



**SURESH'**  
IAS ACADEMY

**TARGETING**

**TNPSC**

**GROUP-II**

**2023**

**QUESTION  
WITH  
SIMPLIFIED  
ANSWER**



English Medium

**15<sup>th</sup>**  
**TEST**

Marks : 300

Time : 3 Hrs

**BIOLOGY**

**MAINS  
WRITTEN EXAM**

Main Concepts of Life Science  
The Cell - Basic Unit of Life  
Classification of living organisms  
Nutrition and Dietetics  
Respiration  
Blood and Blood Circulation  
Endocrine System  
Reproductive System

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TEST

15

வெற்றி ஒன்றே  
இலக்கு

## Answer Key - English

### Unit - 1

1) Define Hydroponics and mention its applications.

#### Hydroponics

3

- Hydroponics is the method of growing plants without soil, using mineral nutrient solutions in water. The containers are made of glass, metal or plastic.
- It was demonstrated by a German Botanist Julius Von Sachs in 1980. Hydroponics is successfully employed for the commercial production of seedless cucumber and tomato.
- Plants are suspended with their roots submerged in water that contain plant nutrients. The roots absorb water and nutrients, but do not perform the anchoring function.

#### Applications

3

- Hydroponic gardening can alleviate poverty while simultaneously easing strains on the environment.
- Hydroponic gardening systems can be set up to recycle water and nutrients, greatly reducing the resources necessary to grow food.
- Hydroponic gardening virtually eliminates the need for herbicides and pesticides.
- It promotes an overall awareness of our environment and can even help to protect the environment by reducing traditional agricultural pollution.

2) What is 'Biological Oxygen Demand'? State its importance.

#### Biochemical Oxygen Demand

3

- BOD – Biochemical Oxygen Demand is applied to determine the aerobic destructibility of organic substances.
- BOD is the biological method used for the measurement of the amount of dissolved

oxygen (DO) used by microbes in the biological process of metabolizing organic molecules present in water.

- The total amount of oxygen gas present in the water is called dissolved oxygen (DO). The non-compound oxygen present in water may either be a by-product of the photosynthesis of the aquatic plants or the dissolved atmospheric oxygen gas.
- In some water bodies, organic matter is a great source of BOD. These organic matters include sewage and other pollutants present in the water bodies.
- The greater the BOD, the lower is the dissolved oxygen available for aerobic animals such as fishes and other aquatic organisms.
- The BOD is accordingly a reliable measure of the organic pollution of water bodies.
- The main reason for treating wastewater prior to its discharge into a water resource is to reduce its BOD level (the demand for oxygen).

#### Importance of BOD

3

- BOD measures the amount of oxygen consumed by microorganisms for the process of decomposition of the organic matters in the water bodies.
- It indicates the amount of organic pollution present in an aquatic ecosystem.
- BOD is calculated in sewage treatment or waste water treatment to find the destruction of organic wastes by aerobic microbes
- It determines the amount of organic matter present in soils, sewages, sediment, garbage, sludge, etc.
- The biochemical oxygen demand also determines the rate of respiration in living beings.

- BOD is also used in the medicinal & pharmaceutical industries to test the oxygen consumption of cell cultures.

**3) What is meant by BMI? Draw the table of BMI.**

**Body Mass Index 2**

- To check the health of the particular person by using their height and weight is defined as body mass index.
- In this method the weight of the adult is mentioned in kilogram and their height is mentioned in square meter. For example BMI of 25 can be said as 25kg/m<sup>2</sup>.

**BMI Limits 1**

- For senior citizens the better range of BMI is 18.5 – 24.9.
- For adult and children, the index is calculated by the height, weight and sex taken into account

**BMI of You 2**

- Below 18.5 – under weight.-(18.5 – 24.9) – range of good index
- (25 – 29.9) – above the level of mentioned weight.
- (30 – 39.9) – It belongs to the fatty index.

**Accuracy of BMI 1**

- BMI includes the natural changes occurs in human body while calculating the index. It gives the healthy height range for certain height.
- While calculating the BMI, the experts may include all other index with height, weight.- Muscles are much density than the fats present in our body. So the heavy weight champions, weight lifters and other sportsman doesn't bother about their weight even if they categorized under overweight because of the muscles.
- The BMI of the particular community may vary because of their life and food styles for example the people belongs to south Asian country have the BMI of 23 along with diabetes.-The BMI index is not applicable to the pregnant woman.

**4) Why we remove the hand, when we touch a very hot pan?**

**Reflex Action 2**

- A reflex is any response that occurs automatically without consciousness. There are two types of reflexes.

**Simple or basic reflexes 1**

- These reflexes are inbuilt and unlearned responses.
- Many of the actions we perform in our day to day life are simple reflexes. e.g., winking of eyes when any dust particles enters, sneezing, coughing, yawning, etc. We perform these actions without thinking.

**Acquired or conditioned reflexes 3**

- These reflexes are the result of practice and learning.
- Playing harmonium by striking a particular key on seeing a music note is an example of conditioned reflexes which required conscious training effort. Can you think of some more examples of conditioned reflexes?
- Most of the reflex actions are monitored and controlled by the spinal cord, hence also known as spinal reflexes.
- The pathway taken by nerve impulse to accomplish reflex action is called reflex arc. Now, let us understand how the body executed reflex action when we touch a hot plate.-When we touch a very hot pan, the stimulus is the heat which is sensed by receptor called as heat receptors or thermo receptors in our hand. This stimulus (heat) in run triggers an impulse in sensory neuron.
- The sensory neuron transmits or conveys the message to the spinal cord.
- Spinal cord interprets the stimulus and the impulse is passed on to the relay neuron which in turn transmits it to a motor neuron.
- Motor neurons carry command from withdraw our hand immediately from the pan.

**5) Describe about cell theory?**

- In 1833, German botanist Matthias Schneider and German zoologist Theodor Schwann

proposed that all plants and animals are composed of cells and that cells were the basic building blocks of life.

**Modern cell theory: 2**

- All organisms are made up of cells.
- New cells are formed by the division of pre-existing cells.
- Cells contains genetic material, which is passed on from parents to daughter cells.
- All metabolic reactions take place inside the cells.

**Exception to Cell Theory 2**

- Viruses are puzzle in biology. Viruses, viroids and prions are the exception to cell theory.
- They lack protoplasm, the essential part of the cell and exists as obligate parasites which are sub-cellular in nature.

**Cell Doctrine (Cell Principle) 2**

The features of cell doctrine are as follows:

- All organisms are made up of cells.
- New cells are produced from the pre-existing cells.
- Cell is a structural and functional unit of all living organisms.
- A cell contains hereditary information which is passed on from cell to cell during cell division.
- All the cells are basically the same in chemical composition and metabolic activities.
- The structure and function of cell is controlled by DNA.
- Sometimes the dead cells may remain functional as tracheids and vessels in plants and horny cells in animals.

**6) Explain about the Nucleus of cell and its functions?****Nucleus 3**

- Nucleus is an important unit of cell which control all activities of the cell.
- Nucleus holds the hereditary information.
- It is the largest among all cell organelles. It may be spherical, cuboidal, ellipsoidal or discoidal.

- It is surrounded by a double membrane structure called nuclear envelope, which has the inner and outer membrane.
- The inner membrane is smooth without ribosomes and the outer membrane is rough by the presence of ribosomes and is continues with irregular and infrequent intervals with the endoplasmic reticulum.
- The membrane is perforated by pores known as nuclearpores which allows materials such as mRNA, ribosomal units, proteins and other macromolecules to pass in and out of the nucleus.
- The pores enclosed by circular structures called annuli.
- The pore and annuli forms the pore complex. The space between two membranes is called perinuclear space.
- Nuclear space is filled with nucleoplasm, a gelatinous matrix has uncondensed envelope, which has the inner and outer membrane.
- During cell division chromatin is condensed into an organized form called chromosome.
- The portion of Eukaryotic chromosome which is transcribed into mRNA contains active genes that are not tightly condensed during interphase is called Euchromatin.
- The portion of a Eukaryotic chromosome that is not transcribed into mRNA which remains condensed during interphase and stains intensely is called Heterochromatin.
- 1 Nucleolus is a small, dense, spherical structure either present singly or in multiples inside nucleus and it's not membrane bound.
- Nucleoli possesses genes for rRNA and tRNA.

**Functions of the nucleus 3**

- Controlling all the cellular activities
- Storing the genetic or hereditary information.
- Coding the information in the DNA for the production of enzymes and proteins.
- DNA duplication and transcription takes place in the nucleus.
- In nucleolus ribosomal biogenesis takes place.

**7) Write the Biological importance of Introns? 3**

**Introns**

**3**

- There are 3 types of RNAs polymerise can be seen in the nucleus of eukaryotes.
- These 3 polymerise performs different types of actions. RNA polymerise which reflects RNA of (28S, 18S, 58S)
- RNA polymerise-III reflects the RNA 5S, RIBISOME RNA and snRNA . The RNA polymerise II reflects the hnRNA(heterogeneous rna) .
- The out index of the eukaryotes which is EXON and the index free indrons which is disturbed by the monosystronic genes may affect.
- The introns are removed by the method of splicing.
- hnRNA can join at 5 ends of methyl guvanocyne which attaches the tryphosphate. This method is called as capping.
- Each exon are present with the index of the polypeptide.
- The removal of indrons and exon order are rigid in nature.where the exon has polypeptide index which creates the new genes .
- The same genes which makes each exon by splicing in order to provide certain amount of protein.
- It is responsible for the protein and activities in animals.
- The current theory optimise that the gene transformation prevails better in horizontal.

**Importance of introns :**

**3**

- Introns act as hot spots in the recombination in the formation of new combinations of exons.
- Introns increase the possibility to create new genes which can result in evolution.
- The introns which has self splicing RNA which helps for horizontal gene transformation.
- These kind of gene transformation plays a vital role in between the prokaryotic and eukaryotic cells .

**8) Write the significance of Sunshine Vitamin? 3**

- Vitamin D is also called as Sunshine vitamin.- It is also a fat soluble Vitamin which is naturally present in sunlight, egg yolk, fish, and milk. **3**

**Significance of Vitamin D**

**3**

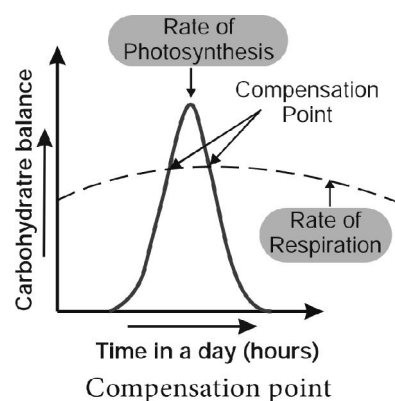
- Vitamin D maintains adequate calcium and phosphate concentrations in blood.
- It prevents weakening of bones.
- Vitamin D has other roles in the body, including cell growth, neuromuscular and immune function, and reduction of inflammation.
- Vitamin D deficiency can cause rickets in children and osteomalacia in adults.

