7. BIOLOGY AND HUMAN WELFARE

Association of Animals for food, shelter, reproduction & protection is termed as Animal Association. It may be

Intra Specific – with in the species.

Inter Specific – between the two different species.

Division of Animal Association

Mutualism Or Symbiosis	Commensalism	Parasitism

Mutalism:- Two organisms belongs to different species live together & mutually benefited is called mutualism.

Eg. Triconympha & Termite
Hydra & Zoochlorella
Legumenous plants & Bacteria
Hermitcrab & Sea Anemone
Crocodile & Pulkinus Bird

Commensalism:- a) Association between two different species, one gets benefit & other neither get benefit nor get harm. It is two type of

b) commensalisms with continuous contact.

Eg. Man & E.coli bacteria (Endo commensal of man) Opalina & Frog.
Sea anemone, Hydra, Obelia – associate on shell of mollusca.

b) Commensalism with out continuous contact

Eg. Frogs, Squirrels, Monkeys, Lizards & Snakes.
Temporarily shelter on trees
Snakes & insects (live in burrow)

Sucker fish (Echinus) & shark

Hyena & lion

Parasitism:- An Association between two different species, are organism gets benefit, the other gets harm.

TYPES

Ecto parasitism	**Endo parasitism**
Mosquito	Trichomonous vaginalis – woman
Sand flies	Leishmania – man
Fruit flies	Entomoeba – intestine of man
Bed bug	Plasmodium
Head house	Taena solium, Ascaris
Leech etc	Mycobacterium tuberculosis etc.

Hyper Parasitism:- Parasitism on parasite is called Hyper parasitism & such parasite is named Hyper parasite.

Amoeba leads parasitic life on Opalina & Bactriophages etc.

TYPE STUDY

	Free – Living Protozoa	**Parasitic Protozoa**
1.	Amoeba proteus (Rhizopoda)	1. Entamoeba histolytica (Rhizopoda)
2.	Euglena Vridis (Flagellata)	2. Trypanosoma gambiense (Flagellata)
3.	Paramoecium caudatum (ciliophore)	3. Leishmania donovani (Flagellata)
		4. Leishmania tropica (Flagellata)
		5. Plasmodium vivax (Sporozoa)

AMOEBA PROTEUS

- Amoeba belongs to sub phylum plasmodroma, class rhizopoda, order lobosa and family Amoebidae

- Amoeba was discovered by Rosel Von Rosenhoeff.
- Amoeba means ever changing.
- Popular name of Amoeba is proteus animalcule.
- Proteus is the name of Greek Sea God.
- Amoeba terricola is terrestial amoeba found is moist soil.
- Amoeba has no shape and symmetry. Amoeba is unicellular.
- The size of Amoeba is 0.25 mm diameter.
- The living membrane covering amoeba is called plasma lemma. It is double membrane made up of lipids and proteins.
- The Bi-molecular lipid layer is sand witched between two protein layers. It is called sandwitch model (or) Robertsonns unit membrane. Fluid Mosaic model of plasma membrane was proposed by Singer and Nicholson. Trilamellar Model was proposed by Danielli and Davson.
- Plasma membrane is selectively permeable / Semipermeable.
- Uroid is the wrinkled portion of Amoeba present at hind end of moving Amoeba.
- Amoeba do not posses pellicle.
- The nucleus of Amoeba is not in a fixed position. The contractive vacuole is also temporarily formed.
- The cytoplasm of Amoeba is distinguishable into outer dense clear ectoplasm and inner granular fluid like endoplasm.
- The endoplasm is differentiated into an outer more dense granular plasmagel and inner less dense fluid like plasmasol.

SOL-GEL MOVEMENT

- Sol-gel (or) Gel-sol conversion is a physico chemical change.
- Hyaline layer – it is thin liquid layer present between plasmalemma and ectoplasm.

- Hyaline caps are found at the tip of pseudopodia. It is the extended portion of Hyaline layer.
- Locomotion in Amoeba takes place by Amoeboid movement. (W.B.C. and embryobnic cell also exhibit Amoeboid movement)
- The locomotory organs of Amoeba are pseudopodia (false feet) They belong to the type called Lobopodia.
- Lobopodia are pseudopodia with blunt finger like with round tips. They contain Ectoplasm and Endoplasm.
- Theories of Amoeboid movements

Adhesion Theory – The protoplasm flows like drop of water in the path of greater ashesion.

- Contraction Theory – (Walding locomotion) proposed by Dellinger. The tips of pseudopodia attach to substratum and contract, there by pulling body forwards.
- Rolling theory (or) Gliding Theory – proposed

THEORIES OF AMOEBOID MOVEMENTS

- Adhesion Theory – The protoplasm flows like drop of water in the path of greater adhesion.
- Contraction Thoery – (Walding Locomotion) proposed by Dellinger. The tips of pseudopodia attach to substratum and contract, thereby pulling body forwards.
- Rolling Theory (or) Gliding Theory - proposed by Jenning, He worked on Amoeba verrucosa, Amoeba move by rolling movement of body surface.
- Surface tension Theory – proposed by Berthold. It was supported by Blutschli, ruhumbler, Psudopodia is formed the point where surface tension becomes reduce.
- Sol-gel Theory – (or) change of viscosity Theory – pur forward by Hyman. It was supported by Pantin and Mast. Sol-gel Theory is widely accepted theory.

Plasmalemma attach to substratum. The outer tube of plasmagel contract. The plassmasol flows in the direction in the movement breaking at a weak spot on plasmagel and form a pseuposium. At the rear and the plasmagel undergo solation and then changes into gel.

- Fountain hypthesis – proposed by Allen. He worked on pelomyxa (giant amoeba)
- Nutrition on Amoeba is Holozoic
- Ingestion of solid food material is called Holozoic Nutrition.
- Ingestion mechanisms

  Circumvallation – It is the method by which Amoeba engulfs active food material. The pseupodia forms a food cup.

  Circumfluence – Method of engulfing passive food material like bacteria.

  Invagination – The plasmalemma forms an invagination vesicle through which it takes solid food materials.

  Pinocytosis – It is also known as cell drinking. It is a method of taking dissolved substances present in water. Pinocytosis was first observed by Edward in Amoeba.
- Food vacuole of Amoeba is analogous to stomach of verterbrates.
- The membrane bound vacuoles formed containing fluid material are called pinosomes.
- The membrane bound vacuole containing soild material are called phagosomes
- Food vacuole is also called gastriole.
- The enzyme released into food vacuole are acidic first and next alkaline. Hentce trytic type. These enzymes are secreted by Endoplasm.
- Digestion of Amoeba is intracellular. Lysosomes play an important role in intracellular digestion.
- Amoeba does not posses cytostome, cytopharynx and cytopyge.
- Contractile vacuoles are absent in marine amoeba and parasitic amoeba.

- Removal of excess water entered into the body through plasmalemma by endosomosis is called osmoregulation.
- Ectoplasm is called jel and endoplasm is called so.
- The jet and sol are two physical states of protoplasm
- If a fresh water Amoeba(hypotonic) is transferred into sea water(Hypertonic) It looses the contractile vacuole.
- An Amoeba placed is an isotonic solution of sea water, it does not posses contractile vacuole.
- If an Amoeba is placed in distilled water the contractile vacuole works at a faster rate.
- Plasma membrane is a selectively permeable membrane
- Contractile vacuole is an organelle involved in Homeostasis.
- Homeostasis means maintenance of steady state (or) internal stability of an organism. The worked Homeostasis is coined by Walte. B. canon.
- Proto zoologists like Duncan wigg, Bovee and Jahn are of the opinion that the contractive vacuole does not contract, Hence they called it as water pulsating vesicle.
- Sexual reproduction is absent in amoeba
- Binary fission occur during favourable conditions. The nuclear division is mitotic.
- Yound Amoeba is completed in half an hour (50+5+10+8) 30 minutes.
- Pseudopodiospores are enveloped by slender cyst wall.
- The pseudopodiospores are useful in tiding over the unfavourable conditions, and for the dispersal of species.
- Amoeba under goes encystment during unfavourable conditions. The cyst wall is made up of 4 layers of chitin.
- Amoeba is an immortal animal.

- Encystment of Amoeba is useful in tiding over unfavourable conditions and dispersal of species.
- Amoeba exhibit regeneration. If in amoeba is cut in not two parts, the part containing nucleus regenerate into a full amoeba, the other part dies. Hence nucleus is necessary for regeneration.

ENTAMOEBA HISTOLYTICA

Entamoeba histolytica belongs to class: Rhizopodia
Order: Lobosa and Family, Amoebidae.

- It was first discovered by Lamibi(1859) and its pathogenic nature was described by Losch.
- It lives in the wall of large intestine (colon) of man as well as in the lumen.
- It feeds on (digests) the mucous membrane of intestine and forms abscesses(ulcers)
- The disease caused by Entamoeba histolytica is amoebic dyssentry.
- Some times Entamoeba histolytica invade into liver of man and cause a disease called Amoebic Hepatitis.
- Entamoeba histolytica may also cause abscess in spleen lung and brain.
- Histolytica means tissue dissolving. Braden reported that E. histolytica produce hyaluronidase (spreading factor) Nakamura and Harinasuta demonstrated proteolytic enzymes.
- Tissue invading, Erythrocyte ingesting enamoeba histolitica trophozoites are large and grown 12-35 μ in diameter. Mode of feeding is phatotrophy and nutrition is holozoic.
- Leumen dwelling forms are small 12-15μ diameter) are called minuta forms.
- Entamoeba histolytica also exhibit dimorphism.
- Body covering of Entamoeba histolytica is plasmalenmma.
- Locomotoryorganelle is pseudopodium(lobopodium). It is monopodial and appear like moving slug.

- The endosome in nucleus contain chromatin, achromatin substance and plastin.
- The chromatin granules in nucleus are in the form of a net work, like spokes of a wheel (cart wheel like nucleus)
- The number of chromosomes in Entamoeba histolytica are six according to Kofoid and Sweezy.
- The food vacuoles of Entamoeba histolytica contain RBC.
- RBC containing food vacuoles and wheel like nucleus are important diagnostic features of E. histolytica.
- Contractile vacuoles and mouth are absent.
- Encystment occur in intestinal cavity.
- Precystic stages contain reserved food materials like glycogen and chromatid bars.
- Mature cysts are tetranucleate without glycogen and chromatid bars. They are 5-20μ in diameter.
- Chromatid bars are called excess chromatin by some and reserved food material by others.
- Entamoeba histolytica has no intermediate host hence monogenetic.
- The mode of infection is by contamination through water, food material and raw vegetables and dropping of housefly and cockroach containing cysts.
- Excystation occur in intestine of man. It is a process of transformation of cyst into Trophozites.
- Amoebiasis is characterized by intestinal ulcers, liver abscess and passage of blood and mucous along with stools. Abdominal pain, inrregularity in Bowels, Head ache are the pathogenic effects.
- Medicines used for curing amoebic dyssentry are emetine, carbarsone, diodoquin, erythromycin, tetracycline, and Timidazole, Chloroquin, cures and controls Amoebic hepatitis & dysentery.

TRYPANOSOMA GAMBIENSE

Trypanosoma and Leishmania belong to sub phylum: Plasmodroma Class: Mastigophora, sub class: Zoomastigina, Order: Protomastigina.

- Dr. Atkins discovered sleeping sickness.
- Ford and Dutton discovered Trypanosoma Gambiense.
- It is a digenetic parasite. Primary host is man.
- Seocndary host and vector is Tse – Tse fly (Glossina Palpalis)
- The resvoir host is Antelope, Giraffee, Elephant, Gnu etc.
- It is histozoic (extracellular) parasite living in plasma of the blood of man later it invade into cerebnrospinal fluid. Castellani discovered Trypanosoma in Cerebrospinal fluid.
- When trypanosoma is present in the blood of man produces Gambia fever.
- When trypanosome is present in cerebrospinal fluid is causes African sleeping sickness. Gambia fever and African sleeping sickness together can be referred as Trypanosomasis.
- Trypanosoma is called Haemoflagellate and exhibit polymorphism.
- Polymorphic forms of Haemoflagellates are:

Leishmania form	Oval shape	Kinetic element present	No flagellum
Leptomonas form	Elongate	Central nucleus with anterior kinetic element	Short flagellum without undulating membrane
Crethidial form	Elongate	Kinetic element lie in front of nucleus	Flagellum present with short undulating membrane
Trypanosoma form	Elongate and curved	Kinetic element lie posterior to nucleus	Long flagellum with undulating membrane.

- Control of Trypanosomasis is by killing the vector by spraying DDT BHC using flyingtraps, killing reservoir host.
- Medicine for gambis fever Bayer 205, Pentamidine, Lomidine, Antrypol etc.
- Chronic cases of Trypanosomiasis are treated with Antimony and Arsenic compounds.

LEISHMANIA DONOVANI

- Leishmania donovani belongs to phylum: Protozoa
  Class: Mastigophora Sub class: Zoomastigina Order: Protomondina
- This parasite was discovered by Leishman and Donovan.
- It is an intracellular parasite(cytozoic) living in the reticuloendotehelial cells of liver, spleen, bone marrow of man.
- It is a digenetic parasite. Man is primary host.
- The secondary host and vector is blood sucking sand fly phlebatomus argentypes. Reservoir host is cat and dog.
- It produces a disease in man called KALA-AZAR (or) DUM-DUM fever.
- Leishmania donovania is a haemoflagellate. It is dimorphic (live in two forms)
- Leishmania form – present in man, oval in shape, covered with periplast. It has nucleus and kineplast flagellum is absent.
- Leptomonas form develop in gut of phlebatomus, elongated and provided with flagellum. No undulating membrane.
- Infection to man is by inoculation. The infective stage is leptomonas form.
- Tartar emetic, Potassium antimonyl tartrate, sodium antimonyl gluconate, Neostiboson are used for curing Kala – Azar.
- Post Kala Azar dermal leishmonoid are white scars present on face and neck.
- The symptoms of Kala Azar are irregular fever, enlargement of Spleen, Anemia and body pains.

LEISHMANIA TROPICA

- Intracellular parasite living in the reticulo endothelial cells of skin. It is a haemo flagellate.
- It produces a disease in man called HELHI BOILD (or) ORIENTAL SORES
- It is a digenetic parasite. Man is primary host.

- The secondary host is blood sucking fly Phlebatomus Papatasi, Phlebatomus Sergenti.
- Treatment by applying antiseptic, ointment, Atebrin, Bergerine sulphate injection.

PLASMODIUM (MALARIAL PARASITE)

Plasmodium belongs to sub phylum: Plasmodroma
Class: Sporozoa, Sub class: Telosporidia, Order: Haemosporidia Family: Plasmodidae.

- Malaria literally means dry air. (Mala – Bad, Airia – Air) This word was coined by Macculoch (1827).
- Charles leveon (1880) Scientist who discovered that the plasmodium is present in the blood of malaria patient.
- Golgi and Selli (1886) discovered that plasmodium is present inside RBC. He discovered Erythrocytic schizogony.
- Lancisi suggested that malaria is prevalent in areas where mosquitoes are prevalent.
- Richard Pfiffer (1892) discovered that plasmodium is introduced into the blood of man by a blood sucking insect.
- Ronald Ross(1898) discovered the occyst present in the wall of stomach of mosquito and awaded Noble prize for it (1902)
- G. Grassi and Gelitti worked out complete life history of plasmodium vivax.
- Short and Gamham(1948) discovered pre erythrocytic and exo erythrocytic cycle in reticuloendothelia cell of liver.
- There are four species of plasmodium which attack man. They are
- Plasmodium vivax Plasmodium faciparam Plasmodium malariae
- Plasmodium ovale of which plasmodium falciparum is deadly pathogenic.
- Plasmodium is an intracellular, pathogenic, protozoan parasite.
- Plasmodium is a diagenetic parasite.
  According to definition (Dictionary – Classical) the host in which the parasite reaches sexual maturity is definitive host and the host in which it undergoes preliminary development is intermediate host.
- According to old concept primary host or definitive host is female. Anopheles mosquito because sexual reproduction of parasite takes place in mosquito.

- Secondary host or intermediate host is man because asexual cycle occurs in man.
- But according to Chandler man is primary host because he is vertebrate and mosquito is secondary because it is an invertebrate.
- Monkey is considered as reservoir host.
- Female Anopheles also acts as a vector of carrier host for plasmodium.
- Sporozoites are the infective stages to man.
- The introduction of the sporozoites into the body of man is by inoculation
- The anticoagulant present in saliva of mosquito is Haemolycin.
- The sporozoites are sickle shaped and about 14 microns long and 1 micron wide.
- Sporozoites are covered by cuticle.
- Sporozoites start pre-erythrocytic cycle.
- During pre-erythrocytic cycle cryptomerozoites are formed at the end.
- Sporozoites first reach liver from blood.
- Cryptomerozoites start the exoerythrocytic cycle.
- During exo-erythrocytic cycle micro and macro metacryptomerozoites are formed.
- During exo pre-erythrocytic cycles Haemozoin is not formed. Hence, the person does not suffer from malaria.
- Exo-erythrocytic cycle is absent in plasmodium falciparum.
- The main function of pre and exo erythrocytic cycles are to increase number of parasites to an enormous number.
- The repeated multiplication of parasite in liver cells and RBC of man is by auto infection.
- Infection to RBC of man is by cryptomerozoites, micrometacryptomerozoites and erythrocytic merozoites. This repeated infrection of RBC by the merozoites formed in man is known as Auto infection.
- The infection to liver cell takes place by sporozoites, cryptomerozoites and macro metacryptomerozoites.
- Endoerythrocytic cycle was studied by Golgi.
- The feeding and growing stage of the parasite in the RBC of man is called Trophozoite stages.
- It feeds on Haemoglobin and as a result haemozoin is formed in the parasite during metabolism.

- Haemozoin is formed from herne of Haemoglobin molecule.
- The signet ring stage is formed as a result of the development of vacuole.
- The plasmodium possensing pseudopodia is called Amoeboid stage.
- The Schuffner's dots appear on the RBC in which the parasite is in schizont stage. The schuffner's dot are stained by ravanovasky stain.
- The schizogony is multiple fission taking place in schizont at the end of vegetative growth.
- The multinucleate stage in plasmodium is the schizont.
- The arrangement of merozoites in the schizont resembling the petals of Rose is called Roete stage.
- The sequence of stages of plasmocium in RBC of man is Trophozoite signet ring-Amoeboid-Schizont-Schozogony-rosette stage - Merozoites
- While RBC breaks the haemozoin released, produce the symptoms of malaria like high fever, shivering chill and profuse sweating head ache and body pains.
- The life cycle of plasmodium in man is called cycle of Golgi. Asexual cycle, Schizogony Cycle.
- The schizogony taking place in liver is also called cryptoschizogony and in RBC called erythrocytic schizogony.
- The incubation period is the time interval between the entry of sporozite in blood till the release of merozoits and Haemozoin(or) first appearance of malaria symptoms.
- Incubation period is 6 to 35 days.
- Prepatent period is the time between the entry of sporozoites into the body till the parasites first appear in the blood stream.
- The prepatent period is 8 to 9 days.
- The effect of plasmodium in man is the destruction of RBC the destruction of liver cells and malaria fever.
- When plasmodium is present in man the spleen is enlarged and becomes black. The bone marrow also turns into blue. The liver also becomes enlarge.
- Transfusion malaria – It occurs if the blood of the donor with latent infection is used for blood transfusion.
- Congential Malaria – It occurs by the transmission of infection from mother's blood into the foetus.
- Therapeutic Malaria – It occurs by injection of the blood of an infected donor.

LIFE CYCLE IN FEMALE ANOPHELES MOSQUITO

- It is also called sexual cycle, cycle of Ross and (Gametogony and Sporogony)
- In the stomach of mosquito the gametocytic stages alone survive other stages are digested.
- The macrogametocyte has small nucleus with dense cytoplasm.
- The microgametocyte has large nucleus with clear cytoplasm. The formation of gametocytes first takes place in the blood of man.
- The gametocytic stages do not survive for more than a week in blood of man.
- The development of gametes from gametocytes is called Gamategenesis.
- The gametogenesis takes place in the stomach (crop) because of low temperature and pH, in stomach of mosquito.
- The nucleus of microgametocyte divide thrice to form eight haploid nuclei.
- The micro gametocyte form 8 flagellum like bodies around them. Each develop into a sperm. This stage is called flagellated body.
- The process of formation of sperm of microgamete is called Exflagellation.
- The unequal division of female gametocyte into large and small cell is called Maturation division.
- The small cell formed during this division is called plocyte or polar body.
- The elevated portion on the female gamete is called reception cone.
- The attraction between sperm and egg is by Chermotaxis.
- The elliptical structure showing gliding movement is ookinette it is the moving zygote. The ookinite is diploid.
- The fertilization or syngamy is angiosgamy and takes place in crop
- Ookinitte is also called verminule.
- ookinette settles on the surface of the stomach and develops into a Oocyst. About 50-500 Oocysts are seen in the stomach wall.
- Ookinite starts the sporogony in Mosquito.
- Oocysts get food material from the stomach of Mosquito.
- The Oocyst containing sprorozoites is known as Sporocyst. It is called Sprotont.
- According to Bano, Oocyst is diploid, Meiosis occur in Oocyst resulting in the formation of haploid sprorozoites. Thus meiosis in plasmodium is post zygotic.

- But according to others all stages are diploid. The gametocytes undergo meiosis and produce haploid gametes.
- Sporogony is the asexual reproduction (multiple fission) taking place in the zygote immediately after fertilization.
- Sporogony is completed in 10-20 days.
- The sporozoits are released into the haemocoel
- The sporozoits settle in the salivary glands and are now ready for infection.

PLASMODIUM	P.VIVAX	P.MALARIAE	P.FALCIPARUM	P. OVALE
1. Distribution	Tropical & Temperate	Tropical & Temperate	Tropical	Tropical
2. Prepatent period	8 days	5 days	5 days	9 days
3. Incubation period	8-12 days	27-35 days	6-25 days	10-14 days
4. Time required for endo-erythrocytic (or) occurance of fever.	Every 48 hours	Every 72 hours	Irregular fever 24-48 hours	48 hours
5. Size of trophozoite in R.B.C	½ to 1/3	½ to 1/3	1/5 to 1/6	½ to 1/3
6. The color of Haemozoin	Yellowish Grey	Gray Black	Black	Grey
7. Merozoites	12 – 24	8 – 12	8 – 24	8 – 14
8. Arrangement of merozoites	Rosette	Rosette	Clusters of grapes	Irregular
9. Schuffner's dots	Present	Zeiemans dots present	Maurer dots present	Present
10. Gametocytes	Fills RBC	Fills RBC	Cresent shaped and present one side	Fills RBC
11. Name of the fever	Benign Tertain	Quartan	Malignant Tertian, Cerebral malaria, (black water fever)	Mild Tortian
12. Exo and Endo erythrocytic	Both Generations Present	Both Generations Present	One generation present exo erythrocytic cycle cycles absent	Both generations present.

CONTROL OF MALARIA

Elimination of Mosquito	:	This can be done by fumigation, spraying DDT elimination of breeding grounds of mosquitoes.
Elimination of Larva of Mosquito	:	By spraying the oils like kerosene, the pupa of mosquito can be killed by asphyxiation.
Biological control	:	It is by introducing the larvivorous fishes like gambusia (Minnow) & Tilapia.
Prophylaxis	:	It means prevention of infection. It is done by applying insect repellents and by using mosquito nets and gloves etc.
Therapy	:	a) Quinine, Nivauin – kill plasmodium in RBC b) Chloroquin – kills all stages including the gametocytic stage c) Paludrin and primaquin – kills plasmodium in liver cells also

- Thomas sidanham discovered that quinine is present in bark of cinchona trees.
- Plasmodium does not produce anti bodies in human blood hence vaccination is not possible for malaria. But recentrly Wasim Siddique developed a vaccine for malaria fever.

PARASITISM AND PARASITIC ADAPTATIONS

Every living organism in this universe has an instinct to survive, for which, they require two basic needs - food and shelter. You know pretty well that green plants can prepare their own food materials in their body through photosynthesis, using CO_2 and H_2O as raw materials **(autotrophs)**. But animals cannot prepare their own food materials in their body. Hence they must depend on plants or other animals for their survival

(heterotrophs)

Certain animals are described as parasites as they survive at the cost of the other animals, called hosts. In such an association, the hosts tend to reject or resist the parasites. Concurrently the parasites have to evolve mechanisms to counteract and neutralize the host's defence in order to be successful with in the host. For this purpose, the parasites have developed many special adaptations such as the loss of unnecessary sensory organs, formation of organs for adhesion, high reproductive capacity, etc.

Parasitism

An intimate association between two organisms of different species in which, 'one is benefited and the other one is often adversely affected' is called **parasitism.** The word parasitism comes from a Greek word *'parasitos'* (*para* - at the side of; *sitos* - food or grain) which means '*one eating at another one's table*'. The organism that obtains nourishment is called the **'parasite'** (the gainer) and the organism from which the nourishment is obtained is called the **'host'** (the loser).

