12th STD.

Register Number | | | | | | |

GOVT. MODEL QUESTION PAPER - 2019 - 20

BIOLOGY

TIME ALLOWED : 3.00 Hours | MAXIMUM MARKS : 70

Only Bio-Zoology questions are given here for 35 Marks. Refer to our Bio-Botany guide for Bio-Botany questions (for another 35 Marks)

BIO-ZOOLOGY

(35 MARKS)

Instructions:

i. Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

ii. Use **Blue** or **Black** ink to write and underline and **pencil** to draw diagrams:

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. Which among the following animals exhibit ovoviviparity?
(a) Frog (b) Shark
(c) Sheep (d) Hen

2. 21st trisomy is observed in
(a) Down's syndrome
(b) Patau's syndrome
(c) Turner's syndrome
(d) Klinefelter's syndrome

3. Which among the codon codes for methionine?
(a) AUG (b) UAA
(c) UUU (d) AUG

4. The disease caused by *Wuchereria bancrofti* is
(a) Malaria (b) Filariasis
(c) Kala-azar (d) Sleeping sickness

5. Which of the following pair is correctly matched?
(a) *Trichoderma polysporum* - Clot buster
(b) *Aspergillus niger* - Butric acid
(c) *Clostridium butyricum* - Cyclosporine A
(d) *Streptococcus* - Citric acid

6. The first clinical gene therapy was done for the treatment of
(a) SCID (b) cancer
(c) AIDS (d) cystic fibrosis

7. Given below are some examples for population interactions. Which among the following shows mutualism?
(a) Lion and deer
(b) Man and tape worm
(c) Hermit crab and sea-anemone
(d) Sucker fish and shark

8. The most abundant green house gas is
(a) Carbon-dioxide (b) Methane
(c) Sulphur-dioxide (d) Nitrous oxide

SECTION – II

Answer **any four** of the following question. **(4 × 2 = 8)**

9. Describe the structure of the head of a human sperm.

10. Mention any four salient features of Human Genome Project.

11. Name an opioid drug and its plant source. How does the drug affect Human body?

12. How does the transgenic cow Rosie's milk differ from normal cow's milk?

13. Differentiate Natality from Mortality.

14. What is Ozone depletion? How is it caused?

SECTION – III

Answer any **three** of the following in which question No. **18 is compulsory.** **(3 × 3 = 9)**

15. Explain multiple fission in *Plasmodium* with a diagram.

16. Write the causes and the differences between Haemophilia and Thalassemia.

17. Explain the secondary treatment of waste water.

18. Explain the steps involved in the preparation of Human insulin artificially.

19. Differentiate *in-situ* and *ex-situ* conservation by sighting examples for each.

Section – IV

Answer all the questions **(2 × 5 = 10)**

20. a. Explain any five techniques of Assisted Reproductive Technology (ART).

(OR)

b. i) Differentiate Divergent and Convergent evolution with examples.

ii) What are the various objections to Darwinism?

21. a. Explain the life cycle of *Plasmodium*.

(OR)

b. Mention the reasons for the richness of biodiversity in the tropics.

Answers

Section – I

1. (b) Shark

2. (a) Down's syndrome

3. (a) AUG

4. (b) Filariasis

5. * None of these above

(a) *Trichoderma polysporum* - cyclosporine A

(b) *Aspergillus niger* - citric acid

(c) *Clostridium butyricum* - butric acid

(d) *Streptococcus* - clot buster

6. (a) SCID

7. (c) Hermit crab and sea-anemone

8. (a) Carbon-dioxide

Section – II

9. **(i)** The head of a human sperm comprises of two parts namely acrosome and nucleus.

(ii) 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.

(iii) It contains hyaluronidase, a proteolytic enzyme, popularly known as sperm lysin which helps to penetrate the ovum during fertilisation.

(iv) The nucleus is flat and oval.

10. **(i)** Although human genome contains 3 billion nucleotide bases, the DNA sequences that encode proteins make up only about 5% of the genome.

(ii) An average gene consists of 3000 bases, the largest known human gene being dystrophin with 2.4 million bases.

(iii) The function of 50% of the genome is derived from transposable elements such as LINE and ALU sequence.

(iv) Genes are distributed over 24 chromosomes. Chromosome 19 has the highest gene density. Chromosome 13 and Y chromosome have lowest gene densities.

11. Opioid drug - Opium
Plant source - Poppy plant
It act as a depressant on the central nervous system.

12. 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.

13.

	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 natality.
2.	Natality rate may be 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.
2.	Birth rate (b) = $\frac{\text{No. of birth per unit time}}{\text{average population}}$	Death rate (d) = $\frac{\text{No. of deaths per unit time}}{\text{average population}}$

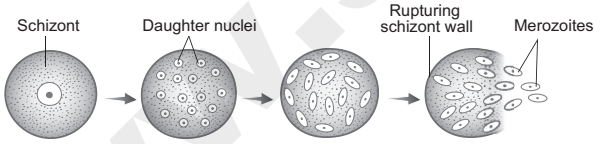
14. Ozone depletion: Thinning of the stratospheric ozone layer is known as ozone depletion. Such depletion causes the 'ozone hole', resulting in poor screening of the harmful UV rays and increase in incidences of skin cancer.