**9) How does plant respiration take place when light intensity is low? 4**

**Compensation point**

**4**

- At dawn and dusk the intensity of light is low.
- The point at which CO<sub>2</sub> released in respiration is exactly compensated by CO<sub>2</sub> fixed in photosynthesis that means no net gaseous exchange takes place, it is called compensation point.
- At this moment, the amount of oxygen released from photosynthesis is equal to the amount of oxygen utilized in respiration.
- The two common factors associated with compensation point are CO<sub>2</sub> and light.
- Based on this there are two types of compensation point. They are CO<sub>2</sub> compensation point and light compensation point.
- C<sub>3</sub> plants have compensation points ranging from 40-60 ppm (parts per million) CO<sub>2</sub> while those of C<sub>4</sub> plants ranges from 1-5 ppm CO<sub>2</sub>.



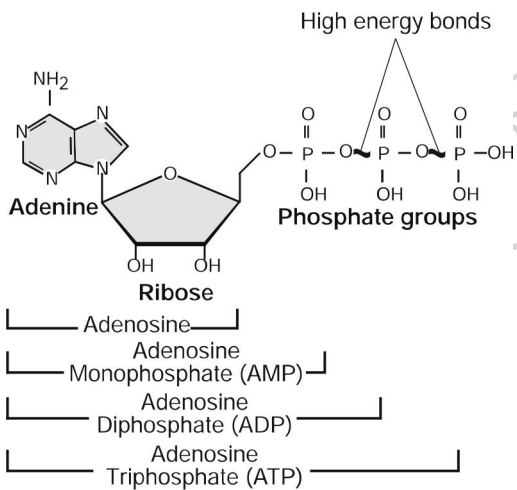
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**10) Explain the structure of ATP?**

**Structure of ATP**

4

- Respiration is responsible for generation of ATP.
- The discovery of ATP was made by Karl Lohman (1929).
- ATP is a nucleotide consisting of a base-adenine, a pentose sugar-ribose and three phosphate groups.
- Out of three phosphate groups the last two are attached by high energy rich bonds.
- On hydrolysis, it releases energy (7.3 K cal or 30.6 KJ/ATP) and it is found in all living cells and hence it is called universal energy currency of the cell.
- ATP is an instant source of energy within the cell.
- The energy contained in ATP is used in synthesis carbohydrates, proteins and lipids.
- The energy transformation concept was established by Lipman (1941).



Molecular structure of ATP

**11) Write a notes on Anaerobic Respiration?**

**Fermentation**

1

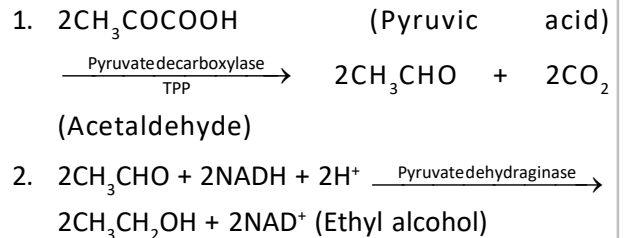
- Some organisms can respire in the absence of oxygen. This process is called fermentation or anaerobic respiration.
- There are three types of fermentation:
  1. Alcoholic fermentation
  2. Lactic acid fermentation

**3. Mixed acid fermentation**

**1. Alcoholic fermentation**

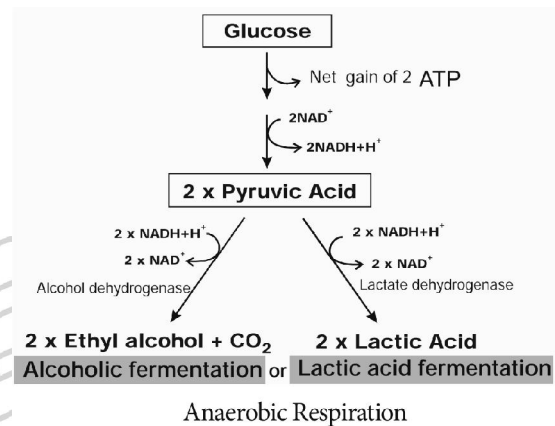
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- The cells of roots in water logged soil respire by alcoholic fermentation because of lack of oxygen by converting pyruvic acid into ethyl alcohol and CO<sub>2</sub>.
- Many species of yeast (Saccharomyces) also respire anaerobically. This process takes place in two steps:



**Anaerobic Respiration**

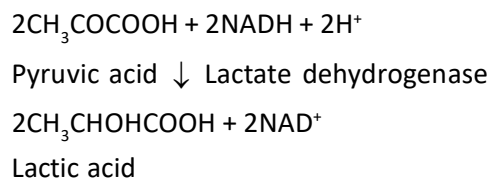
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**2. Lactic acid fermentation**

1

- Some bacteria (Bacillus), fungi and muscles of vertebrates produce lactic acid from pyruvic acid.



**3. Mixed acid fermentation**

1

- This type of fermentation is a characteristic feature of Enterobacteriaceae and results in the formation of lactic acid, ethanol, formic acid and gases like CO<sub>2</sub> and H<sub>2</sub>.

**Characteristics of Anaerobic Respiration**

1

1. Anaerobic respiration is less efficient than the aerobic respiration

2. Limited number of ATP molecules is generated per glucose molecule.
3. It is characterized by the production of CO<sub>2</sub> and it is used for Carbon fixation in photosynthesis.

**12) What is Nitrogen narcosis and mention its effects?**

- When a person descends deep into the sea, the pressure in the surrounding water increases which causes the lungs to decrease in volume.
- This decrease in volume increases the partial pressure of the gases within the lungs.
- This effect can be beneficial, because it tends to drive additional oxygen into the circulation, but this benefit also has a risk, the increased pressure can also drive nitrogen gas into the circulation. **3**
- This increase in blood nitrogen content can lead to a condition called nitrogen narcosis.

**Effects**

**3**

- When the diver ascends to the surface too quickly a condition called 'bends' or decompression sickness occurs and nitrogen comes out of solution while still in the blood-forming bubbles.
- Small bubbles in the blood are not harmful, but large bubbles can lodge in small capillaries, blocking blood flow or can press on nerve endings.
- Decompression sickness is associated with pain in joints and muscles and neurological problems including a stroke.
- The risk of nitrogen narcosis and bends is common in scuba divers. During carbon-dioxide poisoning, the demand for oxygen increases.
- As the O<sub>2</sub> level in the blood decreases it leads to suffocation and the skin turns bluish-black.

**13) Explain CPR and its procedure.**

**Cardio pulmonary resuscitation (CPR)**

**3**

- In 1956, James Elam and Peter Safar were the first to use mouth to mouth resuscitation.
- Cardiopulmonary resuscitation (CPR) is an emergency procedure consisting of chest

compressions often combined with artificial ventilation in an effort to manually preserve intact brain function until further measures are taken to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest.

- It is recommended in those who are unresponsive with no breathing or abnormal breathing, for example, agonal respirations.
- CPR involves chest compressions for adults between 5 cm (2.0 in) and 6 cm (2.4 in) deep and at a rate of at least 100 to 120 per minute.

**Procedure**

**3**

- To do CPR, first of all, make the patient lie down at a solid place and check his nose and throat to see if anything is stuck there.
- There are usually two procedures of CPR, applying pressure to the victim's chest with your palm and giving artificial respiration through the mouth.
- Keeping the palm in the centre of the chest, press it while pumping, repeat this process one to two times.
- By doing this, the victim's heartbeat will start again, after that while pumping, keep the other hand on top of the first hand and tie it with your fingers, now keep your hand and elbow straight.
- If the victim's heart does not start beating even after pumping, then try to give artificial respiration to the patient along with pumping. Press the chest 1-2 inches with your palm and do this at least 100 times per minute and apply pressure on the chest 30 times and give artificial respiration to the victim twice.

**14) Where is the Sino atrial node located in the heart?**

**Why it is called the Pacemaker?**

**Sinu Atrial Node**

**2**

- The aricles and ventricles of the heart makes the process of systole and diastole once which is defined as heart beat. The heart beats for minute with the range of 72-75 times.

**Decentralise of heart beat**

**2**

- The human heart depends on mayogenic type. The parts which snu atrial node which initiates the systole process of the heart.

- It can be seen in right atrial side near upper ventricle. The SA are wider at upper and narrow at lower sides of SA. It consist of thin muscles.
- It acts as the pacemaker of the SA. It enables the electric intiation for the heart beat.

**Enables the systole of heart** 2

- The blood pumps towards the aricular and ventricular by shrink the walls of atricle walls.
- The signals are transmitted in the forms of waves.
- The electric field or signals which are transmitted from SA node to atrial ventricular.
- Atrial ventricular and purginji enables the electrical signal to form the systole process.
- The sinus node continuously generates electrical impulses, thereby setting the normal rhythm and rate in a healthy heart. Hence, the SA node is referred to as the natural pacemaker of the heart.

**15) Explain the Mechanism of Hormone action.**

- Hormones circulate in the blood but their concentration can increase or decrease based on the requirement of the body. 3
- This is controlled by feedback mechanisms.
- These mechanisms control the secretion of endocrine glands by stimulating the hypothalamus, pituitary or both, which inturn governs the secretion of a particular hormone.
- In positive feedback, the secretion of the hormone increases where as in negative feedback further secretion of hormone slows down.
- Hormones are classified into three major groups as peptide hormones, steroid hormones and amino acid derived hormones based on their chemical structure.

**Peptide hormones** 1

- Peptide hormones cannot cross the phospolipid cell membrane and bind to the receptors on the exterior cell surface.
- They are are transported to the golgi, which is the site of modification. It acts as a first messenger in the cell.

**Steroid hormones** 1

- Steroid hormones can easily cross the cell membrane, and bind to their receptors, which are intracellular or intranuclear.
- Upon binding to the receptors, they pair up with another receptor – hormone complex (dimerize).This dimer can then bind to DNA and alter its transcription.

**Amino acid derived hormones** 1

- Amino acid derived hormones are derived from one or two aminoacid with a few additional modifications.
- Thyroid hormone is synthesised from tyrosine and includes the addition of several iodine atoms.

**16) What are Monoclonal Antibodies? Give an example.****Monoclonal Antibodies** 2

- Monoclonal antibodies are artificially engineered in laboratories by scientists as a form of medication.
- This is because they are characterised by their ability to help a human body combat viral infections better. These can target only one specific type of antigen.
- The short-form for them is Moabs or Mabs.
- The body responds by producing antibodies to counteract the virus or antigens, whenever a person falls ill.
- These antibodies are specific to a particular antigen.
- Therefore, scientists can replicate these antibodies and help in the treatment of a disease.
- So far, healthcare professionals have used monoclonal antibodies in the treatment of cancer.

**Examples of Monoclonal Antibodies** 3

- There are four ways in which scientists prepare monoclonal antibodies. They are:
- **Murine:** Murine monoclonal antibodies consist of mouse proteins, and any treatment with these ends with the suffix -omab.



- **Human:** These are made purely from human beings, and any treatment with these ends with the suffix -umab.
- **Humanised:** Humanised monoclonal antibodies are made of parts of mouse proteins attached to human proteins. Any treatment with these ends with -zumab.
- **Chimeric:** These are also a combination of part mouse and part human. The treatment ends with -umab.

