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BIO-ZOOLOGY

REVISED EDITION

(2022-23)

(PART –II)

7. Human Health and Diseases
8. Microbes in Human Welfare
9. Applications of biotechnology
10. Organisms and Population.
11. Biodiversity and its Conservation
12. Environmental Issues.

7: Human Health and Diseases

BOOK BACK QUESTION

(Note :- Question no :1– 14 answers are available in your book)

15) Given below are some human organs. Identify one primary and one secondary lymphoid organ. Explain its role.
Liver, thymus, stomach, thyroid, tonsils.

1. **Thymus –**it is the primary lymphoid organ. T cells maturation occurs in the thymus .
2. **Tonsils -**it is the secondary lymphoid organ.Which help to fight infections and they stop invading germs including bacteria and viruses.

16) Name and explain the type of barriers which involve macrophages.

- Specialized cells **Monocytes,** it can mature to convert a macrophages cells.
- It act as a phagocytosis and digest whole microorganisms.

17) What are interferons? Mention their role.

- **Interferons** induce **antiviral state** in the uninfected cells.
- Complementary substances produced from leucocytes lyse the **pathogenic microbes** or facilitate phagocytosis.

18) List out chemical alarm signals produced during inflammation.

- Tissue damage and infection induce leakage of vascular fluid, containing chemotactic signals like **serotonin, histamine** and **prostaglandins**.
- They influx the **phagocytic cells** into the affected area. This phenomenon is called **diapedesis.**

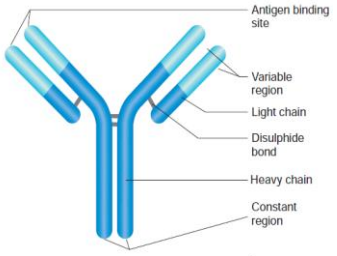
19) Explain the process of replication of retrovirus after it gains entry into the human body.

- The HIV virus enters into macrophages where **RNA** replicates to form **viral DNA** with the help of the enzyme **reverse transcriptase**.
- This viral DNA gets incorporated into the DNA of host cells and directs the infected cells to produce viral particles.
- The macrophages continue to produce virus and in this way acts like a HIV factory.
- Simultaneously, HIV enters into helper T-lymphocytes, replicates and produces progeny viruses.
- The progeny viruses released in the blood attack other helper T-lymphocytes.
- This is repeated, leading to a progressive decrease in the number of helper T lymphocytes in the body of the infected person.
- During this period, the person suffers from bouts of fever, diarrhoea and weight loss.

20) Explain the structure of immunoglobulin with suitable diagram. **(May-2022)**

- In 1950s, **Porter and Edelman** revealed the basic structure of the immunoglobulin.
- An antibody molecule is **Y** shaped structure that comprises of 4 four polypeptide chains.
- Two identical light chains **(L)** of molecular weight 25,000 Da (214 amino acids) .
- Two identical heavy chains **(H)** of molecular weight 50,000 Da (450 amino acids).
- The polypeptide chains are linked together by di-sulphide (S-S) bonds.

- γ One light chain is attached to each heavy chain and 2 heavy chains are attached to each other to form a Y shaped structure. Hence, an antibody is represented by H2 L2.
- γ Each chain **(L** and **H)** has two terminals. They are C - terminal (Carboxyl) and amino or N-terminal.
- γ Each chain (**L** and **H**) has two regions. They have variable (**V**) region and constant (**C**) region.



21. What are the cells involved innate immune system?
    1. Monocytes, Neutrophils - to convert a macrophages cells and it act as a **phagocytosis.**
    2. Complementary substances produced from leucocytes - produce antiviral substance **Interferons**.
    3. Mast cell – they produce the chemical substances serotonin, histamine and prostaglandins, it act as **Inflammatory barriers**.

22. What is vaccine? What are its types?
    - A vaccine **is a biological preparation that provides active acquired immunity** to a particular disease.
    - It resembles a disease-causing microorganism and is often made from weakened or killed forms of the microbes, their toxins, or one of its surface proteins.
    - Vaccine initiates the immunization process. The vaccines are classified 3 types :;

    1. First generation vaccine - is further subdivided into live attenuated vaccine, killed vaccine and toxoids.
       i) Live attenuated vaccines - Measles, mumps, rubella (MMR) and the Varicella (chickenpox) vaccine.
       ii) Killed (inactivated) vaccines - Salk's polio vaccine.
       iii) Toxoid vaccines - contain a toxin or chemical secreted by the bacteria or virus. DPT vaccine
    2. Second generation vaccine - contains the pure surface antigen of the pathogen. E.g. Hepatitis-B vaccine.
    3. Third generation vaccine - contains the purest and the highest potency vaccines which are synthetic in generation. The latest revolution in vaccine is **DNA vaccine** or **recombinant vaccine.**

23. A person is infected by HIV. How will you diagnose for AIDS?
    - ✱ A simple blood test is available that can determine whether the person has been infected with HIV.
    1. **ELISA** test - detects the presence of HIV antibodies. It is a preliminary test.
    2. **Western blot** test - is more reliable and a confirmatory test. It detects the viral core proteins.
    - ✱ If both tests detect the presence of the antibodies, the person is considered to be HIV positive.

24. Autoimmunity is a misdirected immune response. Justify **(May-2022)**
    - ☆ Autoimmunity is due to an abnormal immune response in which the immune system fails to properly distinguish between self and non-self and attacks its own body.
    - ☆ Our body produces antibodies **(auto antibodies)** and **cytotoxic T cells** that destroy our own tissues.
    - ☆ If a disease-state results, it is referred to as auto-immune disease. Thus, autoimmunity is a misdirected immune response.
    - ☆ Autoimmunity is evidenced by the presence of **auto antibodies and T cells** that are reactive with host antigens. When the cells act as antigens in the same body, they are called **autoantigens.**
    - ☆ Autoimmune diseases in human can be divided into **2 broad** categories:-

    1. Organ-specific disease - the autoimmune process is directed mostly against one organ. Examples include **Hashimoto's thyroiditis**, **Graves' disease** (thyroid gland) and **Addison's disease** (adrenal glands).
    2. Non-organ specific (systemic) disorders - autoimmune activity is widely spread throughout the body. **Rheumatoid arthritis** and **multiple sclerosis** are example for systemic disorder.

25. List the causative agent, mode of transmission and symptoms for Diphtheria and Typhoid.

No	Diseases	Causative agent	Site of infection	Mode of transmission	Symptoms
1.	Diphtheria	Corynebacterium diphtheriae	Larynx, skin,nasal, genital passage	Droplet infection	Fever, sore throat, hoarseness and difficulty in breathing.
2.	Typhoid	Salmonella typhi	Intestine	Through contaminated food and water	Headache, abdominal discomfort, fever and diarrhoea.

26. A patient was hospitalized with fever and chills. Merozoites were observed in her blood. What is your diagnosis?

- ⊕ The classic symptoms first develop with the synchronized release of merozoites, **haemozoin** toxin and erythrocyte debris into the blood stream resulting in malaria.
- ⊕ Symptoms are – shivering chills, high fever followed by sweating.
- ⊕ Fever and chills are caused partly by malarial toxins that induce macrophages to release tumour necrosis factor (TNF-α) and interleukin.

27. (i) Write the scientific name of the filarial worm that causes filariasis**.(May-2022)**

ANS : Wuchereria bancroft

(ii) Write the symptoms of filariasis.

ANS : Inflammation of the lymph nodes, the obstruction of lymph vessels causes elephantiasis or filariasis of the limbs, scrotum and mammary glands.

(iii) How is this disease transmitted?

ANS : The life cycle is completed in two hosts, man and the female *Culex* mosquito. The female filarial worm gives rise to juveniles called microfilariae larvae. In the lymph glands, the juveniles develop into adults.

28. List the common withdrawal symptoms of drugs and alcohol abuse.

- ❋ If the intake of the drug or alcohol is abruptly stopped, he or she would develop **withdrawal symptoms**.
- ❋ In a sense, the body becomes confused and protests against the absence of the drug.
- ❋ The withdrawal symptoms may range from mild tremors to convulsions, severe agitation and fits, depressed mood, anxiety, nervousness, restlessness, irritability, insomnia, dryness of throat, etc, depending on the type of drug abuse.

29. Why do you think it is not possible to produce vaccine against 'common cold'?

- ⊗ *Rhino viruses* cause one of the most infectious human ailment called the "**Common cold**".
- ⊗ Do not use an antibiotic to treat viral infections such as common cold .
- ⊗ Always follow the prescription. Skipping doses or failing to complete the prescription may allow antibiotic resistance to develop.

ADDITIONAL QUESTIONS

1) **Amoebiasis :- (May-2022)**

- ❖ Amoebiasis also called amoebic dysentery is caused by ***Entamoeba histolytica***.
- ❖ which lives in the human large intestine and feeds on food particles and bacteria.
- ❖ Infective stage of this parasite is the **trophozoite**, which penetrates the walls of the host intestine and secretes histolytic enzymes causing ulceration, bleeding, abdominal pain and stools with excess mucus.
- ❖ Symptoms of amoebiasis can range from diarrhoea to **dysentery with blood** and mucus in the stool.

2) **Malaria vaccine - (May**-2022)

It is used to prevent malaria.

- The only approved vaccine as of 2015 isRTS,S(Mosquirix).
- It requires four injections and has relatively low efficacy (26–50%).
- Due to this low efficacy, WHO does not recommend the use of RTS,S vaccine in babies between 6 and 12 weeks of age.

3) Innate immunity protects our body against diseases :- **(May-2022)**

1) Anatomical barriers – **Skin**(prevent the entry of microbes),**Mucus membranes** (entraps foreign microbes)
2) Physiological barriers – **Temperature**(inhibits the growth of pathogens), **Low p^H** (kill the microbes), **Chemical mediators**- Lysosomes acts as antibacterial agent, Interferons acts as antiviral agent .
3) Phagocytic barriers – **Monocytes,Neutrophils,Macrophages**-phagocytose, and digest the whole microbes.
4) Inflammatory barriers – **Serotonin, Histamine, Prostaglandins**.They influx the phagocytic cells into the affected area.