Types of parasites

Based on the interaction between the host and the parasite, various types of parasites are recognised. Some of them are listed below.

i) **Ectoparasite:** A parasite that lives on the surface of the host's body is called ectoparasite.

e.g. head lice and itch mites on humans, ticks on dogs, copepods on marine fishes, etc.

The female mosquito is not considered a parasite though it needs human blood for fertility. Can you explain why?

Discuss with your teacher about the food habits of mosquitoes.

ii) **Endoparasite:** A parasite that lives inside the body of the host is called endoparasite. Based on the place where they live, they are again classified into three types, namely:

a) **Cytozoic (intracellular) parasites:** They live within the host's cells.
e.g. *Plasmodium vivax* in man, *Nosema notabilis* in *Sphaerospora polymorpha*, etc.

b) **Histozoic (intercellular) parasites:** They live in between the cells of the tissues and organs of the host.
e.g. *Wuchereria bancrofti, Entamoeba histolytica,* etc.

c) **Coelozoic parasites:** They live within the cavities of the host's body. They are called enterozoic if they live in the alimentary canal.
e.g. *Ascaris lumbricoides*

iii) **Hyperparasite** (Parasite in/on a parasite)**:** It is a parasite which lives in/on the body of another parasite.
e.g. *Nosema notabilis* (a cnidosporan parasite) lives in *Sphaerospora polymorpha* (also a cnidosporan parasite) which lives in the urinary bladder of toad fish.

iv) **Monogenetic parasite:** It is a parasite which completes its life cycle in only one host.
e.g. *Entamoeba histolytica*, *Ascaris lumbricoides,* etc.

v) **Digenetic parasite:** It is a parasite which requires at least two hosts to complete its life cycle.
e.g. *Plasmodium vivax*, *Wuchereria bancrofti,* etc.

NOTE: Parasites living in the gut of the host are called 'enterozoic parasites'. *Ascaris* is **enterozoic** and **coelozoic**, where-as *Entamoeba* is **enterozoic** and **histozoic**.

Types of Hosts

i) **Primary host** or **Definitive host:** It is the host that harbours the adult stage or sexually mature stage of a parasite or the host in which the parasite undergoes sexual reproduction.
e.g. Man for *Wuchereria bancrofti,* female *Anopheles* for *Plasmodium,* etc.

ii) **Intermediate host** or **Secondary host:** It is the host that harbours the developing 'larval or immature or asexual' stages of a parasite or the host in which the parasite

undergoes asexual reproduction.

e.g. Man for *Plasmodium*, female *Culex* for *Wuchereria*, etc.

iii) Reservoir host: It is the host tha t lodges the infective stages of a parasite in its body when the main host is not available. In the reservoir host, the parasite neither undergoes development nor causes any disease.

e.g. Monkey for *Plasmodium*, African antelope (*Gnu*) for *Trypanosoma gambiense*, etc.

Vector

It is an organism (generally an insect) which transfers the infective stages of a parasite from one main host to another. Vectors are of two types, namely:

i) Mechanical vector: It is the vector, which merely transfers the infective stages of a parasite but no part of the parasitic development takes place in it.

e.g. House flies and cockroaches in the case of *Entamoeba*.

ii) Biological vector: It is the vector in which the parasite undergoes a part of the development before it gets transferred to another host.

e.g. Female *Anopheles* mosquito in the case of *Plasmodium* and female *Culex* mosquito in the case of *Wuchereria*.

Parasitic adaptations

Parasites have evolved special adaptations to meet the requirements and lead successful life in the hosts.

- ❖ In order to live in the host, some parasites have developed structures like hooks, suckers, rostellum, etc., for **'anchoring'**. **e.g.** *Taenia solium*
- ❖ Some intestinal parasites have developed **protective cuticle** to withstand the action of the digestive enzymes of the host. **e.g.** *Ascaris lumbricoides*
- ❖ Some intestinal parasites produce **'anti enzymes'** to neutralize the effect of host's digestive enzymes. **e.g.** *Taenia solium*
- ❖ Some parasites live as **'obligatory anaerobes'** as the availability of oxygen is very rare for them. **e.g.** *Entamoeba histolytica*, *Taenia solium*, etc.
- ❖ Some intestinal parasites live as **'facultative anaerobes'** i.e., if oxygen is not available, they live anaerobically and if oxygen is available, they respire aerobically**e.g.** *Ascaris*

lumbricoides

- The morphological and anatomical features are greatly simplified while emphasizing their **reproductive potential**. For example, an *Ascaris* lays nearly two lakh eggs per day. In *Taenia solium* the body is divided into 700 to 900 proglottids of which each proglottid acts as a unit of reproductive system and releases approximately 35,000 eggs.

- The life cycles of endoparasites are more complex because of their extreme specialization. For example, life cycle of certain parasites like *Fasciola hepatica* (sheep liver fluke) is very complex involving many developmental stages and two intermediate hosts, to increase the chances of reaching a new definitive host.

- Certain parasites like *Entamoeba* develop cysts to tide over the unfavourable conditions like desiccation while reaching the new host.
  Some parasites elude production of vaccines against them (smart parasites!) as they keep changing their surface antigens form time to time.
  e.g. *Plasmodium*, HIV, etc.

Brood parasitism

Do you know: In villages, the eggs of ducks are mixed with those of hen and allowed to be incubated by hen. A kind of human induced 'brood parasitism'!

Effects of parasites on hosts

In general, the parasites cause weakening of the body of their hosts by causing the deprivation of nutrients, fluids and metabolites as they compete with their hosts for the same. They may also cause pathological effects in their hosts such as

- **Parasitic castration:** Some parasites cause the degeneration of gonads of the host, making it sterile. This effect is called **parasitic castration** .
  e.g. *Sacculina* (root headed barnacle, a crustacean) causes the degeneration of ovaries in the crab *Carcinus maenas*.

  Neoplasia: Some cause an abnormal growth of the host cells in a tissue to form new structures. This effect is called **neoplasia** which leads to cancers.
  e.g. Some viruses

- **Gigantism:** Some parasites cause an abnormal increase in the size of the host. This

effect is called **gigantism**.

e.g. The larval stages of *Fasciola hepatica* cause gigantism in snail (an intermediate host)

- **Hyperplasia:** Some parasites cause an increase in the **number of cells**. This effect is called **hyperplasia** .

  e.g. *Fasciola hepatica* in the bile ducts of sheep

- **Hypertrophy:** Some parasites cause an abnormal increase in the **volume/size** of the infected host cells. This effect is called **hypertrophy**.

  e.g. RBC of man infected by *Plasmodium*

- Most of the parasites cause various types of diseases like

  i) African sleeping sickness by *Trypanosoma gambiense*
  ii) Delhi boils/Tashkent ulcers/Oriental sores by *Leishmania tropica*
  iii) Kala azar/Dum dum fever/Visceral leishmaniasis by *Leishmania donovani*
  iv) Malaria by *Plasmodium sps*
  v) Elephantiasis by *Wuchereria bancrofti*.

'An ideal parasite should be able to thrive within the host without harming it'. Do you believe in it? Then why didn't Natural Selection lead to the evolution of such totally harmless parasites? Clue: Think of the phenomenon of 'Ecolological balance in nature

HEALTH AND DISEASE

Health

The term health is very frequently used by everybody. How do we define it? For a long time, **'health'** was considered a state of body and mind where there was a balance of certain 'humors' according to **'Good humor'** hypothesis. This is what early Greeks like Hippocrates as well as the Indian Ayurveda system of medicine asserted. According to this hypothesis, it was thought that persons with **'black bile'** belonged to **hot personality** and **would have fevers**. This idea was arrived at by 'a pure reflective thought'. The discovery of 'the circulation of blood by William Harvey using experimental method' and 'the demonstration of normal body temperature using thermometer in persons with black bile' disproved the 'Good humor' hypothesis.

In later years, biology stated that mind influences our immune system through neural system and endocrine system and that our immune system maintains our health.

Hence, mind and mental status can affect our health. ***Health*** *is a state of complete physical, mental and social well-being and not merely 'absence of any disease' or 'absence of physical fitness*'.

Of course, our health may be affected by–

i) **Genetic disorders** – deficiencies with which a child is born or the defects inherited by the child from its parents.

ii) Infections – by either animal parasites or bacteria or virus or fungi.

iii) Life style – type of food and water we take, timings of food intake, amount of rest and exercise we give to our bodies, habits such as smoking, drug and alcohol abuse, etc.

When people are healthy, they are more efficient at work. This increases productivity and brings economic prosperity. Health also increases longevity of people and reduces infant and maternal mortality. Balanced diet, personal hygiene and regular exercise are very important to maintain good health. Since times immemorial, yoga has been practiced to achieve physical and mental health. Awareness about diseases and their effect on different bodily functions, vaccination against infectious diseases, proper disposal of biological wastes, control of vectors and maintenance of hygienic food and clean water resources are necessary for achieving good health.

Disease

Any change from the normal state of health that causes discomfort or disability is called **disease**. When the functioning of one or more organs or systems of the body is adversely affected characterized by various signs and symptoms, we say that we are not healthy or we have a disease. Diseases can be broadly grouped into two types namely - infectious and non-infectious.

i) **Infectious diseases:** The diseases which are easily transmitted from one person to another are called infectious diseases. These are caused by pathogens. Theseare very common and every one of us might have suffered from any of these diseases, at sometime or the other.

e.g. Amoebic dysentery, Malaria, Elephantiasis, Typhoid, Pneumonia, Common cold, Ringworm, etc.

ii) **Non-infectious diseases:** The diseases which are not transmitted from one person to another and are not caused by pathogens are called non-infectious diseases.
e.g. Genetic disorders, kidney problems, heart problems, etc.

Common Parasites causing diseases in man

A wide range of forms that belong to protozoans, helminths, bacteria, fungi, viruses, etc., could cause diseases in man. Such disease causing forms are called pathogens. The pathogens can enter our body by various means, multiply and interfere with normal vital activities, resulting in morphological and physiological damage. A few representative members from different groups of pathogenic organisms are discussed here along with their life cycle, pathogenicity, treatment and preventive measures against these diseases.

BRIEFACCOUNT OF SOME OTHER DISEASES

Bacterial diseases

i) **Typhoid fever:** It is caused by*Salmonella typhi* which is a Gram negative bacterium. It mainly lives in the small intestine of man and then migrates to other organs through blood. It can be confirmed by **Widal test**.

Mode of infection: Contamination through food and water.
Symptoms: Sustained fever with high temperature upto 104°F, weakness, stomach pain, constipation, headache and loss of appetite. Intestinal perforation and death may also occur in severe cases.

A classic case in medicine: Mary Mallon nicknamed Typhoid Mary, was a cook by profession and was a typhoid carrier. She continued to spread this disease for several years through the food she prepared.

ii) **Pneumonia:** It is caused by Gram positive bacteria such as ***Streptococcus pneumoniae*** and ***Haemophilus influenzae***. They infect the alveoli of lungs in human beings.
Mode of infection: Contamination by inhaling the droplets/aerosols released by an infected person or even by sharing the utensils with an infected person.
Symptoms: The alveoli get filled with fluid leading to severe problems in respiration. In severe cases, the lips and finger nails may turn gray to bluish in colour.

Viral Diseases

It is not an exaggeration to say that there is no person in this world who has not suffered from cold at least once in life.

Common cold: It is caused by **Rhino virus** group of viruses. They infect nose and respiratory passage but not lungs.

Mode of infection: Contamination by direct inhalation of the droplets resulting from cough or sneezes of an infected person or indirectly through contaminated objects such as pens, books, cups, door-knobs, computer keyboard or mouse etc.
Generally all the medicines that are used against cold cause drowsiness. Try to find out the reason for this from your family doctor.

Symptoms: Nasal congestion, discharge from nose, sore throat, hoarseness, cough, headache, tiredness, etc., which usually last for 3-7 days.

Do you know: 'Cold' treated is cured in just **ONE** week, and 'cold' untreated is cured in **SEVEN DAYS**. What is the implied meaning?

Fungal Diseases

Ringworm: It is one of the most common infectious diseases in man. It is caused by many fungi belonging to the genera ***Microsporum***, ***Trichophyton*** and ***Epidermophyton.***
Heat and moisture help these fungi grow in the skin folds such as those in the groin or between the toes.
Mode of infection: Contamination by using towels, clothes or combs of the infected persons or even from soil.
Symptoms: Appearance of dry, scaly, usually round lesions accompanied by intense itching on various parts of the body such as skin, nails and scalp.

Prophylaxis

i) **In the case of bacterial & viral diseases:** The advancements made in biological science have armed us to deal with many infectious diseases effectively. The immunization programmes by the use of vaccines have enabled us to completely eradicate a deadly disease like smallpox. A large number of other infectious diseases like polio, diphtheria, pneumonia and tetanus have been controlled to a large extent by the use of vaccines.

ii) **In general:** Biotechnology is at the verge of making available newer and safer vaccines.

Discovery of antibiotics and various other drugs has also enabled us to treat infectious diseases effectively.

TOBACCO, DRUGS AND ALCOHOLABUSE (TDA ABUSE)

Recent surveys and statistics show that the use of tobacco, drugs and alcohol has been on the rise especially among the youth. This is really a cause of concern as it could result in many harmful effects. Proper education and guidance would enable the youth to safeguard themselves against these dangerous habits and follow healthy lifestyles. Any addict requires counselling and medical help to get rid of the habit.

Tobacco

Tobacco has been used by human beings for more than 400 years. It contains a large number of chemical substances including **nicotine**, an alkaloid. While buying cigarettes one cannot miss the statutory warning present on the packet **'Smoking is injurious to health'** .

Mode of abuse: It is smoked or chewed as gutkha or used in the form of snuff.

Effect: Smoking increases the carbon monoxide (CO) level and reduces the oxygen level in the blood. Nicotine stimulates the adrenal gland to release adrenaline and nor-adrenaline into blood. These hormones raise the blood pressure and increase the heart rate. Smoking is associated with bronchitis, emphysema, coronary heart disease, gastric ulcer and increases the incidence of cancers of throat, lungs, urinary bladder etc. Smoking also paves the way to hard drugs. Yet, smoking is very prevalent in society, both among young and old. Tobacco chewing is associated with increased risk of cancer of the oral cavity.

Do you think **passive smoking** is also dangerous? Why?

Drugs

Drugs are the chemical substances used in the treatment, cure and prevention of diseases so as to enhance one's physical or mental well being. For hundreds of years, several plants, fruits and seeds with hallucinogenic properties have been used in folk-medicine, religious ceremonies (such as '**bhang**' on the **'Holi festival'** day) and rituals all over the globe. ***When these are taken for a purpose other than the medicinal use or in excess amounts that impair one's physical or psychological functions, it constitutes 'drug abuse'.***

The drugs commonly abused are **opioids, cannabinoids** and **coca akaloids**. Majority of them are obtained from flowering plants but some are obtained from certain fungi.

a) Opioids: These are the drugs obtained from opium poppy plant *Papaver somniferum* (vernacular name**: 'Nallamandu mokka'**). They bind to specific opioid receptors present in our central nervous system and gastrointestinal tract. Some of them are morphine, heroin, etc.

i) Morphine: It is extracted from the dried latex of the unripe seed capsule (pod) of poppy plant. It occurs as colourless crystals or a white crystalline powder.

Mode of abuse: Generally it is taken orally or by injection.

Effect: It is a very effective sedative and painkiller. It is very useful in patients who have undergone surgery.

ii) Heroin: It is a white, bitter, odourless and crystalline compound, obtained by the **acetylation of morphine.**
Chemically it is **diacetylmorphine.** It is commonly called '**smack'**.

Mode of abuse: Generally it is taken by **'snorting'** and injection.
Effect: Heroin is a depressant and slows down the body functions.

b) Cannabinoids: These are a group of chemicals obtained from Indian hemp plant *Cannabis sativa* (vernacular name: **Ganjai mokka).** They interact with cannabinoid receptors present in the brain. The flower tops, leaves and the resin of this plant are used in various combinations to produce marijuana, hashish, charas and ganja. These days, cannabinoids are being abused by even some sports-persons (doping).

Mode of abuse: These are generally taken by **inhalation** and **oral ingestion.**
Effect: Show their effects on cardiovascular system of the body.

c) Coca alkaloid or **Cocaine:** It is a white, crystalline alkaloid that is obtained from the leaves of Coca plant *Erythroxylum coca*, native to South America. It is commonly called **'coke** or **crack'.**

Mode of abuse: It is usually snorted
Effect: It has a potent stimulating action on the central nervous system as it interferes with the transport of the neurotransmitter **'dopamine'**. Hence it produces a sense of euphoria and increased energy. Its excessive dosage causes hallucinations. Other well-known plants with hallucinogenic properties are *Atropa belladonna*

and *Datura*. Certain drugs like 'Barbiturates (sleeping pills), Amphetamines (cause sleeplessness), Benzodiazepines (tranquilizers), Lysergic acid diethyl amides (LSD) and other similar drugs, normally used as medicines to treat patients with mental illnesses like depression, insomnia, etc.,' are often abused.

Adolescence and TDA abuse

Adolescence: It is the time period between the beginning of puberty and the beginning of adulthood. In other words, it is the bridge linking childhood and adulthood. The age between 12-18 years is considered **'adolescence period'**. It is both 'a period and a process' during which a child becomes mature. It is accompanied by several biological and behavioural changes. Thus, adolescence is a very **'vulnerable phase'** of mental and psychological development of an individual.

TDA abuse: Curiosity, desire for adventure and excitement, experimentation, are the common causes for the motivation of youngsters towards the use of tobacco, drugs and alcohol. The first use of drugs or alcohol may be out of curiosity or experimentation, but later the person starts using them to escape facing problems. Recently 'stress from the pressure to excel in academics or examinations' has played a significant role in alluring the youngsters to try certain drugs. Television, movies, newspapers and internet also help promoting this wrong perception. Other factors that are associated with tobacco, drug and alcohol abuse among adolescents are unstable or unsupportive family structures and peer pressure.

The consumption of drugs in any form is a non bailable offence. But the seeds of *Opium* are easily available in any provision store. They are treated in such a way that they can never germinate. They are generally used in the preparation of some curries. What are they? **Clue:** Find the Telugu name of poppy seeds.

Addiction and Dependence

The TDA abuse leads to addiction and dependence.

Addiction: It is a psychological attachment to certain effects such as euphoria. The most important thing one fails to realise is, the inherent **'addictive nature'** of tobacco, drugs and alcohol. With the repeated use of TDA, the tolerance level of the receptors present in our body increases. Consequently the receptors respond only to higher doses leading to greater intake and addiction. However it should be clearly borne in mind that

use of TDA even once, can be a fore-runner to addiction. Thus, the addictive potential of tobacco, drugs and alcohol pull the users into a vicious circle leading to their regular use (abuse) from which they may not be able to get out. In the absence of any guidance or counseling, people get addicted and become dependent on them.

Dependence: It is the tendency of the body to manifest a characteristic and unpleasant condition (withdrawal syndrome) if the regular dose of drugs or alcohol is abruptly discontinued. The withdrawal syndrome is characterised by anxiety, shakiness (tremors), nausea and sweating which may be relieved when the regular use is resumed again. Dependence leads the patients to ignore all social norms.

Adverse effects of drugs and alcohol abuse

The immediate adverse effects of drugs and alcohol abuse are manifested in the form of reluctant behaviour, vandalism and violence. Excessive doses of drugs may lead to coma and death due to respiratory or heart failure or cerebral haemorrhage. A combination of drugs or their intake along with alcohol generally results in overdosing and even death. **The most common warning signs of drug and alcohol abuse among the youth include 'drop in academic performance, lack of interest in personal hygiene, depression, fatigue, aggressive behaviour, loss of interest in hobbies, change in sleeping and eating habits, fluctuations in weight, appetite, etc'.**

Those who take drugs intravenously are much more likely to acquire serious infections such as HIV, HBV (Hepatitis-B virus), etc., as the viruses are transferred from one person to another by the sharing of infected needles and syringes. The chronic use of drugs and alcohol damages nervous system and liver. The use of drugs and alcohol during pregnancy is also known to affect the foetus adversely.

Some sports-persons take drugs such as anabolic steroids to enhance their performance. The side-effects of the use of these drugs in females include masculinisation, increased aggressiveness, mood swings, depression, abnormal menstrual cycles, excessive hair growth on the face and body and the enlargement

of clitoris. In males it includes acne (pimples), increased aggressiveness, mood swings, depression, reduction in the size of testicles, decreased sperm production, kidney and liver dysfunction, enlargement of breasts, premature baldness and the enlargement of the prostate gland.

Prevention and Control

The age-old adage of **'Prevention is better than cure'** holds true here also. Some of the measures useful for prevention and control of TDA abuse among the adolescents are:

i) **Avoid undue parental pressure:** Every child has his/her own choice, capacity and personality. The parents should not force their children to perform beyond their capacity by comparing them with others in studies, games, etc.

ii) **Responsibility of parents and teachers:** They should look for the danger signs and counsel such students who are likely to get into the 'trap'.

iii) **Seeking help from peers:** If peers find some one abusing drugs or alcohol, immediately it should be brought to the notice of their parents or teachers so that they can guide them appropriately.

iv) **Education and counselling**: Educating and counselling the children to face problems, stress and failures as a part of life.

v) **Seeking professional and medical help:** A lot of help is available in the form of highly qualified psychologists, psychiatrists and de-addiction and rehabilitation programmers.

BIOLOGY AND HUMAN WELFARE

1. Internal accumulation of tissue fluid without swelling is
   (1) Necrosis (2) Neoplasia
   (3) Oedima (4) Flatulence

2. Diseases which are biologically adopted to and found normally in lower animals but which under some condition infect man also is.
   (1) Oedema (2) Necrosis
   (3) Lymphangitis (4) Zoonosis

3. Read the following:
   A. Hyperplasy is increase of cell size due to infection.
   B. Accumulation of lymph inepididymis is thydrocoel
   C. Accumulation of interstitial fluid & some proteins leaked from capillaries into tissues is edema.
   (1) A & B are correct, C is incorrect
   (2) All are true
   (3) All are incorrect
   (4) B & C are correct, A is incorrect.