**Uses**

**1**

- Used in cancer treatment.
- By using the protein which is present in the upper surface of the cancer cells has used as the medicine for the treatment.
- Function of monoclonal antibody cocktail against covid-19
- The anti agents of human body such as monoclonal antibodies has opposed by the immunity region of the human body.

**17) Explain the different infertility treatments?**

**In-Vitro Fertilization (IVF)**

**2**

- In vitro fertilization is the most commonly used assisted reproductive technology (ART).
- In vitro fertilization, as its name-fertilization is done by fusing ovum from the female donor and sperm from the male donor outside the body under strict laboratory conditions.
- This results in a zygote, or famously known as a test-tube baby.
- After embryo culturing, an embryo is transferred to the uterus of the mother.
- This method is commonly performed in the case of women with damaged or clogged Fallopian tubes.

**Zygote intrafallopian transfer (ZIFT)**

**2**

- Zygote intra-fallopian transfer (ZIFT), also known as Tubal Embryo Transfer is analogous to IVF. ZIFT is an ART procedure where fertilization happens in a laboratory.
- The thus formed zygote is then conveyed to the Fallopian tube of the mother using laparoscopy.

- ZIFT proceeds as follows: egg retrieval from ovaries, fertilization, carrying the zygote into the uterine tubes for implantation and further development.
- ZIFT is not for women with abnormal uterine tubes.

**Gamete Intra-Fallopian Transfer (GIFT)**

**2**

- Unlike IVF and ZIFT, GIFT is an in-vivo fertilization procedure where the gametes – sperm and ova are conveyed directly into the fallopian tube.
- In GIFT, fertilization and zygote formation is more natural as it takes place within the female body.
- However, this technique is carried out only if there is enough sperm count and at least one fallopian tube is functional. GIFT is an alternative for IVF.

**18) What is Dolipore Septum?**

**Dolipore septum**

**3**

- The transverse septa which divide divide both monokaryotic and dikaryotic hyphae into segments are incomplete; they contain a central pore which permits cytoplasmic continuity between adjacent segments.
- The septal pore is surrounded by a barrel-shaped flange of thickened wall material. Such septa. Which are characteristic of basidiomycete mycelia, are known as dolipore septa (Lat. dolium- large jar, cask).
- Septal development begins by centripetal ingrowth of a membrane on which wall material (glucan and chitin) is deposited at both faces from associated vesicles.
- The thickening surrounding the pore results from more rapid deposition of wall material, but there is evidence that very thick pore rims may be an artefact associated with chemical fixation.
- The pore itself may be blocked by an occlusion shaped like two champagne corks attached end to end, but blockage of the pore is not a permanent feature.
- In some cases there is a transverse central plate in the pore canal.

- Overarching the septal pore on each side of the septum is a specialized portion of endoplasmic reticulum known as the septal pore cap or parenthesome (parenthesis - round bracket. Gr. soma- body).
- In some cases a second parenthesome (outer cap) has been reported. In many basidiomycetes with holobasidia (ie. Homobasidiomycetes), the parenthesomes are perforated (fenestrated), but in many Heterobasidiomycetes, e.g.
- Auricularia, there is only a single perforation or none. Other variations in ultrastructure are known and can be characteristic of different groups of basidiomycetes, that the dolipore/parenthesome complex is considered to be of taxonomic significance.

**Important role****3**

- An important role of the dolipore/parenthesome complex is to secure the integrity of hyphal cells and to maintain intercellular communication and transport of some organelles.
- A variety of cytoplasmic structures has been reported from within the pores of *Rhizoctonia solani*.
- These include small tubular and filamentous structures, small vesicles, tubular endoplasmic reticulum and other plugging material.
- The movement of mitochondria through the septal pore cap has also been documented.
- Whilst the movement of most organelles through the septal pore is permitted, the passage of nuclei is not, and this is possibly a consequence of their larger size.
- The migration of nuclei following plasmogamy between two sexually compatible monokaryotic mycelia is associated with enzymatic dissolution of the dolipore.
- Another important function of dolipores is the repair of hyphal damage, the septal pore being rapidly plugged by electron-dense material in the compartment of a hypha.

**Unit - 2****1) What is Transpiration? Explain about the importance and factors affecting the transpiration.****Transpiration****2**

- Transpiration is the evaporation of water from the aerial parts of the plant especially through stomata in leaves. Stomata are open in the day and closed at night.
- The opening and closing of the stomata is due to the change in turgidity of the guard cells.
- When water enters into the guard cells, they become turgid and the stoma open. When the guard cells lose water, it becomes flaccid and the stoma closes.
- Water evaporates from mesophyll cells of leaves through the open stomata, this lowers water concentration in mesophyll cells.
- As a result, more water is drawn into these cells from the xylem present in the veins through the process of osmosis.
- As water is lost from the leaves, pressure is created at the top to pull more water from the xylem to the mesophyll cells, this process is called transpiration pull.
- This extends up to the roots causing the roots to absorb more water from the soil to ensure continuous flow of water from the roots to the leaves.

**Types of Transpiration****2**

- There are three types of transpirations
- **Stomatal transpirations:** Loss of water from plants through stomata. It accounts for 90 – 95% of the water transpired from leaves.
- **Cuticular transpiration :** Loss of water in plants through the cuticle.
- **Lenticular transpiration:** Loss of water from plants as vapour through the lenticles. The lenticles are tiny openings that protrude from the barks in woody stems and twigs as well as in other plant organs.

**Factors affecting Transpiration****4**

- Transpiration is affected by several external factors such as temperature, light, humidity, and wind speed.

- Internal factors that affect transpiration include number and distribution of stomata, percentage of open stomata, water status of the plant, canopy structure etc.

**Significance of Transpiration 4**

- Creates transpirational pull for transport of water.
- Supplies water for photosynthesis
- Transports minerals from soil to all parts of the plant
- Cools the surface of the leaves by evaporation.
- Keeps the cells turgid; hence, maintains their shape.

**2) What are Psuedo Cereals? How are they economically important?**

**Pseudo Cereals 3**

- It is an important category of grains, called pseudo-cereals, is considered as rich foods because of their protein quality and content, high mineral content, and healthy and balance food quality. Quinoa (*Chenopodium quinoa*), amaranth (*Amaranthus sp.*), and buckwheat (*Fagopyrum esculentum*) fall under this category.
- Both minor millets and pseudo-cereals are morphologically different, although similar for micronutrient bioavailability, and their grains are gluten-free.

**Economical Importance of Pseudo Cereals 9**

- The cultivation of these millets can make dry lands productive and ensure future food as well as nutritional security.
- Although the natural nutrient profile of these crop plant species is remarkably good, little development has occurred in advances in molecular genetics and breeding efforts to improve the bioavailability of nutrients.
- The productivity of major crops has been predicted to be lower under marginal environments, the good news is that the nutrient-rich underused neglected crops are very resilient to harsh environments (drought, salinity, and extreme temperature) and yield well with limited resources.

- These neglected crops are important because of their contribution to biodiversity and climatic resilience, their rich nutrition profile, and their means of livelihood of the poor in various parts of the world

- The most important part is its excellent storing capacity without deterioration even with significant insect and pest attacks. This has earned it the popular name of “famine crop” as it can resist storage pests for as long as 10 years, ensuring a year-round food supply.

- The cultivation of the pseudo cereals can be done in any kind of soil.

- Output of the crop may not be varied depends upon the properties of the soil.

- Pseudo cereals are highly nutritive, rich in proteins, vitamins, and minerals. Because of its nutraceutical value and climate resilience, amaranth has been relaunched and is being promoted as a suitable crop for food and nutritional security.-It ensures the nutritional value in baked products, so it will be favourable for export.

**3) What is Occupational Disease? How you will involve for awareness in future?**

- An occupational disease is a health condition or disorder (e.g., cancer, musculoskeletal disorders, post-traumatic stress, etc.) that is caused by your work environment or activities related to your work.

- In general, health conditions or disorders that occur among a group of people with similar occupational exposures at a higher frequency than the rest of the population are considered to be occupational diseases. **2**

**7 Important occupational disease 7**

- This list was established based on information from the CDC, the CCOHS, the National Institute of Occupational Health and Safety (NIOSH), the ILO and the European Agency for Safety and Health at Work.

**1. Dermatitis:**

- According to NIOSH, allergic and irritant dermatitis (also known as ‘contact dermatitis’)

is the most important cause of occupational skin diseases, and account for 15 to 20 per cent of all reported occupational diseases in the U.S. Contact dermatitis is caused by a wide array of physical, biological or chemical agents.

- NIOSH also cites a study saying that 75 per cent of patients with occupational contact dermatitis end up developing chronic skin disease.

### **2. Respiratory illnesses:**

- This can include asthma, disease of the lung and chronic obstructive pulmonary disease (COPD).
- According to OHCOW, asthma is considered to be the most common occupational lung disease in Canada.
- Furthermore, OHCOW states that there are over 300 chemicals in the workplace that are known to cause asthma, with the disease being most prevalent in the auto parts, foam and plastic manufacturing industries.
- The ILO lists work-related asthma as being caused by sensitizing agents or irritants.

### **3. Musculoskeletal disorders (MSDs)**

- MSDs are prevalent in most workplaces, even in office settings. Indeed, office workers may be at risk of repetitive strain injuries (RSI) such as carpal tunnel syndrome or tendonitis.
- This EU-OSHA says that most work-related MSDs develop over time and can be caused by repetitive movements, awkward positions, handling loads, high work demands, lack of breaks, etc.
- According to Workplace Safety & Prevention Services (WSPS), MSDs account for 43 per cent of all work-related injuries.

### **4. Hearing loss**

- NIOSH conducted a study from 2000 – 2008 among U.S. workers who had higher occupational noise exposures than the general population.
- They found that 18 per cent of their surveyed sample had hearing loss. NIOSH says that workers in the mining, construction and

manufacturing industries need better hearing conservation strategies.

### **5. Cancer**

- The European Agency for Safety and Health at Work states that cancer accounts for 24 per cent of global work – related deaths.
- Occupational cancers occur when workers are in contact with carcinogenic substances in their workplace.
- Certain substances are associated with different cancers, and certain carcinogens can be especially prevalent in certain industries.
- Asbestos-related diseases are now some of the most well-known incidences of occupational disease.
- These include cancers such as lung cancer, gastro-intestinal cancer, cancer of the larynx or pharynx and mesothelioma (a cancer which occurs in the thin layer of tissue cover in most internal organs).
- Asbestos exposure is the number one cause of occupational death in Canada.
- The Mesothelioma Center says that 445 Canadians were diagnosed with mesothelioma in 2016 (around 1.6 of every 10,000 Canadians).
- Canada's mesothelioma rate is one of the highest in the world. In 2017, 490 Canadians dies from mesothelioma.

