

12th

STD

PUBLIC EXAM - MARCH 2023

PART - III
BIOLOGY

Reg. No.

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TIME ALLOWED : 3.00 HOURS]

(with Answers)

[MAXIMUM MARKS : 70

Instructions:

1. Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
2. Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART - II

(Bio-Zoology) 35 Marks

SECTION - I

- Note :** (i) Answer **all** the questions (8 × 1 = 8)
(ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

1. Patau's Syndrome is also referred to as:
(a) 13 - Trisomy (b) 18 - Trisomy (c) Turner's Syndrome (d) 21 - Trisomy
2. If Buds are formed on the outer surface of the parent body, it is called as:
(a) Gemmules (b) Endogenous budding
(c) Fragmentation (d) Exogenous budding
3. Colostrum is rich in:
(a) IgD (b) IgE (c) IgM (d) IgA
4. Interferons are:
(a) anti-biotics (b) anti-bacterial substances
(c) anti-fungal substances (d) anti-viral substances
5. Contraceptive pills contain:
(a) Relaxin and prolactin (b) Progesterone and estrogen
(c) Progesterone and relaxin (d) Estrogen and relaxin
6. The Athlete's foot disease in human is caused by:
(a) Protozoa (b) Virus (c) Fungi (d) Bacteria
7. The animals that are at high risk of extinction due to habitat destruction is:
(a) Amphibians (b) Mammals (c) Echinoderms (d) Birds
8. Enzyme used for removing oily stains from the clothes:
(a) Cellulase (b) Pectinase (c) Protease (d) Lipase

SECTION - II

- Note :** Answer **any four** of the following questions. (4 × 2 = 8)
9. What are the three layers of uterine wall?
 10. Which are called as non-sense codons in genetic code?
 11. Differentiate Convergent Evolution and Divergent Evolution.
 12. Name any four human viral diseases.
 13. Give the expansion of:
(a) CFC (b) PAN
 14. What are Stenotherms? Give examples.

[1]

SECTION - III

Note : Answer any three of the following questions.

Q.No. 19 is Compulsory. (3 × 3 = 9)

15. What is meant by regeneration? Give example.
16. Mention any three applications of karyotyping.
17. What is single cell protein? Write its uses.
18. What are the differences between in-situ and ex-situ conservation?
19. What are the multipotent cells involved in replenishing adult tissue? What is the rich source for it?

SECTION - IV

Note : Answer the following questions. (2 × 5 = 10)

20. (a) Describe the structure of human sperm with a neat labelled diagram.

(OR)

- (b) Explain the structure of immunoglobulin with suitable diagram.
21. (a) Explain the structure of RNA which plays a vital role in protein synthesis by transferring amino acids with diagram.

(OR)

- (b) List out the human activities causing biodiversity loss.

ANSWERS

SECTION - I

1. (a) 13-Trisomy
2. (d) Exogeneous budding
3. (d) IgA
4. (d) anti-viral substances
5. (b) Progesterone and estrogen
6. (c) Fungi
7. (a) Amphibians
8. (d) Lipase

SECTION - II

9. **The three layers of uterine wall:** The wall of the uterus has three layers of tissues, which together form the uterine wall. The outermost thin membranous serous layer called the perimetrium, the middle thick muscular layer called myometrium and the inner glandular layer called endometrium.
10. UAA, UAG and UGA codons are designated as termination (stop) codons and also are known as “non-sense” codons in genetic code.

11.

Divergent evolution	Convergent evolution
Structures which are similar in origin but perform different functions are called homologous structures that brings divergent evolution.	Organisms with different structural patterns but similar function are termed as analogous structures that brings convergent evolution

12. **Human viral diseases:**

- (i) Common cold
- (ii) Mumps
- (iii) Measles
- (iv) Viral hepatitis

13. (i) CFC - Chlorofluorocarbon
(ii) PAN - Peroxyacetyl Nitrate

14. Organisms which can tolerate only a narrow range of temperature are **Stenotherms**.

Examples: Fish, Frogs, Lizards and Snakes.

SECTION - III

15. **Regeneration** is regrowth in the injured region. Regeneration was first studied in Hydra by Abraham Trembley in 1740. Regeneration is of two types, (i) morphallaxis and (ii) epimorphosis.

(i) **Morphallaxis:** The whole body grows from a small fragment. **E.g.** *Hydra* and *Planaria*.