4. Defaecation with difficulty due to excessive absorption of water from faecal matter is
   (1) Edema (2) Constipation
   (3) Zoonosis (4) Oedema

5. Illustrate the following:
   A. Entomoeba. histolytica lives in mucous & submucous layers of intestines.
   B. E. histolytica lives in serous & muscular layer of rectum.
   (1) Both A & B are false
   (2) A& B are true & B is correct explanation to A
   (3) A is incorrect & B is correct
   (4) B is incorrect & A is correct

6. The ingested RBC present in Entameba stage is
   (1) Precystic (2) Tetranucleated
   (3) Magna (4) Cystic stage

7. The endocommesal amoeba is
   (1) E. coli (2) E. gingivalis
   (3) E histolytica (4) 1 & 2

8. A flagellate parasite that lives in the vagina of women is
   (1) Triconympha (2) Trichinella
   (3) Trichomonas (4) Trichinais

9. Mosquitoes, bed bugs and leeches are
   (1) Intermittent parasite
   (2) Obligatory parasite
   (3) Hypoparasites
   (4) Facultative

10. Which of the following is not an association between two different – species.
    (1) Symbiosis
    (2) Commensalism
    (3) Parasitism
    (4) Predation

11. Match up:

A. Basicladia	1. Sea cucumbers	
B. Adamsia	2. Sharks	
C. Echeneis	3. Polynyx	
D. Fierasfer	4. Turtles	
E. Chaetopterus	5. Eupagurus	

	A	B	C	D	E
(1)	IV	II	I	V	III
(2)	V	IV	III	II	I
(3)	I	II	III	IV	V
(4)	IV	V	II	I	III
(5)	III	IV	II	V	I

12. After encystment no of mitotic divisions that E. histolytica undergoes is
    (1) Only once (2) Three
    (3) Four (4) Two

13. The parasites which require hosts of only one species to complete life cycle are known as
    (1) Polygenetic (2) Monogenetic
    (3) Digenetic (4) None

14. Reserve food in the cystic form of Entameba histolytica
    (1) Chromatid bodies & Haemoglobin
    (2) Chromatoid bodies & Glycogen
    (3) Glycogen mass + Chromatid bodies
    (4) Glycogen & Haemoglobin

15. Identification character of magma form.
    (1) Pseudoposium & absence of food vacuoles
    (2) Cart wheel shaped nucleus.
    (3) Pseudopodia & Flagella
    (4) Pseudopodia & food vacuoles with erythrocytes

16. In Fierasfer and sea cucumber, the benefited partner is
    (1) Sea cucumber (2) Fierasfer
    (3) 1 & 2 (4) None

17. Coelozoic parasite in the following is
    (1) Trypanosoma (2) Trichomonas
    (3) Tryconympha (4) Triarthrius

18. Read the following:
    Assertion: The parasites which are not constantly associated with host body for nourishment are intermittent parasites.
    Reason: Intermittent parasites are different from temporary ectoparasites
    (1) A & R are false
    (2) A is false and R is true
    (3) A & R are true
    (4) A is true and R is false

19. The most complicated life cycle is in
    (1) Trematodes (2) Cestodes
    (3) Sporozoans (4) Mastigophorans

20. An example for interspecific interaction is
    (1) Toad fish - Sphaerospora
    (2) Pulvianus - Crocodiles
    (3) Cat - Rat
    (4) Man - Schistosoma

21. Match the following:
    A. Paragonimus
    B. Taenia hominis
    C. Leishmania
    D. Entameba
    E. Sphaerospora

1. Enterozoic
2. Hyperparasitism
3. Non-pathogenic
4. Trigenetic
5. Reticulo endothelial cells

	A	B	C	D	E
(1)	II	III	I	V	IV
(2)	IV	III	V	I	II
(3)	III	IV	II	I	V
(4)	V	IV	III	II	I

22. Minuta form of entamoeba feeds on
    (1) Erythrocytes
    (2) Chromatoid bodies
    (3) Bacteria (4) Glycogen

23. In between the entry of cryptozoites and formation of cryptomerozoites the time taken is
    (1) 11 days (2) 12 days
    (3) 7-8 days (4) 10 days

24. The color of Haemozoin granules in the RBC's is
    (1) Red (2) Purple
    (3) Brown (4) Orange

25. The cycle including both haploid and diploid stages in Plasmodium is
    (1) Golgi cycle (2) Ross cycle
    (3) Exo-erythrocytic (4) Pre-erythrocytic

26. The organ enlarged due to the infection of plasmodium.
    (1) Liver (2) Spleen
    (3) Erythrocytes (4) 2 & 3

27. The formation of sporozoite stage from the ookinete takes about.
    (1) 5 days (2) 8 days
    (3) 10 days (4) 12 days

28. Schizogony takes place in schizont stage which results in the formation of
    (1) 20-30 cryptozoites
    (2) 30-35 merozoites
    (3) 20-30 cryptomerozoites
    (4) 6-24 merozoites

29. The tape worm which show apolysis are
    (1) Polytic tape
    (2) Apolytic tape
    (3) Multipolytic tape
    (4) None

30. The terminal portion of the vasa difference in taenia solium is
    (1) Cirrus Sac
    (2) Muscular Cirrus Sac
    (3) Muscular Cirrus
    (4) Vasa efference

31. The outer embryonic membrane in the embryo of Taenia solium is formed from
    (1) Embryonic cell (2) Megameres
    (3) Mesomeres (4) Micromeres

32. Pick the correct order.
    (1) Micromeres – Embryonic cell – Embryo – Morula
    (2) Embryonic cell – Micromeres – Morula - Embryo
    (3) Embryonic cell – Mesomeres – Morula - Embryo
    (4) Embryonic cell – Embryo – Micromeres – Embryo

33. How many pairs of hooks are present in hexacanth.
(1) 2 pairs (2) 3 pairs
(3) 4 pairs (4) 6 pairs

34. The sequence of the passage of Hexacanth in secondary host from stomach is.
(1) Small intestines – Stomach – Liver – Heart – Voluntary muscles
(2) Stomach – Small intestines – Heart – Liver – Voluntary muscles
(3) Stomach – Small intestines – Heart – Voluntary muscles - Liver
(4) Stomach – Small intestines – Liver – Heart – Voluntary muscles

35. The cysticercus larva survives in pig for
(1) 2 – 3 years (2) 4 - 5 years
(3) 5 – 6 years (4) 8 – 10 years

36. The muscles present in the 4 suckers of Taenia solium scolex are
(1) Straited (2) Circular
(3) Longitudinal (4) Oblique

37. Tape worm with only three proglottids is
(1) Taenia echinococcus
(2) Hymenolopis
(3) Dibothrium
(4) T. cucumaria

38. Tegument in Taenia is made up of
(1) Chitin & Proteins
(2) Protein & Lipids
(3) Lipids & Phenols
(4) Chitin & Phenols

39. Pick out the nematode parasite with lips
(1) Ascaris (2) Wuchereria
(3) Loa – Loa (4) 2 & 3

40. The Microfilaria die if they do not infect the mosquito within
(1) 50 days (2) 30 days
(3) 70 days (4) 90 – 100 days

41. The third stage microfilaria undergoes these many moultings
(1) 3 moultings (2) 4 moultings
(3) 2 moultings (4) 1 moultings

42. Time required for the maturation of Wuchereria is
(1) 7-20 months (2) 5-18 months
(3) 20-25 months (4) 4-10 months

43. In this part of the body of mosquito the microfilaria becomes short and stout.
(1) Thorasic muscles
(2) Salivary glands
(3) Stomach
(4) Intestines

44. Triconympha and termites, if they are seperated
(1) Can live independently
(2) Cannot live independently
(3) Both become parasite
(4) Both become commensals

45. The association that exists between sea cucumber & fierasfer is
(1) Commensalism (2) Parasitism

(3) Mutualism (4)Symbiosis

46. Parasite in the urinary bladder of toad fish is
(1) Nossema (2) Sphaerospora
(3) Leishmania (4) Ancylostoma

47. Obstruction of movement of food in the intestine is caused by
(1) Plasmodium & Ascaris
(2) Leishmania & Trypanosma
(3) Taenia & Ascaris
(4) Plasmodium & Nosema

48. The common character among Ascaris, Enterobius and Acylostoma is
(1) All are hyper parasites
(2) All are digenetic
(3) All are intracellular
(4) All are monogenetic

49. The protective covering layer of Ascaris & Enterobius is
(1) Cuticle (2) Pellicle
(3) Tegument (4) Plasmalemma

50. The rapid increase in the number of cells in the organ of host due to the presence of a parasite is known as
(1) Hyperplasia (2) Hypertrophy
(3) Over growth (4) Necrosis

51. The abnormal increase in the size of snails, is due to presence of parasite
(1) Leishmania (2) Acylostoma
(3) Ascaris (4) Fasiola

52. Parasite that is responsible for degeneration of gonads of their host making them sterile is
(1) Leishmania (2) Fasciola
(3) Ascaris (4) Sacculina

53. The parasites which obtain nourishments from host time to time are
(1) Obligatory parasite
(2) Facultative
(3) Intermittent
(4) Permanent

54. The limiting membrane of Trophozoite of Entameba is
(1) Cuticle (2) Plasmalenma
(3) Pellicle (4) Tegument

55. After encystment, number of mitotic divisions that E. hiotolytica undergoes is
(1) Two (2) Three
(3) Four (4) One

56. Infective stage of Wuchereria to culex female is
(1) Microfilaria (2) Rhabditis
(3) First sausage (4) Second sausage

57. The nematode parasite that lives in the sub conjuctional tissue of eye is
(1) Dracunculus (2) Ascaris
(3) Wuchereria (4) Loa Loa

58. Microfilaria exhibit Nocturnal Periodicity that appear in the peripheral circulation between
(1) 9pm – 4 pm (2) 9 pm – 4 am
(3) 10 pm – 4 pm (4) 10 pm – 4 am

59. This stage larva is infective stage of filarial worm to man.
(1) 225 – 330 Micron long

(2) 1500 – 2500 Mn
(3) 124 – 250 Mn
(4) 1600 – 3000 Mn

60. Malignant tertian malaria is caused by
(1) Plasmodium falciparum
(2) P. ovale
(3) P. vivax
(4) P. malariae

61. Mutualism is found in
(1) hermit crab and sea anemone
(2) butterfly and flower
(3) zoochlorellae and hydra
(4) E. coli and man

62. Schuffner's dots produced by plasmodium are
(1) reserve food
(2) antibodies
(3) hormones
(4) antigens

63. The ovoviviparous parasite is
(1) Ascaris
(2) Plasmodium
(3) Wuchereria
(4) Taenia

64. Termites cannot digest cellulose of wood in the absence of
(1) Tryconympha
(2) Plasmodium
(3) Wuchereria
(4) Taenia

65. The infective stage of plasmodium is
(1) Trophozoite
(2) Sporozoite
(3) Mycobacterium
(4) Pulvianus bird

66. Plasmodium was discovered in the blood of man by
(1) P. Manson
(2) R. Ross
(3) Laveran
(4) Golgi

67. In plasmodium life cycle, the results of fusion of microgamete and macrogamete forms
(1) Oocyte
(2) Ookinete
(3) Schizont
(4) Oosphere

68. The malaria fever occurs due to the
(1) mosquito bite
(2) deficiency of blood
(3) liberation of haemozoin
(4) enlargement of liver

69. The larvivorous fish which is useful in controlling mosquitoes
(1) Gambusia
(2) Barbus
(3) Catla
(4) Arius

70. Which one is celebrated as malaria day?
(1) 20^{th} August
(2) 15^{th} August
(3) 26^{th} August
(4) 5^{th} August

71. In plasmodium, the micro and megagametes are formed in
(1) blood of man
(2) liver of man
(3) gut of female anopheles
(4) WBC of man

72. The trophozoite of entamoeba histolytica reproduces by
(1) binary fission
(2) sporulation
(3) mitosis
(4) amitosis

73. Apolysis is the process of
(1) development of unfertilized eggs
(2) separation of gravid proglolttids from strobila
(3) destruction of phagocytes
(4) cellular digestion

74. In the interspecific association, if one is benefited and the other is neither harmed nor benefited, it is called
(1) symbiosis
(2) mutualism
(3) commensalisms
(4) antibiosis

75. In animal associations, if one partner is benefited and the other is put to loss, is
(1) predation
(2) competition
(3) symbiosis
(4) parasitism

76. The association between termites and trichonympha is
(1) mutualism
(2) parasitism
(3) symbiosis
(4) predation

77. Relation between sea-anemone (Adamsia) and hermit crab is
(1) symbiosis
(2) cooperation
(3) mutualism
(4) antagonism

78. In commensalisms, the commensal is
(1) equal to host
(2) larger than host
(3) smaller than host
(4) more intelligent than host

79. Relation between E. Coli and man is an example of
(1) commensalisms with continuous contact
(2) parasitism
(3) hyper parasitism
(4) symbiosis

80. A parasite which is parasitic on another parasite is
(1) obligate parasite
(2) facultative parasite
(3) hyper parasite
(4) double parasite

81. Father of malariology is
(1) Pasteur
(2) Snow
(3) Laveron
(4) Garnham

82. Anticoagulant in the saliva of mosquito is
(1) Haemoglobin
(2) Haemocyanin
(3) Haemozoin
(4) Haemolysin

83. Lymphedema is caused by the parasite
(1) Ascaris lumbricoides
(2) Trichinella spiralis
(3) Taenia solium
(5) Wuchereria bancrofti

84. Read the following:
A. Taenia solium can live in the intestines of the human host, but not in other mammals.
B. Taenia solium is an obligala parasite.
(1) Both A & B are false.
(2) Only A is true, but B is not the correct explanation to A
(3) Both A & B are true but B is not the correct explanation to A

85. Plasmodium lives in
(1) Bone marrow
(2) Pancreas
(3) Reticulo endothelial cells of liver
(4) Leucocytes

86. Which part of Taenia solium helps in attaching the walls of intestine of man.
(1) Hooks (2) Suckers
(3) Rostellum (4) Scolex

87. The structures responsible for excretion in Taenia.
(1) Excretory canals (2) Flame cells
(3) Renette cells (4) Nephridia

88. Arrange the sequence of larvae in Taenia.
(1) Proscolex (2) Egg capsule
(2) Hexacanth (4) Oncosphere
(5)Cysticercus
(1) 2-3-4-1-5 (2) 1-5-4-3-2
(3) 2-4-3-5-1 (4) 4-2-3-1-5

89. The structures that help in increasing the area of absorption in Taenia solium.
(1) Line cells (2) Microvilli
(3) Typhlosole (4) Intestinal caecae

90. Active trophozite in the RBC of man
(1) Signet ring (2) Schizont
(4) Amebiod (4) 1 + 3

91. The role of mosquito in the spread of malaria was suggested by
(1) R. Pfeiffer (2) Laveron
(3) Manson (4) Maculoch

92. One of the following is mismatch.
(1) Cryptogony – Liver
(2) Phanerogony – Anopheles stomach
(3) Merogony – Anopheles stomach
(4) Gametogony – Anopheles proventriculus.

93. One of the following is used in the control of malaria.
(1) Minnow
(2) Bladderwort
(3) Guppy & Gambusia
(4) All the above

94. Parenchyma of Taenia solium is formed with
(1) Ectoderm (2) Endoderm
(4) Mesoderm (4) All the above

95. One of the following might have been difficult if alimentary canal is present in Taenia solium.
(1) Proglotisation
(2) Apolysis
(3) Strobilization
(4) 2 + 3

96. Parenchyma in Taenia solium acts as
(1) Transport medium
(2) Nutrition medium
(3) Excretory medium
(4) Reproductive

97. One of the following is shortest cestode parasite of man.
(1) Hymenolepsis nana
(2) Echinococcus
(3) Dibothrium
(4) T.nana

98. The main function of Excretory system of Taenia solium is
(1) Osmoregulation (2) Diffusion
(3) Ingestion (4) None

99) One of the following is a careful measures for prevention & Control of TDA abuse among the adolescents
A: Avoid undue parental pressure & Responsibility of Parents and teachers.
B: Seeking help from peers, Education & counselling
C: Seeks professionals and Alcohol & Drugs consumption persons
1) A & C is true, B is false.
2) B & C are true, A is false
3) A & B are true, and C is false
4) A, B & C is true & None is false

100) (Assertion) A: Adolescence period is 'valuable phase'.
(Reason) R: Because it is occupied by several physical & behavioral changes.
1) A is true, R is false & R is the correct explanation of A.
2) A is false, R is true, but R is not the correct explanation of A.
3) A & R are true, but R is not the correct explanation of A.
4) A & R are true, are R is the correct explanation of A.

KEY

1. 3	2. 4	3. 2	4. 2	5. 4
6. 3	7. 1	8. 3	9. 1	10. 2
11. 4	12. 4	13. 2	14. 2	15. 4
16. 2	17. 2	18. 4	19. 1	20. 3
21. 2	22. 3	23. 4	24. 3	25. 2
26. 2	27. 3	28. 4	29. 2	30. 3
31. 2	32. 2	33. 2	34. 4	35. 3
36. 2	37. 1	38. 2	39. 1	40. 3
41. 3	42. 2	43. 1	44. 2	45. 1
46. 2	47. 3	48. 4	49. 1	50. 1
51. 4	52. 4	53. 3	54. 2	55. 1
56. 1	57. 4	58. 4	59. 2	60. 1
61. 1	62. 4	63. 3	64. 1	65. 2
66. 3	67. 2	68. 3	69. 1	70. 2
71. 3	72. 1	73. 2	74. 3	75. 4
76. 3	77. 3	78. 3	79. 1	80. 3
81. 3	82. 4	83. 4	84. 3	85. 3
86. 4	87. 2	88. 3	89. 2	90. 3
91. 3	92. 3	93. 4	94. 3	95. 2
96. 1	97. 1	98. 1	99. 4	100. 4

8. PERIPLANETA AMERICANA (COCKROACH)

Phylum : **Arthropoda**
Subphylum : **Mandibulata**
Class : **Insecta**
Subclass : **Exopterygota**
Order : **Orthoptera**

1. Cockroach belongs to the class insects and the order **Dictyoptera** or **Orthopteras.**
2. Cockroach is nocturnal, omnivorous and cursorial animal.
3. The term Periplaneta American was introduced by **Burmeister (1838)**
4. Zoological names of Cockroaches:
   a) **Periplaneta Americana –** American cockroach
   b) **Blatta orientalis –** Oriental Cockroach.
   c) **Blatella germanica –** Germany cockroach
   d) **Blatta australasiae –** Australian cockroach.
5. Blatta orientalis is black in colour and it is commonly as **black beetle**.
6. The wings are well developed in both both sexes of periplaneta Americana and extend beyond the body.
7. The wings are reduced and bestigeal in female blatta orientalis. In male they don't reach the posterior end.

EXOSKELETON:

8. The body of cockroach is externally covered by Chitinous Exoskeleton.
9. Exoskeleton is secreted by epidermal cell.
10. Exoskeleton is composed of nitrogenous polysaccharides + Chitin + Proteins.
11. In cockroach the body wall consists of outer cuticle, middle epidermis and inner dermis.
12. The cuticle in cockroach is 3 layered.
    a) **Epicuticle –** Outer layer (Waxy nature) consists of outer lipid and inner protein.
    b) **Exocuticle -** Composed of Melanin made of tough Chitin.
    c) **Endocuticle –** Inner layer made of soft laminated Chitin.
13. Main function of the cuticle or Exoskeleton is to prevent the loss of water.
14. The Exoskeleton is divided into several plates known as Sclerites. Four Sclerites are present around each segment.
15. Dorsal Sclerite is **tergum.** Ventral Clerite is **sternum** and the lateral sclerites and **pleura (or) plurites.**

16. The sclerites are joined by **arthroidal membrane.**
17. Arthroidal membrane is soft and flexible and consist of epicuticle and endocuticle.
18. Arthroidal membrane is devoid of exocuticle.
19. The sensory immovable bristles covering the body and appendages are the outgrowths of the cuticle.
20. The movable hair like setae are secreted by **Trichogen cells.**
21. **Oenocytes** are the wax secreting cells of the epidermis and they are also helpful in storage of reserve food.
22. The boby of Cockroah is divisible into three part of Tagmata.
    1) Head 2) Thorax 3) Abdomen
23. The Exoskeleton of the head of cockroach forms head capsule.
24. The head capsule is composed of 6 Chitinous plates. 2 apicranial plates, 1 frons, clypeus, 2 genae (cheek plates).
25. The Endoskeleton of the head of cockroach is **tentorium.**
26. The tentorium is formed by cuticular invagination.
27. The head of cockroach is attached to the thorax or cervicum or neck and it is **hypognathus** arrangement.
28. They are present in between two compound eyes in the **vertex.**
29. The dorsal sclerites of the exoskeletonare the tergal plates.
30. The ventral sclerites are **sternal** plates.
31. The tergal plates and sternal plates are connected on the lateral sides by pleura.
32. The non – Chitinous part of the exoskeleton is **pleura** and **orthroidal** membranes.
33. The type of segmentation in cockroach is external and heteronomous metamerism.
34. Total number of segments of cockroach is 18 in adults, 20 in embryo.
35. The head region is with 6 fused segments. Fusion of segments is also known as **tagmosis.**
36. Thoracic region is with 3 segments. Abdominal region is with 10 segments.
37. Total number of abdominal segments during the embryonic stage is – 11 .

Head:

1. Head is the first tagma of cockroach.
2. It is formed by the fusion of 6 embryonic segments.
3. Head bears 6 sclerites – 2 epicranial plates, 1 frons 1 clypeus and 2 genae.
4. Two epicranial plates are between the eyes on the top of the head. These two are fused into **Vertex.**
5. Below the epicranium large frons is present. It is the largest sclerite of the head.

6. Below the frons clypeus is present. Genae are the lateral scleritis. Genae are cheek scleritis.
7. Artroidal membrane is absent between the scleritis of head.
8. The opening of the head is occipital foramen.
9. Oesophagus, trachea, aorta, nerve cord pass through the occipital foramen.

CEPHALIC APPENDAGES:

1. In cockroach the head contains:
    a) One pair of antennae (appendages of 2nd cephalic segment)
    b) One pair of fenestrae or ocelli.
    c) One pair of compound eyes (appendages of 1st cephalic segment)

2. Antennae in cockroach are tactile and olfactory sense organs
3. Antenna of cockroach is divisible into 3 parts, large basal segment scape, short pedicel and many jointed large flagellum.
4. Each antenna has three regions. A large basal scape followed by smaller **Pedical** and a long filamentous many jointed flagellum.
5. The movement of antenna is by extrinsic muscles present between tentorium and scape.
6. Fenestrae in cockroach are vestigial simple eyes, they are photoreceptors.
7. Compound eyes in cockroach are useful in mosaic vision.
8. Neck is the non segmented region and is the extension of the articular membrances. It is supported ventrally by chitinous rings.
9. At the back of the head occipital foramen is present and is supported by arched sclerite **occiput.**

THORAX:

1. The exoskeleton of thorax includes dosal terga, ventral sterna and lateral pleura. Pleura of thorax are divided into epimeron and epistermire
2. Number of sclerites in thorax and abdominal segments is 13.
3. The tergal plates of thorax are pronotum, mesonotum and metanotum.
4. The largest tergal plate in cockroach is pronotum.
5. Thorax bears two pairs of stigmata, two pairs of wings and three pairs of legs.

WINGS:

1. The wings in cockroach arise from thr dorsal surface of mesothorax.
2. In cockroach 1st pair of wings are thick, leathery and protect the 2nd pair of wings. They are not useful in flight.
3. The 1st pair of wings are called tegmina or elytra.
4. The 2nd pair of wings in cockroach are thin membranous and delicate.

5. Cockroach flies with the help of 2nd pair of wings.
6. The two pairs of wings in cockroach are supported by Chitinous Nervures (or) veins.
7. Movement of wings is by direct and indirect muscles. Indirect muscles run longitudinally between mesothorax and metathorax. Indirect muscles extend between tergum and sternum.
8. The flight mechanism is synchronous and is by synchronous contraction of muscles, which is turned by nerve stimulation.

LEGS:

1. In cockroach 3 pairs of legs are present, so it is hexapod animal.
2. Legs are present on the ventral side of thorax, each thoracic segment is with one pair of legs.
3. Each leg is made up of 5 segments, or podomeres, they are coax, trochanter, femur, tibia, tarsus.
4. The largest podomere in the leg of cockroach is tibia. The bristles on tibia are called tibial spurs.
5. The shortest and triangular podomere is trochanter.
6. The 5 jointed part in the leg of cockroach is Tarsus (with tarsomeres).
7. The last segment of the tarsus ends with a pair of claws and a spongy pad arolium or pulvilus.
8. Arolium is useful to give firm grip, when cockroach walks on smooth surface.
9. the tarsomereas of podomeres – coax, trochanter, femur, tibla, tarsus.
10. Strongest podomere is femur.
11. Largest podomere is tibla.
12. The distal podomere is tarsus.
13. The proximal podomere is coax.
14. Coxa is fixed to the tergal segment.
15. Trochanter freely moves to the tergal segment.
16. Trochanter freely moves over coax but fixed to the femur.
17. Highly muscular podomere is coax.
18. While walking 1 and 3rd leg of one side and 2nd led of the other side form into a tripod.
19. Two tripods are formed by 6 legs.

ABDOMEN:

1. Abdomen is 11 segmented in embryo and 10 segmented in adult.
2. The endoskeleton of thorax and abdomen are formed by the invagination of cuticular plates known as apodemes. Muscles are attached to abodemes.
3. The abdomen bears 8 pairs of stigmata, anus and a pair of anal cerci.

4. Anal cerci are attached to 10^{th} tergum of abdomen. These are the appendages of 11^{th} embryonic segment.
5. The anal cerci in cockroach are useful for hearing so they are auditory organs.
6. Total number of segments present in anal circus – 15.
7. Stink glands or odorous glands are present on the arthroidal membrane in between 5^{th} and 6^{th} tergal plates of the abdomen.
8. Anal styles are present in male, arising from the sternum of the 9^{th} segment.
9. Anus is situated on the ventral aperture side of the 10^{th} segment. It is surrounded by 4 plates, 1 anterior epiproct, 1 posterior hypoproct, 2 lateral paraprocts. These are the sclerities of 11^{th} embryonic segment.
10. Male genital aperture is a ventral aperture present in between 9^{th} and 10^{th} segments.
11. Female genital aperture is a ventral aperture present in between 9^{th} and 10^{th} segments.
12. In female 7^{th} sternal plate is broad shaped. It is produced into a pair of valves known as **Gynovalvuler** plates or **apical plates posteriorly.**
13. In female cockroach the sternum of 7^{th}, 8^{th} and 9^{th} segments form a brood pouch or genital pouch.
14. In both male and female cockroaches genital apertures are surrounded by chitinous structures known as gonapophyses or external genitalia or phalomeres.
15. Gonapophyses help in copulation and egg laying.
16. Muscles in cockroach are striated, provoding the quick movement of body parts. Abdomen of cockroach is non muscularised.
17. These muscles are attached to inner surface of exoskeleton.
18. The endoskeleton in cockroach is **Tentorium.** It supports brain and oesophagous. In the thorax dorsal, ventral and lateral apodemes are present as endoskeleton.
19. The inwardly folded cuticular plates in cockroach are called apodemes. They provide space for attachment of muscles.