### **6. Stress and mental health disorders**

- Multiple sources state that mental health disorders can also be considered as occupational diseases in certain contexts.
- Post traumatic stress disorder (PTSD) is most commonly cited. PTSD can affect workers in high pressure workplaces, such as the military or law enforcement.
- According to 2013 statistics presented by the Canadian Mental Health Association, 8 per cent of Canadians who experience a traumatic event develop PTSD.

### **7. Infectious diseases**

- NIOSH states that healthcare workers run the risk of contracting infectious disease such as

hepatitis B and C, tuberculosis (TB) and even the human immunodeficiency virus (HIV).

- It also notes that TB is also a risk for workers in social services or correctional facilities as they are in constant contact with high-risk populations. This is also the case for lab workers.
- NIOSH says that "Bloodborne and airborne pathogens represent a significant class of exposures for the 6 million U.S. health care workers.

**Prevention methods**

**1.5**

- The information from CCOHS and other health and safety agencies and providers to learn about how to eliminate the hazards and control the risks in your workplace.
- Some hazards and their controls will be specifically outlined in legislation. In all cases, the employer has a duty of due diligence and is responsible for 'taking all reasonable precautions, under the particular circumstances, to prevent injuries or accidents in the workplace'.
- In situations where there is not a clear way to control a hazard, or if legislation does not impose a limit or guideline, you should seek

guidance from occupational health professional such as an occupational hygienist or safety professional about what is "good practice" or "standard practice" when working in that situation.

**In general**

**1.5**

- Learn about the hazards at your workplace (e.g., find out what products are being used, understand how actions such as heavy lifting can affect the body, etc.)
- Employers should develop – and employees should follow – systems, programs, procedures, and practices that are designed to protect people from workplace hazards.
- Communicate all health hazards and exposures to employees. Provide the appropriate information and training for the hazards present.
- Work with health professional to investigate injuries or illnesses that may have characteristics that suggest it may be work-related. (e.g., tell your health professional where you work, what you do, and what products you work with).
- Keep a list of all jobs and industries you have worked in.

**4) Differentiate between plant cell and Animal Cell?**

S. No	Plant cell	Animal Cell	12
1	Usually they are larger than animal cells	Usually smaller than plant cells	
2	Cell wall present in addition to plasma membrane and consists of middle lamellae, primary and secondary walls	Cell wall absent	
3	Plasmodesmata present	Plasmodesmata absent	
4	Chloroplast present	Chloroplast absent	
5	Vacuole large and permanent	Vacuole small and temporary	
6	Tonoplast present around vacuole	Tonoplast absent	
7	Centrioles absent except motile cells of lower plants	Centrioles present	
8	Nucleus present along the periphery of the cell	Nucleus at the centre of the cell	
9	Lysosomes are rare	Lysosomes present	
10	Storage material is starch grains	Storage material is a glycogen granules	

**5) Explain about the Nucleic acids in plant cell?**

**Nucleic Acids**

**6**

- As we know DNA and RNA are the two kinds of nucleic acids. These were originally isolated from cell nucleus.

- They are present in all known cells and viruses with special coded genetic programme with detailed and specific instructions for each organism heredity.

- DNA and RNA are polymers of monomers called nucleotides, each of which is composed of a nitrogen base, a pentose sugar and a phosphate.
- A purine or a pyrimidine and a ribose or deoxyribose sugar is called nucleoside. A nitrogenous base is linked to pentose sugar through n-glycosidic linkage and forms a nucleoside.
- When a phosphate group is attached to a nucleoside it is called a nucleotide. The nitrogen base is a heterocyclic compound that can be either a purine (two rings) or a pyrimidine (one ring).
- There are 2 types of purines – adenine (A) and guanine (G) and 3 types of pyrimidines – cytosine (C), thymine (T) and uracil (U).
- A characteristic feature that differentiates DNA from RNA is that DNA contains nitrogen bases such as Adenine, guanine, thymine (5-

methyl uracil) and cytosine and the RNA contains nitrogen bases such as adenine, guanine, cytosine and uracil instead of thymine.

- The nitrogen base is covalently bonded to the sugar ribose in RNA and to deoxyribose (ribose with one oxygen removed from C<sub>2</sub>) in DNA. Phosphate group is a derivative of (PO<sub>4</sub><sup>3-</sup>) phosphoric acid, and forms phosphodiester linkages with sugar molecule.

**Formation of Dinucleotide and Polynucleotide**

**6**

- Two nucleotides join to form dinucleotide that are linked through 3' -5' phosphodiester linkage by condensation between phosphate groups of one with sugar of other.
- This is repeated many times to make polynucleotide.

Nucleoside	Nucleotide
It is a combination of base and sugar.	It is a combination of nucleoside and phosphoric acid.
<b>Examples</b> Adenosine = Adenine + Ribose Guanosine = Guanine + Ribose Cytidine = Cytosine + Ribose Deoxythymidine = Thymine + Deoxyribose	<b>Examples</b> Adenylic acid = Adenosine + Phosphoric acid Guanylic acid = Guanosine + Phosphoric acid Cytidylic acid = Cytidine + Phosphoric acid Uridylic acid = Uridine + Phosphoric acid

**6) Define:**

- Eugenics**
- Euphenics**
- Euthenics**

**a) Eugenics**

**4**

- Application of the laws of genetics for the improvement of human race is called eugenics.
- The term eugenics means “well born” and was coined by Francis Galton in 1885.
- For the betterment of future generations it is necessary to increase the population of outstanding people and to decrease the population of abnormal and defective people by applying the principles of eugenics.
- Two methods of Eugenics
- i) Constructive method or Positive eugenics

- ii) Restrictive method or Negative eugenics

**i) Positive eugenics**

- Positive eugenics attempts to increase consistently better or desirable germplasm and to preserve the best germplasm of the society.
- The desirable traits can be increased by adopting the following measures:
  - Early marriage of those having desirable traits
  - Subsiding the fit and establishing sperm and egg banks of precious germplasm
  - Educating the basic principles of genetics and eugenics
  - Improvement of environmental conditions
  - Promotion of genetic research

**ii) Negative eugenics**

- Negative Eugenics attempts to eliminate the defective germplasm of the society by adopting the following measures:
- i) Sexual separation of the defectives
- ii) Sterilization of the defectives
- iii) Control of immigration and
- iv) Regulation of marriages

**b) Euphenics 4**

- "Euphenics" means the improvement of the phenotype by biological means.

Euphenics involves the incorporation of the advances in

- Molecular biology
  - Immunology, neurophysiology
  - Other rapidly growing biological fields
  - Into medical practice for management of genetic diseases and their prevention
- Euphenics has been advocated as "a corrective measure for our genetic ills."

**Examples of Euphenics:**

- New-born screening programs to identify and treat new-borns for conditions where early diagnosis and treatment benefit the new-born
- 1. e.g. Phenylketonuria (PKU) is caused by deficient activity of the enzyme phenylalanine hydroxylase can lead to mental retardation
- 2. In order to prevent neurological damage, lifelong adherence to a low-phenyl alanine diet (PKU diet) is required.
- 3. If the new born with PKU is identified at birth itself, the PKU diet can be started soon after thereby ensuring normal growth and development
- Reproductive information and counseling
- Studies with mentally retarded (mild) children indicated that exposure to environmental stimulation improved their IQ

**c) Euthenics 4**

- Euthenics" is "improvement in the environment."
- Mere improvement of the genotype is of no use unless the improved genotype is given access to a suitable environment which will

enable the genes to express themselves readily

- Thus the solution of improving the human race does not lie in contrasting heredity and environment but rather in the mutual interaction of heredity and environment factors
- This environmental manipulation is called euthenics and has considerable broader prospects for success

**Examples**

- Laws for the protection of the foetus from environmental harm may be described as euthenics
- e.g. Government-required warnings on alcohol and cigarette containers that drinking or smoking while pregnant may harm the fetus.
- Adding iodine to salt (to prevent thyroid deficiency), vitamin D to milk (to prevent rickets), or folic acid to cereal products (to prevent spina bifida) are other examples, as is vaccinating women for rubella to prevent rubella in the fetus (rubella may damage the fetus)

**7) What is PUFA? Give two examples and state the potential benefits of PUFA?**

**PUFA structure 5**

- Polyunsaturated fatty acids are hydrocarbon chains containing two or more double bonds.
- The characterisation of PUFAs as either an n-3 PUFA or n-6 PUFA refers to the position of the first double bond relative to the methyl end of the fatty acid.
- In nature, double bonds are usually in the cis (bent) format. However, approximately 2–5% of the fatty acids present in ruminant milk and meat and 5–20% in hydrogenated oils are in the trans (straight) orientation.

**Fatty Acids 3.5**

- PUFA intake may protect against COPD development through a reduction in COPD-related inflammation. Varraso et al.
- [43] reported no significant relationship between PUFA intake and risk of COPD in two cohort studies.
- However, high dietary intake of n-3 is inversely associated with COPD risk in a dose-

dependent manner. The associations between PUFAs and COPD are inconsistent.

- PUFA supplementation improves exercise capacity in COPD and may reduce the rate of lung function deterioration. Based on limited proof there is a weak support for the role of n-3 PUFAs in COPD, with some evidence for the improvement of functional ability.

**Polyunsaturated fatty acids versus saturated fatty acids** **3.5**

- Polyunsaturated fatty acids (PUFA), including omega-3 and omega-6 fatty acids, are plentiful in fish oils and smaller amounts are present in some meat fats.
- Interest in meat fatty acid composition stems mainly from the need to find ways to produce healthier meat that is, with a higher ratio of PUFA to SFAs and a more favorable balance between n-6 and n-3 PUFA.
- In pigs and beef fed with grains, the drive has been to increase n-3 PUFA in meat and this can be achieved by feeding linseed or linseed oil.

- Ruminant meats (beef and lamb) are a relatively good source of n-3 PUFA due to the presence of naturally high levels of 18:3 and long chain n-3 PUFA.
- Grazing also provides antioxidants including vitamin E, which maintain PUFA levels in meat and prevent quality deterioration during processing and display (Wood, Richardson, & Nute, 2004).
- PUFA appear to offer direct protection against heart disease, particularly against thrombosis, but it is not clear whether the other PUFAs in the diet (from vegetable oils) offer protection or simply displace SFA.
- Consequently, it is often recommended that vegetable oils (rich in PUFA) should not simply be added to a diet but should be used to replace other fats where needed.
- Replacement of SFAs with PUFAs has been associated with reduced CHD risk, although there is heterogeneity in both fatty acid categories.

**8) Differentiate the events in inspiration and expiration.**

<b>Inspiration</b>	<b>Expiration</b> <span style="float: right;"><b>12</b></span>
Respiratory centre initiates the stimuli during inspiration.	Respiratory centre terminates the stimuli during expiration.
↓	↓
The diaphragm and expiratory muscles contract.	The diaphragm relax but internal intercostal muscles contract.
↓	↓
The thoracic volume increases as the chest wall expands.	The thoracic volume decreases as the chest wall contracts.
↓	↓
The intra pulmonary pressure is reduced.	The intra pulmonary pressure is increased
↓	↓
The alveolar pressure decreases than the atmospheric pressure	The alveolar pressure increases than the atmospheric pressure
↓	↓
Air is taken inside due to expansion of alveoli.	Air is sent out due to the contraction of alveoli.
↓	↓
Air flows into the alveoli until the alveolar pressure equalizes the atmospheric pressure and the alveoli get inflated.	Air flows out of the alveoli until the alveolar pressure equalizes the atmospheric pressure and the alveoli get deflated.