- (a) When *Hydra* is accidentally cut into several pieces, each piece can regenerate the lost parts and develop into a whole new individual.
- (b) The parts usually retain their original polarity, with oral ends, by developing tentacles and aboral ends, by producing basal discs.

(ii) **Epimorphosis:** It is the replacement of lost body parts. It is of two types, **reparative** and **restorative** regeneration.

- (a) **Reparative regeneration:** Only certain damaged tissue can be regenerated. **E.g.** human beings (liver tissue)
- (b) **Restorative regeneration:** Several body parts can develop. **E.g.** star fish, tail of wall lizard.

16. **Applications of karyotyping:**

- (i) It helps in gender identification.
- (ii) It is used to detect the chromosomal aberrations like deletion, duplication, translocation, non-disjunction of chromosomes.
- (iii) It helps to identify the abnormalities of chromosomes like aneuploidy.

17. **Single cell protein** refers to edible unicellular microorganisms like *Spirulina*. Protein extracts from pure or mixed cultures of algae, yeasts, fungi or bacteria may be used as ingredient or as a substitute for protein rich foods and is suitable for human consumption or as animal feed.

18. *In-situ* and *Ex-situ* are two types of biodiversity conservation strategies.

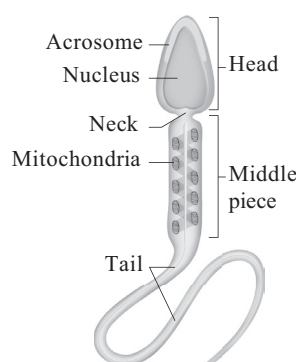
S.No	<i>In-situ</i> Conservation	<i>Ex-situ</i> Conservation
(i)	It is the on-site conservation or the conservation of genetic resources in natural populations of plant or animal species.	This is a conservation strategy which involves placing of threatened animals and plants in special care locations for their protection.
(ii)	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.
(iii)	National Parks, Biosphere Reserve, Wild Life Sanctuaries form <i>insitu</i> conservation strategies.	Zoological parks and Botanical gardens are common <i>exsitu</i> conservation programs.

19. **Adult stem cells:**

- (i) An adult stem cell or somatic stem cell can divide and create another cell similar to it.
- (ii) They are multipotent
- (iii) It can act as a repair system of the body, replenishing adult tissues.
- (iv) The red bone marrow is a rich source of adult stem cells.

SECTION - IV20. (a) **Structure of Human Sperm:**

- (i) The human sperm is a microscopic, flagellated and motile gamete. The whole body of the sperm is enveloped by plasma membrane and is composed of a head, neck middle piece and a tail.
- (ii) The head comprises of two parts namely acrosome and nucleus.
- (iii) Acrosome is a small cap like pointed structure present at the tip of the nucleus and is formed mainly from the golgi body of the spermatid.
- (iv) It contains hyaluronidase, a proteolytic enzyme, popularly known as sperm lysin which helps to penetrate the ovum during fertilization. The nucleus is flat and oval.

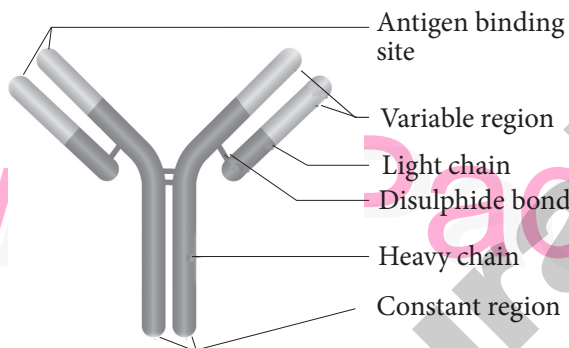


Structure of human sperm

- (v) The neck is very short and is present between the head and the middle piece. It contains the proximal centriole towards the nucleus which plays a role in the first division of zygote and the distal centriole gives rise to the axial filament of the sperm.
- (vi) The middle piece possesses mitochondria spirally twisted around the axial filament called mitochondrial spiral or nebenkern. It produces energy in the form of ATP molecules for the movement of sperms.
- (vii) The tail is the longest part of the sperm and is slender and tapering.
- (viii) It is formed of a central axial filament or axoneme and an outer protoplasmic sheath. The lashing movements of the tail push the sperm forward.

