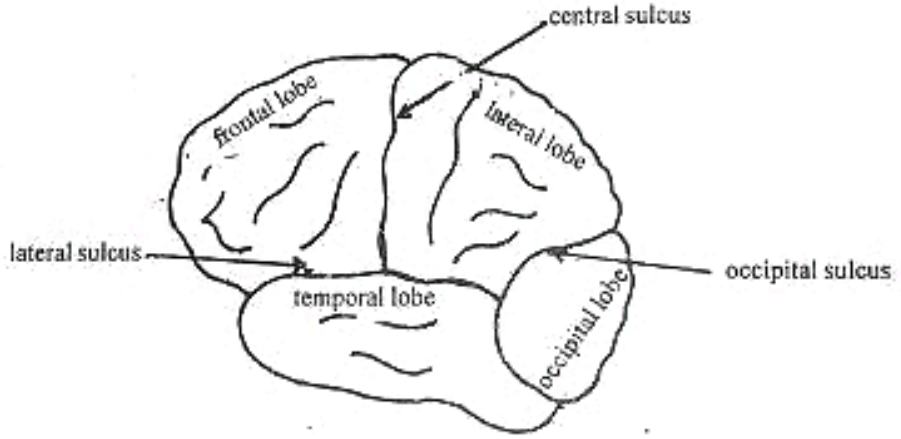
Use as proteins - *Sachcharomyces* (yeast), Mushrooms (*Pluvotus, Agaricus, Lentinus*)

Antibiotics - *Penicillium, Streptomyces* species
Enzymes - *Aspergillus, Bacillus, Sachcharomyces* species
Amino acid (glutamic acid, lysine) - *Corynebacterium* species
Vitamin B_{12} - *Streptomyces* species

Agriculture:
Heterotrophic micro-organisms are used in producing compost from bio waste
Use of *Bacillus thruengiensis* as a bioinsecticide/biopesticide
Production of biofertilizer - e.g. *Rhizobium* inoculatns produced commercially are added to soil containing legumes so that nitrogenous nutrients will be increased by nitrogen fixation of the bacterium
Use of fungal inoculates to increase phosphate/mineral absorption in plants.

Environmental management:
Aquatic pollution (oil spills/carbonic pollutants) and chemical pollution (toxic metals/ heavy metals) can be eliminated using the ability of micro-organisms to degrade and remove such pollutants. This is known as bioremediation. Accelerate waste water decomposition in industrial food processing and in chemical plants, to reduce biological oxygen demand (BOD) in active sludge in trickling filter method of treating waste water. Also, used to decompose solid waste /refuse etc.

3.



Is the largest section of the brain, where a deep longitudinal fissure separates the two hemispheres. Each individual hemisphere is equipped with a central cavity which is known as the lateral ventricle. These cavities are filled with cerebral spinal fluid. Two distinct layers comprise the cerebrum. The cerebral cortex is the outer layer containing gray matter. This is heavily convoluted. There are folds (cerebral gyri) and the grooves in between these folds are known as cerebral sulci. The inner white brain matter known as the corpus collosum connects the two hemispheres. Inside the white matter are the nuclei/ganglions. These are known as the thalamus and the basal body.

Each hemisphere is divided into five lobes (frontal, parietal, occipital, temporal and insula) and there are the central, lateral and the occipital sulci.

Sensory impulses are received from receptors from most parts of the body. The senses are alerted. Reviews sensory information such as vision, hearing, pain, tactile, temperature, speech, smell, taste etc. Stores sensory information as memory.

Learning, analytical ability, intelligence, personality, concentration, emotions, motivation, motor control, skills will be controlled. The right hemisphere will control the left side of the body and vice versa.

4. (a) Three major systems in aquaculture
i. extensive ii. semi-intensive iii. intensive

(i) **Extensive system:**
No supplementary feeding. Cultured fish are dependent on natural food available in the environment. There is no water quality maintenance. Harvesting does not require removal of water. Cast net and gill nets are used for harvesting. Stocking density is low. Therefore, low yield.

(ii) **Semi-intensive system:**
Supplementary feed is provided. Also, feed on natural food available in the environment. Water quality is maintained to some extent. Stocking density is higher than extensive but lower than intensive. Harvesting is by draining the water and collecting with nets e.g. seining. Yield is higher than in extensive but lower than intensive.

(iii) **Intensive system:**
Stocking density is higher than both the previous systems. Depends entirely on artificial (supplementary) feeding and avoids feeding on natural food available in the environment. Water quality is maintained; dissolved oxygen, temperature and pH of water are maintained. Harvesting is by draining the water and collecting with nets e.g. seining. Yield is higher than from the other two systems. Expenditure too is higher.