**9) Mentions the problems in oxygen transport of human respiration system?**

**Respiratory System 3**

- Human Respiratory System is a network of organs and tissues that helps us breathe. The primary function of this system is to introduce oxygen into the body and expel carbon dioxide from the body.

**Problems in Oxygen transport 9**

- When a person travels quickly from sea level to elevations above 8000ft, where the atmospheric pressure and partial pressure of oxygen are lowered, the individual responds with symptoms of acute mountain sickness (AMS)– headache, shortness of breath, nausea and dizziness due to poor binding of O<sub>2</sub> with haemoglobin.
- When the person moves on a long–term basis to mountains from sea level the body begins to make respiratory and haematopoietic adjustments.
- To overcome this situation kidneys accelerate production of the hormone erythropoietin, which stimulates the bone marrow to produce more RBCs.
- When a person descends deep into the sea, the pressure in the surrounding water increases which causes the lungs to decrease in volume.
- This decrease in volume increases the partial pressure of the gases within the lungs.
- This effect can be beneficial, because it tends to drive additional oxygen into the circulation, but this benefit also has a risk, the increased pressure can also drive nitrogen gas into the circulation.
- This increase in blood nitrogen content can lead to a condition called nitrogen narcosis.
- When the diver ascends to the surface too quickly a condition called ‘bends’ or decompression sickness occurs and nitrogen comes out of solution while still in the blood forming bubbles.
- Small bubbles in the blood are not harmful, but large bubbles can lodge in small

capillaries, blocking blood flow or can press on nerve endings.

- Decompression sickness is associated with pain in joints and muscles and neurological problems including stroke.
- The risk of nitrogen narcosis and bends is common in scuba divers.
- During carbon–dioxide poisoning, the demand for oxygen increases.
- As the O<sub>2</sub> level in the blood decreases it leads to suffocation and the skin turns bluish black.

**10) Explain about the Human Circulatory System?**

**Human Circulatory System 2**

- The human circulatory system consists of a network of arteries, veins, and capillaries, with the heart pumping blood through it.
- Its primary role is to provide essential nutrients, minerals, and hormones to various parts of the body.
- Alternatively, the circulatory system is also responsible for collecting metabolic waste and toxins from the cells and tissues to be purified or expelled from the body.

**Features of Circulatory System 1**

- The crucial features of the human circulatory system are as follows:
- The human circulatory system consists of blood, heart, blood vessels, and lymph.
- The human circulatory system circulates blood through two loops (double circulation) – One for oxygenated blood, another for deoxygenated blood.
- The human heart consists of four chambers – two ventricles and two auricles.
- The human circulatory system possesses a body-wide network of blood vessels. These comprise arteries, veins, and capillaries.
- The primary function of blood vessels is to transport oxygenated blood and nutrients to all parts of the body.
- It is also tasked with collecting metabolic wastes to be expelled from the body.
- Most circulatory system diagrams do not visually represent its sheer length.

- Theoretically, if the veins, arteries, and capillaries of a human were laid out, end to end, it would span a total distance of 1,00,000 kilometres (or roughly eight times the diameter of the Earth).

**Organs of Circulatory System 2**

- The human circulatory system comprises 4 main organs that have specific roles and functions. The vital circulatory system organs include:
- Heart-Blood (technically, blood is considered a tissue and not an organ)
- Blood Vessels
- Lymphatic system

**Heart**

- The heart is a muscular organ located in the chest cavity, right between the lungs.
- It is positioned slightly towards the left in the thoracic region and is enveloped by the pericardium.
- The human heart is separated into four chambers; namely, two upper chambers called atria (*singular: atrium*), and two lower chambers called ventricles.

**Double Circulation**

- The way blood flows in the human body is unique, and it is quite efficient too.
- The blood circulates through the heart twice, hence, it is called double circulation.
- Other animals like fish have single circulation, where blood completes a circuit through the entire animal only once.
- The main advantage of double circulation is that every tissue in the body has a steady supply of oxygenated blood, and it does not get mixed with the deoxygenated blood.

**Blood 2**

- Blood is the body's fluid connective tissue, and it forms a vital part of the human circulatory system.
- Its main function is to circulate nutrients, hormones, minerals and other essential components to different parts of the body.

- Blood flows through a specified set of pathways called blood vessels.
- The organ which is involved in pumping blood to different body parts is the heart. Blood cells, blood plasma, proteins, and other mineral components (such as sodium, potassium and calcium) constitute human blood.
- Blood is composed of: -Plasma – the fluid part of the blood and is composed of 90% of water.
- Red blood cells, white blood cells and platelets constitute the solid part of blood.

**Types of Blood Cells**

- The human body consists of three types of blood cells, namely:

**Red blood cells (RBC) / Erythrocytes**

- Red blood cells are mainly involved in transporting oxygen, nutrients, and other substances to various parts of the body. These blood cells also remove waste from the body.

**White blood cells (WBC) / Leukocytes**

- White blood cells are specialized cells, which function as a body's defence system. They provide immunity by fending off pathogens and harmful microorganisms.

**Platelets / Thrombocytes**

- Platelets are cells that help to form clots and stop bleeding. They act on the site of an injury or a wound.

**Blood Vessels 2**

- Blood vessels are a network of pathways through which blood travels throughout the body.
- Arteries and veins are the two primary types of blood vessels in the circulatory system of the body.

**Arteries**

- Arteries are blood vessels that transport oxygenated blood from the heart to various parts of the body.
- They are thick, elastic and are divided into a small network of blood vessels called capillaries.

- The only exception to this is the pulmonary arteries, which carries deoxygenated blood to the lungs.

**Veins**

- Veins are blood vessels that carry deoxygenated blood towards the heart from various parts of the body.
- They are thin, elastic and are present closer to the surface of the skin.
- However, pulmonary and umbilical veins are the only veins that carry oxygenated blood in the entire body.

**Lymphatic System** **2**

- The human circulatory system consists of another body fluid called lymph. It is also known as tissue fluid.
- It is produced by the lymphatic system which comprises a network of interconnected organs, nodes and ducts.
- Lymph is a colourless fluid consisting of salts, proteins, water, which transport and circulates digested food and absorbed fat to intercellular spaces in the tissues.
- Unlike the circulatory system, lymph is not pumped; instead, it passively flows through a network of vessels.

**Functions of Circulatory System** **1**

- The most important function of the circulatory system is transporting oxygen throughout the body. The other vital functions of the human circulatory system are as follows:
- It helps in sustaining all the organ systems.
- It transports blood, nutrients, oxygen, carbon dioxide and hormones throughout the body.
- It protects cells from pathogens.
- It acts as an interface for cell-to-cell interaction.
- The substances present in the blood help repair the damaged tissue.

**11) What is Metamorphosis? Explain the function and role of thyroxine?**

- Metamorphosis is a process by which animals undergo extreme, rapid physical changes some time after birth. **3**

- The result of metamorphosis may be change to the organism's entire body plan, such as a change in the animal's number of legs, its means of eating, or its means of breathing.

**Functions of thyroid** **3**

- Thyroxine stimulates normal growth and development, especially the skeletal and nervous systems.
- It controls the rate of cellular oxidation and increases the basal metabolic rate.
- The basal metabolic rate (BMR) is defined as the amount of heat produced in the body in a given time, in complete state of physical and mental rest at 20o C room temperature.

**Actions of thyroxine** **6**

- This hormone is very essential for the development of nervous system particularly at the time of birth and during the first year
- This hormone increases the metabolism of all tissues except brain, gonads and accessory sex organs, lymph nodes, spleen and lungs
- The most important function is to increase the absorption of glucose from the small intestine.
- This hormone reduces serum cholesterol level
- It promotes protein anabolism, and helps in growth
- It increases heart beat rate, force of contraction and pulse pressure
- Presence of optimum level of thyroxine in the blood maintains efficient muscle functions and
- The optimum level of thyroxine in the blood is also necessary for normal gonadal

**12) Briefly explain Parthenogenesis and its types?**

**Partheno Genesis** **6**

- (Gr. Parthenos – virgin, Genesisproduce) Development of an egg into a complete individual without fertilization is known as parthenogenesis.
- It was first discovered by Charles Bonnet in 1745. Parthenogenesis is of two main types namely, Natural Parthenogenesis and Artificial Parthenogenesis.

- In certain animals, parthenogenesis occurs regularly, constantly and naturally in their life cycle and is known as natural parthenogenesis.

**Natural parthenogenesis are of different types:****6**

- Arrhenotoky:** In this type only males are produced by parthenogenesis. eg: honey bees
- Thelytoky:** In this type only females are produced by parthenogenesis. eg: Solenobia
- Amphitoky:** In this type parthenogenetic egg may develop into individuals of any sex. eg: Aphid

**Unit - 3**

- 1) **Why is mosquito called as the most dangerous species? Discuss briefly with reference to various diseases it causes?**

**Dangerous facts about mosquitos****5**

- Most people instantly associate mosquitoes with malaria. But these tiny flying insects can transmit a number of other diseases too.
- Viruses transmitted by insects like mosquitoes are called arthropod-borne or arboviruses.
- Like malaria, these viruses are transmitted to vertebrate hosts through the bite of a female mosquito when she takes a blood meal to assist with her egg development.
- Most vertebrate hosts for these arboviruses are non-human. They include birds, primates and agricultural animals.
- But some arboviruses can be transmitted to humans with severe negative outcomes.
- Five of the most important arboviruses affecting communities in Africa include the chikungunya, dengue, West Nile, yellow fever and Zika viruses.
- It is estimated that half of the world's population is at risk of being infected by an arbovirus.
- Some mosquito-borne diseases but not all can be fatal to humans.
- This confirms that every effort must be made to prevent being bitten by a mosquito and

infected using both pharmaceutical and non-pharmaceutical measures.

**Chikungunya****2**

- The symptoms of chikungunya virus include headaches, a rash, fatigue, fever and muscle and joint pain.
- Generally these symptoms clear within a week.
- Occasionally, an infection can result in a severe fever and extremely painful joints, which can last for months or years, inducing a hunched, contorted appearance.
- Unfortunately, there are no antiviral or vaccine treatments available for chikungunya virus. Deaths from chikungunya are rare and are generally associated with other underlying health problems.
- The chikungunya virus was first identified in 1952 during an outbreak in Tanzania.
- It is transmitted by *Aedes aegypti* and *Aedes albopictus* mosquitoes.
- Over 100 countries across the globe have reported chikungunya virus cases.
- The risk of outbreaks is extremely high wherever these mosquito species are present around homes and urban areas.
- Female *Aedes* mosquitoes tend to feed just after sunrise and around sunset.
- They lay eggs that can survive drying out. This makes vector control rather challenging.
- Current control strategies focus on reducing the number of water containers that these mosquitoes like to breed in, the use of insecticides against adult mosquitoes and personal protection to prevent mosquito bites

**Dengue****2**

- The World Health Organization has classified dengue virus as one of the top ten global health threats.
- It's one of the fastest spreading mosquito-borne diseases. At least half of the world's population is at risk of infection.
- Like chikungunya virus, dengue is spread by *Aedes aegypti* and *Aedes albopictus* mosquitoes.