(OR)

(b) Structure of immunoglobulin :



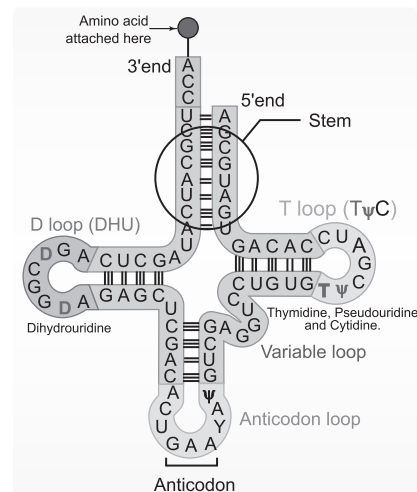
Structure of immunoglobulin

- (i) In the 1950s, experiments by Porter and Edelman revealed the basic structure of the immunoglobulin.
- (ii) An antibody molecule is Y shaped structure
- (iii) It comprises of 4 polypeptide chains, two identical light chains (L) of molecular weight 25,000 Da (approximately 214 amino acids)
- (iv) Two identical heavy chains (H) of molecular weight 50,000 Da (approximately 450 amino acids).
- (v) The polypeptide chains are linked together by di-sulphide (S-S) bonds.
- (vi) One light chain is attached to each heavy chain two heavy chains are attached to each other to form a Y shaped structure. Hence, an antibody is represented by $H_2 L_2$.

- (vii) Each chain (L and H) has two terminals. They are C - terminal (Carboxyl) and amino or N-terminal.
- (viii) 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.
- (ix) Antibodies responding to different antigens have very different (V) regions but their (C) regions are the same in all antibodies.
- (x) 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.
- (xi) Consequently each antibody monomer has two such antigen - binding regions.
- (xii) The (C) regions form the stem of the antibody monomer that determine the antibody class and serve common functions in all antibodies.

20. (a) Structure of tRNA :

- (i) The transfer RNA, (tRNA) molecule of a cell acts as a vehicle that picks up the amino acids scattered through the cytoplasm and also reads specific codes of mRNA molecules. Hence it is called an **adapter molecule**. This term was postulated by Francis Crick.



Holley's two-dimensional clover leaf model of transfer RNA

- (ii) The two dimensional clover leaf model of tRNA was proposed by Robert Holley. The secondary structure of tRNA looks like a clover leaf. In actual structure, the tRNA is a compact molecule which looks like an inverted L.

- (iii) The **clover leaf model of tRNA** shows the presence of three arms namely DHU arm, middle arm and TΨC arm. These arms have loops such as amino acyl binding loop, anticodon loop and ribosomal binding loop at their ends.
- (iv) In addition it also shows a small lump called variable loop or extra arm. The amino acid is attached to one end (amino acid acceptor end) and the other end consists of three anticodon nucleotides. The anticodon pairs with a codon in mRNA ensuring that the correct amino acid is incorporated into the growing polypeptide chain.
- (v) Four different regions of double-stranded RNA are formed during the folding process. Modified bases are especially common in tRNA. Wobbling between anticodon and codon allows some tRNA molecules to read more than one codon.

(OR)

(b) Biodiversity loss caused by human activities:

Even though India is one of the 17 identified mega diverse countries of the world, it faces lots of threats to its biodiversity.

- (i) Human activities, both directly and indirectly are main reason for habitat loss and biodiversity loss.
- (ii) Fragmentation and degradation due to agricultural practices, extraction (mining, fishing, logging, harvesting) and development (settlements, industrial and associated infrastructures) leads to habitat loss.
- (iii) Fragmentation leads to formation of isolated, small and scattered populations and as endangered species.
- (iv) Some of the other threats are
- Specialised diet,
 - Specialized habitat requirement
 - Large size, small population size
 - Limited geographic distribution
 - High economic or commercial value.
- (v) Large mammals require larger areas to obtain the necessities of life - food, cover, mates than do smaller mammals.
- (vi) Mammals have specialized dietary needs such as carnivores, frugivores and the need to forage over much larger areas than general dietary herbivores and omnivores.
- (vii) Mammals also have low reproductive output other than small rodents.



