

COMMON HALFYEARLY EXAMINATION- 2023

B

Standard - XII

Time : 3.00 hrs

ZOOLOGY

Marks: 70

Part - I

Note:- i) Answer all the questions.

ii) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer. 15×1=15

- 1) Division of nucleus amitotically or mitotically is called as
a) Cytokinesis b) Karyokinesis c) metaphase d) prophase
- 2) The male sex hormone testosterone is secreted from
a) Sertoli cells b) Epididymis c) Prostate gland d) Leydig cell
- 3) Cells which nourishment to the sperms till maturation are
a) Leydig cells b) Egg mother cells c) Sertoli cells d) Interstitial cells
- 4) A contraceptive pill prevents ovulation by
a) blocking fallopian tube b) stimulating release of FSH and LH
c) inhibiting release of FSH and LH
d) causing immediate degeneration of released ovum
- 5) Which of the following phenotypes in the progeny are possible from the parental combination A×B?
a) A and B only b) A,B and AB only c) AB only d) A, B, AB and O
- 6) Which of the following is the correct sequence of event with reference to the central dogma?
a) Replication, Transcription, Translation b) Transcription, Translation, Replication
c) Transcription, Replication, Translation d) Duplication, Translation, Transcription
- 7) The book "Philosophie zoologique" written by
a) Charles Darwin b) Jean Baptiste de Lamarck
c) August Weismann d) Haeckel
- 8) The sporozoite of the malarial parasite is present in _____
a) RBC of human suffering from malaria
b) Saliva of infected female Anopheles mosquito
c) Spleen of infected humans
d) Gut of female Anopheles mosquito
- 9) When mammalian cells are infected with viruses _____ produce antiviral specific substances.
a) lysozyme b) interferons c) Immunoglobulins d) paratope
- 10) _____ are used for removing oily stains from the laundry
a) pectinase b) protease c) lipase d) cellulase
- 11) The genetic defect adenosine deaminase deficiency may be cured permanently by
a) introducing bone marrow cells producing ADA into embryo at an early stage of development
b) Enzyme replacement therapy
c) periodic infusion of genetically engineered lymphocytes having ADA cDNA
d) administering adenosine deaminase activators

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XII - ZOOLOGY – ANSWERS

PART – I (15 × 1 = 15)

1.	b) Karyokinesis
2.	d) Leydig cell
3.	c) Sertoli cells
4.	c) inhibiting release of FSH and LH
5.	d) A, B, AB and O
6.	a) Replication, Transcription, Translation
7.	b) Jean Baptiste de Lamarck
8.	b) Saliva of infected female Anopheles mosquito
9.	b) interferons
10.	c) lipase
11.	a) introducing bone marrow cells producing ADA into embryo at an early stage of development
12.	b) Hepatitis B
13.	b) van't Hoff's rule
14.	b) reserpine
15.	c) Dobson Unit

PART – II (6 X2 = 12)

16. Cervical cancer is caused by a sexually transmitted virus called Human Papilloma virus (HPV).

The most common symptoms and signs of cervical cancer are pelvic pain, increased vaginal discharge and abnormal vaginal bleeding.

17. Sex linked inherited traits are more common in males than females because, males are hemizygous and therefore express the trait when they inherit one mutant allele.

18. Template strand

i) During replication, one strand of DNA with polarity 3' → 5' acts as a template, and is called the template strand.

ii) It is also known as leading strand

Coding strand

i) During replication, one strand of DNA with polarity 5' → 3' has a sequence same as RNA (except thymine instead of uracil) and is displaced during transcription. This strand is called coding strand

ii) It is also known as lagging strand

19. Sudden appearance of vestigial organs in highly evolved organisms is called atavistic organs. Example, presence of tail in a human baby is an atavistic organ.
20. 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.
21. Cells involved in innate immunity are monocytes (macrophages), neutrophils, helper T-cells, B-cells, dendritic cells.
22. Animals are known to modify their response to environmental changes (stress) in reasonably short time spans. This is known as **Acclimatization**.
23. Coextinction of a species is the loss of a species as a consequence of the extinction of another. (Eg., orchid bees and forest trees by cross pollination).
24. Ecological sanitation (EcoSan) is a sustainable system for handling human excreta by using dry composting toilets. EcoSan toilets not only reduce wastewater generation but also generate the natural fertilizer from recycled human excreta, which forms an excellent substitute for chemical fertilizers.