4) **Cell mediated immunity :-**

- When pathogens are destroyed by cells without producing antibodies, then it is known as cell mediated immunity. This is brought about by T cells, macrophages and natural killer cells.

5) **Antibody mediated immunity or humoral immunity :-**

- When pathogens are destroyed by the production of antibodies, then it is known as antibody mediated or humoral immunity. This is brought about by B cells with the help of antigen presenting cells and T helper cells. Antibody production is the characteristic feature of **vertebrates** only.

6) **Thymus Uses :-**

- One of its main secretions is the hormone **thymosin**. It stimulates the T cell to become mature and **immunocompetent**.Thus thymus is **most active** during the **neonatal and pre-adolescent periods.**

7) **Lymph node :-**

- Lymph node is a small bean-shaped structure and is part of the body's immune system.
- It is the **first one to encounter** the antigen that enters the tissue spaces.
- Lymph nodes filter and trap substances that travel through the lymphatic fluid.
- They are packed tightly with white blood cells, namely lymphocytes and macrophages.
- Lymph node has 3 zones. They are the **cortex, paracortex and medulla**.
- The outer most layer of the lymph node is called **cortex,** which consists of B-lymphocytes, macrophages, and follicular dendritic cells.
- The **paracortex** zone is beneath the cortex, which is richly populated by T lymphocytes and interdigitating dendritic cells.
- The inner most zone is called the **medulla** which is sparsely populated by lymphocytes, but many of them are plasma cells, which actively secrete antibody molecules.

8) Differentiate Paratope and Epitope

1. **Epitope -** Active part of Antigen , Binds with the antibody.
2. **Paratope -** Active part of antibody, Binds with the antigen.

9) Define Anaphylaxis :-

- ❋ Anaphylaxs is the classical immediate hypersensitivity reaction.
- ❋ It is a sudden, Systematic, Severe and immediate hypersensitivity reaction occurring as a result of rapid generalized mast – cell degranulation.

10) Define Hapten :-

- ☯ Haptens are substance that are non – immunogenic but can react with the products of a specific immune response.

11) **Peyer's patches :-**

- ◈ They are oval-shaped areas of thickened tissue that are embedded in the mucus-secreting lining of the small intestine of humans and other vertebrate animals.
- ◈ Peyer's patches contain macrophages, dendritic cells, Tcells, and B cells.

12) **Tonsils** (palatine tonsils) :-

- Θ **They** are a pair of soft tissue masses located at the back of the throat (pharynx).
- Θ The tonsils are part of the lymphatic system, which help to fight infections.
- Θ They stop invading germs including bacteria and viruses.

13) **Spleen :-**

- ⧫ It is a secondary lymphoid organ located in the upper part of the abdominal cavity close to the diaphragm.
- ⧫ Spleen contains B and T cells. It brings humoral and cell mediated immunity.

14) **Adenoids :-**

- ➢ They are glands located in the roof of the mouth,behind the soft palate where the nose connects to the throat.
- ➢ The adenoids produce antibodies that help to fight infections.
- ➢ Typically, the adenoids shrink during adolescence and may disappear by adulthood.

15) **Antigen** (Ag) :-

- ⊕ It is used in two senses, the first to describe a molecule which generates an immune response.
- ⊕ A molecule which reacts with antibodies.

16) Antibodies :-

- ⊗ Antibodies are immunoglobulin (Ig) protein molecules synthesized on exposure to antigen that can combine specifically with the antigen.
- ⊗ The antibodies are classified into five major categories, based on their physiological and biochemical properties. They are **IgG** (gamma), **IgM** (mu), **IgA** (alpha), **IgD** (delta) and **IgE** (epsilon).

17) **Hypersentivity / Overactive Immune Response :-**

- ❖ The exaggerated response of the immune system to certain antigens present in the environment is called **allergy (allo-altered, erg-reaction)**.
- ❖ The substances to which such an immune response is produced are called **allergens**. An allergen is an antigen that causes an allergic reaction.
- ❖ The common examples of **allergens** are mites in dust, pollens and some proteins in insect venom.
- ❖ **Symptoms** of allergic reactions include sneezing, watery eyes, running nose and difficulty in breathing.
- ❖ Allergy is a form of over active immune response mediated by **IgE** and **mast cells.**

-: GOD GRACE :-

8: Microbes in Human Welfare

BOOK BACK QUESTION

(Note :- Question no :1– 7 answers are available in your book)

8. How is milk converted into curd? Explain the process of curd formation.
   - ⊙ The LAB bacteria grows in milk and convert it into curd, thereby digesting the milk protein casein.
   - ⊙ A small amount of curd added to fresh milk as a starter or inoculum contains millions of *Lactobacilli.*
   - ⊙ Which under suitable temperature ($< 40^0$C) multiply and convert milk into curd.
   - ⊙ Curd is more nutritious than milk as it contains a number of organic acids and vitamins.

9. Give any two bioactive molecules produced by microbes and state their uses.
   1. Streptokinase produced by the bacterium *Streptococcus* and genetically engineered *Streptococci* are used as "**clot buster**" for **removing clots from the blood vessels** of patients who have undergone myocardial infarction.
   2. Recombinant **human insulin** has been produced predominantly using *E. coli* and *Saccharomyces cerevisiae* for therapeutic use in human.

10. Define the following terms :-

a. Antibiotics –
- Antibiotics are chemical substances produced by microorganisms which can kill or retard the growth of other disease causing microbes even in low concentration. Antibiotic means "**against life**".
- Antibiotics are used to treat diseases such as plague, meningitis, diphtheria, syphilis, leprosy, tuberculosis.

b. Zymology **–(May-2022)**
- 🖮 It is an applied science which deals with the biochemical process of fermentation and its practical uses - **Zymology.**

c. Superbug –
- ⊙ An informal for a bacterium that has become resistant to antibiotics that usually are used to treat it.

11. Write short notes on the following.

a) Brewer's yeast –
- Θ *Saccharomyces cerevisiae* commonly called brewer's yeast is used for fermenting malted cereals and fruit juices to produce various alcoholic beverages.
- Θ Wine and beer are produced without distillation, whereas whisky, brandy and rum are obtained by fermentation and distillation.

b) Ideonella sakaiensis –
- Θ It is currently tried for recycling of PET plastics. These bacteria use PETase and MHETase enzymes to breakdown PET plastic into terephthalic acid and ethylene glycol.

c) Microbial fuel cells – **(May-2022)**

- ❖ A microbial fuel cell is a bio-electrochemical system that drives an electric current by using bacteria.
- ❖ Microbial fuel cells work by allowing bacteria to oxidize and reduce organic molecules.
- ❖ Bacterial respiration is basically one big redox reaction in which electrons are being moved around.
- ❖ A MFC consists of an anode and a cathode separated by a proton exchange membrane.
- ❖ Microbes at the anode oxidize the organic fuel generating protons which pass through the membrane to the cathode and the electrons pass through the anode to the external circuit to generate current.

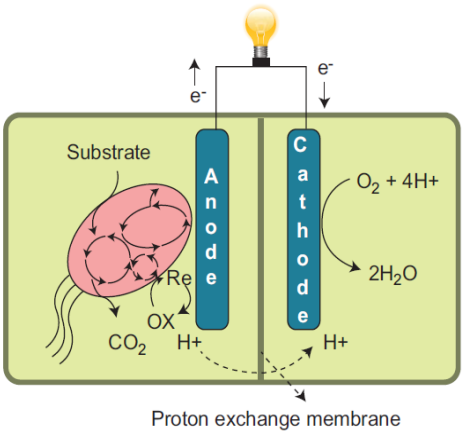


Fig. 8.3 Microbial fuel cell

12. List the advantages of biogas plants in rural areas.

- ♦ Biogas is a mixture of different gases produced by the breakdown of organic matter in the absence of O_2 .
- ♦ Biogas can be produced from raw materials such as agricultural wastes, manure, municipal wastes, plant material, sewage, food waste, etc.,
- ♦ Biogas primarily consists of methane (63 percent), along with CO2 and hydrogen.
- ♦ Methane producing bacteria are called **methanogens** and one such common bacterium is *Methanobacterium*.
- ♦ The *Methanogens* are also present in anaerobic sludge and rumen of cattle.
- ♦ The excreta of cattle called dung is commonly called "**Gobar**".
- ♦ Gobar gas is generated by the anaerobic decomposition of cattle dung.
- ♦ The outlet is connected to a pipe to supply biogas. The slurry is drained through another outlet and is used as fertilizer. Biogas is used for cooking and lighting.

13. When does antibiotic resistance develop? **(May-2022)**

- ⊕ Antibiotic resistance occurs when bacteria develop the ability to defeat the drug designed to kill or inhibit their growth. It is one of the most acute threat to public health.
- ⊕ Antibiotic resistance is accelerated by the misuse and over use of antibiotics, as well as poor infection prevention control.
- ⊕ Narrow spectrum antibiotics are preferred over broad spectrum antibiotics.
- ⊕ They effectively& accurately target specific pathogenic organisms and are less likely to cause resistance.
- ⊕ "**Superbug**" is a term used to describe strains of bacteria that are resistant to the majority of antibiotics commonly used today.

14. Which is referred to as Industrial alcohol ? why ? / Preparation of Ethanol **(March -2020).**

- ✪ *Saccharomyces cerevisiae* is the major producer of ethanol (C_2H_5OH). It is used for industrial, laboratory and fuel purposes. So ethanol is referred to as **industrial alcohol**.
- ✪ Bacteria such as *Zymomonas mobilis* and *Sarcina ventriculi* are also involved in ethanol production.
- ✪ The process of ethanol production starts by milling a feed stock followed by the addition of dilute or fungal **amylase (enzyme)** from *Aspergillus* to break down the starch into fermentable sugars.
- ✪ Yeast is then added to convert the sugars to ethanol which is then distilled off to obtain ethanol which is upto 96 percent in concentration.