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(with Answers)

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PART - I

- Note :** (i) Answer **all** the questions. (15 × 1 = 15)
- (ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

- The golden age of reptiles was :
(a) Paleozoic era (b) Mesozoic era
(c) Proterozoic era (d) Cenozoic era
- The highest DDT concentration in aquatic food chain shall occur in :
(a) Cell
(b) Seagull (Fish eating birds)
(c) Phytoplankton
(d) Crab
- Exo-erythrocytic schizogony of Plasmodium takes place in :
(a) Stomach (b) RBC
(c) Liver (d) Leucocytes
- Allergy involves :
(a) IgA (b) IgE
(c) IgM (d) IgG
- Which one of the following is true to gastrulation?
(a) Formation of three germ layer embryo from single layer embryo.
(b) Formation of multicellular structure from zygote.
(c) Attachment of blastocyst to the uterine wall.
(d) Formation of specific organs from Primary germ layers.
- The first ejaculation of the semen is _____.
(a) Orchidectomy (b) Infertility
(c) Spermarche (d) Azoospermia
- Which of the following Codon codes for methionine?
(a) UUU (b) AUG
(c) AUC (d) UAA
- _____ was the first human like being.
(a) Ramapithecus (b) Homo erectus
(c) Hominids (d) Australopithecus
- ZW-ZZ system of sex determination occurs in :
(a) Reptiles (b) Birds
(c) Fishes (d) All of the above
- Animals that can move from Fresh, water to Sea water :
(a) Catadromous (b) Stenothermal
(c) Anadromous (d) Eurythermal
- Dodo, Passenger pigeon and Steller's sea cow have become extinct due to _____.
(a) Habitat Loss
(b) Over exploitation
(c) Shifting cultivation
(d) Habitat fragmentation
- The mode of sexual reproduction in bacteria is by:
(a) Conjugation
(b) Formation of gametes
(c) Zoospore formation
(d) Endospore formation
- _____ is used to lower blood cholesterol level.
(a) Statins (b) Clot buster
(c) Tetracycline (d) Cyclosporin A

[6]

14. Competition between species leads to :
 (a) Amensalism (b) Extinction
 (c) Symbiosis (d) Mutation
15. The male sex hormone testosterone is secreted from :
 (a) Epididymis (b) Sertoli cells
 (c) Prostate gland (d) Leydig cell

PART - II

Note : Answer **any six** of the following. Question No. 24 is Compulsory. (6 × 2 = 12)

16. What is Plasmotomy?
17. Differentiate spermiogenesis and spermatogenesis.
18. What is Mayer-Rokitansky Syndrome?
19. What is Lyonisation?
20. What are Okazaki fragments?
21. What is bio-remediation?
22. "Red data book" - What do you know about it?
23. Define Eutrophication.
24. Vaccine is not produced against Chickenpox. Why?

PART - III

Note : Answer **any six** of the following. Question No. 33 is Compulsory. (6 × 3 = 18)

25. How does juvenile phase differ from reproductive phase?
26. Draw a labeled sketch of a spermatozoan.
27. Differentiate tubectomy and vasectomy.
28. Write the salient features of Mutation theory.
29. What are the functions of immunoglobulin?
30. Define Fermentors.
31. 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.
32. Differentiate Natality and Mortality.
33. AIDS is not a disease. But it facilitates the attack by other organisms. Why?

PART - IV

Note : Answer **all** the questions. (5 × 5 = 25)

34. (a) Explain the various phases of the menstrual cycle.
 (OR)
 (b) What is infertility? Write its causes.
35. (a) Write the salient features of Human Genome Project (HGP).
 (OR)
 (b) Darwin's finches and Australian marsupials are suitable examples of adaptive radiation - Justify the statement.
36. (a) What are the steps to be adopted to lead healthy life style?
 (OR)
 (b) Write the differences between primary and secondary immune responses.
37. (a) What are the advantages and disadvantages of cloning?
 (OR)
 (b) What is population dispersion? Explain its types.
38. (a) Write the general strategies in conservation.
 (OR)
 (b) Explain the process of sewage treatment.

ANSWERS**PART - I**

- (b) Mesozoic era
- (b) Seagull (Fish eating birds)
- (c) Liver
- (b) IgE
- (a) Formation of three germ layer embryo from single layer embryo.
- (c) Spermatheca
- (b) AUG
- (b) Homo erectus
- (d) All of the above
- (a) Catadromous

11. (b) Over exploitation
12. (a) Conjugation
13. (a) Statins
14. (b) Extinction
15. (d) Leydig cell

PART - II

16. Plasmotomy :

- (i) Plasmotomy is the division of multinucleated parent into many multinucleate daughter individuals with the division of nuclei.
- (ii) Nuclear division occurs later to maintain normal number of nuclei.
- (iii) Plasmotomy occurs in *Opalina* and *Pelomyxa*.
- (iv) It is a method of asexual reproduction.