Cause: Ozone depletion is caused by CFC - Carbon Fluro Carbons.

Section – III

15. (i) In *Plasmodium*, multiple fission occurs in the schizont and in the oocyte stages. When multiple fission occurs in the schizont, the process is called schizogony and the daughter individuals are called merozoites.

(ii) When multiple fission occurs in the oocyte, it is called sporogony and the daughter individuals are called sporozoites.



Multiple Fission in *Plasmodium*

16. Haemophilia:

Cause: Haemophilia is caused by a recessive X-linked gene.

Thalassemia:

Cause: Thalassemia is caused by gene mutation resulting in excessive dumution of RBC'S due to the formation of abnormal hemoglobin molecules.

	Haemophilia	Thalassemia
1.	It is a hereditary disease	It is an autosomal recessive disorder.
2.	Recessive gene for haemophilia lacks a normal clotting substance (thromboplastin) in blood.	Defects in either the alpha or beta globin chain causing the production of abnormal hemoglobin molecules resetting in anemia.
3.	It is also known as bleeder's disease.	It is also known as cooley's anaemia.

17. 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) 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.

(iii) 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.

(iv) 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.

18. **(i)** The insertion of human insulin gene on the plasmids of E.coli.

(ii) The polypeptide chains are synthesized as a precursor called pre-pro insulin, which contains A and B segments linked by a third chain (C) and preceded by a leader sequence.

(iii) The leader sequence is removed after translation and the C chain is excised, leaving the A and B polypeptide chains.

(iv) Insulin was the first ever pharmaceutical product of recombinant DNA technology administered to humans.

Pre pro insulin → Pro insulin → Insulin.

19.

	***In-situ* Conservation**	***Ex-situ* 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 *insitu* conservation strategies.	Zoological parks and Botanical gardens are common *exsitu* conservation programs.

Section – IV

20. a. A collection of procedures which includes the handling of gametes and / or embryos outside the body to achieve a pregnancy is known as Assisted Reproductive Technology. ART includes

(i) **Intra-uterine insemination (IUI):** This is a procedure to treat infertile men with low sperm count. The semen is collected either from the husband or from a healthy donor and is introduced into the uterus through the vagina by a catheter after stimulating the ovaries to produce more ova. The sperms swim towards the fallopian tubes to fertilize the egg, resulting in normal pregnancy.

(ii) **Zygote intra-fallopian transfer (ZIFT):** The zygote is allowed to divide to form 8 celled blastomere and transferred to the fallopian tube by laparoscopy. The zygote continues its natural divisions and migrates towards the uterus where it gets implanted.

(iii) **Intra uterine transfer (IUT):** Embryo with more than 8 blastomeres is inserted into uterus to complete its further development.

(iv) **Gamete intra-fallopian transfer (GIFT):** Transfer of an ovum collected from a donor into the fallopian tube. In this, the eggs are collected from the ovaries and placed with the sperms in one of the fallopian tubes. The zygote travels toward the uterus and gets implanted in the inner lining of the uterus.

(v) **Intra-cytoplasmic sperm injection (ICSI):** In this method, only one sperm is injected into the focal point of the egg to fertilize. The sperm is carefully injected into the cytoplasm of the egg. Fertilization occurs in 75 - 85% of eggs injected with the sperms. The zygote is allowed to divide to form an 8 celled blastomere and then transferred to the uterus to develop a protective pregnancy.

(OR)

b. (i)

S. No	Divergent evolution	Convergent evolution
1.	Structures which are similar in origin but perform different functions are called homologous structures that brings divergent evolution.	Organisms having different structural patterns but similar function are termed as analogous structures that brings convergent evolution
2.	**E.g.** Thorn of *Bougainvillea* and tendril of *Curcurbita* are homologous structures but their functions are different.	**E.g.** the wings of birds and insects are different structurally, but perform the same function of flight.

(ii) Some objections raised against Darwinism were

(i) Darwin failed to explain the mechanism of variation.

(ii) Darwinism explains the survival of the fittest but not the arrival of the fittest.

(iii) He focused on small fluctuating variations that are mostly non-heritable.

(iv) He did not distinguish between somatic and germinal variations.

(v) He could not explain the occurrence of vestigial organs, over specialization of some organs like large tusks in extinct mammoths, oversized antlers in the extinct Irish deer, etc.,

21. a. **Life cycle of plasmodium:**

(i) The life cycle of *Plasmodium* involves three phases namely **schizogony, gamogony and sporogony.**

(ii) The parasite first enters the human blood stream through the bite of an infected **female *Anopheles*** mosquito. As it feeds, the mosquito injects the saliva containing the **sporozoites**.