PART – III (6 X 3 = 18)

25. The mammary glands secrete a yellowish fluid called **colostrum** during the initial few days after parturition. It has less lactose than milk and almost no fat, but it contains more proteins, vitamin A and minerals.
- Colostrum is also rich in **IgA** antibodies. This helps to protect the infant's digestive tract against bacterial infection. Breast milk is the ideal food for infants as it contains all the constituents in suitable concentration and is easily digestible. It is fully sufficient till about 6 months of age and all infants must be breast fed by the mother to ensure the growth of a healthy baby.
26. Pedigree is a "family tree", drawn with standard genetic symbols, showing the inheritance pathway for specific phenotypic characters.
- Pedigree analysis is the study of traits as they have appeared in a given family line for several past generations.
27. **DNA**
- i) Sugar is deoxyribose sugar
 - ii) Double – stranded structure
 - iii) Nitrogen bases are Adenine, Guanine, Cytosine and Thymine
- RNA**
- i) Sugar is ribose sugar
 - ii) Single – stranded molecule
 - iii) Nitrogen bases are Adenine, Guanine, Cytosine and Uracil
28. Lamarck's "Theory of Acquired characters" was disproved by **August Weismann** who conducted experiments on mice for twenty generations by cutting their tails and breeding them. All mice born were with tail. Weismann proved his germplasm theory that change in the somatoplasm will not be transferred to the next generation but changes in the germplasm will be inherited.

29. Antibodies are immunoglobulin (Ig) protein molecules synthesized on exposure to antigen that can combine specifically with the antigen.

The functions of immunoglobulin are agglutination, precipitation, opsonisation, neutralization etc.,

30. 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. Antibiotics should be used only when prescribed by a certified health professional. When the bacteria become resistant, antibiotics cannot fight against them and the bacteria multiply.

31.

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.

32. Characters of a Biome

Location, Geographical position (Latitude, Longitude)

Climate and physiochemical environment

Predominant plant and animal life

Boundaries between biomes are not always sharply defined. Transition or transient zones are seen as in case of grassland and forest biomes.

- 33.
- i) identify and protect all threatened species
 - ii) identify and conserve in protected areas the wild relatives of all the economically important organisms
 - iii) identify and protect critical habitats for feeding, breeding, nursing, resting of each species
 - iv) resting, feeding, and breeding places of the organisms should be identified and protected.
 - v) Air, water, and soil should be conserved on a priority basis
 - vi) Wildlife Protection Act should be implemented

PART – IV (5 X 5 = 25)**34. a) Infertility**

Inability to conceive or produce children even after unprotected sexual cohabitation is called infertility. That is, the inability of a man to produce sufficient numbers or quality of sperm to impregnate a woman or inability of a woman to become pregnant or maintain a pregnancy.

The causes for infertility are tumours formed in the pituitary or reproductive organs, inherited mutations of genes responsible for the biosynthesis of sex hormones, malformation of the cervix or fallopian tubes and inadequate nutrition before adulthood. Long-term stress damages many aspects of health especially the menstrual cycle. Ingestion of toxins (heavy metal cadmium), heavy use of alcohol, tobacco and marijuana, injuries to the gonads and aging also cause infertility.

Other causes of infertility

Pelvic inflammatory disease (PID), uterine fibroids and endometriosis are the most common causes of infertility in women.

Low body fat or anorexia in women. i.e. a psychiatric eating disorder characterised by the fear of gaining weight.

Undescended testes and swollen veins (varicocele) in scrotum.

Tight clothing in men may raise the temperature in the scrotum and affect sperm production.

Under developed ovaries or testes.

Female may develop antibodies against her partner's sperm.

Males may develop an autoimmune response to their own sperm.