- ✪ The two most common type of biofuels in use today are ethanol and biodiesel, both of them represent the first generation of biofuel technology.
- ✪ Ethanol is often used as a fuel, mainly as a biofuel additive for gasoline.

$$\underset{\text{(Glucose)}}{C_6H_{12}O_6} \xrightarrow[\text{Fermentation}]{\text{Yeast}} \underset{\text{(Ethanol)}}{2C_2H_5OH} + 2CO_2\uparrow$$

15. What is Bioremediation ?
- ✡ The use of naturally occurring or genetically engineered microorganisms to reduce or degrade pollutants is called bioremediation.
- ✡ Bioremediation is less expensive and more sustainable than other remediations available.
- ✡ It is grouped into *in situ* bioremediation(treatment of contaminated soil or water in the site) and
- ✡ *ex situ* bioremediation (treatment of contaminated soil or water that is removed from the site and treated) .

Addition Questions

1) Differentiate between the Prebiotics - Probiotics
- ✱ **Prebiotics -** are compounds in food that induce the growth or activity of beneficial microorganisms.
- ✱ **Probiotics -** are live microorganisms intended to provide health benefits when consumed, generally by improving or restoring the gut flora.

2) Uses of Microbes in industrial products :-
- ♣ Microbes are used to synthesize a number of products valuable to human beings.
- ♣ Products like beverages, antibiotics, organic acids, amino acids, vitamins, biofuels, single cell protein, enzymes, steroids, vaccines, pharmaceutical drugs, etc.

3) Antibiotics and its uses :-
- ⊙ Antibiotics are chemical substances produced by microorganisms which can kill or retard the growth of other disease causing microbes even in low concentration. Antibiotic means "**against life**".
- ⊙ Antibiotics are used to treat diseases such as plague, meningitis, diphtheria, syphilis, leprosy, tuberculosis.

ONE WORD QUESTIONS

1) The_____ grows in milk and convert it into curd, thereby digesting the milk protein casein.- **LAB bacteria.**
2) During cheese production, milk is usually acidified &the enzyme____ is added to cause coagulation.- **Rennet.**
3) Large holes in Swiss cheese is due to the production of large amount of carbon-di-oxide by the bacterium --- **Propionibacterium shermanii.**
4) The dough used in the preparation of idlis and dosas are fermented by the bacteria-- ***Leuconostoc mesenteroides*.**
5) The dough used in bread making is fermented by --- ***Saccharomyces cerevisiae*** **(Baker's Yeast).**
6) Who discovered **Streptomycin** and was the first to use the term "**antibiotic**" in (1943).- **Selman Waksman.**
7) Who discovered first antibiotic (Penicillium) in 1926 - **Alexander Fleming**.
8) Penicillin(antibiotics that kill bacteria) is produced by the fungi - ***Penicillium notatum* & *Penicillium chrysogenum*.**
9) The **"queen of drugs"** referred as - **Penicillin** .
10) **Fleming, Chain** and **Florey** were awarded the **Nobel prize** in 1945 for the discovery of - **Penicillin.**

9: Applications of biotechnology

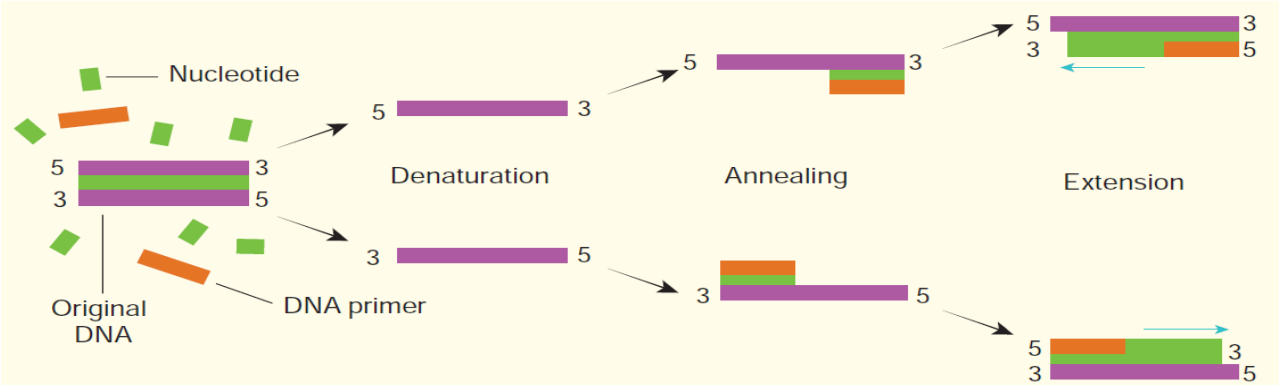
BOOK BACK QUESTION

(Note :- Question no :1– 9 answers are available in your book)

10. Mention the number of primers required in each cycle of PCR. Write the role of primers and DNA polymerase in PCR. Name the source organism of the DNA polymerase used in PCR.

1. **Two primers** required in each cycle of PCR.
2. The primer template is used to **synthesize DNA** by using Taq – DNA polymerase.
3. Tag polymerase is obtained from the bacterium **Thermus aquaticus**.

11. How is the amplification of a gene sample of interest carried out using PCR? **(May-2022)**



- There are the three steps involved in PCR :-

1. Denaturation - The double stranded DNA of interest is denatured to separate into two individual strands by high temperature .
2. Renaturation or primer annealing - Each strand is allowed to hybridize with a primer (renaturation or primer annealing).
3. Synthesis or primer extension - The primer template is used to synthesize DNA by using Taq – DNA polymerase.

- During denaturation the reaction mixture is heated to 95^0C for a short time to denature the target DNA into single strands that will act as a template for DNA synthesis.
- Annealing is done by rapid cooling of the mixture, allowing the primers to bind to the sequences on each of the two strands flanking the target DNA.
- During primer extension or synthesis the temperature of the mixture is increased to 75^0C for a sufficient period of time to allow Taq DNA polymerase to extend each primer by copying the single stranded template.
- At the end of incubation both single template strands will be made partially double stranded.
- The new strand of each double stranded DNA extends to a variable distance downstream.
- These steps are repeated again and again to generate multiple forms of the desired DNA. This process is also called **DNA amplification.**

12. What is genetically engineered Insulin?

- Insulin was the first ever pharmaceutical product of **recombinant DNA** technology administered to humans.
- The approval to use recombinant insulin for **diabetes mellitus** was given in **1982.**
- In **1986** human insulin was marketed under the trade name ' **Humulin' .**

13. Explain how "Rosie" is different from a normal cow ?

- ⊕ In 1997, Rosie, the first transgenic cow produced human protein enriched milk, which contained the human alpha lactalbumin.
- ⊕ The protein rich milk (2.4 gm/litre) was a nutritionally balanced food for new born babies than the normal milk produced by the cows.

14. How was Insulin obtained before the advent of rDNA technology ?. What were the problems encountered ?

- ⧫ In the early years, insulin isolated and purified from the pancreas of pigs and cows was used to treat diabetic patients.
- ⧫ Due to minor differences in the structure of the animal insulin as compared to human insulin, it resulted in the occurrence of allergic reactions in some diabetic patients.
- ⧫ Production of insulin by recombinant DNA technology started in the late 1970s.

15. ELISA is a technique based on the principles of antigen-antibody reactions. Can this technique be used in the molecular diagnosis of a genetic disorder such as Phenylketonuria?

- Θ Yes, one can use antibody against the enzyme (that is responsible for the metabolism of phenylanaline) to develop ELISA based diagnostic technique.
- Θ The patient, in which the enzyme-protein complex is absent would give a negative result in ELISA when compared to the normal indidual.

16. Gene therapy is an attempt to correct a Genetic defect by providing a normal gene into the individual. By this the function can be restored. An alternate method would be to provide gene product known as enzyme replacement therapy, which would also restore the function. Which in your opinion is a better option? Give reasons for your answer.

- ✪ Gene therapy is better than enzyme replacement therapy.
- ✪ Gene therapy can cure permanently the genetic disorder. But the enzyme replacement therapy can temporary solution for certain periods.

17. What are transgenic animals? Give examples.

- ☯ **Transgenesis** is the process of introduction of extra (foreign/ exogenous) DNA into the genome of the animals to create and maintain stable heritable characters.
- ☯ The foreign DNA that is introduced the animals that are produced by DNA manipulations are called **transgenic animals** or the **genetically engineered** or genetically modified organisms.
- ☯ Transgenic animals such as mice, rat, rabbit, pig, cow, goat, sheep and fish have been produced .

18. If a person thinks he is infected with HIV, due to unprotected sex, and goes for a blood test. Do you think a test such as ELISA will help? If so why? If not, why?

- ✱ ELISA is detects the presence of HIV antibodies. It is a preliminary test can be used in diagnose of AIDS.
- ✱ ELISA is to detect the presence of specific antibodies or antigens in a sample of serum urine etc. It is a very important diagnostic tool to determine if a person is positive or negative.

19. Explain how ADA deficiency can be corrected ?

- Θ In some children ADA deficiency could be cured by **bone marrow transplantation**.
- Θ Where defective immune cells could be replaced with **healthy immune cells** from a donor.
- Θ In some patients it can be treated by enzyme replacement therapy, in which **functional ADA** is injected into the patient.

- Θ During **gene therapy** the lymphocytes from the blood of the patient are removed and grown in a nutrient culture medium.
- Θ A healthy and functional human gene, ADA **cDNA encoding** this enzyme is introduced into the lymphocytes using a retrovirus.
- Θ The genetically engineered lymphocytes are subsequently returned to the patient.
- Θ Since these cells are not immortal, the patient requires periodic infusion of such **genetically engineered lymphocytes.**
- Θ The disease could be cured permanently if the gene for ADA isolated from bone marrow cells are introduced into the cells of the early embryonic stages.