- Both viruses share the same control interventions and non-specific symptoms of headaches, a rash, fever and muscle and joint pain, so they are often misdiagnosed.
- Most human cases of dengue are asymptomatic or present with mild symptoms, which last for two to seven days.
- In certain individuals, dengue virus progresses to severe disease and symptoms include persistent vomiting, bleeding gums or nose and enlarged liver.
- This must be treated as a medical emergency as these complications can be lethal. Dengue virus can be diagnosed using a rapid diagnostic test or a polymerase chain reaction (PCR) test.
- But there is no treatment available. A vaccine has been developed and has been approved for use in a few countries – but is not widely available in Africa at present.

**Zika**

2

- The Zika virus was identified in humans in the 1950s. But it only became a pathogen of major public concern in 2016 following the 2015 Zika virus pandemic.
- The virus is transmitted by *Aedes aegypti* and *Aedes albopictus* mosquitoes, and is generally non-lethal in humans.
- Most people infected with Zika virus do not show any symptoms.
- A few have non-specific symptoms like fever, rash, headaches, muscle and joint pains and conjunctivitis.
- These can last two to seven days.
- Individuals infected with Zika virus while pregnant are at an increased risk of stillbirth, abortion, neurological disorders or delivering children with birth defects, including microcephaly.
- PCR testing can be used to diagnose Zika virus, but there is no treatment available.

**Yellow Fever**

2

- *Aedes aegypti* and *Aedes albopictus* mosquitoes are also responsible for the transmission of yellow fever, so named

because the virus causes jaundice (yellowing of eyes and skin due to impaired liver function).

- Symptoms in mild cases include fever, headaches, chills, back pain, fatigue, jaundice, vomiting and bleeding from the mouth, nose, eyes or stomach.
- These generally clear within five days. Approximately 50% of the small number of patients who develop severe symptoms will die with 10 days of becoming infected. Yellow fever can be diagnosed by PCR or enzyme-linked immunosorbent assay (ELISA).
- Although there is no treatment for yellow fever, a very effective vaccine is widely available.
- A single vaccine dose provides lifelong immunity, so all individuals living in or travelling to areas endemic for yellow fever should take the vaccine.

**West Nile**

2

- The West Nile virus was first isolated from a woman in the West Nile region of Uganda. It is transmitted by mosquitoes belonging the genus *Culex*.
- The natural vertebrate hosts are wild birds. But the virus can be transmitted to a number of different animals, including humans, through the bite of an infected mosquito.
- Approximately 80% of the people infected with West Nile virus will not show any symptoms.
- Those who do become symptomatic have mild non-specific symptoms that include headaches, fever, tiredness, body aches, nausea, vomiting and, occasionally, a rash.
- A small proportion of symptomatic patients, however, develop severe disease. This is associated with neurological impairment, and can be fatal in extreme cases.

**2) Write the features of Ti Plasmid and why it is called as natural Genetic Engineer?**

**Ti Plasmid**

3

- Plasmids are extra chromosomal, self replicating ds circular DNA molecules, found

in the bacterial cells in addition to the bacterial chromosome.

- Plasmids contain Genetic information for their own replication.

**pBR 322 Plasmid****2**

- pBR 322 plasmid is a reconstructed plasmid and most widely used as cloning vector; it contains 4361 base pairs.
- In pBR, p denotes plasmid, Band R respectively the names of scientist Boliver and Rodriguez who developed this plasmid.
- The number 322 is the number of plasmid developed from their laboratory.
- It contains ampR and tetR two different antibiotic resistance genes and recognition sites for several restriction enzymes. (Hind III, EcoRI, BamH I, Sal I, Pvu II, Pst I, Cla I), ori and antibiotic resistance genes.-Rop codes for the proteins involved in the replication of the plasmid.

**Ti Plasmid****2**

- Ti plasmid is found in Agrobacterium tumefaciens, a bacterium responsible for inducing tumours in several dicot plants.
- The plasmid carries transfer (tra) gene which help to transfer T- DNA from one bacterium to other bacterial or plant cell.
- It has Onc gene for oncogenicity, ori gene for origin for replication and inc gene for incompatibility.
- T-DNA of Ti-Plasmid is stably integrated with plant DNA. Agrobacterium plasmids have been used for introduction of genes of desirable traits into plants.

**Competent Host (For Transformation with Recombinant DNA)****2**

- The propagation of the recombinant DNA molecules must occur inside a living system or host.
- Many types of host cells are available for gene cloning which includes E.coli, yeast, animal or plant cells.
- The type of host cell depends upon the cloning experiment.

- E.coli is the most widely used organism as its genetic make-up has been extensively studied, it is easy to handle and grow, can accept a range of vectors and has also been studied for safety.

- One more important feature of E.coli to be preferred as a host cell is that under optimal growing conditions the cells divide every 20 minutes.

- Since the DNA is a hydrophilic molecule,it cannot pass through cell membranes, In order to force bac teria to take up the plasmid, the bacterial cells must first be made competent to take up DNA.

- Since the DNA is a hydrophilic molecule,it cannot pass through cell membranes, In order to force bac teria to take up the plasmid, the bacterial cells must first be made competent to take up DNA.

- This is done by treating them with a specific concentration of a divalent cation such as calcium.

- Recombinant DNA can then be forced into such cells by incubating the cells with recombinant DNA on ice, followed by placing them briefly at 42°C (heatshock) and then putting them back on ice.

- This enables bacteria to take up the Recombinant DNA.

- This technique is advantageous because the liposome protects the introduced DNA from being damaged by the acidic pH and protease enzymes present in the vacuole.

**Lipofection Biolistics:****2**

- The foreign DNA is coated onto the surface of minute gold or tungsten particles (1-3 µm) and bombarded onto the target tissue or cells using a particle gun (also called as gene gun/ micro projectile gun/shotgun).

- Then the bombarded cells or tissues are cultured on selected medium to regenerate plants from the transformed cells.

**Indirect or Vector-Mediated Gene Transfer 4**

- Gene transfer is mediated with the help of a plasmid vector is known as indirect or vector mediated gene transfer.
  - Among the various vectors used for plant transformation, the Ti-plasmid from *Agrobacterium tumefaciens* has been used extensively.
  - This bacterium has a large size plasmid, known as Ti plasmid (Tumor inducing) and a portion of it referred as T-DNA (transfer DNA) is transferred to plant genome in the infected cells and cause plant tumors (crown gall).
  - Since this bacterium has the natural ability to transfer T-DNA region of its plasmid into plant genome, upon infection of cells at the wound site, it is also known as the **natural genetic engineer** of plants.
1. The foreign gene (e.g. Bt gene for insect resistance)
  2. plant selection marker gene, usually an antibiotic gene like npt II which confers resistance to antibiotic kanamycin are cloned in the T DNA region of Ti-plasmid in place of unwanted DNA sequences.

**3) Explain about modern trends in Taxonomy? Write the Difference between classical and modern taxonomy?**

**Modern trends in taxonomy 2**

- The complete knowledge of taxonomy is possible with the principles of various disciplines like Cytology, Genetics, Anatomy, Physiology, Geographical Distribution, Embryology, Ecology, Palynology, Phenology, Bio-Chemistry, Numerical Taxonomy and Transplant Experiments.

**Chemotaxonomy**

- Proteins, amino acids, nucleic acids, peptides etc. are the most studied chemicals in chemotaxonomy.
- Chemotaxonomy is the scientific approach of classification of plants on the basis of their biochemical constituents.
- As proteins are more closely controlled by genes and less subjected to natural selection,

it has been used at all hierarchical levels of classification starting from the rank of 'variety' up to the rank of division in plants.

- The chemical characters can be divided into three main categories.
1. Easily visible characters like starch grains, silica.
  2. Characters detected by chemical tests like phenolics, oil, fats, waxes.
  3. Proteins.

**Aims of chemotaxonomy 1**

- To develop taxonomic characters which may improve existing system of plant classification.
- To improve present day knowledge of phylogeny of plants.

**Biosystematics 1**

- Biosystematics is an "Experimental, ecological and cytotaxonomy" through which life forms are studied and their relationships are defined.
- The term biosystematics was introduced by Camp and Gilly in 1943.
- Biosystematics is closer to Cytogenetics and Ecology and much importance given not to classification but to evolution.

**Aims of biosystematics 1**

- The aims of biosystematics are as follows:
1. To delimit the naturally occurring biotic community of plant species.
  2. To establish the evolution of a group of taxa by understanding the evolutionary and phylogenetic trends.
  3. To involve any type of data gathering based on modern concepts and not only on morphology and anatomy.
  4. To recognize the various groups as separate biosystematic categories such as ecotypes, ecospecies, cenospecies and comparium.

**Karyo taxonomy**

- Utilization of the characters and phenomena of cytology for the explanation of taxonomic problem is known as cytotaxonomy or karyotaxonomy.

- The characters of chromosome such as number, size, morphology and behaviour during meiosis have proved to be of taxonomic value.

**Serotaxonomy (Immunotaxonomy)** 1

- Systematic serology or serotaxonomy had its origin towards the end of twentieth century with the discovery of serological reactions and development of the discipline of immunology.
- Smith (1976) defined it as “the study of the origins and properties of antisera.”
- The classification of very similar plants by means of differences in the proteins they contain, to solve taxonomic problems is called serotaxonomy.

**Importance of serotaxonomy**

- It determines the degree of similarity between species, genera, families etc.
- by comparing the reactions of antigens from various plant taxa with antibodies raised against the antigen of a given taxon.

**Example:**

- The assignment of *Phaseolus aureus* and *P. mungo* to the genus *Vigna* is strongly supported by serological evidence by Chrispeels and Gartner.

**Molecular taxonomy (molecular systematics / molecular phylogenetics)** 2

- Molecular Taxonomy is the branch of phylogeny that analyses hereditary molecular differences, mainly in DNA sequences, to gain information and to establish genetic relationship between the members of different taxonomic categories.
- The advent of DNA cloning and sequencing methods have contributed immensely to the development of molecular taxonomy and population genetics over the years.
- The results of a molecular phylogenetic analysis are expressed in the form of a tree called phylogenetic tree.
- Different molecular markers like allozymes, mitochondrial DNA, microsatellites, RFLP (Restriction Fragment Length Polymorphism),

RAPD (Random amplified polymorphic DNA), AFLPs (Amplified Fragment Length Polymorphism), single nucleotide polymorphism- (SNP), microchips or arrays are used in analysis.

**Uses of molecular taxonomy**

- Molecular taxonomy helps in establishing the relationship of different plant groups at DNA level.
- It unlocks the treasure chest of information on evolutionary history of organisms.