BODY CAVITY:

1. The body cavity of cockroach is filled with blood, so it is known as **haemocoel.**
2. In cockroach the body cavity is divisible into 3 chambers pericardial sinus, perivisceral sinus and perineural sinus.

DIGESTIVE SYSTEM:

1. The digestive system of cockroach is divisible into two parts.
   1) Alimentary canal 2) Digestive Glands
2. The digestive system is developed from the embryonic archenteron.

3. The alimentary canal of cockroach is divisible into 3 parts:
   a) Foregut or stomodaeum.
   b) Midgut or mesenteron.
   c) Hindgut or proctodaeum.
4. In cockroach stomodaeum and proctodaeum are ectodermal derivatives, so their cavities are lined by cuticle.
5. The mesenteron is endodermal derivative, so the cuticular lining is absent in its cavity.
6. In cockroach the stonodaeum contain:
   a) Preoral cavity or cibarium b) Mouth c) Pharynx
   d) Oesophagus e) Crop f) Gizzard.

MOUTH PARTS:

1. In cockroach the mouth parts are present in the preoral cavity or cibarium.
2. Mouth parts of cockroach are biting and chewing type of mandibulate type or orthopteran.
3. In cockroach mouth parts are modified for taking all types of food materials or omnivorous feeding.
4. The arrangement of mouth parts in cockroach is **Hypognathus** type.
5. In cockroach the mouth parts contains:
   a) Labrum or upper lip b) Mandibles or jaws.
   c) Hypopharynx or Tongue d) First maxillae.
   e) Labium or lower lip or second maxillae.
6. In cockroach labrum is attached to the clypeus.
7. Labrum is internally lined by chitinous epipharynx. It is secondary appendage of 3rd cephalic segment.
8. Epipharynx in cockroach is provided with **Gustatory Setae**, useful for sensing the taste of food material.
9. The well developed parts present in the mouth parts of cockroach are – **Mandibles or Gnathobases.**
10. In cockroach the mandibles are suspended from the sided of the head capsule and have a ball and socket attachment with the head**. These are the appendages of 4th cephalic segment.**
11. Chitinous teeth are present on the inner margin of mandibles.
12. The mandibles work as jaws and are used for crushing and cutting the food material.
13. Mandibles are operated by two sets of antagonistic muscles abductor and adductor muscles.
14. The abductors pull the two mandibles apart.
15. The abductors bring, the two mandibles together infront of the mouth for crushing the food.

16. Maxillae or 1st pair of maxillae belong to the **5th cephalic segment.**
17. In arthropods 2 types of appendages are present:
    a) Uniramous appendages. Eg: Antennae of cockroach and leg of cockroach.
    b) Biramous appendages. Eg: 1st maxillae and 2nd maxillae of cockroach.
18. The 1st maxillae of cockroach contain:
    a) Cardo and Stipes - Protopodite.
    b) Maxillary palp - Exopodite
    c) Galea and Lacinia - Endopodite.
19. The Maxilliary palp in cockroach is 5 segemented.
20. The smaller chitinous lobe present at the base the maxillary palp is Palpiger.
21. The maxillae hold the food and bring it to the mandibles for cutting.
22. In cockroach the labium contain:-
    Mentum, submentum – segments of the protopodit.
    Labial Palp – forms exopodite.
    Glossa, paragloss – Form endopodite.
23. The labial palp in cockroach is 3 segemented it is attached to the mentum by **Palpiger.**
24. In the labium outer paraglossa and inner glossa are together called ligula.
25. Ligula of labium helps in preventing the foof particles falling down at the time of mastication.
26. The hypopharynx of cockroach is also known as the **tongue.**
27. The common salivary duct opens into the hypopharynx.
28. The cavity surrounded by mouth parts is preoral cavity.
29. Preoral cavity is divided into anterior **cibarium** and posterior **salivarium.**
30. Salivarium contains hypopharynx.

SALIVARY GLANDS:

1. Salivary glands in cockroach are one pair present on either side of the crop.
2. The lobules of salivary glands are called acini.
3. The enzyme secreting cells of salivary glands are known as zymogen cells.
4. The saliva in cockroach is stored in salivary receptacles.
5. The enzymes present in the saliva of cockroach is
   1) Salivary amylase or zymase, 2) Invertase.
6. Salivary receptacle is followed by receptacular duct.
7. It is surrounded by Chitinous rings.
8. Each salivary gland is followed by glandular duct.
9. Common glandular duct opens into common receptacular duct.
10. The later duct formed is efferent salivary duct.
11. Efferent salivary duct opens into the base of hypopharynx.

ALIMENTARY CANAL:

1. Cockroach ingests food with the help of lacinia.
2. Mandibles are useful in cutting the food.
3. Cibarium is the preoral cavity present before the mouth.
4. Mouth opens into pharynx is followed by oesophagous.
5. Food is stored in crop.
6. Carbohydrates are digested in the crop region.
7. Carbohydrates are converted into simple sugars by amylase and invertase.
8. The largest part of alimentary canal in cockroach is the **crop**.
9. Crop is also useful to store food materials.
10. Highly muscular and contractile part of the alimentary canal **Gizzard**.
11. The gizzard in cockroach contains:- 6 chitinous teeth and 6 cliliary regions. This region is called armarium. It contains circular muscles only.
12. The gizzard acts as grinding mill and filtering apparatus.
13. Gizzard forms stomodeal valve into the mesenteron.
14. The mesenteron or midgut in cockroach is not lined by chitin because it is endodermal derivative.
15. The mesenteron in cockroach is useful for the absorption of digested food.
16. In cockroach the stomodaeum and mesenteron are separated by hepatic caecae.
17. Hepatic caecae in cockroach are 7 to 8, they open into the mesenteron.
18. The hepatic caecae of cockroach are compared with the pancreas of vertebrates.
19. The hepatic caecae or gastric caecae are concerned with digestion.
20. The digestive juice of hepatic caecae contain enzymes like trypsin, erypsin (proteolytic) and lipase (lipolytic).
21. In cockroach the proteins are digested by trypsin and erypsin.
22. In cockroach the fats are digested by lipase.
23. In cockroach during digestion of food materials the semidigested food present in the mesenteron gets back into the crop is called regurgitation.
24. The stomodael valves of the gizzard secretes the peritrophic membrane, it covers the food material bolus.
25. The proctodaeum or hind gut of cockroach is divisible into 3 regions ileum, colon and rectum.
26. The water present in undigested material is absorbed by rectal papillae in the rectum.
27. In cockroach the undigested waste is sent out in the form of faecal pellets.
28. In cockroach the food materials are stored in the fat bodies (Corpora adipose or adipose tissues).
29. The fat bodies of cockroach are useful for the storage of fats, glycogen proteins and nitrogen wastes.

EXCRETORY SYSTEM:

1. Excretory organs of cockroach are malighian tubules, they are also the organs of water balance.
2. In cockroach the mesenteron and proctodaeum are separated by malphigian tubules.
3. Malphighian tubules are 60 – 80 in number, they open into the ileum (hindgut).
4. Malphighian tubules are internally lined by glandular epithelim with brush border.
5. Each malphighian tubule is divided into 2 parts distal secretory part and proximal absorptive part.
6. The main excretory material of cockroach is uric acid, so it is **uricotelic animal.**
7. The malphighian tubules opened into the alimentary canal is an adaptation to conserve the water.
8. In cockroach some of the uric acid is stored in fat bodies through out the life, this is known storage excretion.
9. besides malphighian tubules other structures like nephrocytes, fat bodies, cuticle and uricose glands are also helpful in excretion.
10. Fat bodies contain urate cells and trophocytes. Urate cells store the uric acid and the trophocytes store the food material. Mycetocyte store bacteria which are useful in biosynthesis of vitamins, proteins, oenocytes store fat.
11. Nephrocytes are the chains of cells along the heart. These are also called **pericardial cells.** They excrete uric acid.
12. Some of the nitrogenous waste materials are also removed through peel off cuticle.
13. **Uricelli majores** (or) **Utriculi majores** also extrete nitrogen waste materials.

RESPIRATORY SYSTEM:

1. Respiratory system in cockroach is well developed.
2. The type of respiratory system in cockroach is tracheal system.
3. The respiratory system of cockroach contains:
   a) Stigmata, b) Atria, c) Trchea, d) Longitudinal tracheal trunks, e) tracheoles, f) Tracheolar liquor.
4. Stigmata or spiracles are the respiratory openings of cockroach.
5. Number of stigmata presents in cockroach – 10 pairs, 2 pairs in the thoracic region and 8 pairs in the abdominal region.
6. Stigmata are present on lateral plates called pleura (nonchitinopus parts).
7. Each stigmata is surrounded by annular sclerite called the **peritreme.**
8. In cockroach the stigmata present from mesothorax to 8^{th} abdominal segment, each segment with a pair of stigmata.

9. The arrangement of stigmata in cockroach is called **Holopneustic** arrangement.
10. In cockroach the stigma are absent in prothorax, 9^{th} and 10^{th} abdominal segments.
11. The stigmata that are permanently open in cockroach are 1^{st} pair of thoracic stigmata and 1^{st} pair of abdominal stigmata.
12. In cockroach the stigmata open into a wide tube called atrium.
13. The bristles or hairs present in stigmata are useful for preventing the entry of micro organisms and dust particles.
14. Trachea in cockroach are formed bythe invagination of ectoderm. Three pairs of longitudinal trached trunks are present – one pair lateral, one pair dorsal and one pair ventral.
15. The tracheal tubes are internally lined by a chitinous layer called **intima.**
16. Intima is formed by chitinous subustance **cuticuline.**
17. In trachea the intima is produced into spiral thickenings called **taenidia** (chitinous rings).
18. The taenidia prevents the closure of trachea.
19. The trachea do not collapse due to the presence of taenidia.
20. tracheoles in cockroach are minute tubules supported by a protein – trachein.
21. Chitinous rings are absent in tracheoles.
22. In tracheoles of cockroach the chitinous rings are absent to facilitate the diffusion of gases. Trachedes are present in the tissues.
23. The terminal parts of tracheoles are filled with a fluid called tracheolar liquor.
24. In cockroach the exchange of gases takes place between teacheolar liquor and tissues.
25. The muscles useful for respiration in cockroach are tergosternal muscles.
26. In cockroaches the respiratory mechanism includes inspiration and expiration.
27. Inspiration occurs due to relaxation of tergo sternal muscles.
28. Expiration occurs due to contraction of tergo sternal muscles.
29. During expiration most of CO_2 is sent through the body wall by diffusion method.
30. In cockroach exchange of gases takes place directly ion the tissues.

NERVOUS SYSTEM:

1. The nervous system of cockroach is typical invertebrate type with nerve ring and two ventral nerve cords.
2. In cockroach nercous system is divisible into three parts:
   a) Central nervous system (CNS). b) Peripheral and c) Stomatogastric.
3. The central nervous system contains brain, double ventral nerve cord ans segmental ganglia.

4. Brain is biolobed. It is formed by the fusion of 3 pairs ganglia – protocerebrum, deutocerebrum, tritocerberum.
5. The sub – oesophageal ganglia is also formed by the fusion of 3 pairs of ganglia. It is the motor center.
6. In cockroach supra oesophageal ganglia and sub – oesophageal ganglia are connected by circum oesophageal connectives.
7. Number of segmental ganglia in cockroach is 9.3 thoracic and 6 abdominal ganglia.
8. In cockroach the abdominal ganglia are present in 1, 2, 3, 4, 6 and 7 abdominal segments.
9. In cockroach segmental ganglia are absent in 5, 8, 9, 10 segments.
10. The biggest abdominal ganglia is the 6^{th} ganglion. It is fused ganglion which supplies nerves 7, 8, 9, 10 segments and anal cerci.
11. Brain gives out nerves to the labrum, antennae and compound eyes.
12. Sub – oesophageal ganglion gives nerves to the mandibles, maxillae and labium.
13. Various nerves arising from the central nervous system constitute the peripheral nervous system.
14. Supra oesophageal ganglia give out three pairs of nerves – Optic, antennary and labrofrontal.
15. Optic Nerves are formed from protocerebrum and go to the eyes. Antennary are formed from due to cerebrum and innervate antennae. Labro frontals are formed from tritocerebrum and divided into labral that goes to labrum and frontal that connects the sympathetic nervous system.
16. 3 pairs of nerves are formed from sub – oesophageal ganglia mandibular, maxillary and labial that innervate mandibles, maxillae and labium respectively.
17. The segmental ganglia of metathorax give out nerves to 1^{st} abdominal segment.
18. The nerves formed from first 5 abdominal ganglia innervate 2^{nd} , 3^{rd} , 4^{th} , 5^{th} and 6^{th} abdominal segements.
19. last abdominal ganglion gives out three pairs, that innervate 7^{th} , 8^{th} and 9^{th} segments.
20. The sympathetic nervous system in cockroach is also called somatogastric nervous system.
21. Somatogastric or sympathetic or Autonomous nervous system is formed by <u>frontal</u>, <u>occipital</u>, <u>visceral</u> or <u>ingluvial</u> and <u>proventricular</u> ganglia.
22. Frontral ganglion is present infront of the brain. It is connected to the brain by a pair of frontal nerve. It is also connected with the <u>occipital</u>, or <u>hypocerebral</u> ganglion by a recurrent nerve.
23. Three nerves form from occipital ganglion. Two are lateral one median. Lateral nerves are connected <u>Carpora cardiaca</u> and <u>Corpora allata</u>. Median nerve is connected to the visceral ganglion present over the crop.

24. A pair of nervous are formed from visceral ganglion. One of it is connected to **proventricular** ganglion present over gizzard.
25. Nerves from the sympathetic system are innervated to alimentary canal and heart, it is useful to control them.
26. The nerve impulses in cockroach are quickly transmitted by **gaint plexes.**

SENSE ORGANS:

27. The sense organs of cockroach are a) compound eyes, b) ocelli (simple eyes), c) sensillae.
28. Compound eyes in cockroach are kidney shaped or bean shaped, they are meant for mosaic vision.
29. Each compound eye is composed of about 2000 ommatidia.
30. The structural and functional or visual unit of compound eye is **ommatidium.**
31. The outer most hexagonal, chitnous, transparent regions is cornea or lens.
32. Cornea is secreted by 2 corneagen cells or lenticular cells present below it.
33. The crystalline cone is present below the corneagen cells, it is also known as 2^{nd} lens, surrounded by 4 vitrellae.
34. In ommatidium crystalline cone and vitrellae form the focusing region or dioptical region.
35. The rhabdome is surrounded by 7-8 retinular cells or retinulae.
36. The rhabdome or optic rod is secreted by retinulae. It is made of 7 rhabdomers.
37. The photoreceptor part of ommatidium is **Rhabdome.**
38. In ommatidium the receptor region is formed by rhabdome and retinulae.
39. The pigment sheath present around the vitrillae or cone cells is iris pigment sheath.
40. The pigment sheath around the retinular cells is retinular pigment sheath.
41. The vision in cockroach during day time is mosaic and the image is apposition image.
42. The vision in cockroach during dim light is super position vision.
43. Depending on intensity of light two types of images are formed in compound eyes. Apposition image during bright light in diurnal insects like houseflies and butter flies. Supraposition image during dim light in nocturnal insects like moths.
44. Sensillae are receptors which are modified epidermal cells.
45. Each sensilla has trichogen Cell for forming the movable bristle and tormogen cells or hair membrane cells. These are innervated by nerve endings, Neurosensory cells also present.
46. Tactile sensilla are found on antennae, and legs.
47. Olfactory sensillae are found on antennae.
48. Auditory sensillae are present on anal cerci (for hearing)
49. Gustatory sensillae are present on maxillae and epipharynx.

PERIPLANETA AMERICANA (COCKROACH)

1. Excretion in insects is performed by
   (1) Green land
   (2) Malphigian tubule
   (3) Nephridia
   (4) (4) Flame cells

2. Peripatus belongs to
   (1) Chilopoda
   (2) Onycophora
   (3) Chelicerata
   (4) Mandibulata

3. The larva trilobite belongs to
   (1) Spider (2) Crab
   (3) Scolopendra (4) Limulus

4. Biramous appendages are characteristics of
   (1) Merostomata (2) Arachnida
   (3) Crustacea (4) Onycophora

5. Wingless insect in which metamorphosis is absent
   (1) Lepisma (2) Fire fly
   (3) Bed-bug (4) Pediculus

6. Match the following:
   A. Diplopoda
   B. Arachnida
   C. Peripatus
   D. Book gills
   1. Mesosomal appendages
   2. Discontinous distribution
   3. Poisonous claws
   4. Gnathochilarium
   5. Spider

	A	B	C	D
(1)	III	V	I	IV
(2)	IV	V	II	I
(3)	V	III	I	II
(4)	III	V	I	II

7. Stink glands are seen in
   (1) Chilopoda (2) Chelicerata
   (3) Diplopoda (4) Myriapoda

8. Arrange the following in order
   1. Tibia 2. Coxa
   3. Femur 4. Trochanter
   5. Tarsus
   (1) 2-1-3-5-4 (2) 1-2-4-5-3
   (3) 2-4-3-1-5 (4) 2-3-4-5-1

9. Hypognathus head is
   A. Head is connected to thorax at 90^R angle & mouth parts facing upwards & posteriorly
   B. Head is connected to thorax at 90^R angle & mouth parts facing downwards.
   C. The Head of cockcrows is small and triangular
   (1) A is correct & B & C are false
   (2) A & B are correct & C is false
   (3) A is incorrect & B & C are correct.
   (4) C is correct & A & B are false

10. The second segment of antennae is
    (1) Pedicel (2) Scape
    (3) Scapus (4) Frons

11. Which of the layers of cuticle is impermeable to water but permeable to Co_2.
    (1) Exocuticle (2) Endocuticle
    (3) Epicuticle (4) 1 + 3

12. Read the following:
    A. Muscles in cockroach are striated and in the form of bundles.
    B. In cockroach body wall does not show muscles but are confined to segments.

(1) A is correct & B is false
(2) A is incorrect & B is true
(3) B is correct & correct explanation to A
(4) A & B are correct, A is correct explanation to B

13. These many chitinuous ridges & pads of bristles are present in the gizzard of cockroach.
(1) 6 + 6 (2) 5 + 4
(3) 6 + 7 (4) 7 + 7

14. How many longitudinal folds are present lining the inner walls of rectum in cockroach.
(1) 7 (2) 3
(3) 6 (4) 2

15. Each spiracle is surrounded by a round annular sclerite called
(1) Peritremata (2) Perisome
(3) Peritreme (4) Intima

16. Tracheal tube is lined inside by a chitinuous layer called
(1) Initima (2) Taenidia
(3) Trachein (4) Atrium

17. The arrangement of Abdominal ganglions in cockroach is
(1) 1,2,3,5,6,7 (2) 1,2,3,4,6,7
(3) 1,3,4,5,6,7 (4) 1,2,3,4,5,7

18. Cornea a biconvex lens is produced by these many epidermal cells.
(1) 2 pairs (2) 2
(3) 4 cells (4) 1 cell

19. Which intergal plate in cockroach abdomen is very thin & notched.
(1) 5 (2) 7
(3) 8 (4) 10

20. Read the following:
A. Acini are small lobules present in haepatic caecae.
B. Acini secrete zymase or amylase enzyme which digest carbohyd - rates
(1) A & B are true
(2) A is true & B is incorrect explanation to A
(3) A is false & B is true
(4) B is correct explanation to A, A & B are true

21. Pollen basket is present on the tibia of which leg.
(1) 1st pair (2) 2nd pair
(3) 4th pair (4) 3rd pair

22. These cells produce movable & solid bristles in cockroach.
(1) Tromogen cells
(2) Trichogen cells
(3) Tripoden
(4) Oenocytes

23. Water conservation organ of cockroach is
(1) Cloaca (2) Crop
(3) Rectum (4) Colon

24. Match the following:

A. Broad podomere	1. Femur
B. Smallest triangular	2. Tarsus
C. Strongest	3. Tibia
D. Longest	4. Coxa
E. 5 seg. Podomere	5. Trochanter

	A	B	C	D	E
I)	IV	V	III	I	II

II)	III	V	II	I	IV
III)	V	III	II	I	IV
IV)	IV	V	I	III	II

25. Fat bodies of cockroach are Analogous to
    (1) A & C are true B is false
    (2) B is true, A & C are false
    (3) A & B are true & C is false
    (4) All are correct
26. In cockroach brain is supported by
    (1) Tentonium (2) Mesorium
    (3) Prostomium (4) Thorax

27. Image formed in cockroach is
    (1) Apposition
    (2) Super position
    (3) Pseudo position
    (4) None

28. Mesothorasic wings are pad like referred as Hemielytra. Stink fond at the base of leg. Young ones are nymph. Name the insect.
    (1) Pediculus (2) Cimex
    (3) Hirundinaria (4) Lacca

29. Of these stages secrete coccon.
    (1) Imago (2) Caterpillar
    (3) Pupa (4) Chrysalis

30. In larvae of many agnatic insects respiration is carried on by
    (1) Trachea
    (2) Book gills
    (3) Trachea & gills
    (4) Trachea & Book gills

31. Tick the correct answer.
    (1) Ants, Bees – Lypris
    (2) Housefly - Nauphius
    (3) Peneaus - Zoea
    (4) Crab – Kentrogen

44. Body cavity of arthropods is
    (1) Acoel
    (2) Pseudocoel
    (3) Haemocoel
    (4) Enterocoel

45. Cockroach belongs to the class
    (1) Arachnida
    (2) Hexapoda
    (3) Crustacea
    (4) Trilobita
46. Which of the following is the most common household cockroach?
    (1) Blatta orientalis
    (2) Blatta australiasae
    (3) Periplanata americana
    (4) Blatella germanica

47. Larva of mosquito is
    (1) Maggot
    (2) Caterpillar
    (3) Wriggler
    (4) Tumbler

48. Lac is secreted by
    (1) wax glands
    (2) hypodermal glands
    (3) salivary glands
    (4) green glands

49. The stage of silk insect which feeds on mulberry leaves
    (1) larva
    (2) pupa
    (3) cocoon
    (4) adult

50. Herbivorous insect with piercing and sucking type of mouth parts
(1) mosquito
(2) housefly
(3) lac insect
(4) silk insect

51. Mouth parts of insects are
(1) homologous organs
(2) analogous organs
(3) vestigial organs
(4) atavistic organs

52. Mouth parts of musca are
(1) sponging and sucking type
(2) piercing and chewing type
(3) biting and chewing type
(4) chewing and lapping type

53. Rearing of honey bees is called
(1) sericulture
(2) apiculture
(3) lacciculture
(4) horticulture

54. Parthenogenetically developed bees
(1) Queen
(2) Worker bee
(3) Drone
(4) Grub

55. Match the following and choose the correct combination.

A)	Pupal stage of mosquito	i)	Chrysalis
B)	Larval stage of housefly	ii)	Wriggler
C)	Larval stage of mosquito	iii)	Maggot
D)	Pupal stage of silk moth	iv)	Tumbler
		v)	Grub

	A	B	C	D
(1)	iv	iii	ii	i
(2)	iii	ii	iv	i
(3)	v	iii	iv	i
(4)	i	iii	iv	v

56. Bee poison helps in the treatment of
(1) Cancer
(2) AIDS
(3) Arthritis
(4) Ulcers

57. Break-bone fever is also known as
(1) yellow fever
(2) malaria
(3) filariasis
(4) dengue fever

58. Worker bee is a
(1) sterile female
(2) female
(3) sterile male
(4) male

59. Mouth parts of cockroach are
1) Sponging & Sucking type
2) Biting & chewing type
3) Homologus organs
4) 2 & 3

60. No of segments are present in young cockroach is called nymph.
1) 16 2) 19
3) 20 4) 22

61. The ecdysis occur in mymph followed by a hormone is knows as
1) pituitary 2) thyroxin
3) Ecdysone 4) Adrenaline

62. Fat bodies in cockroach are similar to
    1) The liver of invertebrates, stores food & uric acid
    2) The liver of vertebrates, stores food, uric acid, symbioses and synthesize lipids
    3) The heart of vertebrates, filter the blood & circulation
    4) The brain of invertebrate & co-ordinate the all body function.