20. What are DNA vaccines?

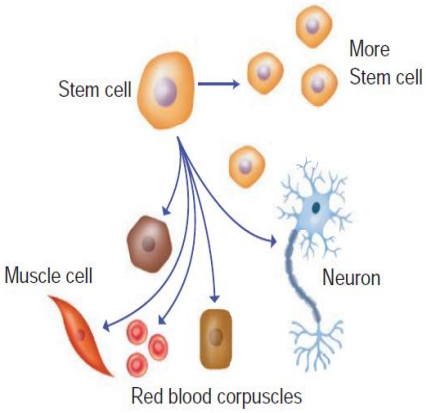
- ◈ Genetic immunisation by using DNA vaccines is a novel approach that came into being in **1990**.
- ◈ The immune response of the body is stimulated by a **DNA molecule.**
- ◈ A DNA vaccine consists of a gene encoding an antigenic protein, inserted onto a plasmid, and then incorporated into the cells in a target animal.
- ◈ DNA instructs the cells to make antigenic molecules which are displayed on its surfaces.
- ◈ This would evoke an antibody response to the free floating antigen secreted by the cells.
- ◈ The DNA vaccine cannot cause the disease as it contains only copies of a few of its genes.
- ◈ DNA vaccines are relatively easy and inexpensive to design and produce.
- ◈ Vaccines produced by these new techniques have definite advantages like producing target proteins, long lasting immunity and trigger immune response only against specific pathogens with less toxic effects.
- ◈ Recombinant hepatitis B vaccine as a subunit vaccine is produced by cloning hepatitis B surface antigen (HbsAg) gene in the yeast, *Saccharomyces cerevisiae.*

21. Differentiate between Somatic cell gene therapy and germline gene therapy :-

SOMATIC CELL GENE THERAPY	GERM LINE GENE THERAPY
Therapeutic genes transferred into the somatic cells.	Therapeutic genes transferred into the germ cells.
Introduction of genes into bone marrow cells, blood cells, skin cells etc.,	Genes introduced into eggs and sperms.
Will not be inherited in later generations.	Heritable and passed on to later generations.

22. What are stem cells ? Explain its role in the field of medicine :-

- ❖ **Stem cells** are undifferentiated cells found in most of the multi cellular animals.
- ❖ These cells maintain their **undifferentiated state** even after undergoing numerous mitotic divisions.
- ❖ Stem cell research has the potential to revolutionize the **future of medicine** with the ability to regenerate damaged and diseased organs.
- ❖ Stem cells are capable of self renewal and exhibit '**cellular potency'**.
- ❖ Stem cells can differentiate into all types of cells that are derived from any of the **three germ layers ectoderm, endoderm and mesoderm.**



❖ In mammals two main types– 1. Embryonic Stem cells (ES cells) and 2. Adult Stem cells.

1. Embryonic Stem cells (ES cells) :-

- ✡ ES cells are **pluripotent** and can produce the three primary germ layers ectoderm, mesoderm and endoderm.
- ✡ Embryonic stem cells are **multipotent stem cells** that can differentiate into a number of types of cells.
- ✡ ES cells are isolated from the **epiblast tissue** of the inner cell mass of a blastocyst.
- ✡ When stimulated ES can develop into more than **200 cells types** of the adultbody.
- ✡ ES cells are immortal i.e., they can proliferate in a sterile culture medium and maintain their undifferentiated state.

2. Adult stem cells :-

- ❋ They are found in **various tissues** of children as well as adults.
- ❋ An adult stem cell or somatic stem cell can divide and create another cell similar to it.
- ❋ Most of the adult stem cells are **multipotent** and can act as a repair system of the body, replenishing adult tissues.The **red bone marrow** is a **rich source** of adult stem cells.

3. The most important and potential application of human stem cells :- **(March- 2020)**

1) The generation of cells and tissues that could be used for **cell based therapies**.
2) Human stem cells could be used to **test new drugs**.

23. One of the applications of biotechnology is 'gene therapy" to treat a person born with a hereditary disease

i) What does "gene therapy" mean? **(May-2022)**

- ✯ This process involves the transfer of a normal gene into a person's cells that carries one or more mutant alleles.

ii) Name the hereditary disease for which the first clinical gene therapy was used.

- ✡ The first clinical gene therapy was given in **1990** by **French Anderson** to a four year old girl with adenosine deaminase (ADA) deficiency.

iii) Mention the steps involved in gene therapy to treat this disease.

- ✡ In some children ADA deficiency could be cured by **bone marrow transplantation**.
- ✡ Where defective immune cells could be replaced with **healthy immune cells** from a donor.
- ✡ During **gene therapy** the lymphocytes from the blood of the patient are removed and grown in a nutrient culture medium.
- ✡ A healthy and functional human gene, ADA **cDNA encoding** this enzyme is introduced into the lymphocytes using a retrovirus.
- ✡ The patient requires periodic infusion of such **genetically engineered lymphocytes.**
- ✡ The disease could be cured permanently if the gene for ADA isolated from bone marrow cells are introduced into the cells of the early embryonic stages.

24. PCR is a useful tool for early diagnosis of an Infectious disease. Elaborate :-

- 🖮 The specificity and sensitivity of PCR is useful for the **diagnosis of inherited disorders** (genetic diseases), viral diseases, bacterial diseases, etc.,
- 🖮 The concept behind PCR based diagnosis of **infectious diseases is simple** – if the pathogen is present in a clinical specimen its **DNA will be present**.
- 🖮 PCR is using the clinical specimen (for example, blood, stool, spinal fluid, or sputum) in the PCR mixture.
- 🖮 PCR is also employed in the prenatal diagnosis of **inherited diseases** by using **amniocentesis**.

- Diseases like sickle cell anemia, β-thalassemia and phenylketonuria can be **detected by PCR** .
- cDNA from PCR is a valuable tool for diagnosis and **monitoring retroviral infections** – eg. Tuberculosis by *Mycobacterium tuberculosis.*
- Several virally induced cancers, like cervical cancer caused by Papilloma virus can be detected by PCR.
- Sex of human beings and live stocks, embryos fertilized ***invitro* can be determined** by PCR .
- PCR technique is also used to **detect sex-linked disorders** in fertilized embryos.

25. What are recombinant vaccines?. Explain the types :-

- Recombinant DNA technology has been used to produce **new generation vaccines**.
- The recombinant vaccines are generally of uniform quality and produce less side effects as compared to the vaccines produced by conventional methods. Different types of recombinant vaccines included :-

1. Subunit recombinant vaccines :-

- Vaccines that use components of a pathogenic organism rather than the whole organism are called **subunit vaccines**; recombinant DNA technology is very suited for developing new subunit vaccines.
- It includes components like **proteins, peptides** and **DNAs of pathogenic organisms**.
- The advantages of these vaccines include **their purity in preparation, stability and safe use**.

2. Attenuated recombinant vaccines :-

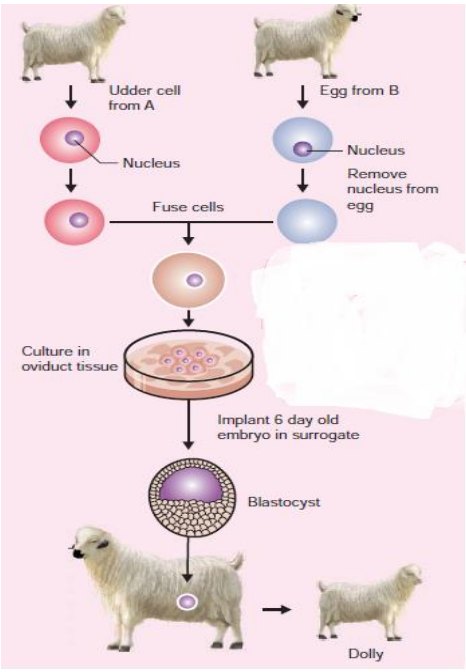
- This includes **genetically modified pathogenic organisms** (bacteria or viruses) that are made nonpathogenic and are used as vaccines.
- It is now possible to genetically engineer the organisms (bacteria or viruses) and use them as live vaccines and such vaccines are referred to as **attenuated recombinant vaccines**.

3. DNA Vaccines :-

- **Genetic immunisation** by using DNA vaccines is a **novel approach** that came into being in **1990**.
- The **immune response** of the body is stimulated by a DNA molecule.
- A DNA vaccine consists of a **gene encoding** an antigenic protein, inserted onto a plasmid, and then incorporated into the cells in a target animal.