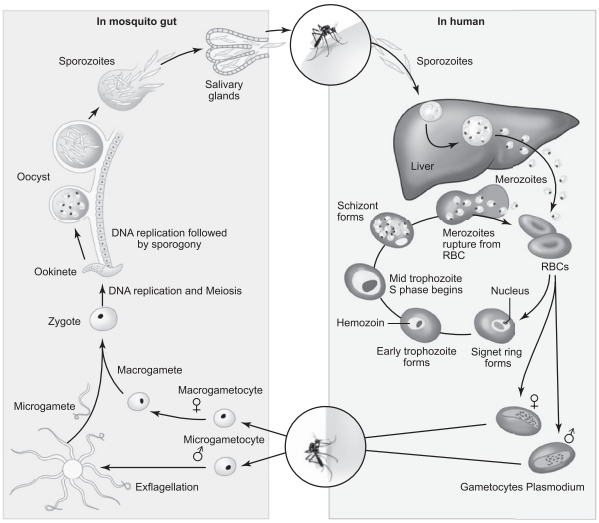
(iii) The sporozoite within the blood stream enter the hepatic cells of the liver and undergoes multiple asexual fission (**schizogony**) and produces **merozoites** which are released from liver cells.

(iv) The merozoites penetrate the RBC's. Inside the RBC of blood, the merozoite of *Plasmodium* to develop as unicellular trophozoites. The trophozoite grows in size and a central vacuole develops pushing them to one side of cytoplasm and becomes the **signet ring stage**.

(v) The trophozoite nucleus then divides asexually to produce the **schizont**. The schizont divides and produces mononucleated merozoites.

(vi) Eventually the erythrocyte lyses, releasing the merozoites and haemozoin toxin into the blood stream to infect other erythrocytes. Lysis of red blood cells results in cycles of fever and other symptoms. This erythrocytic stage is cyclic and repeats itself approximately every **48 to 72 hours** or longer depending on the species of *Plasmodium* involved. The sudden release of merozoites triggers an attack on the RBCs.

(vii) Occasionally, merozoites differentiate into **macrogametocytes** and **microgametocytes**. When these are ingested by a mosquito, they develop into male and female gametes respectively.



(OR)

b. The reasons for the richness of biodiversity in the tropics are:

(i) Warm tropical regions between the tropic of Cancer and Capricorn on either side of equator possess congenial habitats for living organisms.

(ii) Environmental conditions of the tropics are favourable not only for speciation but also for supporting both variety and number of organisms.

(iii) The temperatures vary between 25^0C to 35^0C, a range in which most metabolic activities of living organisms occur with ease and efficiency.

(iv) The average rainfall is often more than 200mm per year.

(v) Climate, seasons, temperature, humidity, photoperiods are more or less stable and encourage both variety and numbers.

(vi) Rich resource and nutrient availability.

12th STD.

Register Number

GOVT. MODEL QUESTION PAPER - 2019-20

ZOOLOGY

TIME ALLOWED : 3.00 Hours MAXIMUM MARKS : 70

Instructions:

i. Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

ii. Use **Blue** or **Black** ink to write and underline and **pencil** to draw diagrams:

PART – I

Note : (i) Answer **all** the questions: **(15 × 1 = 15)**

(ii) Choose the most suitable answer from the given four alternatives and write the option code with the corresponding answer.

1. Plasmotomy is the division of multinucleated parent into many multinucleate daughter cell with the division of nuclei. This is common in _____.

(a) *Noctiluca* (b) *Opalina*
(c) Sea anemones (d) Archaeocytes

2. Spermatids are produce from _____.

(a) Secondary spermatocyte
(b) Primary spermatocyte
(c) Spermatogonium
(d) Spermatocytes

3. Which microbes cause syphilis?

(a) *Neisseria gonorrhoeae*
(b) *Treponema palladium*
(c) *Herpes simplex*
(d) *Trichomonas vaginalis*

4. What can be the blood group of offspring when both parents have AB blood group?

(a) AB only (b) A, B and AB
(c) A, B, AB and 0 (d) A and B only

5. The first codon to be deciphered was

(a) AAA (b) GGG
(c) UUU (d) TTT

6. The most accepted line of descent in human evolution is

(a) *Australopithecus* → *Ramapithecus* → *Homo sapiens* → *Homo habilis*
(b) *Homo erectus* → *Homo habilis* → *Homo sapiens*
(c) *Ramapithecus* → *Homo habilis* → *Homo erectus* → *Homo sapiens*
(d) *Australopithecus* → *Ramapithecus* → *Homo erectus* → *Homo habilis Homo sapiens*.