34. b) Allosomal abnormalities in human beings:

Mitotic or meiotic non-disjunction of sex chromosomes causes allosomal abnormalities. Several sex chromosomal abnormalities have been detected. Eg. Klinefelter's syndrome and Turner's syndrome.

Klinefelter's Syndrome (XXY Males)

This genetic disorder is due to the presence of an additional copy of the X chromosome resulting in a karyotype of 47,XXY. Persons with this syndrome have 47 chromosomes (44AA+XXY). They are usually sterile males, tall, obese, with long limbs, high pitched voice, under developed genitalia and have feeble breast (gynaecomastia) development.

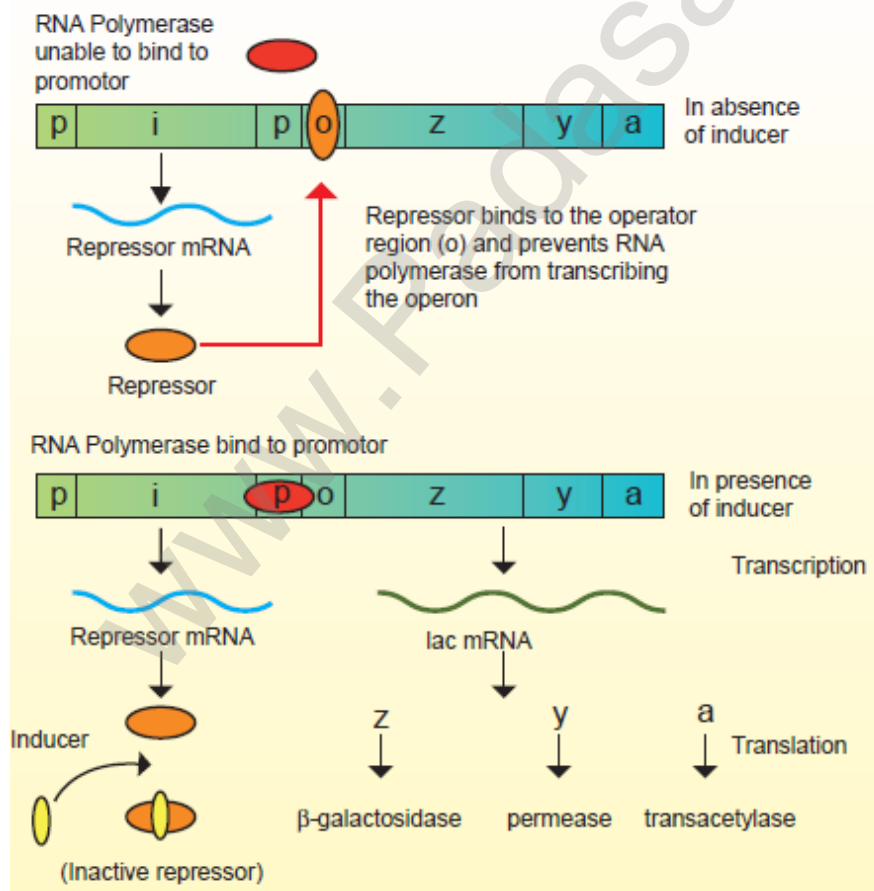
Turner's Syndrome (XO Females)

This genetic disorder is due to the loss of a X chromosome resulting in a karyotype of 45,X. Persons with this syndrome have 45 chromosomes (44 autosomes and one X chromosome) (44AA+XO) and are sterile females. Low stature, webbed neck, under developed breast, rudimentary gonads lack of menstrual cycle during puberty, are the main symptoms of this syndrome.

35. a) **The Lac (Lactose) operon:** The metabolism of lactose in *E. coli* requires three enzymes – permease, P-galactosidase (P-gat) and transacetylase. The enzyme permease is needed for entry of lactose into the cell, P-galactosidase brings about hydrolysis of lactose to glucose and galactose, while transacetylase transfers acetyl group from acetyl Co A to P-galactosidase. The lac operon consists of one-regulator gene (T gene refers to inhibitor) promoter sites (p), and operator site (o). Besides these, it has three structural genes namely lac z, y and lac a. The lac 'z' gene codes for P-galactosidase, lac 'y' gene codes for permease and 'a' gene codes for transacetylase.