26. Explain why cloning of Dolly, the sheep was such a major scientific breakthrough ?.

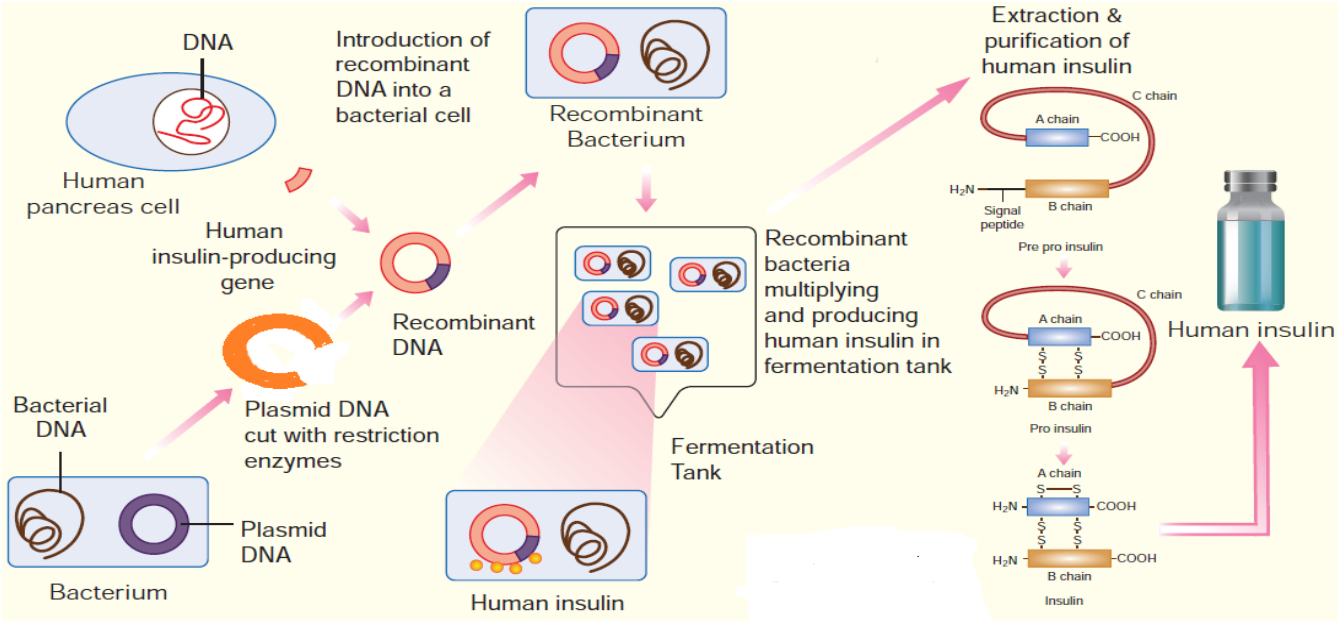
- **Dolly** was the first mammal (Sheep) clone developed by **Ian Wilmut** and Campbell in 1997.
- Dolly, the transgenic clone was developed by **the nuclear transfer technique** and the phenomenon of **totipotency**.
- The mammary gland **udder cells** (somatic cells) from a donor sheep (ewe) were isolated and subjected to starvation for 5 days.
- The udder cells could not undergo normal growth cycle, entered a dormant stage and became **totipotent.**
- An **ovum (egg cell)** was taken from another sheep (ewe) and its nucleus was removed to form an **enucleated ovum**.
- The dormant mammary gland cell/udder cell and the enucleated ovum were fused.
- The outer membrane of the mammary cell was ruptured allowing the ovum to envelope the nucleus.
- The fused cell was implanted into another ewe which served as a **surrogate mother**. Five months later dolly was born.
- **Dolly was the first animal** to be cloned from a differentiated somatic cell taken from an adult animal without the process of fertilization.



27. Mention the advantages and disadvantages of cloning.

- ✱ Offers benefits for clinical trials and medical research.
- ✱ It can help in the production of proteins and drugs in the field of medicine.
- ✱ Aids stem cell research.
- ✱ Animal cloning could help to save endangered species.
- ✱ Animal and human activists see it as a threat to biodiversity saying that this alters evolution which will have an impact on populations and the ecosystem.
- ✪ The process is tedious and very expensive. It can cause animals to suffer.
- ✪ Reports show that animal surrogates were manifesting adverse outcomes and cloned animals were affected with disease and have high mortality rate.
- ✪ It might compromise human health through consumption of cloned animal meat.
- ✪ Cloned animals age faster than normal animals and are less healthy than the parent organism.
- ✪ Cloning can lead to occurrence of genetic disorders in animals.
- ✪ More than 90% of cloning attempts fail to produce a viable offspring.

28. Explain how recombinant Insulin can be produced.



- ♣ The Human insulin is synthesized by the **β cells of Islets of Langerhans** in the pancreas.
- ♣ It is formed of **51 aminoacids** which are arranged in two polypeptide chains, A and B.
- ♣ Both A and B chains are attached together by disulphide bonds. Insulin controls the levels of glucose in blood.
- ♣ It facilitates the cellular uptake and utilization of **glucose for the release of energy**.
- ♣ Deficiency of insulin leads to **diabetes mellitus** which is characterized by increased blood glucose concentration. A continuous program of insulin dependence is required to treat this deficiency.
- ♣ Production of insulin by **recombinant DNA technology** started in the late **1970s.**
- ♣ This technique involved the insertion of human insulin gene and are synthesized as a precursor called **pre-pro insulin**.
- ♣ Insulin was the first ever pharmaceutical product of recombinant DNA technology administered to humans.
- ♣ The approval to use recombinant insulin for diabetes mellitus was given in **1982**.
- ♣ In 1986 human insulin was marketed under the trade name **Humulin**.

ADDITIONAL QUESTIONS

1. What are the **applications of PCR** :-
   1) PCR is very importats in the study of evolutions more specifically phylogenetics.
   2) PCR technique can also be used in the field of forensic medicine.
   3) It is also used in amplification of specific DNA Segment to be used in gene therapy.

2. **Recombinant DNA (rDNA)** :-
   - This also involves extracting a gene from one organism and transferring it to the DNA of another organism, of the same or another species.
   - The DNA produced in this way is referred to as recombinant DNA (rDNA) and this technique as **Recombinant DNA technology .**

3. **Interferons** :-
   - Interferons are proteinaceous, antiviral, species specific substances produced by mammalian cells when infected with viruses.
   - Interferons were discovered by Alick Isaacs and Jean Lindemann in 1957.
   - Based on the structure of interferons they are classified as α, β and γ interferons.
   - The yeast *Saccharomyces cerevisiae* is more suitable for production of recombinant interferons.
   - Interferons are used for the treatment of various diseases like cancer, AIDS, multiple sclerosis, hepatitis C and herpes zoster.

4. **Totipotency (Toti-total) -** It is the ability of a single cell to divide and produce all of the differentiated cells in an organism.

5. **Pluripotency (Pluri-several)** - refers to a stem cell that has the potential to differentiate into any of the threegerm layers-ectoderm, endoderm and mesoderm.

6. **Multipotency (multi-Many) (May-2022) -**
   - It is refers to the stem cells that can differentiate into various types of cells that are related. For example blood stem cells can differentiate into lymphocytes, monocytes , neutrophils etc..

7. **Oligopotency (Oligo-Few) (May-2022) –**
   - It is refers to stem cells that can differentiate into few cell types. For example lymphoid or myeloid stem cells can differentiate into B and T cells but not RBC.

8. **Unipotency** (Uni- Single) - refers to the ability of the stem cells to differentiate into only one cell type.

9. **Uses Of Transgenesis :-**
   1. Transgenesis is a powerful tool to study gene expression
   2. Transgenesis helps in the improvement of genetic characters in animals.
   3. Transgenic animals serve as human diseases which help in the investigation of new treatments for diseases.
   4. Transgenic mice are used for testing the safety of vaccines.
   5. Transgenic animals are used for testing toxicity in animals.

10 . Organisms and Population.

BOOK BACK QUESTION

(Note :- Question no :1– 12 answers are available in your book)

13. What is a Habitat ?
    - A habitat can be considered as the 'address' of the organism.
    - The collection of all the habitat areas of a species constitutes its geographical range.
    - Organisms in a habitat interact with each other and can be part of trophic levels to form food chains and food webs.

14. Define ecological niche :-
    - As every organism has its unique habitat, so also it has an ecological niche which includes the physical space occupied by an organism and its functional role in the community.
    - The ecological niche of an organism not only depends on where it lives but also includes the sum total of its environmental requirements.

15. What is Acclimatisation ?
    - Animals are known to modify their response to environmental changes (stress) in reasonably short time spans. This is known as **Acclimatization**.
    - This is observed when people who have moved from the plains to higher altitudes show enhanced RBC count within a few days of settling in their new habitat.
    - This helps them cope with lower atmospheric oxygen and higher oxygen demand.

16. What is Pedogenesis ?
    - The soil zone of the earth is known as **Pedosphere**.
    - Soil is formed from rocks which are the parent materials of soil, by weathering and is called embryonic soil (Pedogenesis).

17. What is soil permeability ?
    - The characteristic of soil that determines the movement of water through pore spaces is known as soil permeability.
    - Soil permeability is directly dependent on the pore size. Water holding capacity of the soil is inversely dependent on soil porosity.

18. Differentiate between Eurytherms and Stenotherms. **(May-2022)**
    1. Organisms which can survive a **wide range** of temperature are referred to as **Eurytherms.**
       Example : cat, dog, tiger, human.
    2. Those organisms which can tolerate only a **narrow range** of temperature are **Stenotherms.**
       Example : Fish, Frogs, Lizards and Snakes.

19. Explain hibernation and aestivation with examples.
    - In certain conditions, if the organisms is unable to migrate, it may avoid the stress by becoming inactive.
    - This is seen commonly in bears going into **hibernation** during winter.
    - Some snails and fish go into **aestivation** to avoid summer related problems like heat and desiccation.

20. Give the diagnostic characters features of a Biome ?

1. Location, Geographical position (Latitude, Longitude).
2. Climate and physiochemical environment.
3. Predominant plant and animal life.
4. Boundaries between biomes are not always sharply defined. Transition or transient zones are seen as in case of grassland and forest biomes.

21. Classify the aquatic biomes of Earth :-

1. Freshwater - Lakes, ponds, rivers .
2. Brackish water - Estuaries / Wetlands .
3. Marine - Coral reefs, pelagic zones and abyssal zones .

22. What are the ways by which organisms respond to abiotic factors ?

- ◈ Every living organism responds to its environment.
- ◈ There are various ways by which organisms respond to abiotic conditions.
- ◈ Some organisms can maintain constant physiological and morphological conditions or undertake steps to overcome the environmental condition .

23. Classify the adaptive traits found in organisms :-

- ❋ In biology, **adaptation** is a dynamic evolutionary process that fits organisms to their environment and enhancing their evolutionary fitness.
- ❋ Adaptations can be a phenotypic or **adaptive trait** with a functional role in each individual organism that is maintained and has been evolved by natural selection.
- ❋ The adaptive traits may be **structural** adaptation, **behavioural** adaptation and **physiological** adaptation.