**RFLP (Restriction Fragment Length Polymorphism)**

1

- RFLPs is a molecular method of genetic analysis that allows identification of taxa based on unique patterns of restriction sites in specific regions of DNA.
- It refers to differences between taxa in restriction sites and therefore the lengths of fragments of DNA following cleavage with restriction enzymes.

**Amplified Fragment Length Polymorphism (AFLP)**

- This method is similar to that of identifying RFLPs in that a restriction enzyme is used to cut DNA into numerous smaller pieces, each of which terminates in a characteristic nucleotide sequence due to the action of restriction enzymes.

**Random Amplified Polymorphic DNA (RAPD)**

- It is a method to identify genetic markers using a randomly synthesized primer that will anneal (recombine (DNA) in the double stranded form) to complementary regions located in various locations of isolated DNA.

**Significance of Molecular Taxonomy**

- It helps to identify a very large number of species of plants and animals by the use of conserved molecular sequences.
- Using DNA data evolutionary patterns of biodiversity are now investigated.
- DNA taxonomy plays a vital role in phytogeography, which ultimately helps in genome mapping and biodiversity conservation.



- DNA- based molecular markers used for designing DNA based molecular probes, have also been developed under the branch of molecular systematics.

**DNA Barcoding** 1

- DNA barcoding is a taxonomic method that uses a very short genetic sequence from a standard part of a genome.
- The genetic sequence used to identify a plant is known as "DNA tags" or "DNA barcodes".
- Paul Hebert in 2003 proposed 'DNA barcoding' and he is considered as 'Father of barcoding'.

- The gene region that is being used as an effective barcode in plants is present in two genes of the chloroplast, matK and rbcL, and have been approved as the barcode regions for plants.

**Significance of DNA barcoding** 2

- DNA barcoding greatly helps in identification and classification of organism.
- It aids in mapping the extent of biodiversity.
- However, DNA barcoding is a helpful tool to determine the authenticity of botanical material in whole, cut or powdered form.

**Differences between classical and modern taxonomy**

Classical Taxonomy	Modern Taxonomy
It is called old systematics or Alpha ( $\alpha$ ) taxonomy or Taxonomy	It is called Neosystematics or Biosystematics or Omega ( $\Omega$ ) taxonomy
It is pre Darwinean	It is post Darwinean
Species is considered as basic unit and is static	Species is considered as dynamic entity and ever changing

**4) Define Mal Nutrition. What are the types, causes and impacts of Mal Nutrition.**

- Malnutrition is a term that refers to any deficiency, excess or imbalance in somebody's intake of energy and/or nutrients. It can either be due to inadequate intake or an excess intake of calories.
- The term **malnutrition** covers two broad groups of conditions are as follows. 3

**Types of Malnutrition** 2

- **Undernutrition** – This includes **stunting** (low height for age), **wasting** (low weight for height), **underweight** (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals)
- **Overnutrition** – This includes overweight, **obesity** and diet-related **non-communicable diseases** (such as cardiovascular disease, hypertension, cancer, and type-2 diabetes.).

**Diseases caused by malnutrition** 1

- **Marasmus** – It is a form of severe malnutrition. **Nutrient deficiency** is the main cause of marasmus. It occurs in children that

don't ingest enough protein, calories, carbohydrates, and other important nutrients. This is usually due to **poverty** and a **scarcity** of food.

- **Kwashiorkor** – It is a form of **severe protein malnutrition**. In this type malnutrition produced by a severely inadequate amount of protein in the diet.

**Causes: Agricultural practices** 1

- Stagnant/declining agriculture output due to reasons such as reduced soil fertility, fragmented lands or fluctuating market price of farm produce.
- Monoculture agricultural practices

**Low Income** 1

- Relative income of one section of people has been on the decline. This has adverse effects on their capacity to buy adequate food, especially when food prices have been on the rise.

**Public Distribution System:** 1

- The public distribution system of the state is not functioning well or is not accessible to everyone.

**Rural Unemployment** **1**

- The emaciated rural livelihoods sector and lack of income opportunities other than the farm sector have contributed heavily to the growing joblessness in rural areas.
- Lack of sanitation and clean drinking water:

**Migration** **1**

- Seasonal migrations have long been a livelihood strategy for the poorest households in India, as a means to access food and money through casual labour.

**Gender injustice**

- Malnourished girls become malnourished adolescents who marry early and have children who become malnourished, and so the cycle continues. 17

**Lacunae at policy level** **4**

- There is a lack of real-time data that brings all these factors together to show the extent of India's malnutrition.

**Impacts**

- Health Impacts: wasting, stunting etc.
- It can lead to the development of diseases and chronic health conditions.
- Long-term effects of undernutrition include a higher risk of obesity, heart disease and diabetes.
- Undernutrition causes changes in metabolism that may lead to a higher likelihood of developing chronic diseases later in life
- Overweight or obese children have a higher chance of heart disease and type 2 diabetes.

**5) Write a notes on Pentose Phosphate Pathway?****Pentose phosphate pathway** **3**

- Pentose phosphate pathway is also called Hexose monophosphate pathway/ HMP shunt/ Phosphogluconate pathway/ Warburg-Limpam-Dickens cycle.
- It is an alternative route for the metabolism of glucose.
- It is a more complex pathway than glycolysis.
- It is more anabolic in nature.-It takes place in the cytosol.
- The tissues such as liver, adipose tissue, adrenal gland, erythrocytes, testes and

lactating mammary gland are highly active in HMP shunt.

- It concern with the biosynthesis of NADPH and pentoses.

**Reactions of the pathway** **2**

- The sequence of reactions of HMP shunt is divided into two phases-oxidative and non-oxidative phase.

**Oxidative phase** **2.5**

- Glucose-6-phosphate dehydrogenase (G6PD) is an NADP dependent enzyme that converts glucose 6-phosphate into 6-phosphogluconolactone.
- It hydrolyzed by the gluconolactonehydrolase to form 6-phosphogluconate.
- The next reaction involving the synthesis of NADPH is catalyzed by 6-phosphogluconate dehydrogenase to produce 3 keto 6-phosphogluconate which then undergoes decarboxylation to give ribulose-5-phosphate.

**Non-oxidative phase** **2.5**

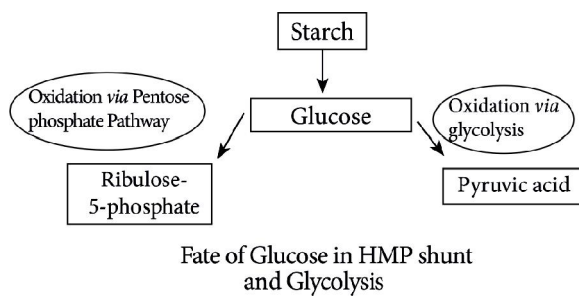
- The non-oxidative reactions are concerned with the interconversion of three, four, five and seven carbon monosaccharides.
- The enzyme epimerase converts ribulose-5-p into xylulose-5-p.
- The enzyme ketoisomerase converts ribulose-5-p into ribose-5-p.
- The enzyme transketolase catalyzes the transfer of 2 carbon moiety from Xylulose-5-phosphate and ribose-5-phosphate to give a glyceraldehyde-3-phosphate and sedoheptulose-7-phosphate.
- Transketolase is dependent on the coenzyme thiamine pyrophosphate(TPP) & Mg<sup>2+</sup> ions.
- Transaldolase brings about the transfer of a 3-carbon fragment from sedoheptulose-7-phosphate to glyceraldehyde-3-phosphate to give fructose 6-phosphate and four carbon erythrose 4-phosphate.
- Transketolase acts on xylulose-5-phosphate and transfers a 2-carbon fragment (glyceraldehyde) from it to erythrose 4-phosphate to generate fructose 6-phosphate and glyceraldehyde 3-phosphate.

- Fructose 6-phosphate and glyceraldehyde 3-phosphate can be further catabolized through glycolysis and citric acid cycle.
- Glucose may also be synthesized from these two compounds.

**Significance of pentose phosphate pathway**

5

- HMP shunt is associated with the generation of two important products, NADPH and pentose sugars, which play a vital role in anabolic reactions.
- Coenzyme NADPH generated is used for reductive biosynthesis and counter damaging the effects of oxygen free radicals
- Ribose-5-phosphate and its derivatives are used in the synthesis of DNA, RNA, ATP, NAD<sup>+</sup>, FAD and Coenzyme A.
- Erythrose is used for synthesis of anthocyanin, lignin and other aromatic compounds.
- It plays a role on fixation of CO<sub>2</sub> in photosynthesis through RUBP.



**6) Discuss about various types of body fluids?**

**Body fluids**

3

- The body fluid consists of water and substances dissolved in them. There are two types of body fluids, the intracellular fluid present inside the cells and the extracellular fluid present outside the cells.
- The three types of extracellular fluids are the interstitial fluid or tissue fluid (surrounds the cell), the plasma (fluid component of the blood) and lymph. The blood flowing into the capillary from an arteriole has high hydrostatic pressure.

- This pressure is brought about by the pumping action of the blood and it tends to force water and small molecules out through the permeable walls of the capillary into the tissue fluid.
- The volume of fluid which leaves the capillary to form tissue fluid is the result of two opposing pressures.
- The water potential lesser than hydrostatic pressure inside the capillary bed which is enough to push fluid into the tissues.
- The tissue fluid has low concentration of protein than that of plasma.
- At the venous end of the capillary bed, the water potential is greater than the hydrostatic pressure and the fluid from the tissues flows into the capillary and water is drawn back into the blood, taking with it waste products produced by the cells.

**Composition of Blood**

1

- Blood is the most common body fluid that transports substances from the part of the body to the other.
- Blood is a connective tissue consisting of plasma (fluid matrix) and formed elements.
- The plasma constitutes 55 of the total blood volume. The remaining 45% is the formed elements that consists of blood cells.
- The average blood volume is about 5000ml (5L) in an adult weighing 70 Kg.

**Plasma**

1

- Plasma mainly consists of water (80-92%) in which the plasma proteins, inorganic constituents (0.9%), organic constituents (0.1%) and respiratory gases are dissolved.
- The four main types of plasma proteins synthesized in the liver are albumin, globulin, prothrombin and fibrinogen.

- Albumin maintains the osmotic pressure of the blood.
- Globulin facilitates the transport of ions, hormones, lipids and assists in immune function.
- Both prothrombin and Fibrinogen are involved in blood clotting.
- Organic constituents include urea, amino acids, glucose, fats and vitamins; and the inorganic constituents include chlorides, carbonates and phosphates of potassium, sodium, calcium and magnesium.
- The byproduct of the plasma are not stable.
- The glucose level in the spleen is highly increase after the food has taken. Because the glucose are taken from the intestine for storage.
- The absorption of the glucose in the blood prevails. So that the glucose level is reducing gradually.
- The amino acids which are produced due to excessive intake of proteins.
- The liver converts the amino acids into urea.
- The blood urea present in the liver veins and aorta is lower than the blood urea present in aorta of the liver.

**Formed elements****1**

- Red blood cells/ corpuscles (erythrocytes), white blood cells / corpuscles (Leucocytes) and platelets are collectively called formed elements.