KEY

1. 2	2. 2	3. 4	4. 3	5. 1
6. 2	7. 3	8. 3	9. 3	10. 1
11. 3	12. 4	13. 1	14. 3	15. 3
16. 1	17. 2	18. 2	19. 4	20. 3
21. 4	22. 2	23. 3	24. 4	25. 3
26. 1	27. 2	28. 2	29. 2	30. 3
31. 3	32. 3	33. 2	34. 3	35. 3
36. 2	37. 1	38. 3	39. 1	40. 1
41. 2	42. 3	43. 1	44. 3	45. 4
46. 1	47. 3	48. 2	49. 1	50. 4
51. 1	52. 1	53. 2	54. 3	55. 1
56. 3	57. 4	58. 1	59. 4	60. 3
61. 3	62. 2			

9. ECOLOGY AND ENVIRONMENT

ECOLOGY:

1. Earth is one of the nine planets in the solar system.
2. Life exist only on earth.
3. The three main components of earth are atmosphere, lithosphere, hydrosphere.
4. The multilayered gases envelope surrounding the earth is called atmosphere.
5. The five connective layers with in the atmosphere are **troposphere, stratosphere, mesosphere thermosphere and exosphere.**
6. The lowest of atmosphere is called **Troposphere.**
7. Troposphere lies immediately surrounding the earth and contains life.
8. At the equator the troposphere extends upto a height of 16 -18 Km.
9. At the poles the troposphere extends upto a height of 8-10 km.
10. Troposphere consists of a mixture of gases which are fairly constant in their abundance. ($N = 78\%$, $O_2 = 21\%$, Organ $= 0.9\%$, $CO_2 = 0.03\%$)
11. There is steady decrease in temperature and water vapour, as light increases.
12. The average atmospheric pressure in the troposphere is 1,014 millibars (or) 1 atmosphere.
13. Air movement and cloud formation occurs in troposphere only.
14. The layer of atmosphere that lies above the troposphere is called **stratosphere.**
15. Thickness of the stratosphere is about 50-55 km.
16. Stratosphere extends up to 50-65 km above the surface of the earth.
17. Stratosphere contains mostly ozone, hence it is called **ozonosphere.**
18. Clouds and water vapour are absent in stratosphere.
19. Ozone present in the stratosphere absorb the U.V. rays and prevents them from reaching the surface of the earth.
20. Mesosphere lies above the stratosphere.
21. Mesosphere extends up to 80-90 km. above the earths surface.
22. Mesosphere is characterized by cold temperature ($-95^{o}C$) at low atmospheric pressure.
23. The layer of atmosphere laying above the mesosphere is called thermosphere.
24. Thermosphere is characterized by steady temperature increases with height.
25. In the thermosphere ultra violet rays and cosmic rays cause ionization of molecules like oxygen and nitric acid. Therefore thermosphere is also called ionosphere.
26. Thermosphere extends up to 500 km above the earth surface.
27. Troposphere reflects low frequency, short radio waves, making telecommunications possible between distant places.

28. The region of atmosphere above the thermosphere is called exosphere (or) outer space.
29. Exosphere extends up to 32,190 km from the surface of the earth.
30. Air density is very low in exosphere.
31. Exosphere has a very high temperature due to solar radiation.
32. Liquid water present on the earth forms the hydrosphere.
33. Three quarters (3/4) of the earths surface is covered by water.
34. Hydrosphere includes oceans, rivers, lakes, ponds, etc.
35. Water is essential for the earth is called **lithosphere.**
36. The solid component of the earth is called lithosphere.
37. The three main layers of the lithosphere are **crust, mantle & core.**
38. The outer solid zone of the lithosphere is called **crust.**
39. Crust has a thickness of about 16-50 kms.
40. The surface of the crust is covered by soil.
41. The process of formation of soil is called pedogenesis.
42. The science which deals with study of soil is called Pedology (or) Edephology.
43. The middle layer of earth is called mantle.
44. The thickness of the mantle is 2880 km.
45. Mantle amounts to 84% of the total volume of earth.
46. Mantle amounts to 67% of the total weight of the earth.
47. Mantle contains hard rock in which iron and magnesium are in abundance.
48. The central part of the earth is called core.
49. The diameter of the core is 2500 km.
50. Temperature of the core is 8000^{o} C.
51. In the core matter occurs in gases (or) liquid state.
52. The core of earth contains iron and nickel.
53. The part of the earth in which organisms present is referred to a biosphere (or) ecosphere.
54. All the living organisms are confined to the biosphere (i.e. a few meters above and a few meters below the surface of the earth).
55. The natural adobe (or) locality of an animal (or) plant is called habitat.
56. The sub divisions of terrestrial habitat are called **biomes.**
57. Distinct large areas of earth with relatively homogenous climatic factors flora and fauna is called biome.
58. The world ecology was coined by Reiter but Ernest Haeckel is falsely credited with the derivation of the term ecology.
59. Lankaester coined the term bionomics for ecology.
60. The reciprocal interrelation between the organisms and their environment is called ecology.

61. The environmental factors which influence the growth, distribution abundance, behaviour and ultimately survival are of two basic types – a biotic environmental factor, biotic environmental factors.
62. Climatic factors are solar radiations, temperature, wind, water, current and rainfall.
63. Physical factors are light, fire, pressure and geomagnetism.
64. Chemical factors are acidity, salinity, inorganic nutrients.
65. The biological (or) biotic factors of ecosystem include all living organisms – plants, animals, bacteria and viruses.
66. The position occupied by an organism in the environment is called habitat.
67. Land is used as a habitat by the terrestrial organism.
68. Water is used as habitat by aquatic organisms.
69. The three major categories of aquatic habitats – marine, brackish water and fresh water.
70. Sub divisions of the terrestrial habitat are called biomes.
71. Biomes are distinct large areas of earth with relatively homogeneous climatic factors and flora and fauna. Eg: deserts, tropical rain forests and praire.
72. The functional status (i.e. Profession) of an organism in a community is termed as **niche.**
73. Each kind of living organism found in an ecosystem is called a **species.**
74. A population is a group of individual of the same species in a particular area.
75. A community consist of the populations of plants and animals living together in a given area.
76. An ecosystem usually contains numerous populations of different species of plants, animals and microbes all interacting with one another as a community and with the special physical environment as well.

LIGHT:

1. Light is the most important physical abiotic factor of the environment.
2. Without light life cannot exist.
3. Light is commonly described as environmental triggers.
4. Sources of light are sun, moon, stars, lightening and bioluminescent organisms.
5. Sun is a thermonuclear reactor where hydrogen is transformed into Helium, due to this tremendous amount of energy is generated.
6. The radiant energy is in form of electromagnetic waves.
7. Sun light is formed of cosmic rays, gamma rays, x-rays, ultra violet rays, visible light, infrared rays, radio waves etc.
8. U.V. rays, visible light and infrared rays are biologically significant.
9. Visible light has a wave length ranging between 380 mμ and 760 mμ.
10. The visible light consist of a spectrum of 7 colours VIBGYOR.
11. The ultimate source of light is sun.

12. The amount of solar radiation reaching the surface of the earth is more or less constant and it is called solar flux or solar constant.
13. The amount of solar flux is 1.94 c/cm2/m.
14. The intensity of light is depends upon angle of incidence.
15. Light waves with longer wavelengths are absorbed in the surface layers of water.
16. Heat and infra radiation cannot penetrate up to a depth of 4 m.
17. Red and orange rays penetrate up to a depth of 20 m.
18. Yellow rays penetrate up to a depth of 20 m.
19. Green and blue rays penetrate up to a depth of 100 m.
20. Violet and indigo rays penetrate up to a depth of 200 m.
21. The lighted surface area of water is called euphotic zone.
22. Euphotic zone extends up to a depth of 80 m.
23. The area of water where light is present but is not enough for photosynthesis is called disphotic zone.
24. Disphotic zone extends from 80- 200 m.
25. The area of water below 200 m depth where light is absent is called aphotic zone.

TEMPERATURE :

1. The intensity of heat energy is called temperature.
2. Temperature exerts its influence on all vital activities of organisms like behaviour, metabolism, reproduction, development, etc.
3. The total amount of heat entering the biosphere from the sun is equal to the amount of heat lost into the atmosphere. It is called solar flux or solar constant.
4. Temperature fluctuations are relatively less in aquatic environment than in terrestrial environment.
5. The stratification of different layers in the aquatic medium according to the nature of temperature difference is called thermal stratification.
6. Thermal stratification occurs in fresh water bodies like ponds and lakes, but absent in marine water.
7. The maximum density of water occurs at 4^{o}C. So any water warmer or cooler than 4^{o}C floats on top of this water having 4^{o}C.
8. In summer three layers are formed epilimnion, thermocline, hypolimnion.
9. Epilimnion is the upper layer of water. It is the layer of warm water and its temperature varies between $20 - 27^{o}$ C. In this layer water is constantly stirred by wind.
10. The cool stagnant water of the bottom constitutes the hypolimnion. The temperature ranges between 2^{o}C to 4^{o}C.
11. Thermocline or metalimnion is the middle layer present between the epilimnion and hypoliminion.

12. In thermocline there is a rapid vertical temperature change. The thermal gradiant is at the rate of 1°C per meter.
13. In thermocline the upperregion is about 27 °C and the lower region is about 7 °C. Thus there is gradual decrease in temperature.
14. If the thermocline is formed below the euphotic zone oxygen supply decreases in the hypolimnion. This is called period of summer stagnation in the hypolimnion.
15. During temperature fall, the surface water cools to 4°C hence its density increases and sinks to the bottom stirring the entire water. As a result oxygen is reintroduced into the hypolimnion. This type of water circulation is called fall over turn.
16. The type of stratification that occurs during winter is called winter stratification.
17. In winter two layers are formed – upper layer and lower layer.
18. The temperature of the upper layer is reduced to 0°C and the water there become ice.
19. In the lower layer the temperature of the water column remains at 4°C throughout.
20. Organisms living in the lower layer are less active and so they consume less oxygen and the decomposing power of bacteria decreases. Hence the aquatic organisms do not suffer from hypoxia.
21. During spring season the surface water melts due to high atmospheric temperature. On attaining 4°C the water gets heavy and sinks to the bottom of the pond and the bottom water comes to the surface. Thus the water is stirred up again. This is called spring over turn.
22. Organisms which cannot tolerate wide variations in temperature are called stenothermal. Ex: All most all invertebrates, fishes, amphibians and reptiles.
23. Organisms which can tolerate very large fluctuations in temperature are called eurythermal. Ex: Birds and Mammals
24. In many animals the body temperature changes according to the fluctuations of environmental temperature. These animals are called poikilotherms or ectotherms or cold blooded animals. Ex: All animals except Bird and Mammals.
25. In birds and mammals the body temperature remain constant and it is independent of environmental temperature. These animals are called homeotherms or endotherms or warm blooded animals.
26. Metathermic animals have a little power of regulating their body temperature. Ex: Prototheria, Metatheria.

27. The phenomenon in which animals undergo dormancy to escape from excessive cold during winter season is called hibernation or winter sleep. Ex: Frogs, Toads, Reptiles.
28. The phenomenon in which animals undergo dormancy to escape from high temperature during summer is called aestivation or summer sleep. Ex: protopterus, snakes, lizards, frogs, beetles.
29. To escape from the extremes of temperature, certain animals migrate to places when they can have optimum temperature. This phenomenon is called thermal migration.
30. Vant Hoffs rule states that the rate of chemical reactions are doubled for every $10^{o}C$ increase in temperature.
31. The temperature range (i.e. $4^{o}C$- $45^{o}C$) within which the various metabolic activities occur in organisms is called biokinetic zone.
32. Plague is caused by Xenopsilla (Rat flea). The population of female pleas is more than the males, when the temperature is very high.
33. Thermoreceptor organs are found in pit viper, ticks and mites.
34. The cyclic changes in the morphological structures of organisms in relation to seasons is called cyclomorphosis. Eg: Daphnia.
35. The effect of temperature on body size is explained by Bergmen's rule.
36. Bergmen's rule states that when the animals of one species live in both warmer and colder climates, the animals of colder climates tend to be larger than those of warmer climates.
37. The extremities of mammals (eg: rabbit, fox) like the tail, snout, ears and legs are relatively shorter in colder parts thanthe warmer parts. This phenomenon is called Allen's rule.
38. The fishes living in cold waters are provided with a grated number of vertebrate than in the case of species that live in warm waters. This phenomenon is called Jordan's rule.
39. Animals living in warm, humid regions are dark in colour due to the development of more pigments. But the animals living in cool and dry climate are pale in colour. This phenomenon is called Gloger's rule.

WATER:

1. Water is the most essential component of life and life originated in sea water.
2. Water constitutes about 70-80% of protoplasm.
3. Water exist in three states – liquid, solid, vapour.
4. Liquid water covers about 71% of the earth's surface as oceans and fresh water and it forms the hydrosphere.
5. Water does not give foam with soap is called hard water.
6. Water that give foam with soap is called soft water.

7. Hardness of water is due to the presence of chlorides, sulphates and bicarbonates of calcium and magnesium.
8. Temporary hardness is due to presence of bicarbonates of calcium and magnesium and it can be removed by boiling.
9. Permanent herdness is due to presence of chlorides and sulphates os calcium and magnesium, Permanent hardness cannot be removed by boiling.
10. Water continuously circulates between the atmosphere and the earth's surface. This is called hydrological cycle.
11. Fresh water is hypotonic of the body fluids of aquatic animals. As a result water continuously enters into these bodies by endosmosis and effects the metabolic activities.
12. Removal of excess water from the body is called osmoregulation.
13. In fresh water bony fishes have glomerular kidney excrete hypotonic urine with excess of water.
14. In fresh water protozoan contractile vacuole helps in osmoregulation.
15. Fresh water fishes have chloride cells in their gills for absorbing salts from the surrounding water. Thus the salts loss through urine is compensated.
16. Some fresh water fishes such as Anabas, Clarias, Ophicephalus, Saccrobronchus, Anguilla and Dipnoi fishes have accessory respiratory organs.
17. Accessory respiratory organs help in aerial respiration. i.e. they obtain their oxygen from atmosphere.
18. Marine water is hypertonic to the body fluids. So water continuously goes out of their bodies through exosmosis.
19. Marine fishes drink more and more water to compensate the water loss.
20. Marine fishes have chloride cells in their gills for the excreation of excess of salts from their bodies.
21. Cartilagenous fishes store urea in their blood and excrete hypertonic urine.
22. Marine teleost fishes have aglomerular kidneys.
23. Sea birds have slat glands near the eyes which help in the excretion of excess salts from the body.
24. Animals that can tolerate wide range of salinity are called euryhaline.
25. Animals living in brackish water are usually euryhaline.
26. Animals that cannot tolerate wide range of salinity variations are called stenohaline.
27. Salinity variations usually occur in brackish water.
28. Terrestrial animals are in constant danger of desiccation, so water conservation is the main problem in them.
29. In order to conserve water, desert animals have the following adaptations. 1) Nocturnal 2) Cursorial 3) Fossorial 4) Saltatorial 5) Skin is hygroscopic.

30. In mammals the nephrons have U-Shaped Henle's loop in order to absorb water from the primary urine.
31. Camel stores water in the water cells present in the rumen and reticulum of the stomach.

ENERGY FLOW IN THE ECOSYSTEM:

1. The ultimate source of energy in the biosphere is sun.
2. Energy flow in an ecosystem is unidirectional but not cyclic.
3. Energy is the capacity to do work.
4. Green plants and phytoplankton convert radiant energy from the sun into chemical energy or potential energy through photosynthesis.
5. Energy at rest is called potential energy or fixed energy or chemical energy.
6. The energy produced due to motion is referred to as kinetic energy.
7. Law of conservation of energy states that energy is neither created nor destroyed.
8. Law of kinetic energy states that when energy is transformed from one level to another level, some amount of useful energy is lost into the environment in the form of heat.
9. The differences in the energy levels is called entropy.
10. The chemical constituents like N, C, O2, HO2 and other mineral elements circulate in the biosphere.
11. The rate which radiant energy is stored by photosynthetic and chemosynthetic activity of producer organisms in the form of organic substances which can be used as food material is called primary productivity.
12. The amount of organic materials produced during a given period of time per unit area is called primary production.
13. The green plants are capable of fixing only 1.57 of the solar energy reaching the earth.
14. The total amount of radiant energy converted into sugar by plants through photosynthesis is called gross primary production or gross productivity.
15. .In plants some of the energy is lost through respiration.
16. Gross primary production minus the energy lost during respiration is known as net primary production (N.P = GPP- Production)
17. The total organic material actually present in plants is called net primary production.
18. The organic matter and energy in the consumer level is called secondary production.
19. Only about 10-20% of the primary production is covered into secondary production. The remaining 80-90% is lost by the consumers in the form of faeces.
20. A herbivore can assimilate only 10% of the food which it ingests.

21. A carnivore can assimilate about 20% of the total food it ingests.
22. The energy assimilated retained in the bodies of the consumers in different forms.
23. The gross secondary production is equal to the total plant material by the herbivores minus the stuff post in faeces. It is actually amount to the food digested and assimilated through the gut wall in a herbivore.
24. A part of the energy assimilated by the herbivores is utilized in various metabolic activities like respiration, excretion, secretion, locomotion and reproduction and the rest of the energy is stored in their tissues. This energy is called the net secondary production.

FOOD CHAINS :

1. The transfer of food – energy from plants to animals and then to other animals by successive stages of feeding is called a food chain.
2. in an ecosystem energy is transferred through a series of organisms, each feeding on the preceding organisms and providing raw materials and energy for the next organisms.
3. each stage of the food chain is known as trophic level.
4. The first trophic level is occupied by the autotrophic organisms, so they are called producers.
5. The organisms of the second tropic level are called primary consumers or herbivores.
6. The organisms of the third trophic level are called secondary or primary carnivores.
7. The organisms of the fourth trophic level are called consumers or secondary carnivores.
8. The final carnivore of a food chain is not eaten by other animals, so it is known as climax carnivore.
9. The grazing food chain starts from a green plant base, goes to grazing herbivores and onto carnivores.
10. In Predator food chain one animal captures and devours another animal.
11. An animal that eats another animal is called a predator.
12. The animal consumed by the predator is called prey.
13. A predator that consumed members of its species is known as cannibalistic.
14. An animal that eats dead animal is referred to as scavenger.
15. The plants and animals of a grazing food chain are infected by parasites. The parasites derive their energy from their hosts. Thus a parasitic food chain is formed with in a grazing food chain.
16. The detritus food chain starts from dead organic matter and ends in inorganic compounds.
17. The organic waste materials and the dead bodies of producers, consumers of a grazing food chain from detritus.

18. The organisms which feed exclusively on the dead bodies of animals and plants and organic waste materials are known as detrivores.
19. Detritous ecosystem develops on organic debris, living producers may be absent, sunlight is not directly essential.
20. The interlocking of many food chains in an ecosystem is called food web.
21. The number, biomass and energy of organisms gradually decreases from of a pyramid called ecological pyramid.
22. Ecological pyramid is a graphic representation of the number, biomass and energy of the successive tropic levels of an ecosystem.
23. The concept of ecological pyramid was first described by Charles Elton.
24. Pyramid of numbers depicts the number of individual organisms at different trophic levels of food chain.
25. The total weight of living matter per unit area present in the ecosystem is called biomass.
26. Pyramid of biomass depicts the amount of biomass at different trophic levels of food chain.
27. Pyramid of energy depicts the amount of energy at different trophic levels of food chain.
28. Ecological pyramids are always upright i.e. the apex is pointed upwards.
29. In some ecosystems the number of biomass of producers are less and those of consumers are more. So the apex is directed inverted pyramid.
30. Inverted pyramid of numbers is found in parasitic food chain.
31. Inverted pyramid of biomass is found in pond and lake ecosystem.
32. The pyramid energy is always upright.

Ecosystem

Ecology

The term 'ecology' was introduced by **Reiter** In 1668 and **E Haeckel** (1809) defined It as the study of natural environment including the relations of organisms to one another and to their surroundings. it **R Mishra** is known as **Father of Indian Ecology**. He defined it as the interaction of form. functions and factors.

Autecology It is the branch of ecology. which Is concerned with the study of an individual organism (an Individual species).

Synecology It is the branch of ecology. which deals with the study of a group (or grnupsi of organisms that are associated together as a unit.

Organisms and their Environment

Ecology at the organismic level is essentially physiological ecology, which tries to understand how different organisms are adapted to their environments in terms of not only survival but also reproduction.

The variations in precipitations leads to the formation of major blomes such as desert, rainforest and tundra.

Life exists on different habitats like grassland, deserts, tropical and tenmeratue forests, coniferous forests, arctic and alpine tundra, deep oceon tranches, torrential streams, permafrost polar regions, high mountain tops, boiling thermal spring, stinking compost pits and even air intestine is a unique habitat for many microbes.

Habitat and Niche

Habitat It is a place, where an organism lives. II represents a particular set of environmental conditions suitable for its successful growth.

Ecological niche Ecological niche of an organism includes the physical space occupied by it, its functional role in the community and the conditions of existence.

(i) Each species has Its own unique niche.

(ii) Two species cannot occupy exactly same niche and coexist.

(iii) Closely related *species* of competitors will have similar requirements along the niche dimensions, so that their niche will overlap one another partially or fully.

(iv) If the niche of one species completely overlaps that of another, then one of the **species will be eliminated**

(v) *If the niche overlaps partially. coexistence is possible in two ways*

(a) One species fully occupies Its own fundamental niche excluding the second species from parts of its fundamental niche and leaving, it to occupy a smaller realised niche.

(b) Both species have restricted realised niches, each utilising a smaller range of particular niche dimensions than they would in the absence of other species.

Environmental Factors

The habitat includes both biotic and abiotic factors.

1. **Biotic Factors** The biotic 'actors mostly influence growth and reproduction. *It contain*

   (i) Plants (ii) Animals flip Microbes and (iv) Interaction of organisms.

2. **Abiotic Factors** The most important abiotic factors are temperature, water, light and soil.

Temperature It governs the functions and geographical distribution of organisms. Some organisms are eurythermal while others are stenothermal.

Water It is an important factor for life. Organism now be euryhaline (tolerate wide range of salinity) or stenohaline (can tolerate only a narrow range of saliniy).

Light It Influences life on earth as plants prepare food and release oxygen during photosynthesis.

Soil It sustains life on earth. The physical and chemical properties of soil, such as grain size. porosity. pH and mineral composition determine the type of plant can grow in a particular habitat.

Population

It is a unit of biotic community made up of near permanent group of interbreeding individuals of a species found in a space at a particular time.

Ditforent population characteristics ore as follows

1. Population Attributes

A population has certain attributes Thal an individual organisms does not have.

These ore follows

(i) Birth rate (natality) (ii) Death rube (mortality) (iii) Sex ratio (iv) Population density.

In any population, three ecological age groups ore

(i) Pre-reproductive (ii) Reproductive (iii) Post-reproductive

The age pyramids reflect the growth status of population, *These are*

(i) An expanding/growing population

(ii) A stable population (iii) A declining population

2. **Population Growth**

Population growth depends on factors like

(i) Food availability (ii) Weather Gift Predation pressure

(iv) Competition.

The density of population in a given babied changes due to four basic processes

(i) Natality (ii) Mortality (ii) Immigration (iv) Emigration

The equation for population growth Is

$$N_{t+1}\ N_t\ (B+ I) - (D + E)$$

Nt = population density at time t, E=birth rate I = immigration. D = death rate, E = emigration

The maximum population of species that a particular environment can sustain is called carrying capacity.

The population growth models are

(i) Expouential growth model (ii) Logistic growth model

When the resource availability is unlimited In the habitat the population grows In an **exponential** or **geometric fashion**. No population can continue to grow exponentially as the resource availability becomes limiting at certain point of time.

A population showing **logistic growth** shows sigmoid curve. This growth model is more realistic in nature.

Population Interactions

Living organisms cannot live in isolation and they do interact in various ways to form biological communities.

Interspecific interactions arise from the interaction of populations of two different species. They could he beneficial, detrimental or neutral.

The organisms in a population interact in following ways

1. **Mutualism**

It is the interspecific interaction in which both the interacting ting species are benefttod.

The examples of mutualism are

(i) **Lichens** show Intimate association between a fungus and an alga. The fungus helps in absorption of nutrients and alga prepares food.

(ii) **Mycorrhizae** are mutualistic association between fungi and roots of higher plants.

2. Predation

It is an interspecific interaction, where one animal predator) kill and consumes the other weaker animal called prey).

Prey species have evolved various defence mechanisms to reduce the impact of predation.

(a) Camouflage (cryptic colouration) in some insects and frogs.

(ii) Some animals *(e.g.,* monarch butterfly) are highly distasteful to their predators.

3. Parasitism

It is the interspecific interaction, where one of the species depends on the other species for food and shelter, in this process, the host is damaged.

The parasites have developed one or more *of the following sdoplations*

(i) loss of unnecessary sense organs.

(ii) Presence of hooksladheative organs and suckers. Loss of digestive system

(iii) High reproductive capacity.

Paracites can be ectoparasiles head like, ticks. marine apepods) and endoparasites *(e.g.,* tapeworm. hymnlike).

Food parasitism is the phenomenon in which one grasitic) bird species lays its eggs in the rest of another towards species. *e.g.*. cuckoo lays eggs in the nest of crows.

Commensalism

It is the Interspecific interaction, where one species is bacefitted while the other species is neither benelitted nor harmed.

Examples

(i) Orchids grow as epiphytes on mango or other fruit trees.*Orchids* are benefltted by getting shelter a while tree is neither henefitted nor harmed.

(ii) Barnacles growing on ihe whale an benefitted to move to whore food is available.