24. Write short notes on : Natality and Mortality :- **(March -2020) & (May -2022)**

1. Natality (Population increase):-

- ✡ The production of new individuals in the population by birth, hatching, germination (or) fission.
- ✡ Birth rate number of organisms born per female per unit time.
- ✡ Birth rate (b) = $\frac{\text{number of birth per unit time}}{\text{average population}}$

2. Mortality (Population decrease) :-

- ⊙ Mortality can be expressed as a loss of individuals in unit time or death rate.
- ⊙ The number of members of an original population dying after the lapse of a given time.
- ⊙ Death rate (d) = $\frac{\text{number of deaths per unit time}}{\text{average population}}$

25. Differentiate J and S shaped curve :-

No	**J-shaped growth form**	**S-shaped growth form**
1.	When a population increases rapidly in an exponential fashion and then stops abruptly due to environmental resistance or due to sudden appearance of a limiting factor	Some populations, as in a population of small mammals, increase slowly at first then more rapidly and gradually slow down as environmental resistance increases whereby equilibrium is reached and maintained.
2.	They are said to exhibit J-shaped growth form	Their growth is represented by S shaped growth curve.

26. Give an account of population regulation :-

- ✪ The inherent tendency of all animal populations is to increase in number. But it does not increase indefinitely.
- ✪ Once the carrying capacity of the environment is reached, population numbers remain static or fluctuate depending on environmental conditions.
- ✪ This is regulated by many factors which are :

1. Density independent – Extrinsic factors - include availability of space, shelter, weather, food, etc.
2. Density dependent - Intrinsic factors - competition, predation, emigration, immigration and diseases.

27. Give an account of the properties of soil :- **(May-2022)**

1) Water is one of the main agents in Pedogenesis (soil formation).
2) It is the medium for several different ecosystems.
3) It is present as moisture in the atmosphere and the outer layers of the lithosphere and is uneven in distribution on the earth.
4) Water is heavier than air and imparts greater buoyancy to the aquatic medium. This enables organism to float at variable levels.
5) Water has high heat capacity and latent heat, due to which it can withhold large amounts of heat..
6) Water is physically unique because it is less dense as a solid (ice) than as a liquid.
7) Water is considered as the Universal solvent.
8) Water has high surface tension.

28. Differentiate between Tundra and Taiga Biomes :-

No	**Tundra**	**Taiga**
1.	This is the almost treeless plain in the northern parts of Asia, Europe and North America	The Taiga is 1300-1450 km wide zone south of the Tundra
2.	Winters are long with little daylight, Summers are short, with long daylight hours.	This area has long and cold winters. Summer temperature ranges from 10^0 C to 21^0 C.
3.	Precipitation is less than 250 mm per year	Precipitation ranges about 380-1000 mm annually.
4.	Dwarf willows, birches, mosses, grasses, sedges are the flora here	The Taiga is are trees such as spruce, fir and pine. This is a major source for the logging industry.
5.	Reindeer, arctic hare, musk ox, arctic fox, arctic wolf, bobcat and snowy owl,Polar bears.	Moose, elk, deer and reindeer, squirrels, snow hare wolf, grizzly bear, black bear, bobcat , wolverines

29. List the adaptations seen in terrestrial animals :-

1. Earthworms, land Planarians secrete a mucus coating to maintain a moist situation for burrowing, coiling, respiration, etc.,
2. Arthropods have an external covering over the respiratory surfaces and well-developed tracheal systems.
3. In vertebrate skin, there are many cellular layers besides the well protected respiratory surfaces that help in preventing loss of water.
4. Some animals obtain their water requirement from food as partial replacement of water lost through excretion.
5. Birds make nests and breed before the rainy season as there is availability of abundant food. But during drought birds rarely reproduce.
6. Camels are able to regulate water effectively for evaporative cooling through the skin and respiratory system and excrete highly concentrated urine, and can also withstand dehydration up to 25% of their body weight.

30. Describe Population Age Distribution :-

- ✱ The proportion of the age groups (pre- reproductive, reproductive and post reproductive) in a population is its age distribution attribute.
- ✱ This determines the reproductive status of the population at the given time and is an indicator of the future population size.
- ✱ Usually a rapidly growing population will have larger proportion of young individuals.
- ✱ A stable population will have an even distribution of various age classes.
- ✱ A declining population tends to have a larger proportion of older individuals

31. Describe Growth Models/Curves :-

- Populations show characteristic growth patterns or forms. These patterns can be plotted and termed as J-shaped growth form and S-shaped growth form (Sigmoid form).

1. **J shaped growth form:-**
   When a population increases rapidly in an exponential fashion and then stops abruptly due to environmental resistance or due to sudden appearance of a limiting factor, they are said to exhibit J-shaped growth form.

2. **S-Shaped growth form (sigmoid growth):-**
   Some populations, as in a population of small mammals, increase slowly at first then more rapidly and gradually slow down as environmental resistance increases whereby equilibrium is reached and maintained. Their growth is represented by S shaped growth curve.

32. Tabulates and analysis of two species population interation.

Table 10.3 Analysis of two species population interactions

SN. NO.	TYPES OF INTERATION	SPECIES 1	SPECIES 2	GENERAL NATUE OF INTERACTION	EXAMPLES
1	Amensalism	–	0	The most powerful animal or large organisms inhibits the growth of other lower organisms	Cat and Rat
2	Mutualism	+	+	Interaction favorable to both and obligatory	Between crocodile and bird
3	Commensalism	+	0	Population 1, the commensal benefits, while 2 the host is not affected	Sucker fish on shark

33. Explain parasitism with an example.

- It is the relationship between two species of animals in which one benefits at the expense of the other.
- Ex : Ascaris, Tapeworm are the parasite live in human digestive tract.

34. Differentiate between predator and prey.

1. Predator – is an animal that hunts, kills and eats other animals for food. example : Lion.
2. Prey – is a term used to describe organisms that predator kill for food. example : Deer.

ADDITIONAL QUESTIONS

1. Van't Hoff's rule :-

- Van't Hoff proposed that, with the increase of every 10ºC, the rate of metabolic activity doubles or the reaction rate is halved with the decrease of 10ºC. This rule is referred as the van't Hoff's rule.

2. Bergman's rule :-

- In certain environments, the size and colouration of animals are influenced by temperature. Birds and mammals attain greater body size in colder regions than warmer regions. **(OR)**
- In rule is an eco geographic principle that states that within broadly distributed taxoncmic clade, populations and species of larger size are found in colder and of smaller size are in warmer regions.

3. The Allen Rules :-

Warm blooded animals, living in colder climates, tend to have shorter limbs, ears and other appendages when compared to the members of the same species in warmer climates.

4. Jordon's rule :-

In some aquatic environments, an inverse relationship between water temperature and fish meristic characters is observed - lower the temperature, more the vertebrae .

5. Phototaxis:-

The movement of organism in response to light, either towards the source of light as in Moths (positive phototaxis) or away from light (Euglena, Volvox, earthworm (negative phototaxis).

6. Phototropism:-

The growth or orientation of an organism in response to light, either towards the source of light (positive phototropism) as seen in Sunflower, or a way from light (negative phototropism) as in case of the root of plants.

7. Photokinesis:-

A change in the speed of locomotion (or frequency of turning) in a motile organism or cell which is made in response to a change in light intensity is called Photokinesis. It involves undirected random movement in response to light.

8. Adaptations of aquatic animals :-

1. The pectoral fins and dorsal fins act as stabilizers or balancers and the caudal fin helps in changing the direction as a rudder.
2. Arrangement of body muscles in the form of bundles (myotomes) help in locomotion.
3. Stream lined structure helps in the swift movement of the animals in water.
4. Respiration by gills making use of gases dissolved in water.
5. Presence of air-bladders filled with air for buoyancy.
6. Presence of lateral-line system. They function as rheoreceptors which is helpful in echolocating objects in water.
7. Integuments rich in mucous glands are protected by scales.
8. Maintain water and ionic balance in its body with excretory structures.

11. Biodiversity and its Conservation

BOOK BACK QUESTION

(Note :- Question no :1– 9 answers are available in your book)

10. Define endemism :-

- Θ It is the ecological state of a species being native to **a single defined geographic location**, such as island, nation, countary or other defined zone, or habitat type.
- Θ Organisms that are indigenous to a place are not endemic to it if they are also found elsewhere.

11. How many hotspots are there in India ? Name them.

1. Himalaya (the entire Indian Himalayan region)
2. Western Ghats
3. Indo-Burma: includes entire North-eastern India, except Assam and Andaman group of Islands .
4. Sundalands: includes Nicobar group of Islands .

12. What are the three levels of biodiversity ?

- ✱ Biodiversity' to describe diversity at all levels of biological organization from populations to biomes.
- ✱ There are three levels of biodiversity –

1. Genetic diversity. **2 .**Species diversity. **3.** Community/Ecosystem diversity.

13. Name the active chemical found in themedicinal plant *Rauwolfia vomitoria*. Whattype of diversity it belongs

- ♣ *Rouwolfia vomitaria*, a medicinal plant growing in different ranges of the Himalayas.
- ♣ Concentration of the active ingredient **reserpine** due to **genetic diversity**.

14. "Amazon forest is considered to be the lungsof the planet"-Justify this statement :-

- The Amazon rainforest, a vast area, harbouring millions of species, also called **"Lungs of the planet".**
- More than **20% of the world oxygen is produced** in the Amazon Rainforest.
- It also store CO_2 , a heat-trapping gas that is a major cause of global warming.

15. Red data book'-What do you know about it ?

- ⊗ Red Data book or Red list is a catalogue of taxa facing risk of extinction.
- ⊗ IUCN – International Union of Conservation of Nature and Natural Resources, which is renamed as WCU – World Conservation Union (Morges Switzerland) maintains the Red Data book.
- ⊗ The concept of Red list was mooted in 1963.