7. Which one is right sequence for lifecycle of *Anopheles* mosquito?

(a) Oocyst → ookinete → sporozoites → gamatocyte
(b) Ookinete → oocyst → gametocyte → sporozoites
(c) Gamatocyte → oocyst → sporozoites → ookinete
(d) Gamatocyte → ookinete → oocyst → sporozoites

8. Which of the following is not a macrophage?

(a) Monocyte (b) Microglia
(c) Kupffer cell (d) Lymphocyte

9. The gases produced in anaerobic sludge digesters are

(a) Methane, oxygen and hydrogen sulphide.
(b) Hydrogen sulphide, methane and sulphur dioxide.
(c) Hydrogen sulphide, nitrogen and methane.
(d) Methane, hydrogen sulphide and CO_2.

10. Which one of the microorganism is used for production of citric acid in industries?

(a) *Lactobacillus bulgaricus*
(b) *Penicillium citrinum*
(c) *Aspergillus niger*
(d) *Rhizopus nigricans*

11. Vaccines that use components of a pathogenic organism rather than the whole organism are called "'
(a) Subunit recombinant vaccines
(b) Attenuated recombinant vaccines
(c) DNA vaccines
(d) conventional vaccines.

12. The number of individuals per unit area is known as
(a) population density
(b) population growth
(c) community ecology
(d) population dispersion

13. The organization which published the red list of species is
(a) WWF (b) IUCN
(c) ZSI (d) UNEP

14. For the given assertion and reason identity the suitable answer
Assertion : The environmental conditions of the tropics are favourable for speciation and diversity of organisms.
Reason : The climate seasons, temperature, humidity and photoperiod are more or less stable and congenial.
(a) Both Assertion and Reason are true and Reason explains Assertion correctly.
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) Assertion is true , but Reason is false .
(d) Both Assertion and Reason are false.

15. The population of eagles and hawks is declining because of,
(a) Food scarcity
(b) Game lovers
(c) Harmful effects of pesticides
(d) Very few dead animals are found in fields

Part - II

Answer **any six** of the following : **(6 × 2 = 12)**

Question number **24 is compulsory**.

Each question carries 2 marks. Answer in about 30 words.

16. Why do gametes produced in large numbers in organisms which exhibit external fertilization?

17. How is polyspermy avoided in humans?

18. What is Surrogacy?

19. Differentiate broad spectrum antibiotics and narrow spectrum antibiotics.

20. What is Antibiotic resistances?

21. What are Recombinant vaccines? Explain the types.

22. Define Niche and Guilds.

23. List out the sources of air pollution.

24. List out the effects of smog.

Part - III

Answer any six of the following. **(6 × 3 = 18)**

Question number **33 is compulsory.**

Each question carries 3 marks. Answer in about 45 words.

25. What do you know about Poly Cystic Ovary Syndrome [PCOS]?

26. Which is the ideal contraceptive for female to delay pregrancy? Give two examples.

27. Describe the individuals having following sex chromosomal abnormalities
a) XXY b) XO.

28. Write short notes on structure of the Operon.

29. Explain Darwinian's principles of struggle for existence and natural selection.

30. Classify viral diseases based on their symptoms.

31. Write short notes on Autoimmune diseases.

32. What are the advantages of Eurytherms?

33. List out the general strategies for biodiversity conservation.

Part - IV

Answer **all** the questions **(5 × 5 = 25)**

34. a) Meiotic division during Oogenesis is different from that in Spermatogenesis. Explain how and why?

(OR)

b) Write an essay on various types of birth control methods in India.

35. a) Write short notes on Erythroblastosis foetails.

(OR)

b) Explain the formation of a Nucleosome.

36. a) Darwin's Finches have evolved into different species differing in body, in body size, beak shape and feeding behavior. What does it reflect explain.

(OR)

b) Explain about life cycle of *Plasmodium*.

37. a) Explain about lymphocytes.

(OR)

b) Define Transgenic animals and explain their uses.

38. a) List out and explain the types of extinction.

(OR)

b) Explain about the ways of management of nuclear waste.

ANSWERS

PART – I

1. (b) *Opalina*

2. (a) Secondary spermatocyte

3. (b) *Treponema palladium*

4. (b) A, B and AB

5. (c) UUU

6. (c) Ramapithecus → Homo habilis → Homo erectus → Homo sapiens

7. (d) *Gamatocyte* → *ookinete* → *oocyst* → *sporozoites*

8. (b) Microglia

9. (d) Methane, hydrogen sulphide and CO_2.

10. (c) *Aspergillus niger*

11. (a) Subunit recombinant vaccines

12. (a) population density

13. (b) IUCN

14. (a) Both Assertion and Reason are true and Reason explains Assertion correctly.

15. (c) Harmful effects of pesticides

PART – II

16. Organisms that take part in such process produce large number of gametes because

(i) In external fertilization, there is a great chance that the sperm and the eggs released by the organisms can be affected by factors present in the environment like dessication, predators, etc. So, to make up for the high fatality rate of the gametes, the organism produces a lot of gametes.

(ii) Producing large number of gametes increase the chance for at least some eggs and sperms to meet in the environment ensuring that atleast a stable number of offspring are able to survive and carry on.