17.

Spermiogenesis	Spermatogenesis
It is the process of maturation of spermatids into spermatozoa.	It is the process of formation of sperm cells or male gametes.
Follicle Stimulating Hormone (FSH) stimulate testicular growth and enhances the production of Androgen Binding Protein (ABP) by the sertoli cells and helps in the process of spermiogenesis.	Lutenizing Hormone (LH) acts on the Leydig cells and stimulates the synthesis of testosterone which in turn stimulates the process of spermatogenesis.

18. Mayer-Rokitansky Syndrome:

All women are born with ovaries, but some do not have functional uterus. This condition is called Mayer-Rokitansky syndrome

19. Linoisation:

- (i) In the XY chromosomal system of sex determination, males have only one X chromosome, whereas females have two. In mammals, the necessary dosage compensation is accomplished by the inactivation of one of the X chromosome in females so that both males and females have only one functional X chromosome per cell.
- (ii) Mary Lyon suggested that Barr bodies represented an inactive chromosome, which in females becomes tightly coiled into a heterochromatin, a condensed and visible form of chromatin (Lyon's hypothesis).
- (iii) The number of Barr bodies observed in cell was one less than the number of X-Chromosome. XO females have no Barr body, whereas XXY males have one Barr body.
- (iv) The discovery of X inactivator is attributed by British Genetician Mary Lyon and is called as Lyonisation.

20. Okazaki fragments:

- (i) The discontinuous synthesized fragments of the lagging strand is called okazaki fragments.
- (ii) It can be joined by the enzyme DNA ligase.

21. Bioremediation :

- (i) The use of naturally occurring or genetically engineered microorganisms to reduce or degrade pollutants is called bioremediation.
- (ii) Bioremediation is less expensive and more sustainable than other remediations available.
- (iii) It is grouped into insitu 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).

22. **Red Data Book :**

- (i) Red Data book or Red list is a catalogue of taxa facing risk of extinction.
- (ii) WCU – World Conservation Union maintains the Red Data book.

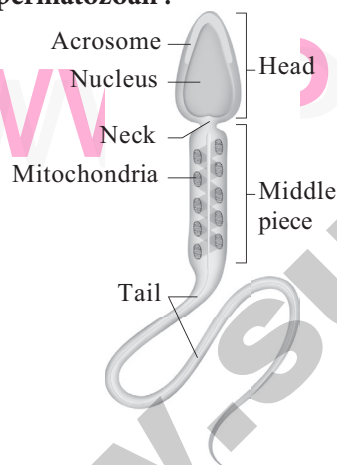
23. **Eutrophication :** When run-off from land containing nutrients reaches water bodies like lakes, it results in dense growth of plant life. This phenomenon is called Eutrophication.

- 24. (i) Acquired naturally in the body of a person once infected with smallpox Immunity develops.
- (ii) When re-infected with the chickenpox virus, this vaccine acts quickly and prevents the disease from recurring.
- (iii) It is for this reason that no vaccine is produced against smallpox.

PART - III

25.

Juvenile phase	Reproductive phase
Juvenile phase/ vegetative phase is the period of growth between the birth of the individual upto reproductive maturity.	During reproductive phase/ maturity phase the organisms reproduce and their offsprings reach maturity period.

26. **Spermatozoan :**

27.

S.No.	Tubectomy	Vasectomy
1.	It is the surgical sterilisation in women.	It is the surgical procedure for male sterilisation.
2.	In this procedure, a small portion of both fallopian tubes are cut and tied up through a small incision in the abdomen or through vagina.	In this procedure, both vas deferens are cut and tied through a small incision on the scrotum to prevent the entry of sperm into the urethra.
3.	It prevents fertilization as well as the entry of the egg into the uterus.	It prevents sperm from heading off to penis as the discharge has no sperms in it.

28. **Mutation Theory :**

- (i) Mutations or discontinuous variation are transmitted to other generations.
- (ii) In naturally breeding populations, mutations occur from time to time.
- (iii) There are no intermediate forms, as they are fully fledged.
- (iv) They are strictly subjected to natural selection.