Jacob and Monod proposed the classical model of Lac operon to explain gene expression and regulation in *E. coli*. In lac a polycistronic structural gene is regulated by a common promoter and regulatory gene. When the cell is using its normal energy source as glucose, the 'i' gene transcribes a repressor mRNA and after its translation, a repressor protein is produced. It binds to the operator region of the operon and prevents translation, as a result, P-galactosidase is not produced. In the absence of preferred carbon source such as glucose, if lactose is available as an energy source for the bacteria then lactose enters the cell as a result of permease enzyme. Lactose acts as an inducer and interacts with the repressor to inactivate it.

The repressor protein binds to the operator of the operon and prevents RNA polymerase from transcribing the operon. In the presence of inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer. This allows RNA polymerase to bind to the promoter site and transcribe the operon to produce lac mRNA which enables formation of all the required enzymes needed for lactose metabolism. This regulation of lac operon by the repressor is an example of negative control of transcription initiation.



35. b) Natural selection can be explained clearly through industrial melanism. Industrial melanism is a classical case of Natural selection exhibited by the peppered moth, *Biston betularia*. These were available in two colours, white and black. Before industrialization peppered moth both white and black coloured were common in England. Pre-industrialization witnessed white coloured background of the wall of the buildings hence the white coloured moths escaped from their predators. Post industrialization, the tree trunks became dark due to smoke and soot let out from the industries.

The black moths camouflaged on the dark bark of the trees and the white moths were easily identified by their predators. Hence the dark coloured moth population was selected and their number increased when compared to the white moths. Nature offered positive selection pressure to the black coloured moths. The above proof shows that in a population, organisms that can adapt will survive and produce more progenies resulting in increase in population through natural selection.

36. a) Viral Disease in Human beings:

S. No	Diseases	Causative agent	Site of infection	Mode of transmission	Symptoms
1	Common cold	<i>Rhino viruses</i>	Respiratory tract	Droplet infection	Nasal congestion and discharge, sore throat, cough and headache
2	Mumps	<i>Mumps virus (RNA virus), Paramyxovirus</i>	Salivary glands	Saliva and droplet infection	Enlargement of the parotid glands
3	Measles	<i>Rubella virus (RNA virus), Paramyxovirus</i>	Skin and respiratory tract	Droplet infection	Sore throat, running nose, cough and fever, reddish rashes on the skin, neck and ears
4	Viral hepatitis	<i>Hepatitis - B virus</i>	Liver	Parenteral route, blood transfusion	Liver damage, jaundice, nausea, yellowish eyes, fever and pain in the abdomen
5	Chicken pox	<i>Varicella - Zoster virus (DNA Virus)</i>	Respiratory tract, skin and nervous system	Droplet infection and direct contact	Mild fever with itchy skin, rash and blisters
6	Poliomyelitis	<i>Polio virus (RNA virus)</i>	Intestine, brain, spinal cord	Droplet infection through faecal oral route	Fever, muscular stiffness and weakness, paralysis and respiratory failure
7	Dengue fever (Break bone fever)	<i>Dengue virus or Flavi virus (DENV 1-4 virus)</i>	Skin and blood	Mosquito vector <i>Aedes aegypti</i>	Severe flu like illness with a sudden onset of fever and painful headache, muscle and joint pain