17. **(i)** During the process of fertilization in humans, the acrosome of the sperm enters through the corona radiata and zona pellucida layers of the ovum by releasing a enzyme called hyaluronidase, which is called acrosomal reaction.

(ii) Once fertilization is accomplished, cortical granules from the cytoplasm of the ovum form a barrier called the fertilization membrane around the ovum. This prevents further penetration of other sperms. Thus polyspermy (entry of more than one sperm into an egg) is prevented.

18. Surrogacy is a method of assisted reproduction or agreement whereby a woman agrees to carry a pregnancy for another person, who will become the newborn child's parent after birth.

19.

Broad-spectrum antibiotics	Narrow-spectrum antibiotics
Broad-spectrum antibiotics act against a wide range of disease-causing bacteria.	Narrow-spectrum antibiotics are active against a selected group of bacterial types.

20. **(i)** Antibiotic resistance occurs when bacteria develop the ability to defeat the drug designed to kill or inhibit their growth.

(ii) Antibiotic resistance is accelerated by the misuse and overuse of antibiotics.

21. The recombinant vaccines are generally of uniform quality and produce less side effects as compared to the vaccines produced by conventional methods.

Types of recombinant vaccines:

(a) Subunit recombinant vaccines:

(i) Vaccines that use components of a pathogenic organism rather than the whole organism are called subunit vaccines.

(ii) It includes components like proteins, peptides and DNAs of pathogenic organisms.

(b) Attenuated recombinant vaccines:

(i) This includes genetically modified pathogenic organisms (bacteria or viruses) that are made non-pathogenic and are used as vaccines.

(ii) 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.

(c) DNA Vaccines:

(i) Genetic immunisation by using DNA vaccines is a novel approach. The immune response of the body is stimulated by a DNA molecule.

(ii) 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.

22. Niche:

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.

Guilds:

Groups of species with comparable role and niche dimensions within a community are termed 'guilds'.

23. (i) Transport sources – Cars, buses, airplanes, trucks and trains

(ii) Stationary sources – Power plants, incinerators, oil refineries, industrial facilities and factories

(iii) Area sources – Agricultural - wood / stubble burning and fireplaces

(iv) Natural sources – Wind-blown dust, wildfires and volcanoes.

24. (i) Smog can make breathing more difficult, especially for people with asthma.

(ii) Smog also affects plants and animals. It damages crops as well as causes health problems in pets, farm animals and human beings.

(iii) Smog has also been known to cause corrosive damage to buildings and vehicles.

Part – III

25. (i) PCOS is a complex endocrine system disorder that affects women in their reproductive years. Polycystic means 'many cysts'. It refers to many partially formed follicles on the ovaries, which contain an egg each. But they do not grow to maturity or produce eggs that can be fertilized.

(ii) Women with PCOS may experience irregular menstrual cycles, increased androgen levels, excessive facial or body hair growth (hirsutism), acne, obesity, reduced fertility and increased risk of diabetes.

(iii) Treatment for PCOS:

- ✦ Healthy lifestyle,
- ✦ Weight loss
- ✦ Targeted hormone therapy.

26. Intrauterine Devices (IUDs)

Intrauterine devices are inserted by medical experts in the uterus through the vagina. These devices are available as copper releasing IUDs, hormone releasing IUDs and

non-medicated IUDs. IUDs increase phagocytosis of sperm within the uterus. IUDs are the ideal contraceptives for females who want to delay pregnancy.

Eg 1: Copper releasing IUDs (Cu T - 380 A, Nova T, Cu 7)

Eg 2 : Hormone releasing IUDs (Progestasert and LNG - 20)

27. (a) Klinefelter's Syndrome (XXY Males)

(i) This genetic disorder is due to the presence of an additional copy of the X chromosome resulting in a karyotype of 47, XXY.

(ii) 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.

(b) Turner's Syndrome (XO Females)

(i) 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.

(ii) Low stature, webbed neck, under developed breast, rudimentary gonads lack of menstrual cycle during puberty are the main symptoms of this syndrome.

28. Structure of the operon:

Each operon is a unit of gene expression and regulation and consists of one or more structural genes and an adjacent operator gene that controls transcriptional activity of the structural gene.

(i) The structural gene codes for proteins, rRNA and tRNA required by the cell.

(ii) Promoters are the signal sequences in DNA that initiate RNA synthesis. RNA polymerase binds to the promoter prior to the initiation of transcription.

(iii) The operators are present between the promoters and structural genes. The repressor protein binds to the operator region of the operon.

29. Struggle for existence:

Organisms struggle for food, space and mate. As these become a limiting factor, competition exists among the members of the population. Darwin denoted struggle for existence in three ways:

(i) Intra specific struggle between the same species for food, space and mate.

(ii) Inter specific struggle with different species for food and space.

(iii) Struggle with the environment to cope with the climatic variations, flood, earthquakes, drought, etc.

Natural selection:

Natural selection does not produce any genetic variations but once such variations occur it favours some genetic changes while rejecting others (driving force of evolution).