29. **Functions of Immunoglobulin :**

- (i) They functions as antibodies.
- (ii) The functions of immunoglobulin are agglutination, precipitation, opsonisation, neutralization etc.,

30. **Fermentors :**

- (i) Production on a large scale requires growing microbes in very large vessels called fermentors (bio-reactor).
- (ii) A fermentor (bio-reactor) is a closed vessel with adequate arrangement for aeration, agitation, temperature, pH control and drain or overflow vent to remove the waste biomass of cultured microorganisms alongwith their products.

31. The number of primers required in each cycle of PCR are two.

Role of Primers DNA Polymerase in PCR:

- (i) During PCR process in the second stage, each separated DNA strand is allowed to hybridize with a primer. This is called renaturation or primer annealing. The primer template is used to synthesize DNA by using Taq-DNA polymerase.
- (ii) Annealing is done by rapid cooling of the mixture, allowing the primers to bind to the sequences in each of the two strands flanking the target DNA.
- (iii) During the third stage known as primer extension or synthesis, the Taq DNA polymerase extends each primer by copying the single stranded template.

Source organism of the enzyme DNA polymerase: *Thermus aquaticus*.

32.

S. No.	Natality	Mortality
1.	Natality is equivalent to birth rate and is an expression of the production of new individuals in the population by birth, hatching, germination (or) fission.	Mortality is the population decline factor and is opposite to natalty.
2.	Natality rate expressed in crude birth rate number of organisms born per female per unit time.	Mortality is expressed as specific mortality, that is, the number of members of an original population dying after the lapse of a given time.
3.	Birth rate (b) = $\frac{\text{No. of birth per unit time}}{\text{Average population}}$	Death rate (d) = $\frac{\text{No.of deaths per unit time}}{\text{Average population}}$

33. (i) AIDS is an acronym for Acquired Immuno Deficiency Syndrome.
 (ii) It is the deficiency of immune system, acquired during the life time of an individual indicating that it is not a congenital disease.
 (iii) AIDS is caused by Human Immuno Deficiency Virus (HIV).
 (iv) AIDS is not a disease, it is a set of symptoms caused by HIV. Advocating safe sex and promoting regular check-up, safe blood for transfusion, use of disposable needles, use of condoms during sexual contact, prevention of drug abuse, AIDS awareness programme by NACO (National AIDS Control Organisation), NGOs (Non-Governmental Organisations) and WHO are to prevent the spreading of AIDS.

PART - IV

34. (a) **Menstrual cycle consists of the following phases are,**

1. Menstrual phase
2. Follicular or proliferative phase
3. Ovulatory phase
4. Luteal or secretory phase

1. Menstrual phase:

- (i) The cycle starts with the menstrual phase when menstrual flow occurs and lasts for 3-5 days.
- (ii) Menstrual flow is due to the breakdown of endometrial lining of the uterus and its blood vessels due to decline in the level of progesterone and oestrogen.
- (iii) Menstruation occurs only if the released ovum is not fertilized.

2. Follicular or proliferative phase:

- (i) The follicular phase extends from the 5th day of the cycle until the time of ovulation.
- (ii) During this phase, the primary follicle in the ovary grows to become a fully mature Graafian follicle and simultaneously, the endometrium regenerates through proliferation.
- (iii) These changes are induced by the secretion of gonadotropins like FSH and LH, which increase gradually during the follicular phase.
- (iv) It stimulates follicular development and secretion of oestrogen by the follicle cells.

3. Ovulatory phase :

- (i) Both LH and FSH attain peak level in the middle of the cycle (about the 14th day).
- (ii) Maximum secretion of LH during the mid cycle called LH surge induces the rupture of the Graafian follicle and the release of the ovum (secondary oocyte) from the ovary wall into the peritoneal cavity. This process is called as ovulation.

4. Luteal or secretory phase:

- (i) During luteal phase, the remaining part of the Graafian follicle is transformed into a transitory endocrine gland called corpus luteum.
- (ii) The corpus luteum secretes large amount of progesterone which is essential for the maintenance of the endometrium.
- (iii) It paves way for the implantation of the fertilized ovum.
- (iv) The uterine wall secretes nutritious fluid in the uterus for the foetus. So, this phase is also called as secretory phase.