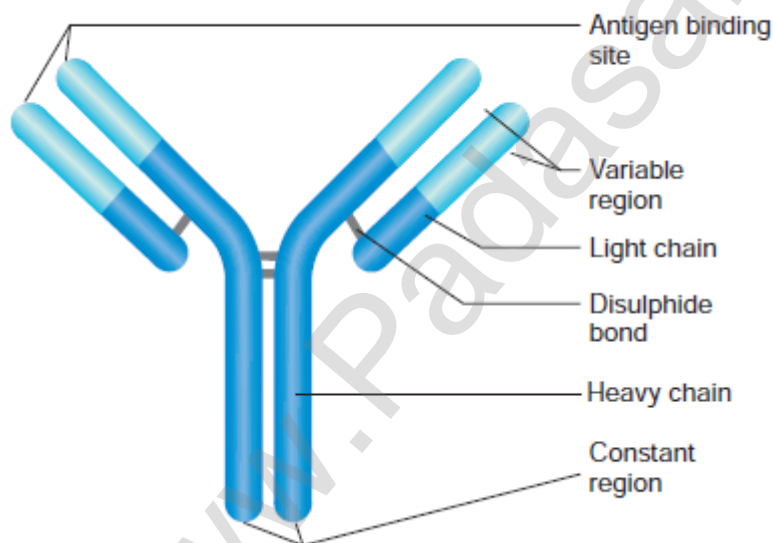
36. b) Structure of Immunoglobulin:

Antibodies are immunoglobulin (Ig) protein molecules synthesized on exposure to antigen that can combine specifically with the antigen.

In the 1950s, experiments by **Porter and Edelman** revealed the basic structure of the immunoglobulin. An antibody molecule is **Y** shaped structure that comprises of four polypeptide chains, two identical light chains (**L**) of molecular weight 25,000 Da (approximately 214 amino acids) and two identical heavy chains (**H**) of molecular weight 50,000 Da (approximately 450 amino acids). The polypeptide chains are linked together by di-sulphide (S-S) bonds. One light chain is attached to each heavy chain and two heavy chains are attached to each other to form a **Y** shaped structure. Hence, an antibody is represented by H_2L_2 . The heavy chains have a flexible hinge region at their approximate middles.

Each chain (**L** and **H**) has two terminals. They are C - terminal (Carboxyl) and amino or N-terminal. Each chain (**L** and **H**) has two regions. They have variable (**V**) region at one end and a much larger constant (**C**) region at the other end. Antibodies responding to different antigens have very different (**V**) regions but their (**C**) regions are the same in all antibodies. In each arm of the monomer antibody, the (**V**) regions of the heavy and light chains combines to form an antigen – binding site shaped to ‘fit’ a specific antigenic determinant. Consequently each antibody monomer has two such antigen – binding regions. The (**C**) regions that forms the stem of the antibody monomer determine the antibody class and serve common functions in all antibodies.

The functions of immunoglobulin are agglutination, precipitation, opsonisation, neutralization etc.,



37. a) **Recombinant Vaccines:**

Recombinant DNA technology has been used to produce new generation vaccines. The limitations of traditional vaccine production could be overcome by this approach.

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 include subunit recombinant vaccines, attenuated recombinant vaccines and DNA vaccines.

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.

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.

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.

37. b) The types of responses observed are

Regulate: Some organisms are able to maintain homeostasis by physiological means which ensures constant body temperature, ionic / osmotic balance. Birds, mammals and a few lower vertebrate and invertebrate species are capable of such regulation.

Conform: Most animals cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature. In aquatic animals like fishes, the osmotic concentration of the body fluids changes with that of the ambient water osmotic concentration. Such animals are called **Conformers**. In case of extreme condition, the inhabitants relocate themselves as in migration.

Migrate: Organisms tend to move away temporarily from a stressful habitat to a new, hospitable area and return when the stressful period is over. Birds migrate from Siberia to Vedanthangal in Tamilnadu to escape from the severe winter periods.