30. Viral diseases are generally classified into four types on the basis of the symptoms produced in the body organs.

(i) Pneumotropic diseases (Eg: respiratory tract infected by influenza)

(ii) Dermotropic diseases (Eg: skin and subcutaneous tissues affected by chicken pox and measles)

(iii) Viscerotropic diseases (Eg: blood and visceral organs affected by yellow fever and dengue fever)

(iv) Neurotropic diseases (Eg: central nervous system affected by rabies and polio).

31. (i) 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.

(ii) Our body produces antibodies (auto antibodies) and cytotoxic T cells that destroy our own tissues.

(iii) If a disease-state results, it is referred to as auto-immune disease. Thus, autoimmunity is a misdirected immune response.

(iv) Autoimmunity is evidenced by the presence of auto antibodies and T cells that are reactive with host antigens.

(v) When the cells act as antigens in the same body, they are called autoantigens.

32. Advantages of Eurythermy:

(i) Adaptations to cold temperatures (cold-eurythemy) are seen as essential for the survival of species during ice ages.

(ii) The ability to survive in a wide range of temperatures increases a species ability to inhabit other areas, an advantage for natural selection.

(iii) Eurythermy is an aspect of thermoregulation in organisms.

33. 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) Resting, feeding and breeding places of the organisms should be identified and protected.

(v) Air, water and soil should be conserved on priority basis.

(vi) Wildlife Protection Act should be implemented.

There are two aspects of conservation strategies

(1) *In-situ* conservation

(2) *Ex-situ* conservation

Part – IV

34. a) Spermatogenesis is the process of production of sperms in the seminiferous tubules of the testes.

Oogenesis is the process of development of the female gomate or ovum in the ovaries.

	Spermatogenesis	Oogenesis
1.	The primary spermatocyte (2n) undergoes I meiotic division to form two secondary spermatocytes.	The primary oocyte (2n) undergoes I meiotic division to form one large haploid secondary oocyte and a small cell called polar body.
2.	Each secondary spermatocytes undergoes II meiotic division to form two spermatids.	The secondary oocyte undergoes II meiotic division to produce one large ovum and a small cell called polar body.
3.	Each primary spermatocyte produces 4 spermatids	Generally only one primary oocyte functions and produces only one ovum.
4.	Millions of sperms are produced at a time.	Only one egg is produced at time.
5.	The meiotic divisions are uniform.	The meiotic divisions results in unequal size of daughter cells.
6.	All the daughter cells become functional gametes.	The polar body disintegrates.
7.	The spermatids are transformed into mature sperms by a process called spermiogenesis.	No such process is seen in oogenesis.

The reason for difference in meiotic divisions is that if all daughter cells formed by oogenesis become functional eggs, the number of zygotes formed will be more than one.

Under normal circumstances, nature promotes the formation of only one embryo which can be implanted in the uterus of the mother and undergo further development. But meiosis must occur to maintain chromosomal number of the species.

Another Reason for the unequal size of daughter cells in oogenesis is that all the cytoplasm and maximum cellular contents are given to the ovum since the polar body will disintegrate.

(OR)

b) **Birth control methods in India:**

Hormonal barrier method:

(i) It prevents the ovaries from releasing the ova and thickens the cervical fluid which keeps the sperm away from ovum.

(ii) Oral contraceptives — Pills are used to prevent ovulation by inhibiting the secretion of FSH and LH hormones.

(iii) A combined pill is the most commonly used birth control pill. It contains synthetic progesterone and estrogen hormones.

(iv) Saheli, contraceptive pill by Central Drug Research Institute (CDRI) in Lucknow, India contains a non-steroidal preparation called centchroman.

Intrauterine Devices (IUDs):

(i) Intrauterine devices are inserted by medical experts in the uterus through the vagina. These devices are available as copper releasing IUDs, hormone releasing IUDs and non-medicated IUDs.

(ii) IUDs increase phagocytosis of sperm within the uterus. IUDs are the ideal contraceptives for females who want to delay pregnancy.

(iii) It is one of the popular methods of contraception in India and has a success rate of 95 to 99%.

Copper releasing IUDs differ from each other by the amount of copper. Copper IUDs such as Cu T-380 A, Nova T, Cu 7, Cu T 380 Ag, Multiload 375, etc. release free copper and copper salts into the uterus and suppress sperm motility. They can remain in the uterus for five to ten years.

Hormone-releasing IUDs such as Progestasert and LNG – 20 are often called as intrauterine systems (IUS). They increase the viscosity of the cervical mucus and thereby prevent sperms from entering the cervix.

Non-medicated IUDs are made of plastic or stainless steel. Lippes loop is a double S-shaped plastic device.

Permanent birth control methods:

(i) Adopted by the individuals who do not want to have any more children.

(i) Surgical sterilisation methods are the permanent contraception methods advised for male and female partners to prevent any more pregnancies.