16. Compare and Contrast the insitu and exsituconservation :-

no	Insitu Conservation	Exsitu Conservation
1.	It is the on-site conservation of genetic resources in natural populations of plant or animal species	This is a conservation strategy which involves placing of threatened animals and plants in special care locations for their protection.
2.	It is the process of protecting an endangered plant or animal species in its natural habitat, either by protecting or restoring the habitat itself , or by defending the species from predators.	It helps in recovering populations or preventing their extinction under simulated conditions that closely resemble their natural habitats.
3.	National parks, Biosphere Reserve, Wild life Sanctuaries from *insitu* conservation strategies.	Zoological parks and Botanical gardens are common exsitu conservation programs.

17.What are called endangered species ? Explain with examples.

- ✱ A species that has been categorized as very likely to become extinct is an Endangered species.
- ✱ Endangered (EN), as categorized by the IUCN Red List, is the second most severe conservation status for wild populations in the IUCN's scheme after Critically Endangered (CR).
- ✱ In 1998 there were**1102** animal and **1197** plant species in the IUCN Red List.
- ✱ In 2012, the list features **3079** animal and **2655** plant species as endangered (EN) worldwide.

18. Why do we find a decrease in biodiversity distribution, if we move from the tropics towards the poles :-

- ⊗ Decrease in biodiversity distribution, if we move from the tropics towards the poles-Because during the cold seasons while **very harsh conditions** prevail for most of the year in polar regions.
- ⊗ The number of species per unit area declines as we move from tropics towards the poles.
- ⊗ The Tundra,Taiga of northern Canada, Alaska, northern Europe, Russia possess less than 12 species of trees.
- ⊗ Columbia located near the equator (0^0) has nearly 1400 species of birds while New York at 41^0N has 105 species and Greenland at 71^0N has 56 species.
- ⊗ Decrease in species diversity occurs as one ascends in a polar region.

19. What are the factors that drive habitat loss ?

- ✱ Development of human society is inevitable. Natural habitats are destroyed for the purpose of settlement, agriculture, mining, industries and construction of highways.
- ✱ As a result species are forced to adapt to the changes in the environment or move to other places.
- ✱ Over population, urbanization, industrialization and agricultural advancements require additional land, water and raw materials every year.
- ✱ The most dramatic example of habitat loss comes from the tropical rainforests 14% of the earth's land surface once covered by these tropical forests, is not more than 6% now.
- ✱ Kodaikanal and Nilgiri hills of Tamil Nadu have been destroyed rapidly for human occupancy. Loss of habitat results in annihilation of plants, microorganisms and forcing out animals from their habitats.

20. Alien species invasion isa threat to endemic species – substantiate this statement.

- Exotic species (non-native; alien) are organisms often introduced unintentionally or deliberately for commercial purpose, as biological control agents and other uses.
- They often become invasive and drive away the local species and is considered as the second major cause for extinction of species.
- Exotic specieshave proved harmful to both aquatic andterrestrial ecosystems.
- Tilapia fish (Jilabi kendai) (*Oreochromis mosambicus*) introduced from east coast of South Africa in 1952 for its high productivity into Kerala's inland waters, became invasive, due to which the native species such as *Puntius dubius* and *Labeo kontius* face local extinction.

21. Mention the major threats to biodiversitycaused by human activities. Explain.

- ✱ According to the Convention of Biological Diversity, direct and indirect human activities have a detrimental effect on biodiversity.
- ✱ Direct human activities like change in local land use, species introduction or removal, harvesting, pollution and climate change contribute a greater pressure on loss of biodiversity.
- ✱ Indirect human drivers include demographic, economic, technological, cultural and religious factors.
- ✱ Monsoon failure, global warming, depletion in ozone layer, landslides in hilly states, pollution are a few indirect effects of human activities which results in the loss biodiversity.

22. What is mass extinction? Will you encounterone such extinction in the near future.Enumerate the steps to be taken to prevent it.

1.Mass extinction :- (May-2022)

- The earth has experienced quite a few mass extinctions due to environmental catastrophes.
- A mass extinction occurred about 225 million years ago during the Permian, where 90% of shallow water marine invertebrates disappeared.

2. Steps to taken for the Preventive measure :-

- Encourage and assist societies throughout the world to conserve nature and to ensure that any use of natural resources is equitable and ecologically sustainable.
- The organization collects, compiles and publishes the IUCN red list of threatened species and their conservation status in theworld. Identification and documentation of species at high risk of extinction.
- It plays a vital role in the implementation of several international conventions on nature conservation and biodiversity.

23. In north eastern states, the jhum culture is amajor threat to biodiversity – substantiate.

- This system is practiced in north-eastern regions of India.
- In shifting cultivation, plots of natural tree vegetation are burnt away and the cleared patches are farmed for 2-3 seasons, after which their fertility reduces to a point where crop production is no longer profitable.
- The farmer then abandons this patch and cuts down a new patch of forest trees elsewhere for crop production.
- When vast areas are cleared and burnt, it results in loss of forest cover, pollution and discharge of CO_2 .
- Which in turn attributes to loss of habitat and climate change.which has an impact on the faunal diversity of that regions.

24. List out the various causes for biodiversity losses.

- Habitat loss, fragmentation and destruction (affects about 73% of all species)
- Pollution and pollutants (smog, pesticides, herbicides, oil slicks, GHGs)
- Climate change , Introduction of alien/exotic species .
- Over exploitation of resources (poaching, indiscriminate cutting of trees, over fishing, hunting, mining).
- Intensive agriculture and aquacultural practices.
- Hybridization between native and non-native species and loss of native species.
- Natural disasters , Industrialization, Urbanization, infrastructure development, Transport – Road and Shipping activity, communication towers, dam construction, unregulated tourism.
- Co-extinction .

25. How can we contribute to promote biodiversity conservation ?

1. Identify and protect all threatened species .
2. Identify and conserve in protected areas the wild relatives of all the economically important organisms.
3. Identify and protect critical habitats for feeding, breeding, nursing, resting of each species .
4. Resting, feeding and breeding places of the organisms should be identified and protected Air, water and soil should be conserved on priority basis .
5. Wildlife Protection Act should be implemented .
6. There are two aspects of conservation strategies
   i) *In-situ* conservation
   ii) *Ex-situ* conservation

26. ' Write a note on :-

1. Protected areas :-

- ✪ These are biogeographical areas where biological diversity along with natural and cultural resources is protected, maintained and managed through legal measures.
- ✪ Protected areas include national parks, wild life sanctuaries, community reserves and biosphere reserves.
- ✪ World Conservation monitoring centre has recognized 37,000 protected areas world-wide.
- ✪ India has about 771 protected areas covering 162099 km2 comprising of National Parks (104), Wild Life Sanctuaries (544), biosphere reserves (18) and several sacred groves.

National Parks in Tamil Nadu	Year of establishment	District(s)
Guindy NP	1976	Chennai
Gulf of Mannar Marine NP	1980	Ramanathpuram and Tuticorin
Indira Gandhi (Annamalai) NP	1989	Coimbatore
Mudumalai NP	1990	Nilgiris
Mukurthi NP	1990	Nilgiris

2. Wildlife sanctuaries :-

- Any area other than the area comprised with any reserve forest or the territorial waters can be notified by the State Government to constitute as a sanctuary if such area is of adequate ecological, faunal, floral, geomorphological, natural or zoological significance.
- This is for the purpose of protecting, endangered factual species.
- Ecoturism is permitted, as long as animal life is undistrubed.
- There are 544 existing wildlife sanctuaries in India covering an area of 118,918 km2, which is 3.62 % of the geographical area of the country (National Wildlife Database, 2017).
- Sanctuaries are tracts of land where wild animals and fauna can take refuge without being hunted or poached.
- Other activities like collection of forest products, regulated harvesting of timber, private ownership of land are permitted.

Prominent WLS in Tamil Nadu	Year of establishment	Districts
Vedanthangal Lake Birds WLS	1936	Chengalpet
Mudumalai WLS	1942	Nilgiris
Point Calimere WLS	1967	Nagapattinam
Indira Gandhi (Annamalai) WLS	1976	Coimbatore
Mundanthurai WLS	1977	Tirunelveli

3. WWF :- The World Wide Fund for nature is an international non-governmental organization in 1961 that works in the field of wilderness preservation and the reduction of human impact on the environment.

ADDITIONAL QUESTION

1. What are types of Species diversity :- **(May-2022)**

1) Alpha diversity- It is measured by counting the number of taxa (usually species) within a particular area, community or ecosystem.
2) Beta diversity - It is species diversity between two adjacent ecosystems and is obtaining by comparing the number of species unique to each of the ecosystem.
3) Gamma diversity - refers to the diversity of the habitats over the total landscape or geographical area.

2. The purpose of preparation of Red List are :-

- ✱ To create awareness on the degree of threat to biodiversity
- ✱ Identification and documentation of species at high risk of extinction
- ✱ Provide global index on declining biodiversity
- ✱ Preparing conservation priorities and help in conservation of action
- ✱ Information on international agreements on conservation of biological diversity
- ✱ Red list has eight categories of species
    - **1)** Extinct
    - **2)** Extinct in wild
    - **3)** Critically Endangered
    - **4)** Endangered
    - **5)** Vulnerable
    - **6)** Lower risk
    - **7)** Data deficiency viii) Not evaluated

3. The reasons for the richness of biodiversity in the Tropics are:-

1) Warm tropical regions between the tropic of Cancer and Capricorn on either side of equator possess congenial habitats for living organisms.
2) Environmental conditions of the tropics are favourable not only for speciation but also for supporting both variety and number of organisms.
3) The temperatures vary between 25^0C to 35^0C, a range in which most metabolic activities of living organisms occur with ease and efficiency.
4) The average rainfall is often more than 200 mm per year.
5) Climate, seasons, temperature, humidity, photoperiods are more or less stable and encourage both variety and numbers.
6) Rich resource and nutrient availability.