- (v) During pregnancy, all events of menstrual cycle stop and there is no menstruation.
- (vi) In the absence of Fertilization, the corpus luteum degenerates completely and leaves a scar tissue called corpus albicans.
- (vii) It also initiates the disintegration of the endometrium leading to menstruation, marking the next cycle.

(OR)

- (b) **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.

Causes :

- (i) Tumours formed in the pituitary or reproductive organs.
- (ii) Inherited mutations of genes responsible for the biosynthesis of sex hormones, malformation of the cervix or fallopian tubes and inadequate nutrition before adulthood.
- (iii) Long-term stress damages many aspects of health especially the menstrual cycle.
- (iv) Ingestion of toxins (heavy metal cadmium), heavy use of alcohol, tobacco and marijuana, injuries to the gonads and aging.

Other causes of infertility :

- (i) Pelvic inflammatory disease (PID), uterine fibroids and endometriosis. are the most common causes of infertility in women.
- (ii) Low body fat or anorexia in women. i.e. a psychiatric eating disorder characterised by the fear of gaining weight.
- (iii) Undescended testes and swollen veins (varicocele) in scrotum. Tight clothing in men may raise the temperature in the scrotum and affect sperm production.
- (iv) Under developed ovaries or testes.
- (v) Female may develop antibodies against her partner's sperm.
- (vi) Males may develop an autoimmune response to their own sperm.

35. (a) **Salient Features of Human Genome Project (HGP) :**

- (i) The human genome contains 3 billion nucleotide bases.
- (ii) An average gene consists of 3000 bases, the largest known human gene being dystrophin with 2.4 million bases.
- (iii) The chromosomal organization of human genes shows diversity.
- (iv) Approximately 30,000 genes are present in human genome and almost 99.9 nucleotide bases are exactly the same in all people.
- (v) Functions for over 50 percent of the discovered genes are unknown.
- (vi) Less than 2 percent of the genome codes for proteins.
- (vii) Repeated sequences make up very large portion of the human genome. Repetitive sequences have no direct coding functions but they shed light on chromosome structure, dynamics and evolution (genetic diversity).

- (viii) Chromosome 1 has 2968 genes whereas chromosome Y has 231 genes.
- (ix) Scientists have identified about 1.4 million locations where single base DNA differences (SNPs – Single nucleotide polymorphism – pronounce as ‘snips’) occur in humans. Identification of ‘SNIPS’ is helpful in finding chromosomal locations for disease associated sequences and tracing human history.

(OR)

(b) Adaptive Radiation :

- (i) The evolutionary process which produces new species diverged from a single ancestral form becomes adapted to newly invaded habitats is called adaptive radiation.
- (ii) Adaptive radiations are best exemplified in closely related groups that have evolved in relatively short time.
- (iii) Darwin's finches and Australian marsupials are best examples for adaptive radiation.

Darwin's finches :

- (i) Their common ancestor arrived on the Galapagos about 2 million years ago.
- (ii) Darwin's finches evolved into 14 recognized species differing in body size, beak shape and feeding behavior. This enabled different species to utilize different food resources such as insects, seeds, nectar from cactus flowers and blood from iguanas, all driven by Natural selection.
- (iii) Genetic variation by mild mutation in the ALX1 gene in the DNA of Darwin finches is associated with variation in the beak shape.
- (iv) Mild mutation in the ALX1 gene leads to phenotypic change in the shape of the beak of the Darwin finches.
- (v) Marsupials in Australia and placental mammals in North America are two subclasses of mammals. Adapted to a particular food resource, locomotory skill or climate.
- (vi) They were separated more than 100 million years ago and each lineage continued to evolve independently.
- (vii) Despite temporal and geographical separation, Marsupials in Australia and placental mammals in North America have produced varieties of species living in similar habitats with similar ways of life.
- (viii) Their overall resemblance in shape, locomotory mode, feeding and foraging are superimposed upon different modes of reproduction.
- (ix) This feature reflects their distinctive evolutionary relationships.
- (x) The marsupials have undergone adaptive radiation to occupy the diverse habitats in Australia, just as the placental mammals have radiated across North America.

36. (a) Steps to be adopted to lead healthy life style are :**Life style modifications:**

- (i) Avoid eating junk food and foods that have preservatives and colouring agents.
- (ii) Physical exercises such as brisk walking and yoga can be done regularly.
- (iii) Following medical advice, if any health problems in addition to life style disorders.
- (iv) To avoid smoking drugs and drinking alcohol.
- (v) To follow a healthy balanced diet rich in vitamins and proteins.
- (vi) 7 – 8 hours of sleep every day is required.