(ii) It blocks the transport of the gametes and prevents conception. Tubectomy is the surgical sterilisation in women.

(iii) 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.

(iv) This prevents fertilization as well as the entry of the egg into the uterus. Vasectomy is the surgical procedure for male sterilisation.

(v) 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.

(vi) Vasectomy prevents sperm from heading off to penis as the discharge has no sperms in it.

35. a) **Incompatibility of Rh – Factor – Erythroblastosis foetalis:**

(i) Rh incompatability has great significance in child birth. If a woman is Rh negative and the man is Rh positive, the foetus may be Rh positive having inherited the factor from its father.

(ii) The Rh negative mother becomes sensitized by carrying Rh positive foetus within her body.

(iii) Due to damage of blood vessels, during child birth, the mother's immune system recognizes the Rh antigens and gets sensitized.

(iv) The sensitized mother produces Rh antibodies. The antibodies are IgG type which are small and can cross placenta and enter the foetal circulation.

(v) By the time the mother gets sensitized and produce anti 'D' antibodies, the child is delivered.

(vi) Usually no effects are associated with exposure of the mother to Rh positive antigen during the first child birth, subsequent Rh positive children carried by the same mother, may be exposed to antibodies produced by the mother against Rh antigen, which are carried across the placenta into the foetal blood circulation. This causes haemolysis of foetal RBCs resulting in haemolytic jaundice and anaemia.

(vii) This condition is known as Erythoblastosis foetalis or Haemolytic disease of the new born (HDN).

(OR)

b) **Formation of a nucleosome:**

(i) In eukaryotes, chromatin is formed by a series of repeating units called **nucleosomes.**

(ii) Korenberg proposed a model for the nucleosome, in which 2 molecules of the four histone proteins H2A, H2B, H3 and H4 are organized to form a unit of eight molecules called **histone octamere.**

(iii) The negatively charged DNA is wrapped around the positively charged histone octamere to form a structure called **nucleosome.** A typical nucleosome contains 200 bp of DNA helix.

(iv) The histone octameres are in close contact and DNA is coiled on the outside of nucleosome.

(v) Neighbouring nucleosomes are connected by linker DNA (H1) that is exposed to enzymes. The DNA makes two complete turns around the histone octameres and the two turns are sealed off by an H1 molecule

(vi) Chromatin lacking H1 has **beads on a string** appearance in which DNA enters and leaves the nucleosomes at random places.

(vii) H1 of one nucleosome can interact with H1 of the neighbouring nucleosomes resulting in the further folding of the fibre.

(viii) The chromatin fiber in interphase nuclei and mitotic chromosomes have a diameter that vary between 200-300 nm and represents inactive chromatin. 30 nm fibre arises from the folding of nucleosome, chains into a **solenoid** structure having six nucleosomes per turn. This structure is stabilized by interaction between different H1 molecules.

(ix) DNA is a solenoid and packed about 40 folds.

(x) In a typical nucleus, the chromatin that is tightly packed (stained darkly) is called heterochromatin. Euchromatin is transcriptionally active and heterochromatin is transcriptionally inactive.

36. a) **Darwin's finches:**

(i) Darwin's finches have evolved into 14 recognized species differing in body size, beak shape and feeding behavior.

(ii) Changes in the size and form of the beak have 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 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 they have adapted in similar way to a particular food resource, locomotory skill or climate.

(vi) They were separated from the common ancestor more than 100 million year 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) Over 200 species of marsupials live in Australia along with many fewer species of placental mammals.

(xi) The marsupials have undergone adaptive radiation to occupy the diverse habitats in Australia, just as the placental mammals have radiated across North America.

(OR)

b) **Life cycle of *Plasmodium*:**

(i) The life cycle of *Plasmodium* involves three phases namely **schizogony, gamogony and sporogony (Fig.)**

(ii) The parasite first enters the human blood stream through the bite of an infected **female *Anopheles*** mosquito. As it feeds, the mosquito injects the saliva containing the **sporozoites**.

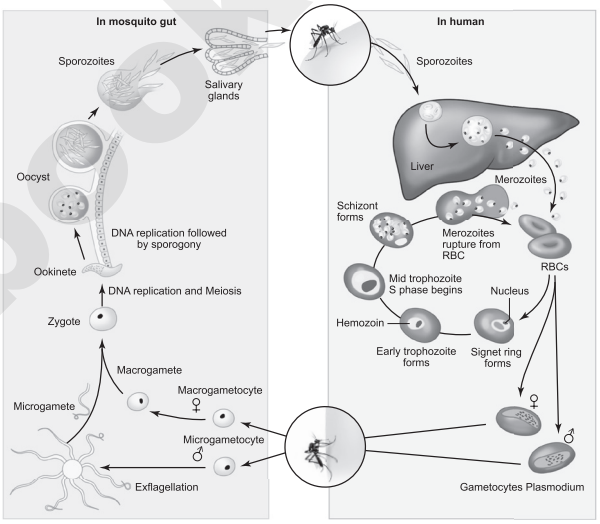
(iii) The sporozoites within the blood stream enter the hepatic cells of the liver and undergoes multiple asexual fission (**schizogony**). This produces **merozoites** which are released from liver cells.