**Red blood cells****1**

- Red blood cells are abundant than the other blood cells. There are about 5 million to 5.5 millions of RBC mm<sup>-3</sup> of blood in a healthy man and 4.5 – 5.0 millions of RBC mm<sup>-3</sup> in healthy women.

- The RBCs are very small with the diameter of about 7m (micrometer).
- The red colour of the RBC is due to the presence of a respiratory pigment, haemoglobin dissolved in the cytoplasm.
- Haemoglobin plays an important role in the transport of respiratory gases and facilitates the exchange of gases with the fluid outside the cell (tissue fluid).
- The biconcave shaped RBCs increases the surface area to volume ratio, hence oxygen diffuses quickly in and out of the cell. The RBCs are devoid of nucleus, mitochondria, ribosomes and endoplasmic reticulum.
- The absence of these organelles accommodates more haemoglobin thereby maximizing the oxygen carrying capacity of the cell.
- The average life span of RBCs in a healthy individual is about 120 days after which they are destroyed in the spleen (graveyard / cemetery of RBCs) and the iron component returns to the bone marrow for reuse.

**White blood cells (leucocytes)****1**

- Are colourless, amoeboid, nucleated cells devoid of haemoglobin and other pigments.
- Approximately 6000 to 8000 per cubic mm of WBCs are shown in depending on the presence or absence of granules, WBCs are divided into two types, granulocytes and agranulocytes.
- Granulocytes are characterised by the presence of granules in the cytoplasm and are differentiated in the bone marrow.
- The granulocytes include neutrophils, eosinophils and basophils.

**Neutrophils**

1

- They are also called heterophils or polymorphonuclear (cells with 3-4 lobes of nucleus connected with delicate threads) cells which constitute about 60% - 65% of the total WBCs.
- They are phagocytic in nature and appear in large numbers in and around the infected tissues.

**Eosinophils**

1

- Have distinctly bilobed nucleus and the lobes are joined by thin strands.
- They are non-phagocytic and constitute about 2-3% of the total WBCs. Eosinophils increase during certain types of parasitic infections and allergic reactions.

**Basophils**

1

- They are less numerous than any other types of WBCs constituting 0.5% - 1.0% of the total number of leucocytes.
- The cytoplasmic granules are large sized, but fewer than eosinophils.
- Nucleus is large sized and constricted into several lobes but not joined by delicate threads. Basophils secrete substances such as heparin, serotonin and histamines.
- They are also involved in inflammatory reactions.

**Agranulocytes**

1

- They are characterized by the absence of granules in the cytoplasm and are differentiated in the lymph glands and spleen.
- These are of two types, lymphocytes and monocytes. Lymphocytes constitute 28% of WBCs. These have large round nucleus and small amount of cytoplasm.

- The two types of lymphocytes are B and T cells. Both B and T cells are responsible for the immune responses of the body.
- B cells produce antibodies to neutralize the harmful effects of foreign substances and T cells are involved in cell mediated immunity.

**Monocytes (Macrophages)**

1

- They are phagocytic cells that are similar to mast cells and have kidney shaped nucleus. They constitute 1-3% of the total WBCs.

**The macrophages**

1

- The central nervous system are the 'microglia', in the sinusoids of the liver they are called 'Kupffer cells' and in the pulmonary region they are the 'alveolar macrophages'.

**Platelets**

1

- They are also called thrombocytes that are produced from megakaryocytes (special cells in bone marrow) and lack nuclei. Blood normally contains 1,50,000 - 3,50,000 platelets mm<sup>-3</sup> of blood.
- They secrete substances involved in coagulation or clotting of blood.
- The reduction in platelet number can lead to clotting disorders that result in excessive loss of blood from the body.

**7) Explain about Hypo and Hyper activity of endocrine glands and relate disorders.**

**Endocrine Glands**

2

- The Endocrine system is a powerful network of various glands.
- They have a great impact on other organ systems and their functions. The chemicals secreted by endocrine glands called hormones.
- Hormones can manipulate or change various cell activities in such a way that they can make us as tall as a tree and as short as a herb. Hence,

hormone level needs to maintain at equilibrium.

- "Too much of anything and too little of anything are always dangerous".
- The term the hormone imbalance also explains the same. In the case of hormones, an excess of the hormone may lead to some diseases, too little hormone also causes disease.
- The endocrine glands itself has a feedback mechanism to counteract the hormone imbalance but sometimes it fails and leads to some disorders or diseases.

**Dwarfism****13**

- Dwarfism is due to hyposecretion of growth hormone (GH) in children, skeletal growth and sexual maturity is arrested.
- They attain a maximum height of 4 feet only.

**Gigantism**

- Gigantism is due to hypersecretion of growth hormone (GH) in children.
- Overgrowth of skeletal structure occurs (up to 8 feet) and the visceral growth is not appropriate with that of limbs.

**Acromegaly**

- Acromegaly is due to excessive secretion of growth hormone in adults.
- Over growth of hand bones, feet bones, jaw bones, malfunctioning of gonads, enlargement of viscera, tongue, lungs, heart, liver, spleen and endocrine gland like thyroid, adrenal etc., are the symptoms of acromegaly.

**Cretinism**

- In infants, hypothyroidism causes cretinism.
- A cretin shows retarded skeletal growth, absence of sexual maturity, retarded mental ability, thick wrinkled skin, protruded enlarged tongue, bloated face, thick and short limbs occurs.

- The other symptoms are low BMR, slow pulse rate, subnormal body temperature and elevated blood cholesterol levels.

**Myxedema**

- Hyposecretion of thyroid in adults causes myxedema. It is otherwise called Gull's disease.
- This disease is characterised by decreased mental activity, memory loss, slowness of movement, speech, and general weakness of body, dry coarse skin, scarce hair, puffy appearance, disturbed sexual function, low BMR, poor appetite, and subnormal body temperature.

**Grave's disease**

- Grave's disease also called as thyrotoxicosis or exophthalmic goitre.
- This disease is caused due to hyper secretion of thyroid. It is characterised by enlargement of thyroid gland, increased BMR (50% - 100%), elevated respiratory and excretory rates, increased heart beat, high BP, increased body temperature, protrusion of eyeball and weakness of eye muscles and weight loss.

**Simple goitre**

- Simple goitre is also known as Endemic goitre. It is caused due to hyposecretion of thyroxine.
- The symptoms includes enlargement of thyroid gland, fall in serum thyroxine level, increased TSH secretion.

**Tetany**

- Tetany is caused due to the hyposecretion of parathyroid hormone (PTH).
- Due to hyposecretion of PTH serum calcium level decreases (Hypocalcemia), as a result serum phosphate level increases.

- Calcium and phosphate excretion level decreases. Generalized convulsion, locking of jaws increased heart beat rate, increased body temperature, muscular spasm are the major symptoms of tetany.

#### **Hyperparathyroidism**

- Hyperparathyroidism is caused due to excess PTH in blood.
- Demineralisation of bone, cyst formation, softening of bone, loss of muscle tone, general weakness, renal disorders are the symptoms of hyperparathyroidism.

#### **Addison's disease**

- Addison's disease is caused due to hyposecretion of glucocorticoids and mineralocorticoids from the adrenal cortex.
- Muscular weakness, low BP, loss of appetite, vomiting, hyper pigmentation of skin, low metabolic rate, subnormal temperature, reduced blood volume, weight loss are the symptoms that occur in Addison's disease.
- Reduced aldosterone secretion increases urinary excretion of Na Cl. and water and decreases potassium excretion leading to dehydration.

#### **Cushing's syndrome**

- Cushing's syndrome is caused due to excess secretion of cortisol.
- Obesity of the face and trunk, redness of face, hand, feet, thin skin, excessive hair growth, loss of minerals from bone (osteoporosis) systolic hypertension are features of Cushing's syndrome.
- Suppression of sexual function like atrophy of gonads are the other symptoms of Cushing's syndrome.

#### **Hypoglycaemia**

- Hypoglycaemia is due to increased secretion of insulin thereby blood glucose level decreases.
- In this disorder blood glucose level lowers than normal fasting index.
- Increased heartbeat, weakness, nervousness, headache, confusion, lack of co-ordination, slurred speech, serious brain defects like epilepsy and coma occurs.

#### **Hyperglycaemia**

- Hyperglycaemia is otherwise known as Diabetes mellitus. It is caused due to reduced secretion of insulin.
- As the result, blood glucose level is elevated. Diabetes mellitus is of two types, Type I Diabetes and Type II Diabetes.
- Type I diabetes is also known Insulin dependent diabetes, caused by the lack of insulin secretion due to illness or viral infections.
- Type II diabetes is also known as Non- Insulin dependent diabetes, caused due to reduced sensitivity to insulin, often called as insulin resistance.
- Symptoms of diabetes includes, polyurea (excessive urination), polyphagia (excessive intake of food), polydipsia (excessive consumption liquids due to thirst), ketosis (breakdown of fat into glucose results in accumulation of ketone bodies) in blood.
- Gluconeogenesis (Conversion of non-carbohydrate form like amino acids and fat into glucose) also occur in diabetes.

#### **Diabetes insipidus**

- Diabetes insipidus is caused due to hyposecretion of vasopressin (ADH) from neurohypophysis.

- The symptom includes frequent urination (polyurea) and excessive consumption of liquids due to thirst (polydipsia).

**8) What is contraception and Explain common contraceptive methods?****Contraception 5**

- Contraception is one of the best birth control measures.
- A number of techniques or methods have been developed to prevent pregnancies in women.
- The devices used for contraception are called contraceptive devices. Common contraception methods used to prevent pregnancy are discussed here.

1. Barrier methods
2. Hormonal methods
3. Intra - Uterine Devices (IUDs)
4. Surgical methods

**1. Barrier Methods 2**

- This method prevents sperms from meeting the ovum. Its entry into the female reproductive tract is prevented by barrier.

**a. Condom: 2**

- Condom prevents deposition of sperms in the vagina. Condoms are made of thin rubber or latex sheath.
- Condom also protect against sexually transmitted diseases (STD) like syphilis, AIDS.

**b. Diaphragm (Cervical cap): 1**

- Vaginal diaphragm fitting into the vagina or a cervical cap fitting over the cervix.
- This prevents the entry of sperms into the uterus.

**2. Hormonal Methods 1**

- Hormonal preparations are in the form of pills or tablets (contraceptive pills).
- These hormones stop (interface with ovulation) the release of egg from the ovary.

**3. Intra - Uterine Devices (IUDs) 2**

- The intrauterine device (IUD) are contraceptive devices inserted into the uterus.
- There are two synthetic devices commonly used in India are Lippe's Loop and Copper-T made of copper and plastic (non irritant).
- This can remain for a period of 3 years. This reduces the sperm fertilizing capacity and prevents implantation.
- This also helps to give adequate time interval between pregnancies.

**4. Surgical Methods 2**

- Surgical contraception or sterilization techniques are terminal methods to prevent any pregnancy.
- This procedure in males is vasectomy (ligation of vas deferens) and in females it is tubectomy (Ligation of fallopian tube).
- These are methods of permanent birth control.



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