5. Competition

It is a type of interaction either among individuals of the same species (intraspecifte) or between population of different species (interspecific. competition).

Amensalism

It is the Interaction between two different species. in which one species is harmed and the other is neither benelitted nor harmed.

Adaptations

Adaptation is any attribute ol the organisms (morphological, physiological and behavioural) that enables the organism to survive and reproduce in Its habitat.

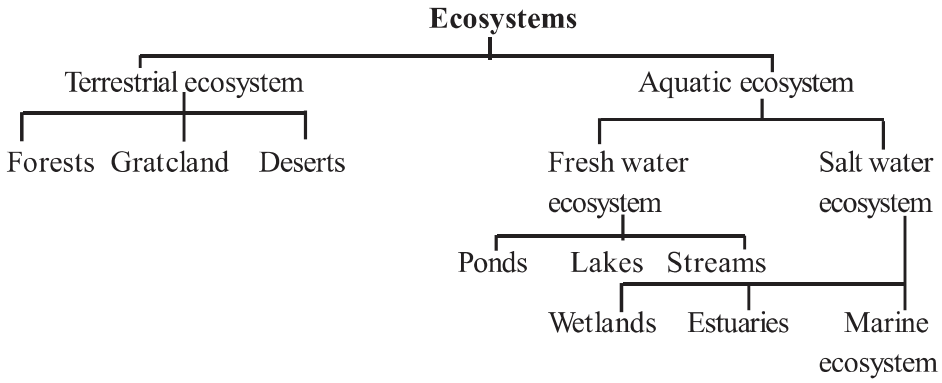
Many adaptations have evolved over a long evolutionary time and are genetically fixed. For example. in the absence of external source of water, the kangaroo rat in North American deserts is capable of meeting all its requirements through its internal fat oxidation.

The tribes living at high altitudes of mountains have a higher count of red blood cells and haemoglobin and high vital capacity than people living in plains.

Ecosystem

Ecosystem is a functional unit of nature, where living organisms interact among themselves and also with the surmundiug physical environment.

Ecosystems*ore classified in following types*



Every ecosystem has non living (abioilc) and living (biotic) components.

Components of Ecosystems

1. Biotic Components

It include autotrophic components (self-nourishing), heterotrophic components (other nourishing) and decomposers.

Biotic Components

- **Producers** Autotrophic organisms, i.e., plants (green) and photosynthetic bacteria.
- **Macroconsumers** or phagotrops heterotrophs. i.e.. animals and non-green plants.
- **Microconsumers** or transformer-decomposers. i.e., microorganisms, bacteria and fungi.

Autotrophic Components

It is mainly constituted by the green plants, algae and all photosynthetic organisms. Chemosynthetic bacteria, photosynthetic bacteria, algae, grasses, mosses, shrubs, herbs and trees manufacture food from simple inorganic substances by fixing energy and are therefore, called producers.

Heterotrophic Components

Heterotrophic components cannot make their own food. They consume the matter built by the producers and are therefore, called as consumers. They may be herbivores, carnivores or omnivores. Herbivores ere called as primary consumers, whereas carnivores and omnivores are called as secondary consumers. Collectively, all are known as macroconsumers.

Decomposers

These arc heterotrophic organisms chiefly b fungi that breakdown the complex compoun protoplasms, absorb some of the products simple substances usable by the producers.

2. Abiotic Components

Abiotic component of an ecosystem consists of substances and factors.

Abiotic Components

- **Inorganic substances**
  Carbon, nitrogen, sulphur, potassium, carbon dioxide water, etc.
- **Organic substances**
  Proteins, carbohydrates, lipids, etc.
- **Climatic regime**
  Temperature, humidity, soil light pressure, etc.

(i) **Temperature** Its range varies in different parts of the earth. It has created different size zones, i.e tropium subtropical, etc.

(ii) **Light** It provides solar energy to the eco heating and photosynthesis.

(iii) **Wind** It controls weather, transpiration, pllination and dissemination of propagation.

(iv) **Humidity** It control formation of clouds, dew, fog, etc.

(v) **Precipitation** It may occur as rainfall, snow deseart hail. etc.

Abiotic and Biotic Components of Various Types of Ecosystem

Component	Marine Ecosystem	Grassland Ecosystem	Forest Ecosystem	Desert Ecosystem
Biotic Components				
1 Producers	Phytoplanktons, diatoms, dinotlageilates. microscopic algae. also members of Phaeophyta and Rhodophyta	Dichanthium, Cynodon, *Digitaria*, Dactyloctenium, Setaria, also few shrubs	Mainly trees, Teaks, sal, *Quercus* in temperate forest Pinus. Abies, Cedrus, *Iuniperus* and Rhododendron	Shrubs bushes, some and very few trees. Cycal cacti, palm, coconuts, *etc*
2. Consumers				
(a) Primary	Crustaceans, molluscs and fishes	Deer, sheep, cow, buffaloes, rabbit, mouse, also some insects, termites, millipedes	Leafhoppers dies, beetle, bugs, spider, deer, mouse, moles	Animals, insects, some and camel
(b) Secondary	Carnivorous fishes	Fox. jackal, snake, frogs, lizards and birds	Lizard, fox, snake and birds	Reptiles
(c) Tertiary	Harring, shad and mackerel carnivore fishes like cod, haddock, halibut, etc	Hawk and vulture	Lion, tiger, wild cats, etc	Vultures
3. Decomposers	Chiefly bacteria and fungi	*Mucot, Aspergillus, Penicillium Fusarium, Cladosporium* and *Rhizopus*	Most fungi *Aspergillus, Polyporus, Fusarium*, Bacteria *Bacillus, Clostridium and Streptomyce*	Fungi and bacteria, when and thermophilic
Abiotic Components	Temperature zones, air. O_2, minerals rich salts, etc	CO_2. H_2O, nitrate, phosphate and sulphates, roughly 19% of the earth's crust	Soil and atmosphere	Rainfall less than 25 min extreme of temperature and cold

Functions of Ecosystem

The *motor functions of any ecosystem* ore

(i) Productivity (ii) Decomposition (iii) Energy flow (iv) Nutrient cycling

(i) Productivity

The rate of biomass production is called **productivity**.

Productivities are two types

(a) **Primary Productivity** It is expressed as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis, It is expressed in terms of weight (g^2) or energy (kcal m^2).

(b) **Secondary Productivity** It is the rate of formation of new organic matter by consumers. The annual net primary productivity of the whole biosphere is approximately 170 billion tons of organic matter.

(ii) Decomposition

Dicomposers breakdown complex organic matter into inorganic substances like carbon dioxide, water and autrients and this process is called **decomposition** .

Dread plant remains such as leaves, bark, flowers and dead remainsof animals, including faecal matter, constitute detritus the raw material for decomposition.

The important steps in the process of decomposition are

(i) Fragmentation (ii) Leaching (iii) Catabolism (iv) Humification (v) Mineralisation.

(i) Energy Flow

The flow of energy from the sun to producers and then to consumers is unidirectional.

In an ecosystem, energy as transferred in the form of food and it leads to degradation and loss of a major part of food eneregy as heat during metabolic activities and very small fraction becomes stored as biomass.

In nature, *bosicoity* two *types of food* chains *are recognised*

(i) Grazing food chain (i) Detritus food chain.

Differences between Grazing and Detritus Food Chains

Crazing Food Chain	Detritus Food Chain
The chain begins with producers as the first trophic level.	The chain begins with detritiveness and decomposers as the first trophic level.
Energy for the food chain comes from sun.	Energy for the food chain comes from organic detritus.
Food chain adds energy into the ecosystem.	It retrieves food energy from detritus and prevents its wastage.
The food chain binds up inorganic nutrients.	The food chain helps in releasing inorganic nutrients to the cycling poo.

Food chains are not isolated units but are hooked together in food wnbs.

In an ecosystem, interlinking pattern of a number of food chains forms a web-like arrangement known as a food web.

ECOLOGY AND ENVIRONMENT

1. Ear lobes of Arctic fox are smaller than that of tropical fox. This is
   (1) Jordan's rule
   (2) Bergman's rule
   (3) Grogers rule
   (4) Allens rule

2. The environmental protection act of government of India was brought out in the year.
   (1) 1974 (2) 1977
   (3) 1981 (4) 1986

3. One of the human diseases due to biomagnification of heavy metals is
   (1) Minamata (2) Asthma
   (3) Tuberculosis (4) Elephantiasis

4. In the pond ecosystem rooted plants occur in
   (1) Ionosphere (2) Stratosphere
   (3) Limenetic zone (4) Littoral zone

5. Read the following:
   Assertion: The incidence of skin cancer is increased in Australia.
   Reason: Formation of seasonal ozone holes.
   (1) A & R are correct.
   (2) A is correct & R is false
   (3) A & R are correct R is not the correct explanation to A
   (4) A & R are correct, R is the correct explanation to A

6. Arrange the following gases according to their quantity of composition in the air from the less to more
   (A) O_2 (B) Ar
   (C) N_2 (D) Co_2
   (1) a, b, c, d (2) d, c, a, b
   (3) b, a, c, d (4) b, d, a, c

7. Following are the statements on Detritus food chain.
   (I) Detritus is a dead or decomposing material
   (II) Detrivores are the micro organisms such as bacteria multi cellular fungi which lie on dead organic matter
   (III) Detrital food chains represent an important component in the energy flow of the eco-system.
   (1) All are correct
   (2) I & II are correct
   (3) II & III are correct
   (4) I & III are correct

8. Match the following:
   A. Cotton fibres
   B. Iron particles
   C. Nickel
   D. So_2
   1. Cyanosis
   2. Bissinosis
   3. Chlorosis
   4. Siderosis
   5. Osteomalacia

	A	B	C	D
(1)	II	IV	I	III
(2)	III	IV	V	I
(3)	II	III	IV	V
(4)	I	II	IV	III

9. Match the following:
   A. Hygroscopic skin
   B. Cleidoic skin
   C. Chitinuous Endoskeleton
   D. Subcuntanous fat is absent
   1. Ostrich
   2. Cockroach
   3. Camel
   4. Molocch
   5. Kangaroo rat

	A	B	C	D
(1)	V	IV	II	I
(2)	IV	V	I	II
(3)	III	II	I	IV
(4)	IV	I	II	III

10. Match the following:
   A. Periyar Tiger Reserve
   B. Corbett Tiger
   C. Ranthambor
   D. Sunderban
   1. West Bengal
   2. Rajasthan
   3. Uttar Pradesh
   4. Kerala
   5. Orissa

	A	B	C	D
(1)	IV	III	II	I
(2)	I	II	III	IV
(3)	II	III	IV	V
(4)	III	IV	V	I

11. Cladiona is a bio-indicator of this pollutant.
   (1) N_2O
   (2) PAN
   (3) So_2
   (4) Organo chloro compound

12. The Mascot of WWF. is
   (1) Bald eagle (2) White bear
   (3) Panda (4) Kiwi

13. Oil eating bacteria is
   (1) Pasturella Multoida
   (2) Pseudomonas Putida
   (3) Odium Albicance
   (4) Mycobacterium Moenas

14. No of tiger reserves in India
   (1) 12 (2) 9
   (3) 15 (4) 24

15. A cod fish which hatches in a temperature of $\mathbf{10^o}$ C to $\mathbf{11^o}$ C has
   (1) 55 Vertebrae
   (2) 56 Vertebrae
   (3) 54 Vertebrae
   (4) 45 Vertebrae

16. Camels sweat only when their body temperature rises to
   (1) $\mathbf{41^o}$ C (2) $\mathbf{40^o}$ C
   (3) $\mathbf{31^o}$ C (4) $\mathbf{35^o}$ C

17. 10% rule is
   (1) Linderman's rule
   (2) Allens rule
   (3) Bergmann's rule
   (4) Vant Hoff's rule

18. The movement of the larva called Pinnotheres with the change of intensity of light is
   (1) Photokinesis
   (2) Phototaxis
   (3) Photosynthesis
   (4) Photoperiodism

19. Read the statement.
(I) Many populations under both laboratory and field conditions follow basic sigmoid pattern.
(II) The sigmoid growth curve shows how in a new environment the density of population increases.
(III) The 'S' curve is also referred to as logistic curve.
(1) All are correct
(2) I & II are correct
(3) II & III are correct
(4) I & III are correct

20. Inverted pyramid of numbers is the characteristic of
(1) Normal food chain
(2) Parasites
(3) Growing population
(4) Declining population

21. Match up zone:
A. Envythermal
B. Bird migration
C. Lentic system
D. Hibernation & Aestivation
E. Lotic Systems
1. Poikilotherms
2. Running water habitats
3. Still water habitats
4. Wide range of tolerance
5. Photo periodism

	A	B	C	D	E
(1)	V	IV	I	III	II
(2)	IV	V	III	I	II
(3)	III	IV	II	I	V
(4)	V	III	I	II	IV

22. Seasonal increase in the limnetic flora is called
(1) Benthos (2) Bloom
(3) Biomass (4) Ecological unit.

23. Read the following:
A. Floating animals come under Nektons.
B. Swimming animals come under Neustons.
C. Producers are absent in Profundal zone
(1) All are correct
(2) A & B are false, C is correct
(3) All are incorrect
(4) A & B are true, C is false

24. The total amount of the living material of a food chain present at any one time forms the pyramid of
(1) Energy (2) Bio-mass
(3) Number (4) Triangular Pyramid

25. Triangular Pyramid represents
(1) Growing Population
(2) Inrease in the number of middled aged.
(3) Denotes stable population
(5) 2 & 3

26. Positive acceleration phase in a population growth is called
(1) Logarithmic phase
(2) Stationary phase
(3) Lagphase
(4) Carrying capacity

27. The type of eco system operated in stagnant water is
(1) Lotic (2) Lentic
(3) Estuary (4) Terrestrial

28. World environment day is on

(1) 5th May (2) 5th June
(3) 5th July (4) 5th Aug

29. Lotic system is maintained in
(1) River (2) Pond
(3) Lake (4) Ocean

30. Pick out the correct sequence of a food chain.
(1) Grass – Snake – Insect - Deer
(2) Grass – Wolf – Deer - Buffalo
(3) Grass – Insect – Bird - Snake
(4) Grass – Bacteria – Rabbit - Wolf

31. O_2 rich, circulating layer of water in a pond is
(1) Hypolimnion
(2) Epilimnion
(3) Profundal zone
(4) None

32. Key industry animal in an ecosystem.
(1) Producers (2) Consumers
(3) Herbivores (4) Reducers

33. Birth & death rates of population is influenced by
(1) Density of population
(2) Growth of population
(3) Age distribution
(4) None

34. Successful nature of a population can be determined by
(1) Natality (2) Mortality
(3) Density (4) Growth

35. Main reason for pollution is
(1) Industrialization
(2) Population Growth
(3) Phtytotoxic Pollutant
(4) 1 & 2

36. National Environment Engineering Research Institute (NEERI) at Nagpur is working on
(1) Noise Pollution
(2) Air Pollution
(3) Water Pollution
(4) Aerosols

37. PH of acid rain is
(1) 2-3 (2) 1-2
(3) 4-5 (4) 3-4

38. Pesticides accumulated in higher organism in the food chain is called
(1) Biomanifestation
(2) Biomagnification
(3) Bioinformatics
(4) Bio-techniques

39. Loss of memory, eye diseases & sterility is caused to human beings because of _____
(1) Mn (2) Mg
(3) Zn (4) Hg

40. Cancer is caused if human beings take _____
(1) Ar (2) Lead
(3) Flouride (4) Flourosis

41. Burning of fossil fuels gives
(1) So_2 (2) No_2
(3) Co_2 (4) Co

42. Motor Vehicles release chloride in which form
(1) Cl_2 (2) Hcl
(3) Mncl (4) All

43. Sound is measured in units of decibels, sound harmful to man is above.
(1) 110 dB (2) 120 db
(3) 140db (4) 114 dB

44. Tajmahal is affected by
(1) Acid rain (2) Thunder
(3) Stormy gale (4) All

45. Carcinogens
(1) Polonium - 210
(2) Polycyclic hydrocarbons
(3) Smog
(4) 1 & 2

46. This is non – degradable pollutant.
(1) Sewage (2) Effluents
(3) DDT (4) None

47. These are colloidal suspensions of line particles in gas.
(1) Hydro carbons (2) Sewage
(3) Effluents (4) Aerosols

48. The ozone umbrella of the stratosphere is peeled off by
(1) Sewage (2) Arsenic
(3) Co_2 (4) None

49. This pollution leads to chromosomal mutations in Birds & Man.
(1) Mercury Pollution
(2) Air Pollution
(3) Land Pollution
(4) Thermal Pollution

50. Solar radiation of wave length less than 3600 millimicrons is
(1) ultraviolet radiation
(2) infrared radiation
(3) radio waves
(4) visible light

51. One of the human diseases due to biomagnification of heavy metals is
(1) Minamata
(2) Asthma
(3) Tuberculosis
(4) Elephantiasis

52. Acid rain will not affect
(1) plants
(2) lithosphere
(3) animals
(4) ozone layer

53. Which of the following gases contributes to global warming?
(1) CO_2
(2) NO_2
(3) CO
(4) SO_2

54. Taj Mahal is affected by
(1) acid rain
(2) thunder
(3) stormy gale
(4) all the above

55. Synecology is the study of
(1) plant community
(2) individual plant
(3) population
(4) none of the above

56. Ecological pyramids were first devised by
(1) Elton
(2) Tansley
(3) Odum
(4) Dudgeon

57. The correct path of energy flow in an ecosystem is
(1) producer – herbivore – carnivore – decomposer
(2) producer – carnivore – herbivore – decomposer
(3) herbivore – carnivore – decomposer – producer
(4) carnivore – decomposer – producer – herbivore

58. When locomotory speed of animals is influenced by light rays, the response is known as
(1) phototaxis
(2) photokinesis
(3) phototrophism
(4) photosynthesis

59. Match the following:

Sanctuary	State
A) Kaziranga wildlife sanctuary	1) Rajasthan
B) Bharatpur bird sanctuary	2) Karnataka
C) Ranganna Theethu bird sanctuary	3) West Bengal
D) Sunderbans tiger reserve	4) Assam
	5) Tamil Nadu

(1) A-4, B-1, C-2, D-3
(2) A-1, B-2, C-4, D-5
(3) A-5, B-3, C-1, D-4
(4) A-3, B-2, C-1, D-4

60. Match the following

A) Ozone	1) Bhopal tragedy
B) CO_2	2) Taj Mahal
C) MIC	3) Kyoto protocol
D) SO_2	4) Hills reaction
	5) Montreal protocol

(1) A-3, B-5, C-2, D-1
(2) A-5, B-3, C-1, D-2
(3) A-1, B-2, C-3, D-4
(4) A-4, B-1, C-3, D-2

61. The dissolved oxygen level in the aquatic medium is
(1) 6 to 7 ppm
(2) 7 to 9 ppm
(3) 4 to 5 ppm
(4) 3 to 4 ppm

62. The UNO declared 16th September as
(1) Malaria day
(2) Children's day
(3) Ozone protection day
(4) Teacher's day

63. National animal of India is
(1) Tiger
(2) Lion
(3) Kiwi
(4) Kangaroo

64. The muddy bottom zone of a lake is called
(1) profundal zone
(2) littoral zone
(3) limnetic zone
(4) thermocline

65. The total dry weight of organisms in a given space or area is called
(1) biome
(2) biomass
(3) community
(4) population

66. Aquatic organisms which are found clinging to the branches of plants are called as
(1) Epineustons
(2) Hyponeuston
(3) Periphytons
(4) Nekton

67. Aquatic organisms with limited power of locomotion are called
(1) Planktons
(2) Nektons
(3) Neustons
(4) Periphytons

68. Animals incapable of tolerating wide fluctuations of salinity are called
(1) Stenohaline
(2) Eurythermal
(3) Stenothermal
(4) Euryhaline

69. Urea is stored in blood and tissues for osmoregulation in
(1) Elasmobranchs
(2) Fresh water teleosts
(3) Marine teleosts
(4) Brackish water fishes

70. Homeostasis is meant for
(1) buoyancy
(2) locomotion
(3) constancy of chemical composition of body fluids
(4) reproduction

71. Water layer that appears between surface and bottom waters during summer stratification is called
(1) Epilimnion
(2) Thermocline
(3) Hypolimnion
(4) Profundal layer

72. The seasonal structural changes that occur cyclically in animals is called
(1) metamorphosis
(2) metagenesis
(3) cyclomorphosis
(4) morphollaxis

73. All the biotic communities in a large area living in particular climate conditions together constitute a
(1) community
(2) niche
(3) biome
(4) ecosystem

74. Functional role of an organism in an ecosystem is
(1) habitat
(2) niche
(3) territoriality
(4) biome

KEY

1. 4	2. 4	3. 1	4. 4	5. 4
6. 4	7. 1	8. 1	9. 4	10. 1
11. 3	12. 3	13. 2	14. 3	15. 3
16. 1	17. 1	18. 1	19. 1	20. 2
21. 2	22. 2	23. 2	24. 2	25. 1
26. 3	27. 2	28. 2	29. 1	30. 3
31. 2	32. 1	33. 3	34. 3	35. 4
36. 2	37. 4	38. 2	39. 1	40. 1
41. 1	42. 1	43. 4	44. 1	45. 4
46. 3	47. 4	48. 4	49. 1	50. 1
51. 1	52. 4	53. 1	54. 1	55. 1
56. 1	57. 1	58. 1	59. 1	60. 2
61. 1	62. 3	63. 1	64. 1	65. 2
66. 3	67. 1	68. 1	69. 1	70. 3
71. 2	72. 3	73. 3	74. 2	

10. Rana tigrina (frog)

- It is common frog. Body of frog is spindle shaped and slightly flattened dorsoventrally.
- Skin of frog is thin scale less and moist.
- Male frog contain vocal sac and coupulatory pads
- In female frog vocal sac and coupulatory pads are absent
- Larva of frog is called tad pole larva is herbivores Adult frog is carnivores
- Disentive system consist of alimatry canal and disestive glands
- RespiratioJKCutane ys respiration – skin
    - Buccopharyngeal respiration (Buccopharyngeal cavity)
    - Pulmonary respiration – lung
- Most sufficient respiration is cutaneous respiration only which helps in exchange of gases O_2 & CO_2
- Buccopharyngal cavity act like force pump
- Blood vascular system is closed type consist of Blood vessels Heart and blood.
- Blood is Red in colour. Contain blood cell & Plasma
- Erythrocytes leucocytes and thrombo cyctes are present
- Erythrocytes are nucleated
- Heart is 3 chambered Auricles are completely divided and ventricle is undivided due to which oxygenated and deoxygenated blood is mixed in ventricle
- Sinus venosus is a peacemaker of heart
- Conus arteriosus is present
- Nervous system is three types

1) Central nervous system - Brain and spinal cord
2) Peripheral nerves system: Cranial Nerves and spinal nerves
3) Autonoic nervous system

- Cranial nerves are "10" pairs
- Brain is divided in three parts fore brain, mid brain and hind brain.
- A pair of optic lobes are present in frog are responsible for sense off sight are called corporabigemina
- Excretory system consists of a pair of mesenophric kideys ureter and urinary bladder and a cloaea.
- Chief excretory product is urea hence called ureotelic
- Male repro ductive system of frog consist of a pair of yellowish ovoid testes seminiferous tubules, vasa efferentia and cloaca.
- Testes are attached to the kidneys and dorsal body wall by a double fold of peritoneum called mesarchium
- Female reproductive system consists of a pair of ovaries oviduct and cloaca.
- Ovaries are attached to the kidney and dorsal body wall by a double fold of peritonium is called mesovarium
- Fertilization is external in frogs in Rainy season male frog seated on female release mass of sperms are called milt and eggs are released by female frog is called spawn. They fertilize in water is called external fertilization.
- Development is external and indirect consists of tad pole larva.
- Tad pole larva centain external gills & Tail.