4. **Gene Banks:-**

- Θ Gene banks are a type of biorepository which preserve genetic materials.
- Θ Seeds of different genetic strains of commercially important plants can be stored in long periods in seed banks, gametes of threatened species can be preserved in viable and fertile condition for long periods using cryopreservation techniques.
- Θ However, it is not economically feasible to conserve all biological wealth and all the ecosystems.
- Θ The number of species required to be saved from extinction far exceeds the conservation efforts.

12. Environmental Issues.

BOOK BACK QUESTION

(Note :- Question no :1– 10 answers are available in your book)

11. Expand :-
    (i) CFC - Chloro Fluoro Carbons.
    (ii) AQI - Air Quality Index
    (iii) PAN – Peroxy Acetyl Nitrate

12. What is SMOG and how it is harmful for us?.
    - ⊙ **Smog** is a type of air pollution caused by tiny particles in the air.
    - ⊙ These reactions create ground-level ozone and particulate matter, **reducing visibility**.
    - ⊙ Smog can make **breathing more difficult,** especially for people with asthma.
    - ⊙ Smog also **affects** plants and animals.
    - ⊙ It damages crops as well as causes **health problems** in pets, farm animals and human beings.
    - ⊙ Smog has also been known to cause **corrosive damage** to buildings and vehicles.

13. List all the wastes that you generate, at home, school or during your trips to other places. Could you very easily reduce the generation of these wastes? Which would be difficult or rather impossible to reduce?
    - ❋ Food wastes , plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes, tires, batteries, old mattresses, wood , paper, metals, electronics.
    - ❋ Recycling and disposal of e-waste may involve significant risk to the health of workers and communities in developed countries.
    - ❋ Great care must be taken to avoid unsafe exposure in recycling operations and leaking of materials such as heavy metals from landfills and incinerator ashes.
    - ❋ '4R'- Refuse, Reduce, Reuse and Recycle mantra is the best available remedy for plastic waste pollution.

14. Write notes on the following:-
    a. Eutrophication :-
    - ❖ When run-off from land containing nutrients reaches water bodies like lakes, it results in dense growth of plant life. This phenomenon is called **Eutrophication.**

    b. Algal Bloom :-
    - ∗ An algal bloom or marine bloom or water bloom is a rapid increase in the population of algae in an aquatic system.
    - ∗ Nutrients stimulate the growth of algae, water hyacinth and can cause clogging of canals, rivers and lakes as well as, displacing native plants.
    - ∗ It causes unsightly foam and unpleasant odours, and deprives the water of dissolved oxygen.

15. What effect can fertilizer run off have on an aquatic ecosystem?
    1. May kill beneficial bacteria and soil organisms.
    2. Can cause eutrophication in water bodies.
    3. Affect aquatic animals and their productivity.
    4. Pesticide containing water, even in trace quantities is unfit for human consumption.
    5. Particles (aerosols) and residues of these chemicals cause air pollution.
    6. Beneficial insects and animals can be affected.

16. How can we control eutrophication? **(May-2022)**

1. Waste water like sewage should be discharge into river or other sytem only after proper treatment.
2. Algal bloom should be removed from water.
3. Use phosphate free detergents to reduce eutrophication.
4. Growth of algae in water can also be controlled by applying algicides such as $CuSO_4$.
5. Prevents flooding of water from agricultural soil containing fertilizers to water system.

17. Discuss the role of an individual to reduce environmental pollution.

- ✪ Catalytic converters in vehicles help to reduce polluting gases drastically
- ✪ Diesel exhaust filters in automobiles cuts particulates
- ✪ Regulate or restrict the use of synthetic fertilisers and pesticides.
- ✪ Planting trees in and around noise sources is an effective solution for noise pollution as plants are known to absorb noise and bring down sound levels.

18. How does recycling help reduce pollution ?

- ☯ Wastewater can be pretreated by scientific methods before discharge to municipal treatment sources.
- ☯ Setting up of Sewage Treatment Plants (STP) and Effluent Treatment Plants (ETP).
- ☯ Cost effective air pollution treatment systems like indoor plants and high performance biofilters can improve indoor air quality.
- ☯ Solid Waste management includes the activities are the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process.
- ☯ It is all about how solid waste can be changed and used as a valuable resource.

19. Discuss briefly the following :

a. Catalytic converter :-

- ⊗ Catalytic converters in vehicles help to reduce polluting gases drastically.
- ⊗ Diesel exhaust filters in automobiles cuts particulates.

b. Ecosan :-

- Θ Ecological sanitation (EcoSan) is a sustainable system for handling human excreta by using dry composting toilets.
- Θ EcoSan toilets not only reduce wastewater generation but also generate the natural fertiliser from recycled human excreta, which forms an excellent substitute for chemical fertilisers.
- Θ This method is based on the principle of recovery and recycling of nutrients from excreta to create a valuable supply for agriculture.

20. What are some solutions to toxic dumping in our oceans?

1. Conserve water- use less water, so excess runoff and waste water will not flow into ocean.
2. Reduce Pollutants – choose nontoxic chemicals and dispose of herbicides, pesticides, and cleaning products properly.
3. Reduce Waste – cut down on industry and manufacturing waste and contain landfills so they don't spill into the ocean.
4. Proper sewage treatment and exploration of eco-friendly waste water treatment options, such as recycling sewage sludge.
5. The "Superbug" was then used for cleaning an oil spill in ocean.

ADDITIONAL QUESTIONS

1. Effects of Air Pollution :-

1) Affects all organisms as they depend on the atmosphere for respiration.
2) Causes irritation in the throat, nose, lungs and eyes. It causes breathing problems and aggravates existing health conditions such as emphysema and asthma.
3) Contaminated air reduces the body's defense mechanism and decreases the body's capacity to fight other infections in the respiratory system.
4) Frequent exposure to polluted air increases the risk of cardiovascular diseases.
5) People who exercise outdoors can sometimes be susceptible to adverse effects of air pollution because it involves deeper and faster breathing.

2. Greenhouse gases / Global warming:-

- ⊙ Increase in the concentrations of greenhouse gases such as CO2, methane, nitrous oxide, CFCs, and ozone
- ⊙ It causes greenhouse effect, warming of the earth, resulting in sea level rise, submerging of islands and sea shores of various parts of the world.

3. Effect of Water pollution :-

1) Destruction of ecosystems- Ecosystems, especially aquatic systems, can be severely affected or destroyed by water pollution.
2) Disruption of food-chains- Water pollution disrupts the natural food chains as well as food webs.
3) Water pollution can be lethal to aquatic organisms and others that depend on these water bodies.
4) Humans and other organisms can get affected by diseases such as hepatitis and typhoid by consuming contaminated water and food.
5) Water pollution can cause eutrophication due to nutrient enrichment.

4. Effect of Noise Pollution :-

1) According to the USEPA there are direct links between noise and health. Heart disease, high blood pressure, stress related illness, sleep disruption, hearing loss (deafness), etc.
2) Increased stress and tension, nervousness, irritability, anxiety, depression and panic attacks.
3) Peptic ulcer, severe head ache, memory loss.
4) Marine animals are affected by noise pollution from offshore activities and port activities.
5) Fire crackers frighten animals. Birds are often affected by increased air traffic.

5. Effect of Agrochemicals :- **(March -2020)**

- ♣ May kill beneficial bacteria and soil organisms.
- ♣ Can cause eutrophication in water bodies.Affect aquatic animals and their productivity.
- ♣ Pesticide containing water, even in trace quantities is unfit for human consumption.
- ♣ Particles (aerosols) and residues of these chemicals cause air pollution.
- ♣ Inhalation of contaminated air can cause respiratory problems.
- ♣ Consumption can lead to poisoning, side effects and after effects.
- ♣ Chemicals can cause skin rashes and irritation of eyes.
- ♣ Many of these chemicals are reported to be carcinogenic.
- ♣ They can trigger hormonal disorders and neurotoxicity.Beneficial insects and animals can be affected.

6. Methods of disposal of radioactive wastes :- **(May-2022)**
    1. Limit generation - Limiting the generation of waste is the first and most important consideration in managing radioactive wastes.
    2. Dilute and disperse - For wastes having low radioactivity, dilution and dispersion are adopted.
    3. Delay and decay - Delay and decay is frequently an important strategy because much of the radioactivity in nuclear reactors and accelerators is very short lived.
    4. Concentrate and confine process - Concentrating and containing is the objective of treatment activities for longer-lived radioactivity.

7. Explain Medical waste and management ? **(May-2022)**
    - ⊙ Medical wastes contain body fluids like blood, urine, body parts and other contaminants,culture dishes, glasswares, bandages, gloves, discarded needles, scalpels, swabs and tissues.
    - ⊙ **Waste disposal:** Involved by incineration, chemical disinfection, autoclaving, encapsulation, microwave irradiation are methods of waste disposals.
    - ⊙ Final disposal includes landfill and burying as per norms inside premises.

8. The management of E-Waste ? **(May-2022)**
    - Electronic waste or E-waste describes discarded electrical electronic devices and components and substances
    - Their disposal is a growing problem because electronic equipment frequently contains hazardous substances.
    - Which are non-degradable Used electronics which are destined for reuse, resale, salvage, recycling, or disposal are also considered e-waste.
    - Recycling and disposal of E-waste may be taken great care and to avoid unsafe exposure in recycling operations and leaking of materials such as heavy metals from landfills and incinerator ashes.

9. The mangement of Plastic Waste :-
    - Θ Plastics are low molecular weight organic polymers that are non-degradable in the natural environment.
    - Θ They are used in several items including cars, bulletproof vests, toys, hospital equipment, carry bags and food containers.
    - Θ Remedies: '4R'- Refuse, Reduce, Reuse and Recycle mantra is the best available remedy for plastic waste pollution.
    - Θ Tamil Nadu State government successfully implemented the ban on single use plastics from 1st January 2019.