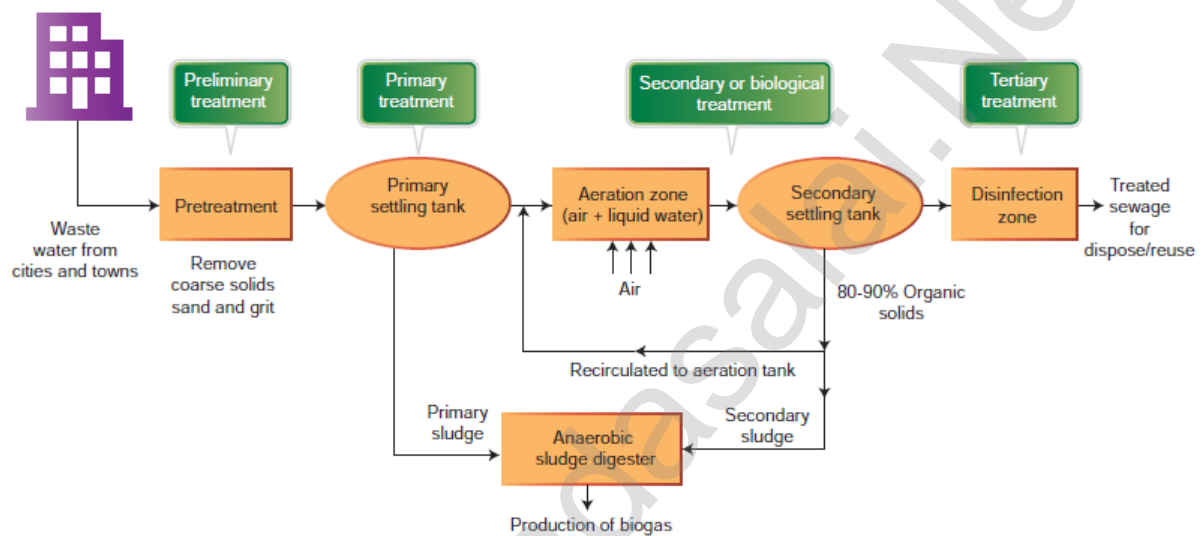
Suspend: In certain conditions, if the organisms is unable to migrate, it may avoid the stress by becoming inactive. This is seen commonly in bears going into **hibernation** during winter. Some snails and fish go into **aestivation** to avoid summer related problems like heat and desiccation. Some lower animals suspend a certain phase of their life cycle, which is referred to as **diapause**.

38. a) Exotic species are organisms often introduced unintentionally or deliberately for commercial purposes, as biological control agents and other uses. They often become invasive and drive away from the local species and is considered as the second major cause for the extinction of species.

Tilapia fish (Jilabi kendai) (*Oreochromis Mozambique*) 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.

Amazon sailfin catfish is responsible for destroying the fish population in the wetlands of Kolkata. The introduction of the Nile Perch, a predatory fish into Lake Victoria in East Africa led to the extinction of an ecologically unique assemblage of more than 200 nature species of cichlid fish in the lake.

38. b) Wastewater Treatment



Wastewater or sewage originates from domestic waste waters, industrial wastes and animal wastes. Realizing the importance of clean potable water, the Government passed the Water (Prevention and Control of Pollution) Act in 1974, which made it mandatory to treat wastewater in treatment plants. The main objective of a wastewater treatment process is to reduce organic and inorganic components in wastewater to a level that it no longer supports microbial growth and to eliminate other potentially toxic materials.

Primary treatment

Primary treatment involves the physical removal of solid and particulate organic and inorganic materials from the sewage through filtration and sedimentation. Floating debris is removed by sequential filtration. Then the grit (soil and small pebbles) are removed by sedimentation. All solids that settle form the primary sludge and the supernatant forms the effluent. The effluent from the primary settling tank is taken for secondary treatment.

Secondary treatment or biological treatment

The primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into floc (masses of bacteria associated with fungal filaments to form mesh like structures). While growing, these microbes consume the major part of the organic matter in the effluent. This

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significantly reduces the BOD (Biochemical oxygen demand or Biological oxygen demand). BOD refers to the amount of the oxygen that would be consumed, if all the organic matter in one litre of water were oxidized by bacteria. The sewage water is treated till the BOD is reduced. The greater the BOD of the waste water more is its polluting potential.

Tertiary treatment

Tertiary treatment is the final process that improves the quality of the waste water before it is reused, recycled or released into natural water bodies. This treatment removes the remaining inorganic compounds and substances, such as nitrogen and phosphorus. UV is an ideal disinfectant for wastewater since it does not alter the water quality – except for inactivating microorganisms.

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