Rana tigrina (Frog)

1) Male frog can be distinguish by the presence of
   a) Vocal sacs b) copulatary pad on the digit of each forelimb
   c) Moist skin d) A & B

2) Frogs are not easily predated by enemies due to
   a) Well developed fore limbs and hind limbs b) Leaping action
   c) Slimmy skin d) Camoflague

3) Frog kills the prey by the process of
   a) Vocal sacs b) Buccal cavity c) Suffocation d) Chewing

4) One of the respiratory organ of frog functions like force pump
   a) Skin b) Bucco pharyngeal cavity c) lungs d) All

5) Choose the three correct statement of the following regarding circulation in frog
   I. Heart is 3 chambered.
   II. Heart situated in pericardial cavity.
   III. Conus arterious is absent.
   IV. Blood contains cry throcytes, leuco cytes and thermbo cycle.
   V. Sinus Venosus is not a pace maker
   a) I,II &V b) I, III & IV c) I,II & III d) I,II & IV

6) Match the following columns and choose the correct answer

A) Olfactory lobes, C-hemisphere And diencephalon	1) Eyes of frog
B) Cerebellum and medulla oblongata	2) Mid Brain
C) Optic lobes	3) Meninges
D) Nicti fating membrane	4) Hind Brain
	5) Fore brain

	A	B	C	D
I	**1**	**2**	**3**	**4**
II	**5**	**4**	**2**	**3**
III	**5**	**2**	**4**	**1**
IV	**5**	**4**	**2**	**1**

7) The mass of eggs are released by the female frog is named
a) Milt b) Spawn c) a & b d) ova

8) The tadpole larva of frog is
a) Terrestrial Gill breathing & carnivores b) Amphibrous Gill breaths and Herbivers c) Aqunatic Grill breathing and Herbivores
d) Aqinote Grill brecthing Insectivores

9) In male frog reproductive organ was efferentia open in to
a) Alimentary canal b) Uretary canal c)Bidders canal d) None of these

10) The ovaries of frog attached to the kidneys and dossal body wall by a double fold of peritoneum called
a) Mesorchium b)Mesovanium c)Mesenchyme d)Paranchyme

11) By the excretion of Chief Nitrosenou waster of frog is called
a) Uricotelic b) Ureotelic c) Ammonotelic d)Guanutelic

12) In frog corpara bigemina are one pair are called
a) Optic lobes b) Olfactory lobes
c)Cerebrel hemispheres d) Crura cerebri

13) During the pulmonary Respiration due to elevation of Bucco pharyngeal cavify the air forces the glottisto open and enter the lungs. Hence Buccopharyngeal cavity is called.
a)Additional respiratory chamber b) Force pump
c) Elevation pump d) Voice Chamber

14) Conus Arteriosus present in frog Absent in
a) Fishes and Amphibians b)Amphibians & Reptiles
c) Reptiles and Avers d) Reptiles, Aves and mammals

15) In frog Sinus venosus is known as
a) Force pump b) Pace Maker c) Heart pump d) Resiratory Organ

16) If frogs skin is Dried continuously with the help of blotting paper inlaboratory as a project the frog will.
a) Survive b)not survive c)Becomes weak d) gets energy

17) In frog most sufficient respiration is
a) Bucco pharyngeal Respiration b)Pulmonary Respiration
c) Cutaneous Respiration d) All

18) Hybernation and Aestivation is performed by frog. During this period they burry the sand and hide themselves becomes in active they donot consume any food but they depend for food on

a) Glycogen and fat b) Reserve Glycogen and fat
c) Lipids and proteins c)On Insects

19. The RBCs of frog is
a) Oval and Non Nucleated b)Nucleated
c) Plate like in structure b) None of these

20) The lower eye lid of a frog is folded into a transparent membrance is known as
a)Lower membrane b)Tympanic membrance
c)Nictitating membrance d) Columella auris.

KEY

1) d 2)d 3)c 4)b 5)d 6) /iv 7)b 8) c 9)c 10)b 11)b 12)a 13)b 14)d 15)b 16) b 17)c 18)b 19)b 20)c

11. Human Anatomy and Physiology - I

Digestion *and* Absorption

Digestion

It involves splitting of food molecules by hydrolysis into smaller molecules that can be absorbed through the epithelium of the gastro-intestinal tract. Human and other animals have holozoic nutrition *(i.e.,* solid or liquid form of food).

Human Digestive System

The human digestive system consists of the alimentary canal and the **digestive glands**.

Alimentary Canal

Theopeningofalimentarycanalis mouth and posteriorlythroughthe anus. *Alimentazy canal consists of different organs*

Mouth The oral cavity has teeth and a muscular tongue.

Teeth Each tooth is embedded in a socket of jaw bone. This attachment is called **thecodont.** Humans .and majority of mammals have two sets of teeth during their life a set of temporary teeth and a set of permanent adult teeth 32. This type of dentition is called diphyodont.

Dental Formula Adult human has heterodont dentition, *i.e.,* Incisors (I), Canine (C),premolar (Pm) and Molar (M). The dental formula in human is $\frac{I2, C1, Pm2, M3}{I2, C1, Pm2, M3}$

Tongue or **Lingua** The muscular organ tongue is attached to the oor of oral cavity by the frenulum. It has small projections called papillae on its upper surface, some of them contain taste buds.

Oesophagus The oesophagus and the trachea open into the pharynx a common passage for food and air).

The oesophagus is a thin, long tube which extends posteriorly passing through the neck, throax and diaphragm and leads to a J-shaped bag-like structure called stomach.

A muscular sphincter (gastro-oesophageal) regulates the opening· of oesophagus into the stomach.

Stomach The stomach, located in the upper left portion of the abdominal cavity has three major parts, *i.e.,* a **cardiac** portion, a **fundic** portion and a **pyloric** portion.

Small Intestine It is distinguishable into three regions, a U-shaped duodenum, a long coiled middle portion jejunum and a highly coiled ileum. It is the widest, shortest and most flexed part of small intestine ileum opens into the large intestine. *It consists of following parts* **caecum**, **colon** and **rectum**.

(a) **Caecum** hosts some symbiotic microorganisms.

(b) **Colon** is divided into three parts, *i.e.,* an ascending, a transverse and a descending part.

(c) **Rectum** The wall of alimentary canal from oesophagus to rectum possesses four layers, *i.e.,* serosa, muscularis, sub-mucosa and mucosa.

The innermost layer lining the lumen of the alimentary canal is the mucosa. This layer forms irregular folds in the stomach and small finger-like foldings called **villi** in the small intestine. The cells lining the villi produce numerous microscopic projections called microvilli giving a brush border appearance.

Mucosa also forms glands in the stomach and crypts in between the bases of villi in the intestine (crypts of Lieberkuhn).

Digestive Glands

The digestive glands are salivary glands, liver and pancreas. **The salivary glands** are of three pairs, *i.e.,* the parotids (cheek), the sub-maxillary/sub-mandibular (lower jaw) and the sub-lingual (below the tongue).

Liver is the largest gland of the body weighing about 1.2-1.5 kg in an adult human.

Organ	Secretion	Main Function
Mouth	-	Mechanically breaks down food.
Silvary glands	Water	Moistens food.
(accessory organs)	Muccus Salivary amylase (ptyalin) Bicarbonate	(Lubricates and binds food into bolus. Starts breakdown of starch and glycogen. Buffering action neutralises acidic food in mouth.
Stomach	-	Stones, mixes, dissovles food; regulates emptying of chyme into small intestine.
Secretory cells in stomach mucosa	Hydrochloric acid	Dissolves food particles kills many microorganisms
	Pepsinogens	Activated forms (pepsins) split apart peptide bonds in protein chains. Lubricates and protects stomach lining.

most Small intestine mixes	Mucus Gastrin –	Smail intestine Digestion and absorption of nutrients; mixes and propels chyme forward. Digestion and abosrption of most nutrients;
	Gastric-inhibitory peptide	and propels chyme forward. inhibits stomach acid secretion and motility.
Secretory cells in stomach mucosa	Assorted enzymes	Breakdown major food molecules.
Intestinal mucosa*	Mucus Secretin	Lubricates chyme. Stimulates pancreatic bicarbonate secretion, inhibits gastric acid secretion.
	Cholecystokinin	Stimulates gall bladder contraction, pancreatic enzyme secretions; inhibits stomach emptying.
Pancreas (accessory organ)	Assorted enzymes (e.g., lipase) Bicarbonate	Breakdown all major food molecules. Buffering action neutralises hydrochloric acid entering small intestine from stomach.
Liver (accessory organ)	Bile salts Bicarbonate	Hydration of emulsified fat droplets. Buffering action neutralises hydrochloric acid entering small intestine from stomach.
Gall bladder (accessory organ)	—	Stores and concentrates bile from liver.
Large intestine (colon)	—	Stores, concentrates undigested matter by absorbing water and salts; mixes and propels materials forward.
Secretory cells in intestinal mucosa	Mucus	Lubricates undigested residues.
Rectum	—	Distension triggers defecation reflex that rids body of undigested and unabsorbed

* Most enzymes are embedded in plasma membrane facing the lumen, some are released into lumen, when cells shed and disintegrate.

The hepatic lobules are the structural and functional units of liver containing hepatic cells arranged in the form of cords. Each lobule is covered bya thin connective tissue sheath called the **Glisson's capsule.**

The bile secreted by the hepatic cells passes through the hepatic ducts and stored in gall bladder.

The bile duct and the pancreatic duct open together into the duodenum as the common hepato-pancreatic duct which is guarded by a sphincter called **sphincter** of **Odii.**

The pancreas is a. compound organ (both exocrine and endocrine) situated between the

U-shaped duodenum. The exocrine part secretes an alkaline pancreatic juice containing enzymes and the endocrine portion secretes hormones, insulin and glucagon.

Process of Digestion

It takes place in following steps

1. Ingestion offood
2. Digestion of food
3. Absorption and assimilation of digested food
4. Egestion of unwanted food

1. Ingestion of Food

Food is taken through mouth cavity. It is masticated by teeth and swallowed. Ingestion takes place in buccal cavity. Salivary glands lubricate the food and bind the food particles together to form bolus. Salivary glands have starch splitting enzyme ptyalin.

2. Digestion of Food

Process of converting complex, insoluble, food particles into simple, soluble and absorbable form is called digestion.

(i) Digestion in Buccal Cavity.

In buccal cavity, salivary amylase acts on starch.

$$\underset{\text{Complex form}}{\text{Starch}} \xrightarrow{\text{Ptyalin}} \underset{\text{Simple form}}{\text{Maltose}}$$

(ii) Digestion in Stomach

The food passes down through the oesophagus into stomach. Now food is mixed with gastric juice and hydrochloric acid, which disinfect the food and create acidic medium.

Pepsin digests proteins and converts them into peptones. Renin converts milk to curd. Digested food now is called chyme.

(iii) Digestion in Small Intestine

Chyme moves to duodenum. Food is mixed with bile (liver) to breakdown fats into smaller globules. Trypsin acts upon proteins and breaks them into peptides. Amylase converts starch into. simple sugar. Lypase converts fats into fatty acids and glycerol. Food passes into ileum and mixes with intestinal juice. Maltase converts maltose into glucose. Lactase converts lactose into glucose and galactose. Sucrase converts sucrose into glucose and

fructose. Trypsin digests the peptides into amino acids. Food now is called chyle.

3. Absorption and Assimilation of Digested Food

Ileum's internal surface has finger-like folds called villi. There is a dense network of blood capillaries and lymph capillaries in each villi. It helps in absorption of food.

Absorption is the process by which the end products of digestion pass through the intestinal mucosa into the blood or lymph. It is carried out by passive, active or facilitated transport mechanisms.

Transport of water depends upon the osmotic gradient. Active transport occurs against the concentration gradient and' requires energy. Nutrients like amino acids, monosaccharides like glucose, electrolytes like Na + are absorbed into the blood by this mechanism.

Fatty acids and glycerol being insoluble cannot be absorbed into the blood. They are re-formed into very small protein coated fat globules called the chylomicrons, which are transported into the lymph vessels (lacteals) in the villi. The absorbed substances finally reach- the tissues, which

utilise them for their activities. This process is called assimilation.

The Summary of Absorption in Different Parts of Digestive System

Mouth	Stomach	Small Intestine	Large Intestine
Certain drugs coming in contact with the mucosa of mouth and lower side of the tongue are absorbed into the blood capillaries lining them.	Absorption of water, simple sugars and alcohol, etc., takes place.	Principal organ for absorption of nutrients. digestion is completed here and the final products of digestion such as glucose, fructose, fatty acids, glycerol and amino acids are absorbed through the mucosa into the blood stream and lymph.	Absorption of water, some The minerals and drugs takes place.

4. Egestion of Undigested Food

Digested food passes into large intestine, Large intestine cannot absorb food but absorbs much of the water, The remaining semi-solid waste is called faeces and is passed into

rectum. 'The digestive wastes, solidified into coherent faeces in the rectum initiate a neural reflex causing an urge or desire for its removal. It is expelled out through the anus.

Role of Digestive Enzymes

1. In Carbohydrates

Carbohydrates in the chyme are hydrolysed by' pancreatic amylase into disaccharides.

$$\text{Polysaccharides (starch)} \xrightarrow{\text{Amylase}} \text{Disaccharides}$$

2. In fats

Fats are broken down by lipases with the help of bile into di and monoglycerides.

$$\text{Fats} \xrightarrow{\text{Lipase}} \text{Diglycerides} \longrightarrow \text{Monoglycerides}$$

3. In Proteins .

Proteins, proteoses and peptones (partially hydrolysed proteins) in the chyme reaching the Pntestine are acted upon by the proteolytic enzymes of pancreatic juice.

$$\left.\begin{matrix}\text{Protein}\\ \text{Peptones}\\ \text{Proteoses}\end{matrix}\right\} \xrightarrow[\text{Carboxypeptidase}]{\text{Trypsin/Chymotrypsin}} \text{Dipeptides}$$

4. In Nucleic Acids

Nucleic acids in the pancreatic juice acts on nucleic acids to form nucleotides and nucleosides.

$$\text{Nucleic acids} \xrightarrow{\text{Nucleases}} \text{Nucleoties} \longrightarrow \text{Nucleosides}$$

The enzymes in the succus entericus (intestinal juice) act on the above products to form following simple absorbable forms.

$$\text{Di and monoglycerides} \xrightarrow{\text{Lipases}} \text{Fatty acids} + \text{Glycerol}$$

$$\text{Dipeptides} \xrightarrow{\text{Dipeptidases}} \text{Amino acids}$$

$$\text{Maltose} \xrightarrow{\text{Maltase}} \text{Glucose} + \text{Glucose}$$

$$\text{Lactase} \xrightarrow{\text{Lactose}} \text{Glucose} + \text{Galactose}$$

$$\text{Sucrase} \xrightarrow{\text{Sucrose}} \text{Glucose} + \text{Fructose}$$

$$\text{Nucleotides} \xrightarrow{\text{Nucleotidases}} \text{Nucleosides} \xrightarrow[\text{Sugars + Bases}]{\text{Nucleosidase}}$$

Major Enzymes Involved in Digestion of Carbohydrate, Protein, Fat and Nucleic Acids

Enzyme	Source	Where Active	Substrate	Main Breakdown Product
Carbohydrate Digestion				
Salivary amylase	Salivary glands	Mouth	Polysaccharides	Disaccharides
Pancreatic amylase	Pancreas	Small intestine	Polysaccharides	Disaccharides
Disaccharidases	Small intestine	Small intestine	Disaccharides	Monosaccharides (e.g., glucose)
Protein Digestion				
Pepsin	Stomach mucosa	Stomach	Proteins	Peptide fragments
Trypsin and chymotrypsin	Pancreas	Small intestine	Proteins and polypeptides	Peptide fragments
Carboxypeptidase	Pancreas	Small intestine	Peptide fragments	Amino acids
Amino peptidase	Intestinal mucosa	Small intestine	Peptide fragments	Amino acids
Fat Digestion				
Lipase	Pancreas	Small intestine	Triglycerides	Free fatty acis and monoglycerides
Nucleic Acid Digestion				
Pancreatic nucleases	Pancreas	Small intestine	DNA and RNA	Nucleotides
Intestinal nucleases	Intestinal mucosa	Small intestine	Nucleotides	Nucleotide bases and monosaccharides

Gastrointestinal Hormones Related to Digestion

The endocrine cells present in different parts of gastrointestinal tract secrete following hormones. All these hormones are proteinaceous in nature.

(i) Gastrin It acts on gastric glands and stimulates the secretion of hydrochloric acid and pepsinogen.

(ii) Secretin It acts on exocrine pancreas and stimulates secretion of water and bicarbonate ions.

(iii) Cholecystokinin (CCK) It stimulates the secretion of pancreatic enzymes and bile juice.

(iv) Pancreozymin It stimulates pancreas to secrete enzymes.

(v) Duocrinin It is an intestinal hormone. It stimulates the secretion of mucus and HCO_3 from Brunner's glands.

(vi) Enterogastrone It inhibits the secretion of gastric juice.

Calorific Fuel Value

It is the amount of energy liberated during complete combustion of 1g of a substance in bomb calorimeter. For carbohydrates, gross energy of per gram caloric value is 4.7 kcal.

For fat, caloric value is 9.45 kcal. For proteins, gross energy ,or per gram caloric value is 4.64 kcal.-

According to these caloric values of different nutrients, fats have the highest calorific fuel value.

Nutritional and Digestive Disorders

The alimentary canal may be injected with the various infectious agents like bacteria, virus tapeworm, roundworm, hookwarm, etc. These infections and other malnutrition may lead to many common digestive disorders,

Some important ones are given here

1. Protein Energy Malnutrition (PEM)

Thecommon PEM disorders are kwashiorkor and marasmus.

(i) Kwashiorkor

It commonly affects the' infants and children between 1-3 years of age. The common symptoms are underweight, stunted growth, loss of appetite, anaemia, bulging eyes. Its main causes are protein deficient diet, diarrhoea, measles, respiratory infections.

(i i) **Marasmus**

It is caused by the deficiency of proteins and total food calorific value that is deficient in all nutrients. Ribs become prominent, limbs become thin and skin becomes dry, thin and wrinkled.

2. **Indigestion**

It occurs due to overeating or due to some non-easily digestile foods. Itcan also be due to smoking, drinking *alcohol* or *certain* stomach *problems.* It can be prevented by avoiding fatty, greasy foods, eating too much citrus fruits, etc.

3.. **Constipation**

It is the condition of difficult egestion of faeces. It can be treated by taking sufficient water and roughage in diet.

4. **Vomiting**

It is the ejection of stomach contents through the mouth. This reflex action is controlled by the vomit centre in the medulla.

5. **Diarrhoea**

The abnormal frequency of bowl movement and increased liquidity of the faecal matter is called diarrhoea. It reduces the absorption of food.

6. **Jaundice**

It is the yellowness of the skin, mucosa membranes and eyes due to excessive secretion of bilirubin and deposition of bile pigments. The. main reason is the inability of the liver dispose of the bilirubin provided by the circulatory system.

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Human Anatomy & Physiology - I

Digestion & Absorption

1) The opening of the common bile duct is guarded by this sphincter
   a) Pyloric b) oddi c) ileo caecal d) muscular mucosa

2) The dental formula of the milk dentition of a baby is
   a) $\frac{2\,1\,2\,3}{2\,1\,2\,3}$ b) $\frac{2\,1\,0\,2}{2\,1\,0\,2}$ c) $\frac{2\,0\,1\,2}{2\,0\,1\,2}$ d) $\frac{2\,1\,0\,2}{2\,1\,0\,2}$

3) The dental formula of the adult man
   a) $\frac{2\,1\,3\,2}{2\,1\,3\,2}$ b) $\frac{2\,1\,2\,3}{2\,1\,2\,3}$ c) $\frac{3\,1\,2\,3}{3\,1\,2\,3}$ d) $\frac{1\,2\,3\,2}{1\,2\,3\,2}$

4) Heparin is produced by
   1. Liver, mast cells, acido phils
   2. Pancreas, mast cells, Baso phils
   3. Liver,mast cells, Baso phils
   4. Pari crees, mast cells, Acdio phils
   5. Saccus enteric us is secreted by
   a) Brunner's glands b) Crypts of lieberkhum.
   b) Chief cells d) Both b & c

5) Name the salivary gland which is absent in man
   1. Infra orbital gland 2. Sub maxillary 3. Parotid gland 4. Sublingual

6) The composition of saliva is in man
   1. Water, salt, mucin & Hcl 2. Water, Salt, mucin, ptyalin & Bilirubin

   3. Water, Salt, mucin, ptyalin & lysozyme 4. Water, Salts, mucin & lysozume

7) The pH of saliva is
   a) 7.4 b) 6.4 c) 6.8 d) 1.5

8) A. Surgeon will give Vit 'K' injection before they start any operation
   R. Vit 'K' is known as Anti hemorrhagic vitamin
   1. A & R are correct 2. A & R are false

3. A & R are correct 'R' is correct explanation of 'A'
4. A & R are correct 'R' is correct explanation of 'A'

9) The dentition of human is
   1. Monophyodont, the codont, Polyphyodont
   2. Heterodont, the codont & Diphyodont
   3. Heterodont, Pleuro dont & Diphyodunt
   4. Homodont, Acrodont & Manophyodont

10) Which of the following is not an enzyme
   1. Trypsin 2. Amylase 3. Lipase 4. Gastrin

11) Kupffer cells are found in
   1. Gall baldder 2. Pancreas 3. Liver 4. Stomach

12) One of the following secretes both enzymes & Hormone
   1. Bone marrow 2. thyroid 3. Pituitary 4. Pancreas

13) Statement:-
   i) Vermiform Appendix arises from a caecum is known as vestigial organ in man
   ii) Hairs present on the body, Extenal ear & wisdom tooth are also vestigeal organs.
   iii) A narrow space between the lips, cheecks & gums is known as vestibule.
   Choose the correct answer
   1) i & ii 2) ii & iii 3) I & iii 4) I,ii & iii

14)

food substance	**Enzyme**	**Products**
I) Proteins	Trypsin	Tripeptides + Depeptrides
II) Tripeptides	Chymotrysin	Depeptrides + Amino acid
III) Dipeptrides	Dipeptridase	Amino acid
IV) Monoglycerides	Lipase	Falty acid + glycerol

Which of the above are in correct?
1) I & II 2) II & III 3) III & IV 4) I,III & IV

15)

food substance	Enzyme	Products
I) Carbohydrates	Amylase	Maltose, Sucrose & Lactose
II) Maltose	Maltase	Glucose + Galactose
III) Sucrose	Invertase	Glucose + cellucose
IV) Lactose	Lactase	Glucose + Galactose

Which of the above are in correct?

1) I & II 2) II & III 3) III & IV 4) I & IV

16) Match the following (2 columns matching)

A. Jaundice	I Spicy food & over eating
B. Vomiting	II Medulla oblongata
C. Diarrhea	III Bilirubin & Biliverdin deposition
D. Indigestion	IV Dehydration
	V Bowel Irregularity due to low content of water

	A	B	C	D
a)	III	II	III	IV
b)	II	I	IV	III
c)	III	II	IV	I
d)	V	III	II	IV

17) In large intestine these substances are absorbed

a) Proteins & alcohol b) Water, simple sugar & alcohol

b) Water, minerals & drugs d) Water, vitamins & disgested food

18) One of the following organ in adult man is thermo regulatory & erythro clastic in function.

a) Heart b) Liver c) Pancreas d) Spleen

19) Which of the following enzymes carries out of the initial step in the digestion of milk in Human?

a) Renin b) lipase c) Trypsin d) Pepsin

20) Brunner's gland is present in

a) Liver b) due denum c) oesop heges d) stomach

21) Assertion (A) In Alcoholic drink, the Alcohol is converted into Glucose in liver
Reason (R) Liver cells are able to produce Glucose from Alcohol by back fermentation.

1. Both A & R are correct
2. Both A & R are false
3. 'A' is true but 'R' false
4. 'R' is true but 'A' false

22) Assertion 'Saliva is a secretion of salivary gland
Reason Saliva is a mixture of water & electrolytes derived from blood plasma

a) A & R are false
b) A is true & R is true & R is the correct explanation of 'A'
c) A is true & R is true & R is the not correct explanation of 'A'
d) A is false & R is true & R is the correct explanation of 'A'

24) Match the following columns & choose the correct answer

A.	Pancreatic Juice	I Intestinal mucosal epithelium
B.	Goblet cells	II liver
C.	Jaundice	III Lipases
D.	Digestion of fat	IV Trypsinogen
		V Amylase

	A	B	C	D
a)	I	II	III	IV
b)	IV	II	III	I
c)	IV	I	II	III
d)	IV	I	II	V

25) In Human being no. of teeth grow twice is
a) 8 b) 12 c) 16 d) 20

26) Identify the correct statement
A: Liver is the first check post in the body which detoxify the toxins.
B: In Alcoholic persons fungal toxins causes liver cirrhosis & liver cancer.
C: Aflatoxins are not metabolized in to the same other nontoxic substances during healthy or general conditions.

a) A is true, B & C are false.
b) B & C are true & A is false
c) A, B & C are true, none is false
d) A & B are true & C is false

27) The salivary glands are present in Human beings are
a) Parotid, Infra orbital, sub lingual gland
b) Parotid gland, sub maxillary & sub mandible
c) Sub maxillary, Infra orbital & Sub lingual gland
d) Parotid gland, sub maxillary & sub lingual.