(iv) The merozoites penetrate the RBC's. Inside the RBC of Blood, the merozoite of *Plasmodium* to develop as unicellular trophozoites. The trophozoite grows in size and a central vacuole develops pushing them to one side of cytoplasm and becomes the **signet ring stage**.

(v) The trophozoite nucleus then divides asexually to produce the **schizont**. The schizont divides and produces mononucleated merozoites.

(vi) Eventually the erythrocyte lyses, releasing the merozoites and haemozoin toxin into the blood stream to infect other erythrocytes. Lysis of red blood cells results in cycles of fever and other symptoms. This erythrocytic stage is cyclic and repeats itself approximately every **48 to 72 hours** or longer depending on the species of *Plasmodium* involved. The sudden release of merozoites triggers an attack on the RBCs.

(vii) Occasionally, merozoites differentiate into **macrogametocytes** and **microgametocytes**. When these are ingested by a mosquito, they develop into male and female gametes respectively.



37. a) **Lymphocytes:**

(i) About 20-30% of the white blood cells are lymphocytes. They have a large nucleus filling most of the cell, surrounded by a little cytoplasm.

(ii) The two main types of lymphocytes are B and T lymphocytes. Both these are produced in the bone marrow. B lymphocytes (B cells) stay in the bone marrow until they mature.

(iii) Then they circulate around the body. Some remain in the blood, while others accumulate in the lymph nodes and spleen.

(iv) T lymphocytes leave the bone marrow and mature in the thymus gland. Once mature, T cells also accumulate in the same areas of the body as B cells.

(v) Lymphocytes have receptor proteins on their surface. When receptors on a B cell bind with an antigen, the B cell becomes activated and divides rapidly to produce plasma cells.

(vi) The plasma cells produce antibodies. Some B cells do not produce antibodies but become memory cells. These cells are responsible for secondary immune response.

(vii) T lymphocytes do not produce antibodies. They recognize antigen-presenting cells and destroy them.

(viii) The two important types of T cells are Helper T cells and Killer T cells. Helper T cells release a chemical called cytokine which activates B cells.

(ix) Killer cells move around the body and destroy cells which are damaged or infected.

(x) Apart from these cells neutrophils and monocytes destroy foreign cells by phagocytosis. Monocytes when they mature into large cells, they are called macrophages which perform phagocytosis on any foreign organism.

(OR)

b) 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 is called the transgene and the animals that are produced by DNA manipulations are called **transgenic animals** or the genetically engineered or **genetically modified** organisms.

Uses Of Transgenesis:

(i) Transgenesis is a powerful tool to study gene expression and developmental processes in higher organisms.

(ii) Transgenesis helps in the improvement of genetic characters in animals. Transgenic animals serve as good models for understanding human diseases which help in the investigation of new treatments for diseases. Transgenic models exist for many human diseases such as cancer, Alzheimer's, cystic fibrosis, rheumatoid arthritis and sickle cell anemia.

(iii) Transgenic animals are used to produce proteins which are important for medical and pharmaceutical applications.

(iv) Transgenic mice are used for testing the safety of vaccines.

(v) Transgenic animals are used for testing toxicity in animals that carry genes which make them sensitive to toxic substances than non-transgenic animals exposed to toxic substances and their effects are studied.

(vi) Transgenesis is important for improving the quality and quantity of milk, meat, eggs and wool production in addition to testing drug resistance.

38. a) **There are three types of Extinction:**

(i) **Natural extinction** is a slow process of replacement of existing species with better adapted species due to changes in environmental conditions, evolutionary changes, predators and diseases. A small population can get extinct sooner than the large population due to inbreeding depression (less adaptivity and variation).

(ii) **Mass extinction:** 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.

(iii) **Anthropogenic extinctions:** These are abetted by human activities like hunting, habitat destruction, over exploitation, urbanization and industrialization. Some examples of extinctions are Dodo of Mauritius and Steller's sea cow of Russia. Amphibians seem to be at higher risk of extinction because of habitat destruction.

(OR)

b) Three ways are employed to manage nuclear wastes

(i) **Spent Fuel Pools** - The spent fuel discharged from the reactors is temporarily stored in the reactor pool. The Spent fuel rods are used in stored cooling ponds. They protect the surroundings from radiation and absorb the heat generated during radioactive decay.

(ii) **Vitrification method** – This prevents reaction or degradation of nuclear waste for extended periods of time and encased in dry cement caskets.

(iii) **Geological Repositories** - A deep geological repository is a nuclear waste repository excavated deep within a stable geologic environment. It is suited to provide a high level of long-term isolation and containment without future maintenance. In India, at Tarapur and Kalpakkam, a wet storage facility of Spent Fuel is the main mode of storage.