(b) Environmental problems caused in Sri Lanka by shrimp farming:
Clearance of mangroves, resulted in low yields in prawns and fish in the lagoons and coastal marine waters and decrease of biodiversity lead to the biodiversity threat. Caused soil erosion. Deterioration of water quality of nearby streams (due to waste from the farms). Flooding of the area resulted due to blocking of drainage channels. Loss of grazing area for cattle. These led to conflicts among different groups of people.

5. (a) Global environment issues concerning the atmosphere:
(1) global warming (2) thinning of ozone layer (3) acid rain

(1) **Global warming:**
This is a result of increase of green house gases (CO_2, CH_4, CGC, nitrous oxide) in the atmosphere. Deforestation and combustion of fossil fuels lead to increase in CO_2. Increase in animal husbandry and in the land area used for paddy cultivation has led to the increase in CH_4. Use of spray, release of CFC to the atmosphere during repairs to CFS containing refrigerators and air conditioners, and also leaks of such appliances would lead to increase in CFS in the atmosphere. Use of fertilizer increases the nitrous oxide levels in the atmosphere.

As a result of increase of green house gas concentrations in the atmosphere the global temperature rises. As a consequence, melting of polar ice caps and increase of sea level due to thermal expansion of water will lead to the flooding of lowlands. In addition, this will also result in changes in rainfall patterns, climate patterns, distribution of animals and plants (biodiversity).

(2) **Thinning of ozone layer:**
During repair of fridges and air conditioners and the leaking of CFC from these, by sprays, perfumes, the CFC that enters the atmosphere will lead to the thinning of the ozone layer. As a result the increase in the UV rays that enter the earth's surface will lead to the following:

- probability of getting skin cancer increase
- glaucoma of eyes increases
- lowering of immunity
- lowering of yields due to decrease in photosynthesis etc.

(3) **Acid rain**
Addition of SO_2, NO and NO_2 (oxides of nitrogen) to the atmosphere will lead to acid rain. As a consequences the following will result:

- Destruction of biodiversity
- Acidification of soil/water/global environment

(b) Limiting the release of green house gases, and substances that thin the ozone layer by signing international agreements. Reforestation, reduction of deforestation, increase and eliminating the use of rebuilt engines. Use of alternative energy sources instead of fossil fuels. (use of engines based on wind power) Use of alternative gases in fridges/ aid conditioners instead of CFC.

6. (a) **Importance of breast feeding:**
Breast milk contains all the nutrients that the baby requires in right proportions. Also antibodies are transferred to the baby. Therefore, immunity develops. Allergies are minimized. The baby is protected from pathogenic micro-organisms. Due to sucking, the facial and jaw muscles will develop. A long lasting relationship between the mother and child will start at an early stage. The iron and lipids in breast milk is better absorbed than that of cow's milk. The amino acids in breast milk is speedily subjected to metabolic activities. Is more suitable for the baby as breast milk contains less Na. A gap between natural pregnancies will be maintained.

(b) **Tropic movements of plants:**
A tropism is a movement of part of a plant in response to and directed by an external stimulus. The movement is almost always a growth movement. Tropic responses are described as positive or negative depending on whether growth is towards or away from the stimulus, respectively. These are irreversible movements that occur very slowly, and are not apparent to the naked eye. These can be further classified according to the stimulus. E.g. phototropism, geotropism, chemotropism, hydrotropism, thigmotropism

Phototropism:
Movement is in response to light. Shoots and coleoptiles are positively phototrophic while some roots are negatively phototropic.

Geotropism:
Movement is in response to gravity. Shoots and coleoptiles are negatively phototrophic while some roots are positively phototropic.

Thigmotropism:
Movement is in response to touch. Tendrils and creepers are positively thigmotrophic.

Auxins are associated with the mechanisms of tropic movements. The dispersion of auxins in the apex will be influenced by light, gravity etc. and cellular growth will be according to these dispersions that will result in movements.

(c) **Theory of natural selection**
Darwin and Wallace proposed that natural selection is the mechanism by which new species arise from pre-existing species (evolution). This theory is based on the following observations:

(1) Individuals in populations have great reproductive potential
(2) however, the numbers of individuals in populations do not change much because all offspring do not survive until reproductive age and some fail to reproduce
(3) Individuals show variations some of which are advantageous, while others are disadvantageous.

Based on the above observations, the following hypothesis was drawn:

'Struggle for existence' - Organisms compete for food, shelter, reproductive partners

'Survival of the fittest' - those individuals with variations better adapted to their environment gain advantage in survival and as a result produce more offspring in the next generation than the less adapted organisms. Based on this process, organisms that are better adapted to the environment get selected.

When the above process occurs in the natural environment, new species are generated.