28) Gastro Intestinal Hormones are
a) Gastrin & Secretin c) Enterogastrone & Cholestokinin
b) Secretin & thyroxin d) 1 & 2

29) Find out the correct series of names

1) Oesophagus, Cardiac stomach, fundus & pyloric
2) fundus, Oesophagus, Cardiac stomach & pyloric
3) fundus, Cardia, Oesophagus & pyloric
4) Cardiac, fundus, Oesophagus & pyloric

30) Find out the correct statement
A: Vomiting is throwing out of the contents of the stomach through the mouth.
B: Vomiting controlled by the vomiting centre is known as medulla oblongata.
C: Indigestion cases due to over eating, spicy foods & anxiety.
D: The normal frequency of Bowel movement and decreased liquidity of the faecal discharge is diarrhea.
1) A & B are true and C & D are false. 2) A, D & C are true and B is false.
3) A, B & C are true and D is false. 4) A, B, C & D are true and none is false.

KEY

1) b 2) b 3) b 4) c 5) b 6) a 7) c 8) c 9) c 10) 2 11) 4 12) 3 13) d
14) 4 15) 4 16) 2 17) 3 18) c 19) b 20) d 21) b 22) c 23) c 24) c 25)d
26) d 27) d 28) d 29) c 30) c

Breathing *and* Respiration

(Human Respiratory System)

Breathing

It is an oxidative process involving the oxidation of food substances such as carbohydrates, fats and proteins within the tissues to form CO_2, water and consequent release of energy. The released energy is temporarily stored as ATP.

Types of Respiration

Respiration may be of two types, *i.e.,* anaerobic respiration (the respiration without oxygen) and aerobic respiration (respiration that requires oxygen).

Anaerobic Respiration

When food is oxidised without using molecular oxygen,the respiration is called anaerobic respiration, *e.g.;* anaerobic bacteria, yeast, parasitic worms like *Ascaris, Taenia, Fasciola,* etc.

In microorganisms, the term 'fermentation' is more commonly used in place of anaerobic respiration, which is defined as the anaerobic breakdown of carbohydrates and other organic compounds into alcohols, organic acids, gases, etc., with the help of microorganisms or their enzymes.

Aerobic Respiration

When oxygen is used for respiration, it is called aerobic respiration, *e.g.,* most plants and animals. In higher animals, whole process of respiration includes external respiration, internal respiration and cellular respiration.

Mechanism of Breathing

The process ofrespiration mainly includes two phases

1. External Respiration

It is the process by which gases are exchanged between the blood and the air. It is a physical process. It is simply the intake of oxygen and giving out of carbon dioxide.

Respiratory movement involve two phases

(i) Inspiration (ii) Expiration

(i) Inspiration

It is a process, by which fresh air enters in the lungs. Inthis, diaphragm becomes flat and gets lowered by the, contraction of its muscle fibres and increases the volume of thoracic cavity. The external intercostal muscles contract and pull the ribs and sternum upwards and outwards direction and thus the volume of thoracic cavity is increased.

(ii) Expiration

It is a process, by which CO_2 is expelled out from the lungs. Muscle fibres of the diaphragm relax make it convex, decreasing the volume of the thoracic cavity. External intercostal muscles relax and pull the ribs downwards and inwards direction, thus decreasing the size of the thoracic cavity.

2. Internal Respiration

It is the process, by which gases are exchanged between blood and tissue fluid and between tissue fluid and cells.

Cellular respiration is the process, by which cells useoxygen (O_2) for metabolism and give off carbon diodide (CO_2) as a waste.

Respiratory Organs of Some Animals

Lungs	Respiratory Organ Animal
Skin	Reptiles and mammals
Gills	Frog, earthworm and leeches
Trachea	Fishes, tadpoles and prawns
Body surface	Insects, centipedes and millipedes
Book lungs	Protozoans, porifers and coelenterates
Book gills	Spider, scorpion, ticks and mites
Mental	King crab, prawn, cray fish and *Daphnia*
Air bladder	Mollusca *(Unio)*
Air Sacs/lungs	Lung fish and bony fishes (e.g., *Labeo)* Birds

Human Respiratory System

Structurally and functionally the conducting part of human respiratory system is highly complicated.

The respiratory system is derived from embryonic endoderm.

The mammalian respiratory system consists of two groups

	Respiratory tracts		**Respiratory organs**
(i)	Nostrils	(i)	Bronchiole
(ii)	Nasal cavity	(ii)	Alveoli
(iii)	Larynx	(iii)	Lungs
(iv)	Trachea	(iv)	Diaphragm
(v)	Bronchi		

1. Respiratory Tracts

Different types of respiratory tracts are as *follows*

(i) Nostrils

Holes of the nose are called nostrils, these are paired openings that open up into the nasal chambers.

(ii) Nasal Cavity

It is divided into two nasal chambers by the nasal septum. Each nasal chamber consists of three. regions, *i.e.,* vestibular, respiratory and olfactory regions.

(iii) Larynx

Larynx contains vocal cords the sound producing elastic fibres called voice box.

- There is a little difference in the size of the larynx in man and woman, it grows larger and becomes prominent in man, therefore, it is called Adam's apple in man,
- Human larynx consists of glottis, cartilages, hyoid bone, thyrohyoid membrane, vocal cords, laryngeal ligaments and muscles.
- Glottis is an opening in the floor of pharynx leading to larynx.
- There are nine pieces of cartilages (3 are single and 3 are paired)
- Epiglottisisaleaf-Iike structure that prevents the entry of food into respiratory tract during swallowing.

(iv) Trachea

The trachea or windpipe is a continuation of the larynx, Trachea is supported by incomplete (C-shaped) rings of hyaline cartilages. The mucosa of trachea is lined with a ciliated pseudostratified epithelium containing mucous secreting Goblet cells, which helps in pushing mucus out.

(v) Bronchi

These are one pair of small, this walled tubular structures formed by the division of trachea at the level of 5th thoracic vertebra.

2. Respiratory Organs

(i) Lungs

Each lung is covered by double membrane called pleurae. The' outer covering membrane of lung is called parietal .pleura. The inner covering membrane of lung is called 'visceral pleura. In human, the right lung has three lobes and left lung has two lobes.

(ii) Alveoli

The alveoli are the ultimate structural and physiological units of lung. These provide great surface area (like villi of intestine in mammals) for gaseous exchange by diffusion. Gaseous exchange occurs across the respiratory membrane of the alveoli.

(iii) Bronchiole

The tertiary bronchi sub-divided into smaller branches, the bronchioles. After repeated branching one of the smaller bronchiole enter a lung lobule called lobular bronchiole.

(iv) Diaphragm

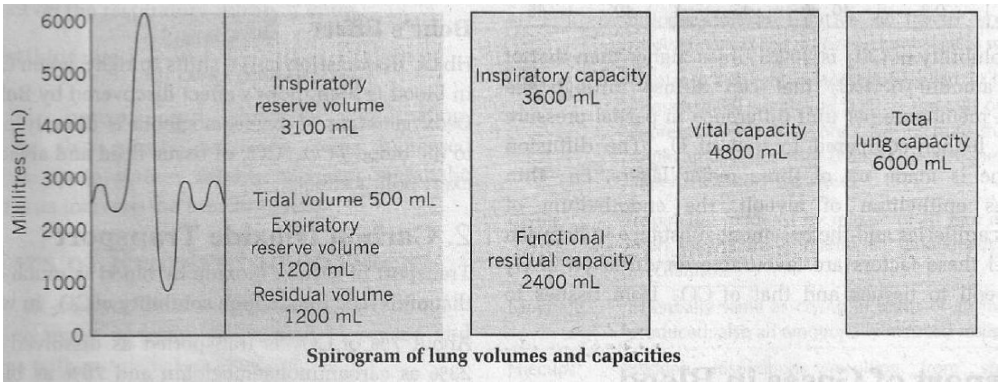
The diaphragm is a dome-shaped muscular structure separating the thoracic and abdominal cavities. The diaphragm is characteristic of mammals. The diaphragm is supplied by the phrenic nerves. Puncturing of diaphragm results in stoppage of breathing and is fatal.

Principal Organs of the Respiratory System

Structure	Description, General and Distinctive Feature	Function
Nose	Jutting external portion supported by bone and cartilage; internal nasal cavity divided by midline nasal septum and lined with mucosa.	Produces mucus; filters, warms and moistens incoming air; resonance chamber for speech.
	Roof of nasal cavity contains olfactory epithelium. Paranasal sinuses around nasal cavity.	Receptors for sense of smell. Same as for nasal cavity; also lighten skull.
Pharynx	Passageway connecting nasal cavity to larynx and oral cavity to oesophagus; three sub-divisions : nasopharynx, oropharynx and laryngopharynx.	Passageway for air and food.
	Houses tonsils (lymphoid tissue masses involved in body protection against pathogens).	Facilitates exposure of immune system to inhaled antigens.
Larynx	Connects pharynx to trachea, framework of cartilage and dense connective tissue; opening (glottis) can be closed by epiglottis or vocal folds.	Air passageway; prevents food from entering lower respiratory tract.
	Houses true vocal cords.	Voice production.
Trachea	Flexible tube running from larynx and dividing inferiorly into two primary bronchi; walls contain C-shaped cartilages that are incomplete posteriorly, connected by trachealis muscle.	Air passageway; cleans, warms and moistens the incoming air.
Bronchial tree	Consists of right and left primary bronchi, which sub-divide within the lungs to form secondary and tertiary bronchi and bronchioles; bronchiolar walls contain complete layer of smooth muscle; constriction of this muscle impedes expiration.	Air passageways connecting trachea with alveoli; cleans, warms and moistens incoming air.
Alveoli	Microscopic chamber at terminal of bronchial tree; walls of simple squamous epithelium underlain by thin basement membrane; external surfaces intimately associated with pulmonary capillaries.	Main sites of gas exchange.
	Special alveolar cells produce surfactant.	Reduces surface tension; helps to prevent lung collapse.
Lungs	Paired composite organ located within pleural cavities of thorax, composed primarily of alveoli and respiratory passageways; stroma is fibrous elastic connective tissue, allowing lungs to recoil passively during expiration.	House of respiratory passages smaller than the primary bronchi.
Pleurae	Serous membranes; parietal pleura lines thoracic cavity, visceral pleura covers external lung surfaces.	Produce lubricating fluid and compartmentalise lungs.

Respiratory Volumes and Capacities

The quantities of air, that lung can receive, hold or expel under different conditions are called pulmonary or respiratory volumes and combination of two or more pulmonary volumes are called pulmonary capacities, The apparatus commonly used to measure the pulmonary volumes is a spirometer or respirometer.



Spirogram of lung volumes and capacities

The recording of breathing is known as spirogram. There are four respiratory volumes, *i.e.,* Tidal Volume (TV), Inspiratory Reserve Volume (IRV), Expiratory Reserve Volume (ERV), Residual Volume (RV) and four respiratory capacities, *i.e.,* Inspiratory Capacity (IC), Functional Residual Capacity (FRC), Vital Capacity (VC) and Total Lung Capacity (TLC).

Respiratory Volume and Capacity for Males and Females

Measurement	Adult Male Average Value	Adult Female Average Value	Description
Respiratory Volumes			
Tidal Volume TV	500 mL	500 mL	Amount of air inhaled or exhaled with each breath under resting conditions.
Inspiratory Reserve Volume IRV	3100 mL	1900 mL	Amount of air that can be forcefully inhaled after a normal tidal volume inhalation.
Expiratory Reserve Volume ERV	1200 mL	700 mL	Amount of air that can be forcefully exhaled after a normal tidal volume exhalation.
Residual Volume RV	1200 mL	1100 mL	Amount of air remaining in the lungs after a forced exhalation.
Respiratory Capacities			
Total Lung Capacity (TLC)	6000 mL	4200 mL	Maximum amount of air contained in lungs after a maximum inspiratory effort; TLC = TV + IRV + ERV + RV
Vital Capacity VC	4800 mL	3100 mL	Maximum amount of air that can be expired after a maximum inspiratory effort; VC = TV + IRV + ERV (should be 80% TLC)
Inspiratory Capacity IC	3600 mL	2400 mL	Maximum amount of air that can be inspired after a normal expiration; IC = TV + IRV
Functional Residual Capacity FRC	2400 mL	1800 mL	Volume of air remaining in the lungs after a normal tidal volume expiration; FRC = ERV + RV

Exchange of Gases

Breathing p onary ventilation) is the process of moving air into and out of the lungs.

Pulmonary Gas Exchange

Alveoli are the primary sites of exchange of gases. Exchange of gases also occur between blood and tissues. Solubility of gases as we::' as the thickness of the membranes involved in diffusion are. important factors that can affect the rate of diffusion, Partial pressure of O_2 and CO_2 in the atmospheric air and the two sites of diffusion are given ahead.

Partial Pressure (in mm Hg) of Oxygen and Carbon Dioxide

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissue
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

As the solubility of CO_2 is 20-25 times higher than that of O_2, the amount of CO_2 that can diffuse through the diffusion membrane per unit difference in partial pressure is much higher compared to that of O_2, The diffusion membrane is made up of three major layers, *i.e.,* thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance in between them. All these factors are favourable for diffusion of O_2 from alveoli to tissues and that of CO_2 from tissues to alveoli.

Transport of Gases in BIood

Blood transport oxygen from the respiratory organs to the tissue cells and also transports carbon dioxide from the tissue cells to the respiratory membrane.

1. Oxygen Transport

98.5% of oxygen (O_2) is transported by blood with the help of . the respiratory pigment haemoglobin present in erythrocytes (RBCs).

1 molecule of haemoglobin can carry as much as 4 oxy.gen molecules.

1 gram of haemoglobin binds about 1.34 mL of oxygen (O_2), Thus, 100 mL of pure blood carries about 20 mL of oxygen.

Oxygen-Haemoglobin Dissociation Curve

When a graph is plotted between per cent saturation of haemoglobin and oxygen tension, a curve is obtained, which is termed as Hb-O_2 dissociation curve.

At normal condition' that is on *p*CO_2 of 40 mm Hg concentration, this curve' is sigmoid and normal. Due to increase in concentration of CO_2, curve is shifted towards right side. Due to decrease in concentration of CO_2, curve is shifted towards left side. '

Bohr's Effect

Hb-O_2 dissociation curve shifts to right, when CO_2 tension in blood is high. Bohr's effect discovered by **Bohr** in 1904. Deoxygenation of oxyhaemoglobin is directly proportional to the blood *pC02*. CO2 of tissue fluid and alveoli does not exert Bohr's effect.

2. **Carbon Dioxide Transport**

Transport 'of carbon' dioxide by blood is much easier than that of oxygen due to high solubility of CO_2 in water.

About 7% of CO_2 is transported as dissolved in plasma, 23% as carbaminohaemoglobin and 70% as bicarbonates.

Most of the CO_2 is ,transported by blood in the form of sodinm bicarbonate in plasma.

Chloride Shift or Hamburger's Phenomenon

To maintain electrostatic neutrality of plasma, many chloride ions diffuse from plasma into RBCs and bicarbonate ions· pass out. The chloride content of RBCs increases, when oxygenated- blood becomes deoxygenated. This is termed as **chloride shift** or **Hamburger shift**.

Entering of cr ions into RBCs is known as positive chloride shift. Shifting of Cl" ions from RBCs into plasma is known as **negative chloride shift**.

Haldane's Effect

It is important in promoting CO_2 transport. Oxyhaemoglobin behaves as a strong acid. As more and' more oxyhaemoglobin forms in the lungs, it releases more and more H+ ions increasing the acidity of blood. This is known as Haldane's effect.

Regulation of Respiration

Respiratory movements are under the control of medulla oblongata.

- The basic rhythm of respiration is controlled by the respiratory centre present in brain

stem (medulla and pons). The medullary rhythmic area can be divided into a Dorsal Respiratory Group (DRG) and a Ventral Respiratory Group (VRG).

- The receptors for chemical regulation are located in carotid bodies, aortic bodies and in brain.
- The carotid and aortic bodies are situated in association with heart. The carotid and aortic bodies are responsible for the detection of O_2 concentration in blood and its affect on breathing; These are considered as peripheral chemoreceptors. Thus, the blood oxygen does not have direct effect on the respiratory centre of brain.

$$\text{Breathing rate} \propto \frac{1}{O_2 \text{ concentration}}$$

- Along with nervous and chemical coordination, temperature also affects breathing rate. Increased temperature up to certain extent, increases metabolic activities; thus increase the breathing rate.

Disorders of Respiratory System

Bronchitis is caused by the permanent swelling in bronchi. As a result of bronchitis, cough is caused and thick mucous with pus cells is spitted out.

Bronchial asthma is an allergic attack of breathlessness associated with bronchial obstruction.vcharacterised by coughing and difficult breathing.

Emphysema, a condition, in which the walls separating the alveoli breaks resulting in the reduction of surface area for the exchange of respiratory gases. Heavy cigarette smoking leads to emphysema.

Pneumonia is an acute 'infection or inflammation of the alveoli. The most common cause of pneumonia is the pneumococcal bacterium *Streptococcus pneumoniae*

Lung cancer is believed that lung cancer is caused by .excessive smoking. The tissue increases limitlessly, which is called malignancy. The blood capillaries are ruptured, blood starts flowing and death is caused by excessive bleeding.

Hay fever is an allergic disorder of nasal lining. It. develops due to hypersensitivity of the lining to pollen grains or other foreign particles. There is an episode of sneezing that begins following allergy.

Occupational Respiratory Disorders

Anthracosis pneumoconiosis of eoal workers deposition of fibrous tissue in the lungs causing bronchitis and emphysema.

Silicosis It is du'e to long exposure to dust containing silicon compounds. Workers of glass industry, potters, gold and copper miners develop progressive fibrosis in the liver.

Composition of Respiratory Gases

The percentage of oxygen in inhaled air (inspired air) is about 21~, whereas in expired air is about 16%.

Composition of Air During Breathing

Air	Oxygen	Carbon Dioxide	Nitrogen	Water Vapour
Inspired air	20.84%	0.04%	78.62%	0.5%
Expired air	15.70%	4.00%	78.62%	6.2%

- Each gas in the mixture exerts a part of the total pressure proportional to its concentration, *i.e.*, the partial pressure. This is denoted as, pO_2 and pCO_2.

Partial Pressure (in mm Hg) of Respiratory Gases

Gas	Oxygen	Carbon dioxide	Nitrogen
Inspired air	158	0.3	596
Alveolar air	100-105	40	573
Venous blood	40	46	573
Arterial blood	95-100	40 5	73
Expired air	116	32	565

Respiratory Pigments in Some Animals

Name of Pigment	Colour (oxidised)	Metal	Place	Example
Haemoglobin	Red	Fe	RBC	Chordata (vertebrate)
Haemocyanin	Blue	Cu	Plasma	Mollusca and Arthropoda
Haemoerythrin	Red	Fe	Corpuscle	Annelida, *Sipunculoidea* and *Lingula*
Echinochrome	Red	Fe	Coelomic fluid	Echinodermata
Haemoglobin	Red	Fe	Plasma	Earthworm, *Nereis, Arenicola, Chironomus* insect and *Planorbis*
Pinnaglobin	Brown	Mn	Coelomic fluid	*Pinna* (mollusc)

Some Common Medical Terminology	
Terminology	**Explanation**
Apnea	Absence of breathing
Eupnea	Normal breathing
Hypopnea	Decreased breathing rate
Hyperpnea	Increased breathing rate
Dyspnea	Painful breathing
Orthopnea	Inability to breath in a horizontal position
Acapnoea	Absence of CO_2 in blood
Hypocapnea	Deficiency of CO_2 in blood
Hypercapnea	Excess of CO_2 in blood

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Breathing and Respiration
(Human Respiratory System)

(1) The double layered membranes covered to the lungs is known as
(a) Pericardial Membrane (b) Pleura (c) Nicera (d) Corona

(2) The mid ventral part of the hyoid cartilage forms the laryngeal prominence called
(a) Trachea (b) Pharynx (c) Adam's Apple (d) Canchae

(3) In adult males vocal cards are thicker, longer produce
(a) High pitch voice (b) Low pitch voice
(c) Both a & b (d) no pitch vocice

(4) The space between the true vocal cards is called
(a) Epiglottis (b) Glotis
(c) rima glottis (d) arytenoids cartrilages

(5) A healthy Human breaths normally per minutes is
(a) 12 to 13 times (b) 12 to 15 times
(c) 12 to 16 times (d) 13 to 18 times

(6) The volume of the air involved in breathing movements can be estimated by
(a) Barometer (b) Spiro meter
(c) Sphygmomano meter (d) Calorimeter

(7) Match the following and choose the correct answer

(a) Tidal Volume	I)	100 to 1100 ml.
(b) Residual Volume	II)	1100 to 1200 ml.
(c) Expiratory Reserve Volume	III)	6000 to 8000 ml per minute
(d) Inspiratory Capacity (IC)	IV)	V.C.
	V)	IV + IRC

	A	B	C	D
1)	I	II	III	IV
2)	II	IV	I	III
3)	III	II	I	V
4)	III	II	I	IV

(8) Total lung capacity (TLC) means
(a) TV + IRV + ERV (b) VC + RV
(c) FRC (d) All

(9) In one of the following organ respiratory rhythm centre is present in man
(a) Fore Brain (b) Mid Brain
(c) Medulla oblongata (d) Pans varoli

(10) Conchae are known as
(a) Nasal Chambers
(b) Three thin twisted bony plates in Nasal chambers
(c) Respiratory Part (d) b & c

(11) Transport of oxygen by RBC is
(a) 3% (b) 30% (c) 97% (d) 100%

(12) The conditions are favorable for dissociation of O_2 from oxyhemoglobin under these conditions oxygen dissociation curve shifts away from the Y axis.
(a) to the left (b) to the right
(c) to the right and left (d) None of these.

(13) The effect of PCO_2 & its concentration on the oxygen affinity of Hemoglobin is called
(a) Chloride shift (b) Hamburg's Phenomena
(c) Bohr effect (d) Haldane's phenomena

(14) The percentage of CO_2 is comed through plasma in dissolved condition is
(a) 5% (b) 6% (c) 7% (d) 10%

(15) Match the following and choose the correct answer

(a) Asbestosis				I) Inhalation of coal dust
(b) Silicosis				II) Inhalation of Cold dust
(c) Siderusis				III) Hyper ferremia
(d) Black lung Cancer				IV) Asbestos Industry
				V) Silica dust
	A	B	C	D
1)	I	II	III	IV
2)	IV	V	III	II
3)	IV	V	III	I
4)	V	IV	III	I

(16) Pneumonia is caused by bacteria is known as
(a) Step to cocci (b) Strep to cocus pneumoniae
(c) Salmonellatyphi (d) Mycobacterium tuberculosis

(17) Bronchitis is the inflammation of the bronchi symptoms include
(a) Acute cough with thick mucus
(b) Chronic cough with thick mucus
(c) Chronic cough with thin mucus
(d) sneezing with flowing of mucus

(18) Respiration is controlled by
(a) Cerebellum (b) Medulla oblongata
(c) Olfactary lobes (d) Hypothalamus

(19) Which of the following chemical reaction can occur aerobically
(a) Krebs cycle (b) Glycolysis
(c) Conversion of lactic acid to pyruric acid
(d) Conversion of pyruric acitd to Acetyl co A

(20) Partial pressure of O_2 in the inspirable and expired air is respectively
(a) 158 & 40 mm Hg (b) 158 & 116 mm Hg
(c) 100 and 95 mm Hg (d) 40 & 95 mm Hg

(21) Which combination of muscles contraction causes inspiration
(a) Internal intercostals – Diaphragms
(b) Diaphragm – Abdominal complex
(c) External Intercostals
(d) External – Internal Intercostals

(22) Increase of oxy hemoglobin leads to increase in acidic nature is
(a) Bohr's effect (b) Hamburg's Phenomena
(c) Halden's effect (d) Chloride shift

(23) Assertion (A) Tidal volume is the volume of air inspired or expired with the normal breath. Reason (R): Adult person contains 500 ml expired
or inspired volume of air with each normal breath.
(a) Both A & R are true but R is the correct explanation of A.
(b) Both A & R are true, but R is not the correct explanation of A.
(c) A is true & R is false.
(d) R is true and A is false and R is the correct explanation of A.

(24) Match the following and choose the correct answer

(a) Vestibule		I)	Prevent entry of food in trachea
(b) Epiglottis		II)	Contraction of diaphragm
(c) Inspiration		III)	Relaxation of diaphragm
(d) Expiration		IV)	Inside the nose
		V)	Out side the nose

	A	B	C	D
1)	V	I	II	III
2)	V	I	II	III
3)	IV	I	III	II
4)	IV	II	I	III

(25) Match the following and choose the correct answer

(I)	Black lung	-	lung disease – coal workers
(II)	Asthma	-	lung disease – Allergic disorder
(III)	Pneumonia	-	lung disease – Streptococci Pneumoniae
(IV)	Typhoid	-	lung disease – Salmonella typhi

(a) I, IV & V (b) I, II III

(c) II, III, IV (d) I, III, IV

KEY

1) b	2) c	3) b	4) c	5) c	6) b	7) 3	8) b	9) c	10) d
11) c	12) b	13) c	14) c	15) 3	16) b	17) b	18) b	19) b	20) b
21) c	22) b	23) b	24) b	25) b.					