(OR)

(b)

S. No.	Primary Immune Response	Secondary Immune Response
1.	It occurs as a result of primary contact with an antigen.	It occurs as a result of second and subsequent contacts with the same antigen.
2.	Antibody level reaches peak in 7 to 10 days.	Antibody level reaches peak in 3 to 5 days.
3.	Prolonged period is required to establish immunity.	It establishes immunity in a short time.
4.	There is rapid decline in antibody level.	Antibody level remains high for longer period.
5.	It appears mainly in the lymph nodes and spleen.	It appears mainly in the bone marrow, followed by the spleen and lymph nodes.

37. (a) **Advantages and Disadvantages of Cloning :****Advantages :**

- (i) Offers benefits for clinical trials and medical research. It can help in the production of proteins and drugs in the field of medicine.
- (ii) Aids stem cell research.
- (iii) Animal cloning could help to save endangered species.

Disadvantages :

- (i) 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.
- (ii) The process is tedious and very expensive.
- (iii) It can cause animals to suffer.
- (iv) Reports show that animal surrogates were manifesting adverse outcomes and cloned animals were affected with disease and have high mortality rate.
- (v) It might compromise human health through consumption of cloned animal meat.
- (vi) Cloned animals aged faster than normal animals and are less healthy than the parent organism as discovered in Dolly.
- (vii) Cloning can lead to occurrence of genetic disorders in animals.
- (viii) More than 90% of cloning attempts fail to produce a viable offspring.

(OR)

(b) **Population Dispersion :**

Populations have a tendency to disperse or spread out in all directions, until some barriers are reached. This is observed by the migration of individuals into (Immigration) or out (Emigration) of the population area.

- (i) **Migration :** Migration is a peculiar and unique kind of mass population movement from one place to another and back. To avoid the severe winter cold, Siberian cranes migrate from Siberia to Vedanthangal in Tamil Nadu and return back in spring. Some fishes are known to migrate from sea to fresh water (anadromous migration, Salmon) and some from fresh water to sea (catadromous migration, Eel).
- (ii) **Emigration :** Under natural conditions, emigration usually occurs when there is overcrowding. This is regarded as an adaptive behavior that regulates the population in a particular site and prevents over exploitation of the habitat. Further, it leads to occupation of new areas elsewhere.
- (iii) **Immigration :** It leads to a rise in population levels. If the population increases beyond the carrying capacity, it can result in increased mortality among the immigrants or decreased reproductive capacity of the individuals. Both emigration and immigration are initiated or triggered by weather and other abiotic and biotic factors.

38. (a) **General strategies in conservation :**

- (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) air, water and soil should be conserved on priority basis
- (v) wildlife Protection Act should be implemented

(OR)

(b) **Process of Sewage treatment:**

Sewage treatment is usually performed in the following three stages:

Primary treatment:

- (i) Primary treatment is the physical removal of solid and particulate organic and inorganic materials from the sewage through filtration and sedimentation.
- (ii) Floating debris is removed by sequential filtration and the grit (soil and small pebbles) are removed by sedimentation.
- (iii) All solids settle forms the primary sludge and the supernatant forms the effluent and is taken for secondary treatment.

Secondary treatment or biological treatment :

- (i) 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).
- (ii) This 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.

- (iii) The sewage water is treated till the BOD is reduced. The greater the BOD of the waste water more is its polluting potential.
- (iv) Once the BOD of sewage water is reduced significantly, the effluent is then passed into a settling tank where the bacterial "flocs" are allowed to sediment, which is called activated sludge. A small part of activated sludge is pumped back into the aeration tank to serve as the inoculum.
- (v) The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. Here, the bacteria which grow anaerobically, digest the bacteria and the fungi in the sludge. During digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and CO_2 , which form biogas and can be used as a source of energy.

Tertiary treatment :

- (i) 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.
- (ii) This treatment removes the remaining inorganic compounds and substances, such as nitrogen and phosphorus.
- (iii) UV is an ideal disinfectant for wastewater since it does not alter the water quality – except for inactivating microorganisms. UV is a chemical-free process that can completely replace the existing chlorination system and also inactivates chlorine-resistant microorganisms like *Cryptosporidium* and *Giardia*.

